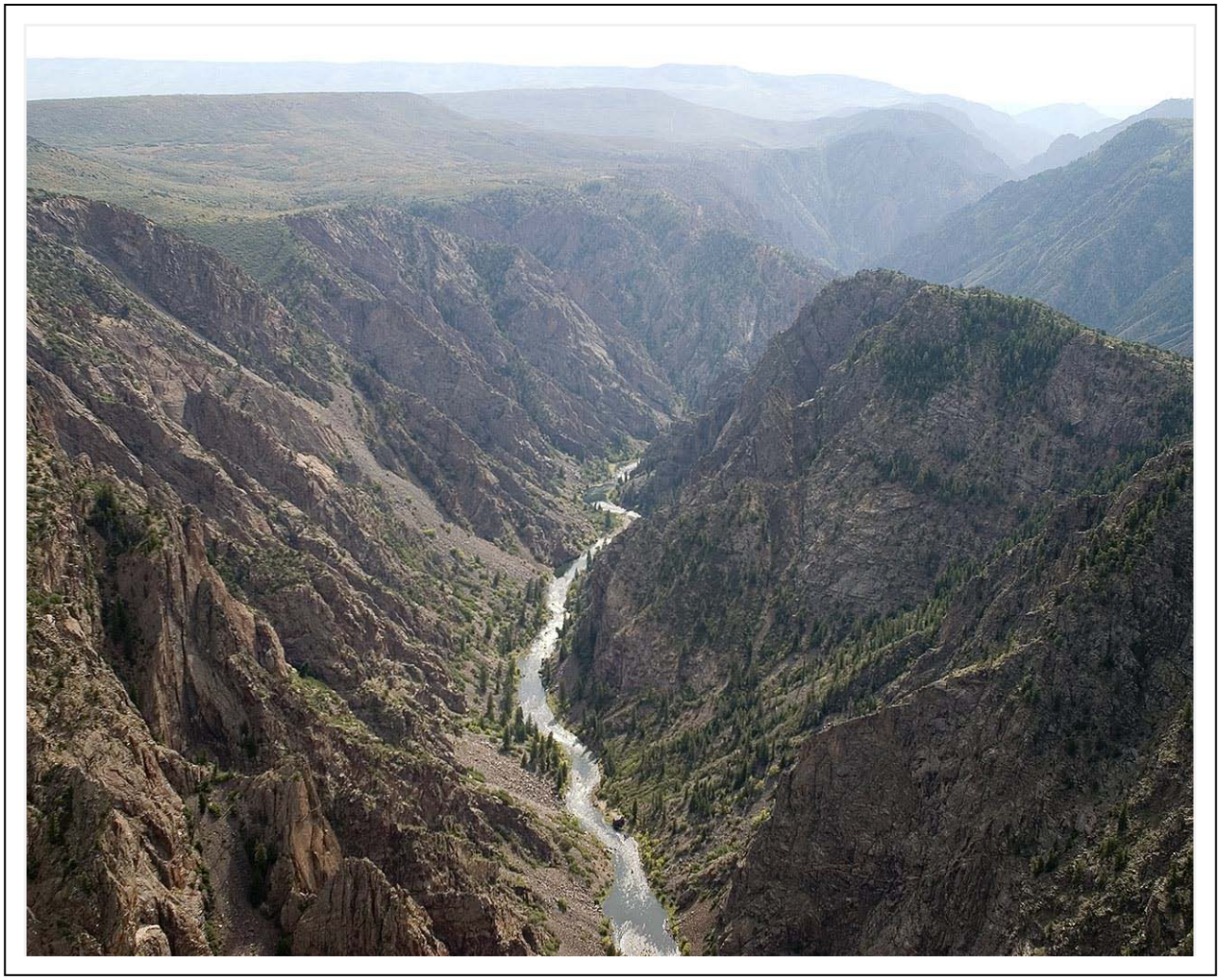
National Park Service
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Natural Resource Program Center

Vegetation Classification and Mapping Project Report, Black Canyon of the Gunnison National Park

Natural Resource Technical Report NPS/NCPN/NRTR—2010/361



ON THE COVER
Black Canyon of the Gunnison from near Tomichi Point
Photograph by: Lisa Lynch, NPS

Vegetation Classification and Mapping Project Report, Black Canyon of the Gunnison National Park

Natural Resource Technical Report NPS/NCPN/NRTR—2010/361

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August 2010

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Acronyms and Abbreviations

AA	Accuracy Assessment
APFO	Aerial Photography Field Office (USDA)
BLCA	Black Canyon of the Gunnison National Park
BLM	United States Bureau of Land Management
BOR	United States Bureau of Reclamation
BPU	Biophysical Unit
CEGL	Community Element Code
CNHP	Colorado Natural Heritage Program
CPVAC	Colorado Plateau Vegetation Advisory Committee
CURE	Curecanti National Recreation Area
DBH	Diameter at Breast Height (4.5 feet)
DCA	Detrended Correspondence Analysis
DEM	Digital Elevation Model
DOQQ	Digital Orthophotograph Quarter Quadrangle
DRC	Diameter at Root Crown
e^2M	engineering-environmental Management, Inc.
ES	Ecological System
ESRI	Environmental Systems Research Institute
FGDC	Federal Geographic Data Committee
GIS	Geographic Information System
GPS	Global Positioning System
I&M	Inventory and Monitoring Program
ISA	Indicator Species Analysis
ITIS	Integrated Taxonomic Information System
MMU	Minimum Mapping Unit
NAD	North American Datum
NCPN	Northern Colorado Plateau Network
NM	National Monument
NPS	National Park Service
NRCS	Natural Resource Conservation Service
NVC	National Vegetation Classification
NVCS	National Vegetation Classification Standard
QA/QC	Quality Assurance/Quality Control
RSGIG	Remote Sensing and Geographic Information Group (BOR)
SEUG	Southeast Utah Group of the National Park Service
TNC	The Nature Conservancy
TSN	Taxonomic Serial Number
UNESCO	United Nations Education, Science, and Cultural Organization
USDA	United States Department of Agriculture
USDI	United States Department of the Interior
USFS	United States Forest Service
USGS	United States Geological Survey
UTM	Universal Transverse Mercator

Summary

The Northern Colorado Plateau Inventory and Monitoring Network, with the support of the U.S. Geological Survey - National Park Service Vegetation Mapping Program undertook this project to describe and map vegetation at Black Canyon of the Gunnison National Park (BLCA). This collaborative effort involved many project partners, particularly BLCA natural resources staff, the Western Region office of NatureServe, engineering-environmental Management, Inc., and their cooperators.

The mapping area is 22,989 hectares (56,807 acres), encompassing the entire park as well as an environs of adjacent public and private lands. Ecologists and photo interpreters identified vegetation alliances and plant associations for BLCA and determined how best to map them using 1:12,000-scale, true color aerial photography and digital orthophotography. The team collected vegetation and environmental data from 112 classification plots and 16 observation points. Supplemental fuels data were collected during the project in Gambel oak, pinyon-juniper, ponderosa pine, Douglas-fir, and quaking aspen communities. Assessment of map accuracy entailed sampling of another 762 data points. Fieldwork and mapping were completed between 2001 and 2004.

Analysis of the vegetation data revealed 77 National Vegetation Classification plant associations, vegetation alliances, or park special vegetation types within the park and environs, 56 of which are shared with the adjacent Curecanti National Recreation Area (CURE). Twenty-eight plant associations were documented exclusively from accuracy assessment data, the remainder from vegetation plots and observation points.

Vegetation and land use were interpreted to as detailed a level as possible from high-resolution, 9” x 9” stereo pairs of 1:12,000-scale true color aerial photography. Polygons representing vegetation or land use map classes were delineated on Mylar overlays on paper plots of the orthophotographs and transferred to a spatial database where they were adjusted as necessary using on-screen digitizing techniques. The project used the program standard minimum mapping unit of 0.5 ha with few exceptions.

Thirty-five (34 polygon and 1 point-based) map classes were developed for BLCA. The BLCA vegetation mapping project area was divided into 3,270 polygons. A total of 3,135 map polygons represent 24 natural and semi-natural vegetation map classes, and 11 land use map classes describe 135 other polygons within the mapping area. Average polygon size across all map classes is 7.0 ha (17.4 acres). Natural and semi-natural vegetation classes cover 22,220 ha (54,857 acres; 96.6% of the project area). Land use/land cover polygons, including roads, ranch developments and NPS facilities, total 788 ha (1,948 acres; 3.4% of the project area). The most common map class is Gambel Oak / Mixed Montane Shrubland (S-QUMX) with 554 polygons covering 28.6% of the mapping area.

Map accuracy was assessed within the BLCA boundary only. Results from a thematic accuracy assessment of 24 vegetation map classes remaining after accuracy assessment analysis indicated an estimate of 83.8% overall map accuracy (Kappa statistic = 82.2%). Ten map classes did not meet the 80% standard for either producer’s or user’s accuracy, but were retained because of

their relative rarity and/or value to Park managers. These map classes are described in the Accuracy Assessment section of this report, as is the justification for retention.

Products resulting from the BLCA vegetation mapping project include:

Available in this report:

- project summary of methods and results
- illustrated dichotomous field key to the vegetation associations
- illustrated guide to the vegetation map classes
- detailed descriptions of vegetation associations
- samples of completed field forms
- field manual used to guide plot and observation point data collection

Available elsewhere[1]:

- geodatabase containing map polygon attribute, land use, aerial photography flight lines, plot data and monument and project boundaries
- ground photography of vegetation plots, observation points, and accuracy assessment points in hard copy and digital formats
- all field data (plot, observation point, and accuracy assessment point) stored in a Microsoft Access database
- hard copy vegetation maps
- metadata for all digital products

Geospatial products are in Universal Transverse Mercator (UTM) projection, Zone 13, using the North American Datum of 1983.

[1] This document and most of the digital products are available on the internet at: http://biology.usgs.gov/npsveg/. Hard copies of the orthophotos, stereo photos, and original data forms are retained by NCPN and the park.

Acknowledgments

This project was completed through the effort and dedication of numerous individuals and organizations. Details of the role of each person mentioned here is described in more detail in the Project Overview section. Angela Evenden (National Park Service), Mike Story and Tammy Hamer (NPS), Karl Brown (USGS/NPS) and Mike Mulligan (USGS) provided project oversight and coordination. Mike Pucherelli of the Bureau of Reclamation Remote Sensing and Geographic Information Group (RSGIG) also supported the early stages of the project. Funding for this project was provided through the USGS-NPS National Vegetation Mapping Program, NPS Fire Program, and the Northern Colorado Plateau Inventory and Monitoring Network.

Numerous individuals collected plot, observation point, and accuracy assessment field data. We appreciate the hard work of Sharon Anderson, Travis Belote, Arne Beuchling, Paul Block, Ginger Bradshaw and her NPS seasonal field crews, Bruce Condie, Chris Lea, Dan Niosi, Buddy Smith, Sarah Topp, and Jim Von Loh.

Janet Coles (then of NatureServe) prepared the preliminary vegetation classification and assigned final association names. Review and revisions of the classification were completed by Marion Reid and Keith Schulz of NatureServe. Marion Reid also created the local association description template. Keith wrote many of the local and global association descriptions. Jim Von Loh wrote most of the local descriptions and assisted with final report preparation.

Janet Coles (then of the USBOR-RSGIG) prepared the initial photo interpretation. Ginger Bradshaw (NPS-BLCA) developed the initial map class concepts. Gerald Manis completed the photo interpretation and developed many of the map class attributes. Gery Wakefield and Aneth Wight (NPS) worked closely with Dan Cogan (then of USBOR-RSGIG) to produce the final vegetation map coverage.

Database management support and development were skillfully performed by Margaret Beer, Russ DenBleyker, and Helen Thomas (NPS) and Jack Doria (e^2M). Their preparation of a project MS Access database for plot, observation point, and accuracy assessment data simplified entry and analysis.

Special thanks to Ken Stahlnecker and Danguole Bockus of Black Canyon of the Gunnison National Park, who made us welcome whenever we arrived to check the map or collect field data, assisted with landowner contacts, and provided helpful advice as to the best way to access remote parts of the park.

For these and other contributors to the success of the project, we are grateful.

Introduction

Vegetation Classification and Mapping Project, Black Canyon National Park

The Black Canyon of the Gunnison National Park (BLCA) Vegetation Mapping Project was organized and coordinated by the Northern Colorado Plateau Network (NCPN) Inventory and Monitoring (I&M) Program between 2001 and 2010, with assistance from several project cooperators. The purpose of this project was to describe and map existing vegetation alliances and plant associations on 22,989 hectares (56,807 acres) within BLCA and its environs, and to provide this information in written, tabular, digital, and spatial formats useful to park resource managers, the NCPN I&M Program, and others. The basic project components consist of a classification and description of the park's vegetation and a spatial database encompassing an interpretation of the vegetation from aerial imagery.

In 2001, the NCPN I&M Program launched a multi-year project to complete vegetation classifications and maps for network park units. Funding was provided by the U.S. Geological Survey (USGS) – National Park Service (NPS) Vegetation Mapping Program and the Northern Colorado Plateau Network. The BLCA Vegetation Classification and Mapping Project was initiated by the NCPN, the Bureau of Reclamation Remote Sensing and Geographic Information Group (RSGIG), BLCA natural resources staff, NatureServe, and private contractors. Project work was coordinated with the USGS-NPS Vegetation Mapping Program. Vegetation plot and observation point data collection occurred between 2001 and 2003. Map accuracy assessment was completed in 2004 and 2005.

The BLCA Vegetation Classification and Mapping Project was closely coordinated with the vegetation classification and mapping effort at Curecanti National Recreation Area (CURE), immediately adjacent to the east side of BLCA. Project methods, results, and products for BLCA are documented in this report. This introductory section describes the NPS I&M Program and the USGS-NPS Vegetation Mapping Program, as well as the BLCA mapping project area. Later sections document the methods and results for each of the major steps in the project: scoping, vegetation classification and description, vegetation mapping, and map accuracy assessment.

The USGS-NPS Vegetation Mapping Program

The National Vegetation Mapping Program is a cooperative project between the USGS and the NPS to inventory, classify, describe, and map vegetation in more than 270 national park units within the United States. Consistent vegetation classification, mapping, and accuracy assessment protocols and standards are applied across projects supported by this program. The National Vegetation Mapping Program is administered by the USGS Center for Biological Informatics in cooperation with the NPS I&M Program. Through implementation of the NPS Natural Resource Challenge (NPS 1999), significant funding became available for completing important natural resource baseline inventories in park units, including vegetation classification and mapping. This support provided the NPS with the opportunity to move forward with dozens of new park unit vegetation classification and mapping projects, including BLCA. Vegetation classification and mapping products produced under this program are incorporated into the USGS National Biological Information Infrastructure Program, which serves as an information-sharing network (http://biology.usgs.gov/npsveg/).

Northern Colorado Plateau Network Inventory and Monitoring Program

The National Park Service developed an inventory and long-term monitoring program for park natural resources over the last two decades of the twentieth century. This effort was enhanced by the NPS Natural Resource Challenge (NPS 1999); as a part of this initiative, the NCPN was formed in 2000 to develop an integrated inventory and monitoring program for 16 park units in Utah, Colorado, Arizona, and Wyoming.

A goal of the NPS I&M Program is to complete baseline inventories of biological and geophysical resources for each park unit. These inventories cover 12 basic data sets needed by park staff to guide resource management. Vegetation classification and mapping constitute one of these data sets. Early in the development of its I&M program, the NCPN made completing vegetation maps for each network park unit a priority. In addition to assisting park management, vegetation maps and classification information would make a significant contribution to NCPN long-term monitoring efforts. In 2001, the network began implementation of a strategy to complete vegetation mapping in the 16 network park units. The BLCA vegetation mapping project is the ninth of the network-coordinated projects to be completed.

Vegetation Mapping Program Standards

The NPS I&M Program established guidance and standards for all vegetation mapping projects in a series of documents:

Protocols

- National Vegetation Classification System (TNC and ESRI 1994a, NatureServe 2003a)
- Field methods and mapping procedures (TNC and ESRI 1994b)
- Statistically rigorous and consistent accuracy assessment procedures (ESRI and TNC 1994)
- Guidelines for using existing vegetation data (TNC 1996)

Standards

- National Vegetation Classification Standard (FGDC 1997)
- Spatial Data Transfer Standard (FGDC 1998b)
- Content Standard for Digital Geospatial Metadata (FGDC 1998a)
- United States National Map Accuracy Standards (USGS 1999)
- Integrated Taxonomic Information System
- Program-defined standards for map attribute accuracy and minimum mapping unit

These documents are available on the USGS-NPS Vegetation Program Web site (http://biology.usgs.gov/npsveg/standards.html).

National Vegetation Classification Standard

The National Vegetation Classification (NVC) is the system used in NCPN vegetation mapping projects (TNC and ESRI 1994a), and is based on the National Vegetation Classification Standard adopted by the Federal Geographic Data Committee (FGDC 1997). The NVC evolved from work conducted primarily by The Nature Conservancy (TNC), NatureServe, and the Natural Heritage Program network over more than two decades (Grossman et al. 1998). The structure of the NVC is based in part on an earlier international vegetation classification developed by the United Nations Educational, Cultural, and Scientific Organization (UNESCO 1973, Driscoll et al. 1984). Use of a standardized classification system helps to ensure data compatibility throughout the NPS and other agencies. The FGDC Vegetation Subcommittee insures that this standard is current and relevant. The substantial revisions to the upper levels of the NVC hierarchy adopted by the Vegetation Subcommittee as Version 2 (FGDC 2008) are not used in this project.

Vegetation classification systems attempt to recognize and describe repeating assemblages of plants in similar habitats. The NVC is a hierarchical system that incorporates physiognomic characters and floristic data to define seven levels of terrestrial vegetation classification. The five upper levels (class, subclass, group, subgroup, and formation) are based on physiognomic features. The two lower levels (alliance and association) are distinguished by differences in floristic composition. The physiognomic units have a broad geographic perspective and the floristic units have utility in local and site-specific applications (Grossman et al. 1998). The physiognomic levels of the NVC are based on physical, structural, and environmental characteristics identifiable from satellite imagery, aerial photography, or ground observations (Table 1). Specific criteria defining physiognomic units are based on ecologic characteristics that vary among major vegetation groups (FGDC 1997).

The alliance and association levels form the base of the NVC hierarchy and are determined by the most abundant or diagnostic species comprising the various layers of a homogenous vegetation community. An association is here defined as a plant community type with a consistent species composition, uniform physiognomy, and similar habitat conditions (Flahault and Schroter 1910). Species composition differentiates associations (TNC and ERSI 1994a). An alliance is "a physiognomically uniform group of plant associations sharing one or more dominant or diagnostic species which, as a rule, are found in the uppermost strata of the vegetation" (Reid and Comer 1998). NatureServe coordinates plant association data for the NCPN vegetation mapping projects. Associations are added to the NVC and older concepts are refined as new data become available.

Table 1. National Vegetation Classification System hierarchy for terrestrial vegetation (FGDC 1997).

Level	Criteria Delineating Level	Example
Class	Structure (height, cover) of dominant vegetation strata	Woodland
Subclass	Growth form characters including leaf type (evergreen, deciduous) for woody plants and persistence (perennial, annual) for herbaceous species	Evergreen woodland
Group	Leaf morphology (broad leaf, microphyllous, xeromorphic), leaf phenology, and climatic conditions	Temperate or subpolar needle-leaved evergreen woodland
Subgroup	Relative degree of human disturbance	Natural/Semi-natural temperate or subpolar needle-leaved evergreen woodland

Table 1. National Vegetation Classification System hierarchy for terrestrial vegetation (FGDC 1997).

Level	Criteria Delineating Level	Example
Formation	Additional physiognomic characteristics, general environmental conditions, relative landscape position, and hydrologic regimes	Rounded-crowned temperate or subpolar needle-leaved evergreen woodland
Alliance	Dominant or diagnostic species of uppermost or dominant stratum	*Pinus edulis* – (*Juniperus* spp.) Woodland Alliance
Association	Other dominant or diagnostic species from any stratum	*Pinus edulis* – *Juniperus* spp. / *Quercus gambelii* Woodland

Other Standards

In addition to vegetation classification, the FGDC sets standards for map spatial accuracy and for metadata employed in NPS vegetation mapping projects. Standards for map products stipulate map scales of 1:24,000 or finer, and minimum polygon size of 0.5 ha (1.24 acres). Positional accuracy for vegetation maps must meet National Map Accuracy Standards, which specify horizontal errors of less than 10.2 m (33.5 ft.) on the ground for 1:12,000-scale maps.

All digital vegetation products resulting from this project are accompanied by FGDC-compliant metadata. Metadata are "data about the data," and describe the content, quality, condition, and other characteristics of the spatial dataset. Metadata are critical elements that expedite the interpretation and exchange of information among users.

Project Area Description

Location and Setting

Black Canyon of the Gunnison National Park (BLCA, Park) was established as a monument in 1933 by President Herbert Hoover on approximately 8,397 ha (20,750 acres) for "the preservation of the spectacular gorges and additional features of scenic, scientific, and educational interest" (Evenden et al. 2002). In 1999, Black Canyon of the Gunnison was designated a national park (U.S. Public Law 106-76). With a total of 4,047 ha of wilderness (10,000 acres) added to the park over the last 75 years, it now covers 12,444 ha (30,750 acres), of which nearly half is officially designated as wilderness (Evenden et al. 2002). The Park is located in west-central Colorado, adjacent to State Highway 50 between the cities of Gunnison and Montrose (Figure 1). Approximately 200,000 visitors annually have been recorded for BLCA (NPS CURE/BLCA 2004). The park provides educational opportunities for visitors, students, and scholars related to natural and cultural resources research. Recreational opportunities include hiking, camping, fishing, and rafting/kayaking the Gunnison River. Water flow in the Gunnison River is controlled by three dams, Blue Mesa, Morrow Point, and Crystal. Crystal Dam regulates the flow that passes through BLCA.

BLCA encompasses rugged mesa, canyon, and rim topography ranging in elevation from 1,645 m (5,400 ft) at the bottom of Black Canyon to 2,743 m (9,000 ft) atop Grizzly Ridge and Poison Spring Hill. Within the Park, the Gunnison River flows for approximately 22.5 km (14 miles); the total length of the Black Canyon is 85 km (53 mi). The Painted Wall represents the highest cliff in Colorado (NPS 2008) at approximately 685 m (2,250 ft).

BLCA is located in Gunnison and Montrose counties, CO, approximately 8 miles (13 km) east of the town of Montrose, and approximately 53 miles (85 km) west of the town of Gunnison, on the southeastern edge of the NCPN (Figure 1). BLCA is accessible via U.S. Highways 50 and 92. Gunnison is the county seat and has a population of 5,409, nearly 36% of the population of Gunnison County (15,147). Montrose is the county seat and has a population of 12,344, over a third of the population of Montrose County. Gunnison County has a low population density of four people per square mile and Montrose County has a moderate population density of 15 people per square mile. BLCA is bordered by private lands and public lands managed by the BLM and USFS (Figure 2). Adjoining the downstream or western boundary of BLCA is the BLM's Gunnison Gorge Conservation Area that covers approximately 233 km^2 (90 mi^2).

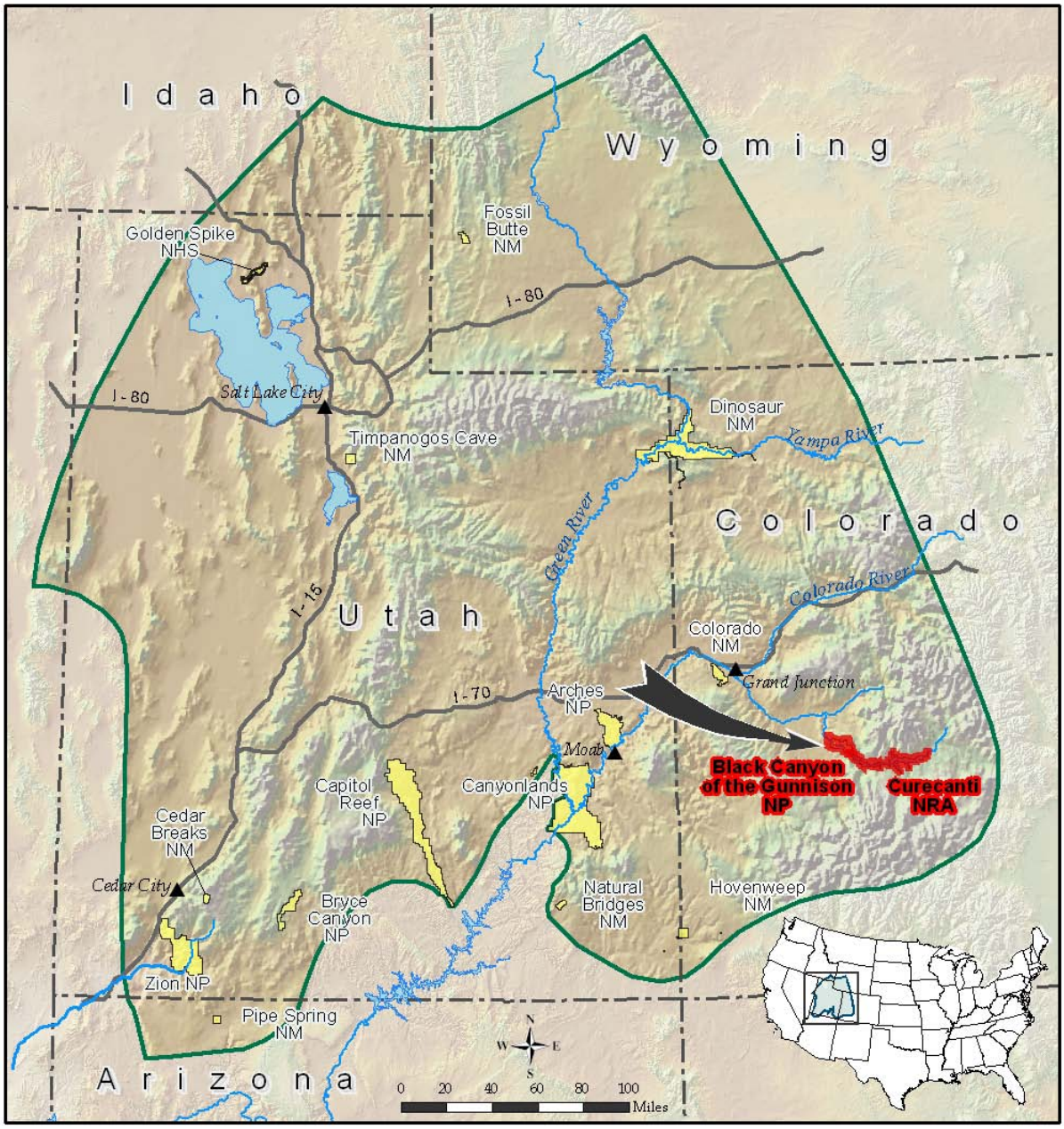


Figure 1. Location of BLCA on the Colorado Plateau.

The BLCA project mapping area includes the entire park, as well as adjacent environs consisting of 10,357 ha (25,593 acres) of adjacent BLM, USFS, and private lands for a total project area of 22,989 hectares (56,807 acres) (Figure 2).

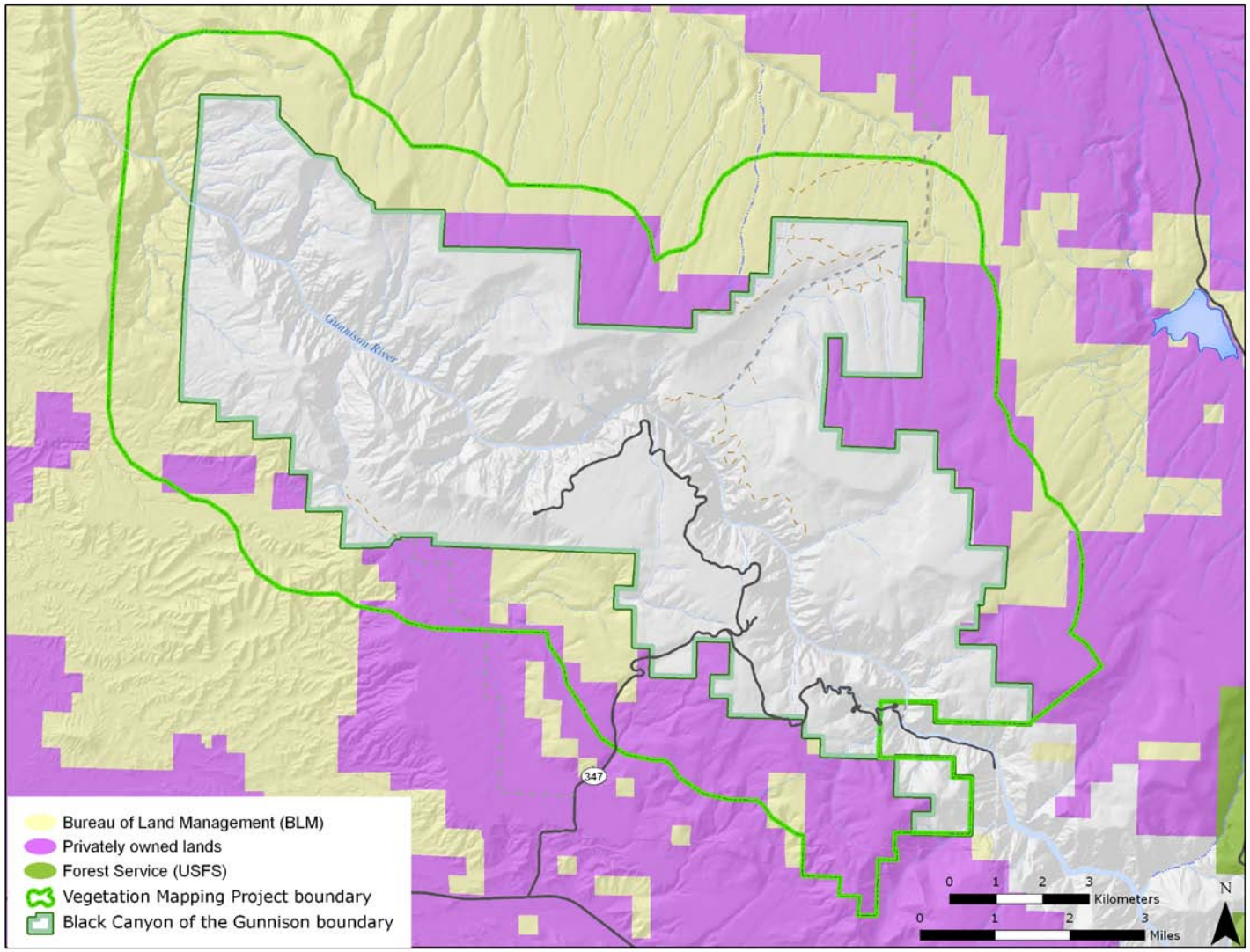


Figure 2. Map of the BLCA vegetation mapping project area boundary showing adjacent land ownership.

Topography and Geologic History

BLCA occupies the southwestern edge of the West Elk Mountains within the Canyon Lands Section of the Colorado Plateau physiographic province (Fenneman and Johnson 1946). The Colorado Plateau is a 33.5 million ha (130,000 mi^2) basin ringed by highlands and dissected by deep canyons. The West Elk Mountains are metamorphic and volcanic in origin, actively erupting approximately 30 million years ago.

The uplands of the western part of BLCA include Pleasant Park and the flank of Green Mountain on the North Rim, and Red Rocks and a small area of Bostwick Park on the South Rim. Grizzly Gulch drains the central portion of North Rim uplands. The eastern uplands on the north rim include portions of Mesa Inclinado, Grizzly Ridge, Poison Spring Hill, Poison Spring Ridge, and Deadhorse Mesa. The central and eastern portions of the South Rim are part of Vernal Mesa. The forces of wind and water erosion combined to carve sedimentary and metamorphic geological layers into their present topographic character and redistributed surficial deposits.



Photo Credit: NPS/Lisa Lynch

Figure 3. The Painted Wall of BLCA showing pegmatite intrusions.

Elevations within BLCA range from 1,996 m (6,547 ft) at the East Portal to 2,523 m (8,289 ft) at High Point on the South Rim and 8,563 feet (2,610 m) at the terminus of Vista Trail on the North Rim. Within BLCA, the Gunnison River loses elevation at an average of 96 feet (29 m) per mile. At Warner Point, the gorge is 2,722 feet (829 m) deep. The western BLCA boundary lies adjacent to the Gunnison Gorge Wilderness Area at approximately 6,000 feet (1,829 m) elevation on the uplands and approximately 5,400 feet (1,646 m) on the Gunnison River.

Climate

Records of climatic conditions have been maintained continuously since 1951 near the southwestern Park boundary at Cimarron, Colorado (Station 051609, Western Regional Climate Center 2008). BLCA is characterized by a semiarid climate, averaging 13.6 inches (34.5 cm) of precipitation annually. Precipitation is relatively evenly distributed throughout the year and takes the form of afternoon showers and thunderstorms from July through October (Figure 5). Total annual snowfall averages approximately 64 inches (162.6 cm) with December and January being the snowiest months.

Conditions within the Park can change significantly during a day and between seasons (Figure 4). Summers are long with hot days averaging 85.3 °F (29.6 °C) and cool nights averaging 43.8 °F (6.6 °C) in July. Hot days typically approach 90 °F (32.2 °C). The hottest temperature on record was 98 °F (36.7 °C) on July 30, 1963. Winters are cold with an average maximum temperature of 33.8 °F (1°C) and an average minimum temperature of 0.5 °F (-17.5 °C) occurring in January. The coldest temperature on record was -43° F (-41.7 °C) on January 13, 1963.

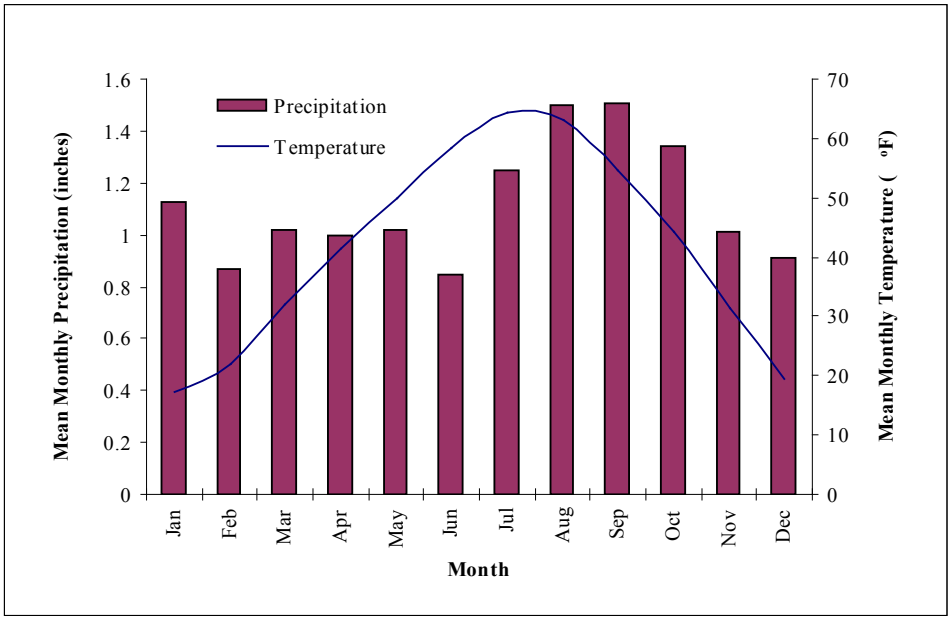


Figure 4. Mean monthly precipitation (in) and temperature (ºF) as recorded at Montrose, Colorado.



Figure 5. Summer thunderstorm at BLCA.

Geology and Vegetation

The primary reason for establishing BLCA was to protect the geologic exposures of the deep canyon and its associated rims and overlooks. The canyon is a narrow gorge cut by the Gunnison River through sedimentary strata and the underlying hard Precambrian gneiss and schist (Figure 7).

The Black Canyon of the Gunnison River is one of the steepest and narrowest canyons in the world (Hogan et al. 2009). Within BLCA there are 22.5 km (14 miles) of canyon exposed, approximately one-quarter of the entire 85 km-long (53 mile-long) Black Canyon. Prior to the damming of the Gunnison River, erosion through the Precambrian bedrock was estimated to occur at the rate of one inch per 100 years (NPS 2008). This high rate of basement rock erosion was due to the steepness of the canyon. The average descent of water through the canyon is 8 m/km (43 ft/mi) and at Chasm View reaches 45 m/km (240 ft/mi). Depths attained through erosion are 829 m (2,722 ft) at Warner Point, 561 m (1,840 ft) at Gunnison Point, and 555 m (1,820 ft) at Chasm View (NPS 2008).

The Gunnison River has exposed a wide range of rocks within the canyon, from the 1.7 billion year old gneiss and schist of the Precambrian Era to Mesozoic – Cenozoic fossiliferous sedimentary rocks, and modern unconsolidated sediments. Precambrian rocks are usually buried by younger sediments, but at BLCA these ancient rock layers are visible in what is considered to be one of the best exposures in the world. Lying on top of the Precambrian rocks are Mesozoic sedimentary strata. No intermediate Paleozoic sedimentary rocks exist within BLCA, indicating that approximately 370 million years of earth history are missing from the landscape.

The two major faults of Black Canyon-Curecanti area (Red Rocks and Cimarron) are Precambrian features reactivated during the Laramide Orogeny (Figure 6). The Red Rocks fault forms the escarpment south of High Point in Black Canyon, and continues beyond East Portal.

This fault is marked by a wide zone of intensely shattered rock, and its displacement is visible from Tomichi Point looking southeast upriver. The Cimarron fault is best exposed at the narrow gap of Blue Creek south of Halfway House, and the escarpment west of historic Cimarron town (Hansen 1965).

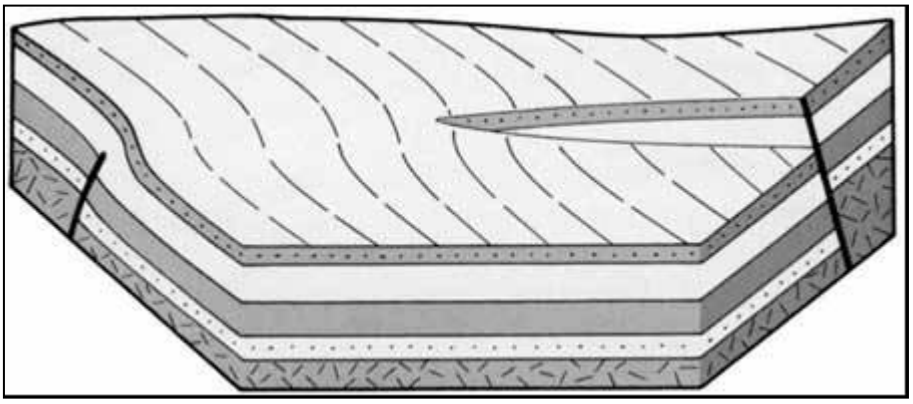


Figure 6. Block diagram showing lateral and vertical passage of a fault into a monocline as exemplified in the Black Canyon area (Hansen 1965).

Geologic processes that created the visible features within BLCA cover a period of nearly 1.7 billion years. From Laramide times to present, the uplifted rocks have been eroded and covered, then weathered and eroded into the mountain, plateau, and canyon landscape visible today. Almost all rock outcrops in BLCA are metamorphic or igneous in origin, although the rims and plateaus include sedimentary rocks ranging in age from middle Precambrian (about 1.7 billion years ago) to Cretaceous (about 25 to 10 million years ago) to more recent overlying surficial deposits.

BLCA lies within the Dry Domain on the edge between the Colorado Plateau Semidesert Province Tropical / Subtropical Steppe Division and Temperate Steppe Division – Mountain Provinces and supports vegetation broadly classified as montane, temperate, or semi-desert (Bailey 2001, Johnston et al. 2001). The area represents portions of the Upper and Middle Gunnison Basins and the landscapes are characterized by river valleys, hills, ridges, plateaus, mountains, and deep, steep-walled canyons (NPS 2006a). Woodlands and shrublands dominate the vegetation in addition to patches of grassland and sparsely vegetated badlands and rock outcrops. The distribution of vegetation is driven by elevation, substrate (geology and soils), aspect, hydrology, and fire. Environmental forces particularly water, carved the area's geologic layers into their present topographic character.

BLCA has been described as an area where ecoregional provinces converge and the element cold desert and Southern Rocky Mountain flora supports diverse native plant communities. Many plant species and several plant communities reach the edges of their range here. Moderate diversity of geologic substrates combines with extreme topographic variation to support plant communities that are sometimes transitional. The impressive river-formed canyon provides spectacular scenery, while the river and canyon system provide habitat for threatened and endangered species. Rapid elevation differences over short linear distances often result in widely varying climatic conditions and diverse plant communities occurring in close proximity.

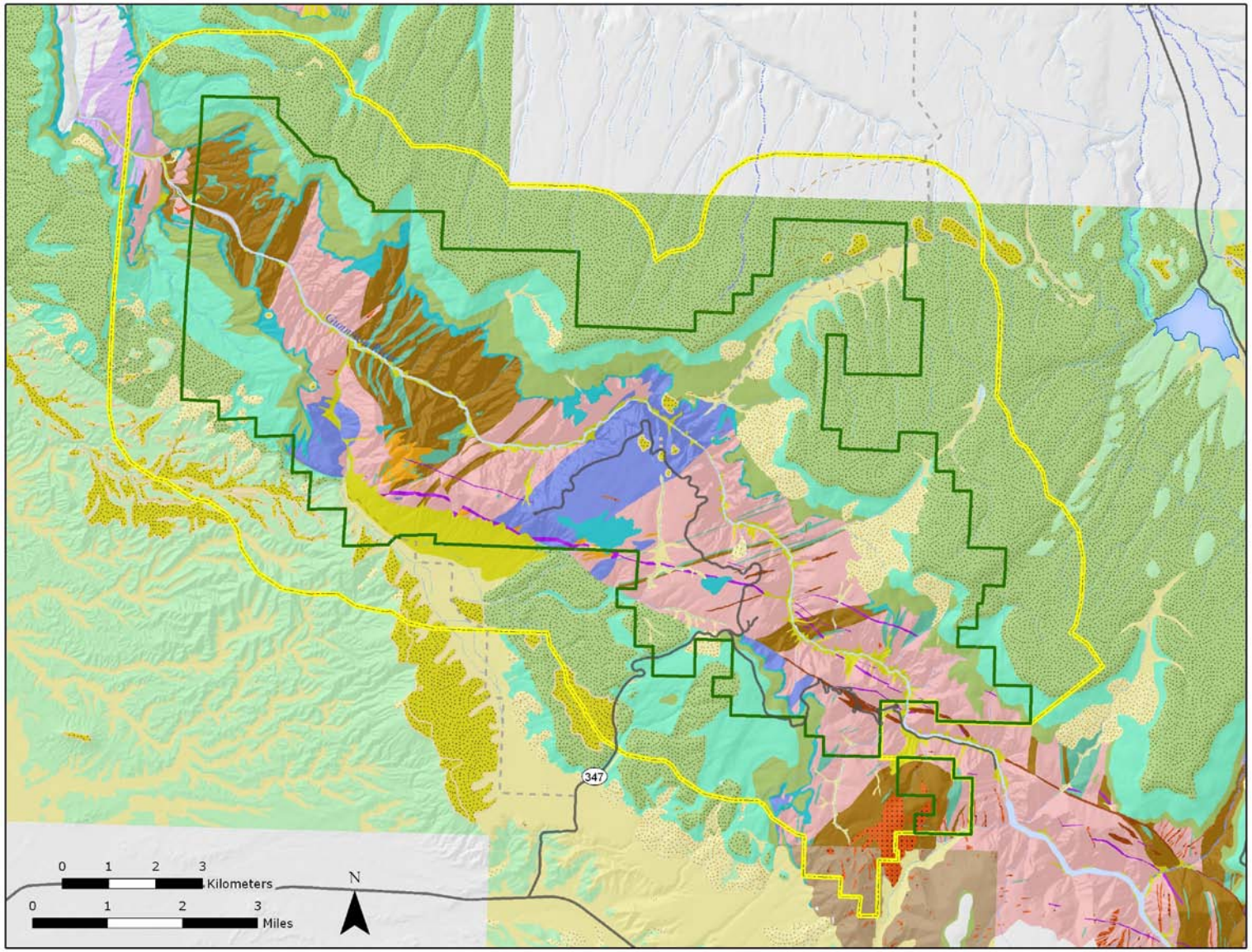


Figure 7a. Geology map of BLCA and vicinity.



Figure 7b. Legend for the BLCA geology map.

The remainder of this section is a summary of the general distribution of vegetation in relation to geology across the BLCA mapping area, organized from oldest to youngest rocks, and illustrated with photos taken by field crew members as part of the vegetation mapping effort. The following description of the geologic history of BLCA is derived from NPS (2008), Hansen (1965), and Taylor (1999).

Metamorphic Gneiss and Schist (Precambrian). These dark-gray (former sedimentary) strata were formed approximately 1.7 billion years ago and represent the oldest exposures within BLCA. The metamorphic and igneous basement rocks are exposed the length of the Park forming the canyon walls and rim edges. They include Vernal Mesa quartz syenite, quartz

monzonite or granite, amphibolite, migmatic gneiss, layered quartzitic gneiss, massive quartzitic gneiss, pegmatite, and mica schist. Precambrian exposures are typically devoid of vegetation and delineated as a geology map class. However, where there are rooting sites in bedrock cracks and broken areas on the canyon rims, open stands of Douglas-fir (*Pseudotsuga menziesii*), ponderosa pine (*Pinus ponderosa*), two-needle pinyon pine (*Pinus edulis*), Rocky Mountain juniper (*Juniperus scopulorum*), Utah juniper (*Juniperus osteosperma*), Gambel oak (*Quercus gambelii*), Utah serviceberry (*Amelanchier utahensis*), or rock spiraea (*Holodiscus dumosus*) may become established. Vegetation also occasionally occurs as hanging gardens on seeps in vertical cliffs above the riverbed, on steep rocky slopes of the upper canyon above the vertical canyon wall, and on the thin soils above the canyon rim (Figure 8).



Figure 8. Vertical cliffs and steep scree slopes of Metamorphic Gneiss and Schist.

Diabase Dikes (Jurassic). These narrow exposures of volcanic rock occur within the canyon, are typically devoid of vegetation, and delineated as a geology map class. When the tops of the diabase dikes are sufficiently broken, sparse shrubs such as rock spiraea may become established (Figure 9).



Figure 9. Small diabase dike in lower left corner of photo.

Entrada Sandstone (Middle Jurassic). These cross-bedded sandy layers were deposited approximately 150 million years ago. Entrada Sandstone is exposed as a long line of vertical cliffs on the North Rim and as caprock exposures near the South Rim on Vernal Mesa. Generally, this layer appears as a pink-to-yellow-gray aeolian sandstone. Entrada Sandstone exposures typically support woodlands of two-needle pinyon pine and Utah juniper, shrublands including littleleaf mountain mahogany (*Cercocarpus intricatus*), mountain mahogany (*Cercocarpus montanus*), green Mormon-tea (*Ephedra viridis*), Utah serviceberry, and snakeweed (*Gutierrezia sarothrae*), or grasslands characterized by muttongrass (*Poa fendleriana*) and Indian ricegrass (*Achnatherum hymenoides*), and the forb hairy golden-aster (*Heterotheca villosa*) (Figure 10).

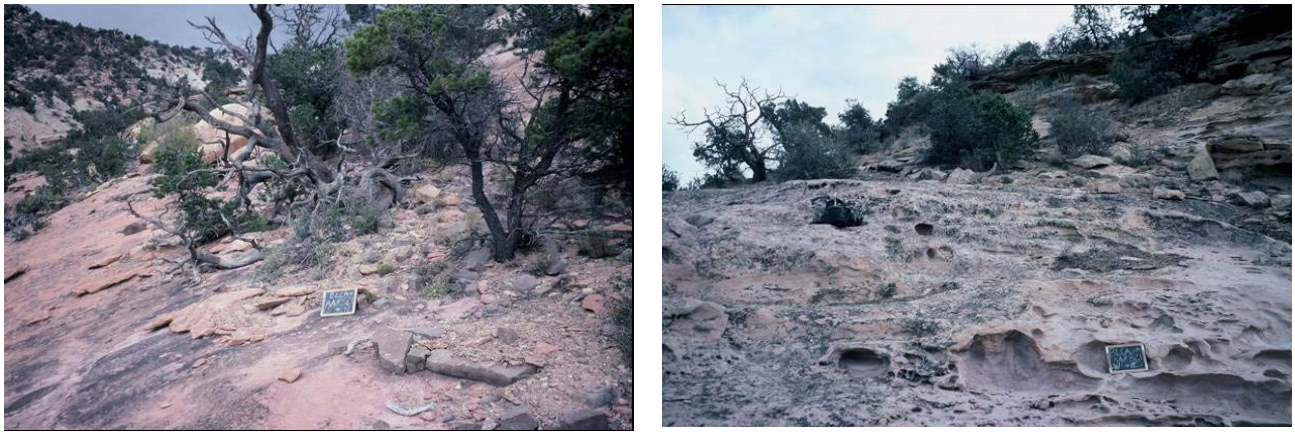


Figure 10. P-J on Entrada Sandstone.

Wanakah Formation (Middle Jurassic). These reddish siltstones were deposited approximately 150-145 million years ago. Wanakah Formation siltstone is exposed in broad, linear, slope-forming bands on both the North and South rims of the canyon comprising the lower edge of Vernal Mesa and Grizzly Ridge. Of marginal marine origin, this formation may be fossil-bearing with fish, ostracods, and trace fossils within its red siltstone, thin red and gray sandstone, and

thin red clay beds. Wanakah Formation exposures may be devoid of vegetation and delineated as a geology map class. Otherwise, they typically support woodlands of Douglas-fir, ponderosa pine, two-needle pinyon pine, and Utah juniper, shrublands including mountain mahogany, littleleaf mountain mahogany, green Mormon-tea, Utah serviceberry, western snowberry (*Symphoricarpos oreophilus*), and Gambel oak (*Quercus gambelii*), or grassland stands characterized by muttongrass and Indian ricegrass (Figure 11).



Figure 11. Pinyon-juniper communities on Wanakah Formation.

Morrison Formation (Upper Jurassic). Deposited about 145 million years ago, the Morrison Formation is exposed on Vernal Mesa and along Grizzly Gulch as low ridges. It is a layer of sediments laid down as alluvium deposited by streams and rivers. Generally, this layer can be described as multi-colored mudstone and siltstone with bentonite, sandstone, and conglomerate that may contain dinosaur fossils. Morrison Formation exposures typically support sparse badlands shrubland communities characterized by mat saltbush (*Atriplex corrugata*), Gardner saltbush (*Atriplex gardneri*), shadscale (*Atriplex confertifolia*), Wyoming big sagebrush (*Artemisia tridentata* ssp. *wyomingensis*), spiny sagebrush (*Picrothamnus desertorum*). Less common are communities dominated by the grasses Salina wildrye (*Leymus salinus*), Indian ricegrass, James' galleta (*Pleuraphis jamesii*), muttongrass, needle-and-thread (*Hesperostipa comata*), and cheatgrass (*Bromus tectorum*), and the forb hairy golden-aster (Figure 12).



Figure 12. Greasewood shrublands and sparse vegetation on Morrison Formation.

Dakota Sandstone and Burro Canyon Formation (Lower Cretaceous). These deposits represent shoreline beach and river deposits laid down approximately 110-100 million years ago. This formation typically outcrops as a resistant light-colored layer atop Vernal Mesa and Grizzly Ridge. Generally, this layer can be described as hard, gray, fissile, siliceous shale, sandstones, gray to maroon mudstones, and some limestones. Dakota Sandstone exposures may support two-needle pinyon pine and Utah juniper woodlands, or shrublands of Gambel oak, Utah serviceberry, mountain big sagebrush (*Artemisia tridentata* ssp. *vaseyana*), or western snowberry shrublands (Figure 13). Some sites support needle-and-thread grasslands.



Figure 13. Pinyon-juniper and sagebrush-serviceberry communities on Dakota Sandstone and Burro Canyon Formation.

Mancos Shale (Upper Cretaceous). This formation was deposited approximately 100 to 80 million years ago and is exposed in the southwestern portion of BLCA, west of Vernal Mesa. It forms sparsely vegetated badlands, low slopes, and hummocky valley bottoms. Exposure can be described as dark gray, silty-to-clayey, marine shale weathering a light gray to light yellow. The formation features minor siltstone and sandstone in the upper portion, with layered bentonite and some limestone beds in the lower portion, and is locally fossiliferous. Mancos Shale exposures may be devoid of vegetation and delineated as a geology map class. When vegetated they typically support sparse Utah juniper woodlands or shrublands including Wyoming big sagebrush, shadscale, Gardner saltbush, mat saltbush, spiny greasebush (*Glossopetalon spinescens* var. *meionandrum*), and spiny sagebrush. Grasses may include Salina wildrye, bluebunch wheatgrass (*Pseudoroegneria spicata*), needle-and-thread, thickspike wheatgrass (*Elymus lanceolatus*), James' galleta, squirreltail (*Elymus elymoides*), and the annual nonnative cheatgrass, along with the nonnative annual forbs tansy mustard (*Descurainia* spp.), desert madwort (*Alyssum desertorum*), Russian-thistle (*Salsola tragus*), or halogeton (*Halogeton glomeratus*) (Figure 14).



Figure 14. Mat saltbush shrublands on Mancos Shale.

Surficial Deposits (Pleistocene and Holocene). Relatively common on the mesas and ridges of the North and South rims, in Grizzly Gulch, and in the bottom of Black Canyon of the Gunnison, surficial deposits date from approximately one-million years ago to the present. The processes of weathering, erosion, and sedimentation are largely responsible for the formation of soil, aeolian sands and loess, new alluvium, talus, colluvium, and landslide deposits. Surficial deposits may be devoid of vegetation and delineated as rock slides, channel bottoms, erosion fans, barrens, open water, or as a variety of vegetated map classes (Figure 15).

Colluvial deposits are common within BLCA and consist of fragments of several geologic strata. These deposits typically provide habitat for the establishment of woodlands, shrublands, and herbaceous communities. Mesic colluvial deposits may support quaking aspen (*Populus tremuloides*) or Douglas-fir forest and woodland stands or mesic shrubs such as chokecherry (*Prunus virginiana*), serviceberry (*Amelanchier alnifolia*), Woods' rose (*Rosa woodsii*), threeleaf sumac (*Rhus trilobata*), Gambel oak, common juniper (*Juniperus communis*), and Oregon-grape (*Mahonia repens*). Drier colluvial sites typically support woodlands characterized by two-needle pinyon pine and Utah juniper, shrubs such as green Mormon-tea, Utah serviceberry, mountain mahogany, mountain big sagebrush, Wyoming big sagebrush, and snakeweed, and graminoid species such as muttongrass, Indian ricegrass, needle-and-thread, and cheatgrass. In the Black Canyon, colluvium supports shrublands characterized by rock spiraea, Utah serviceberry, green Mormon-tea, viscid rabbitbrush (*Chrysothamnus viscidiflorus*), Wyoming big sagebrush, and winterfat.

Moderate to gentle slopes below active rockfall and colluvial zones or swales on gentle slopes support woodlands characterized by two-needle pinyon pine and Utah juniper or shrublands dominated by mountain big sagebrush, Wyoming big sagebrush, and western snowberry whose understories that often include a diversity of grasses and forbs such as western wheatgrass (*Pascopyrum smithii*), Kentucky bluegrass (*Poa pratensis*), Letterman needlegrass (*Acnatherum lettermanii*), needle-and-thread, bluebunch wheatgrass, Junegrass (*Koeleria macrantha*), Sandberg bluegrass (*Poa secunda*), muttongrass, squirreltail, silvery lupine (*Lupinus argenteus*), mule's ears (*Balsamorhiza sagittata*), and sulphur-flower buckwheat (*Eriogonum umbellatum*).

Valley fill as occurs along Grizzly Gulch and alluvial basins including Bostwick Park. This substrate typically develops deep, relatively fine-textured soils supporting shrublands of

mountain big sagebrush, Wyoming big sagebrush, four-wing saltbush (*Atriplex canescens*), horsebrush (*Tetradymia canescens*), snakeweed, prickly pear cactus (*Opuntia polyacantha*), and brittle pricklypear (*Opuntia fragilis*). In the absence of fire, these shrublands may be invaded by Utah juniper trees. Fill and basin plant communities frequently include an understory of Indian ricegrass, needle-and-thread, muttongrass, and cheatgrass.

Above the canyon rims channels, swales, and intermittent drainages support woodlands of two-needle pinyon pine, Utah juniper, or Gambel oak. Less often, shrublands characterized by basin big sagebrush (*Artemisia tridentata* ssp. *tridentata*), mountain big sagebrush, Wyoming big sagebrush, black greasewood (*Sarcobatus vermiculatus*), or rubber rabbitbrush, and grasslands dominated by needle-and-thread or basin wildrye (*Leymus cinereus*) occupy more mesic sites. Dry gravelly washes typically support rubber rabbitbrush, viscid rabbitbrush, basin big sagebrush, or green Mormon-tea. Alkaline or saline flats typically support black greasewood, Gardner saltbush, and halogeton.

Point bars, lower terraces, and river banks sometimes support mesic shrublands of young narrowleaf cottonwood (*Populus angustifolia*), narrowleaf willow (*Salix exigua*), or redosier dogwood (*Cornus sericea*) or grass or grass-like stands characterized by reed canarygrass (*Phalaris arundinacea*), scouring-rush (*Equisetum* spp.), and Baltic rush (*Juncus balticus*) (Figure 15). Riparian plant communities occur in the narrow canyon of the Gunnison River, in tributary canyons, and in association with perennial seeps and springs. Flooding is so frequent and severe in side drainages that complex riparian communities rarely have the chance to develop. Riparian plant species common to BLCA include narrowleaf cottonwood, Rocky Mountain juniper, boxelder (*Acer negundo*), river birch (*Betula occidentalis*), narrowleaf willow, chokecherry, redosier dogwood, rubber rabbitbrush, black greasewood, western wheatgrass, basin wildrye, saltgrass (*Distichlis spicata*), reed canarygrass, scouring-rush (*Equisetum* spp.), Baltic rush, spike rush (*Eleocharis palustris*), and species of sedge. As a result of adjacent agricultural activity and the history of livestock grazing, the banks of Red Rock Creek typically support solid stands of introduced pasture grasses, particularly reed canarygrass and orchard grass (*Dactylis glomerata*). Seeps occasionally provide hanging garden habitat for the *Aquilegia micrantha – Calamagrostis scopulorum* (Mancos Columbine – Ditch Reedgrass) Herbaceous Vegetation association. Seeps emerging from cliff faces also deposit dissolved salts as the water evaporates, staining the surface white.





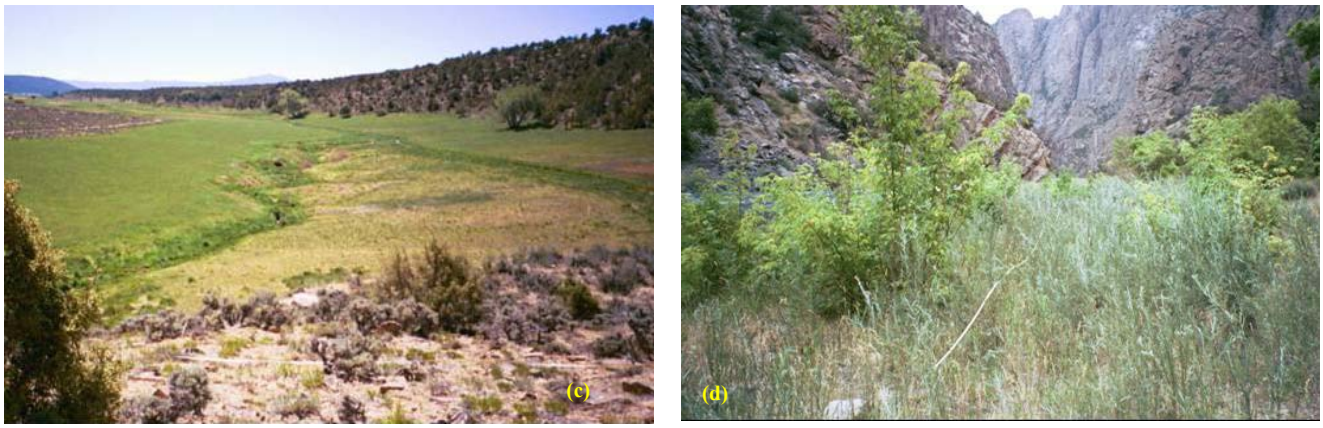


Figure 15. Pinyon-juniper woodlands on landslide deposits (a) and (b). Upland alluvial valley fill (c) and new alluvium on a Gunnison River terrace (d).

Soils

In areas of similar climate and topography, differences in vegetation cover and composition are closely related to soils. Soil series or other soil units are incompletely described for the Park but they vary widely in erodibility and productivity depending on topographic position, parent material, local hydrology, slope, and other factors influencing soil formation processes (NRCS 1975). Soils were formed by weathering of exposed formations (e.g. Entrada Sandstone, Wanakah Formation, Morrison Formation, Dakota Sandstone, Burro Canyon Formation, Mancos Shale, etc.) or by wind or flowing water. Soil texture consists primarily of variations of loam and sand, although heavier soils occur on slope depressions of mountains. Gravels are present in river wash associated with streambeds, gulches, and floodplains. Soil associations have been developed for the BLCA/CURE area (NRCS 1967, NRCS1975), and these are listed and briefly described in Table 2.

Generally formed from shale, limestone, and sandstone, badlands and rock outcrops have little or no soil development. Shallow soils (< 50 cm or 20 inches) occur throughout BLCA on canyon slopes, hill slopes, mountains, mesas, and plateaus underlain by shale, limestone, and sandstone bedrock. Moderately deep to deep soils (>50 cm or 20 inches) are found on alluvial fans, basins, valley alluvium, and some areas of residual upland plains.

Table 2. Soil associations developed for the BLCA/CURE area.

Soil Association	Description
Evanston-Gas Creek-Irim	Deep, nearly level to strongly sloping, well-drained, somewhat poorly drained, and poorly drained loams and sandy loams on flood plains, terraces, and alluvial fans
Billings-Christianburg	Deep, nearly level and gently sloping, fine textured and moderately fine textured soils on alluvial fans, flood plains, and terraces
Chipeta-Persayo	Shallow, nearly level, gently sloping, and hilly, fine textured and moderately fine textured soils derived from shale
Vulcan-Wetterhorn-Ruby	Deep and moderately deep, moderately sloping to steep, well-drained gravelly sandy loams and stony loams on mountains, ridges, and mesas
Rock outcrop-Travesilla	Bare rock outcrop and shallow, rolling to steep, moderately coarse textured soils on hills, ridges, and sides of mesas

Hydrology and Water Resources

BLCA is rich in hydrologic resources including the Gunnison River, perennial and intermittent streams, and seeps and springs. The modern Gunnison River established its present course between 10 and 15 million years ago following the last eruptions of the West Elk and San Juan volcanic fields (NPS 2008). The river began downcutting through the Precambrian basement rocks of the Gunnison Uplift approximately two million years ago. It drains approximately 20,533 km^2 (7,928 mi^2) and flows northwest approximately 290 km (180 mi) to its confluence with the Colorado River near Grand Junction, Colorado. Below the dams the Gunnison River average flow is 2,570 ft^3/s (73 m^3/s) with maximum flows of 35,200 ft^3/s (947m^3/s) and minimum flows of 106 ft^3/s (3m^3/s).

The Gunnison River forms the core of management interest within BLCA (Figure 16). Its hydrology has been heavily modified because it is part of the Colorado River Project. Blue Mesa (completed 1965), Morrow Point (completed 1967), and Crystal (completed 1976) dams comprise the Aspinall Unit operated by the U.S. Bureau of Reclamation (NPS 2006b). The Gunnison River flows into BLCA below the East Portal of the Gunnison Tunnel located in adjacent CURE downstream from Crystal Dam. The Gunnison Tunnel was constructed between 1905 and 1909; water diverted into this structure is used to irrigate crops in the Uncompahgre Valley.



Photo credit: USU Weed survey crew

Figure 16. The Gunnison River in Black Canyon.

Water flowing from BLCA's uplands reaches the Gunnison River via perennial and intermittent drainages. Surface flows occur as a result of snowmelt and increase during and following precipitation events. Debris lines and channel scour indicate that intense flash flooding can occur. Flash floods can result in removal of some vegetation, redepositing boulders and sediments, drainage incision, and burying canyon floor vegetation under sediments, rock, and

debris. The timing and magnitude of flows and water quality, particularly sediment loading, have been markedly altered by dam operations. The major perennial tributary stream is Red Rock Creek, which flows into the southwestern corner of the Park. This creek is somewhat entrenched and flows are enhanced by irrigation return water in the spring and summer months.

The Park also contains limited water resources in the form of intermittent streams, plunge pools, intermittently filled bedrock potholes (tinajas), seeps, and springs. Intermittent streams in side canyons may support stands of riparian and wetland vegetation, especially below bedrock pour-offs where plunge-pools form. Tinajas develop in solution pits formed in level exposures of sandstone and limestone. Seeps and springs provide sufficient water for localized surface flows in canyon heads and moist to saturated soils where they emerge from bedding planes and joints in sandstone cliffs.

Biological Soil Crusts

Biological soil crusts are present on sites within BLCA that historically received little disturbance (Figure 17). Biological soil crusts are a complex mosaic of cyanobacteria, green algae, lichens, mosses, microfungi, and other bacteria (Belnap et al. 2001). The cyanobacteria and microfungi have filaments that weave through the top few millimeters of soil, creating a matrix that stabilizes and protects soil surfaces from erosive forces. The crusts reduce wind and water erosion, fix atmospheric nitrogen and contribute to soil organic matter (Eldridge and Green 1994 in Belnap et al. 2001). The biological soil crusts also function as living mulch that retains soil moisture and discourages growth of annual exotic plant species such as cheatgrass (Belnap et al. 2001). Biological soil crusts at BLCA occupy the nutrient-poor openings between tree canopies and clumps of vascular plants and also hold thin soils over bedrock.



Photo Credit: NPS

Figure 17. Example of well-developed biological soil crusts on the Colorado Plateau (a) and in BLCA (b).

Land Use and Settlement History

The current uses of BLCA are recreational, ranging from sight-seeing and landscape photography to rock climbing and kayaking. Campgrounds are located near Jones Summit on the South Rim, near the South Rim Ranger Station, on Mesa Inclinado on the North Rim, and at the East Portal in adjacent CURE. Hiking trails have been established in a few areas of BLCA, including portions of the inner canyon. Scenic drives and overlooks are popular on both rims and whitewater kayaking occurs on the Gunnison River.

The exact length of human occupation and use in the region is unknown, however, some findings suggest the presence of Paleo-Indians in the area ten to twelve thousand years ago (Barrell 1969). Prehistorically and historically, the region was important to members of the Ute Tribes. The Utes were historically a hunter-gatherer culture and made seasonal use of most of the BLCA region. Spanish explorers passed through the area in 1765 (Juan Rivera) and in 1776 (Fathers Dominguez and Escalante). Anglo-American exploration began during the 1850s. Captain John Gunnison described the Gunnison River and the Black Canyon in 1853 while seeking a transcontinental railroad route. Captain Gunnison considered the 53-mile-long canyon to be impassable, however in later years (1882-1940) a 15-mile long route was established in the Black Canyon between Sapinero and Cimarron.

Treaties between the Ute Tribe and the U.S. government ultimately relocated the Utes to a reservation in northeastern Utah by 1882, opening the Black Canyon area to Anglo-American settlements. The town of Montrose, Colorado was incorporated that same year. Another settlement of the early 1880s was Cimarron, located in the southwestern corner of the Park, which was a center of gold and silver prospecting and mining during its early years. Sheep and cattle ranching, some farming for oats, potatoes, and hay, establishment of railroads to move agricultural and natural resource products, and construction of businesses to provide support were subsequently established in the region. The village of Cimarron and the Park currently retain remnants of the railroad, homesteading, and ranching history.

Accessible lands within BLCA have been grazed for over a century; ranching began on a moderate to large scale in the 1880s and the area was used by livestock through present. In 1884, Montrose County tallied 9,202 head of sheep and 4,867 head of cattle, and in the 1930s approximately 250,000 head of sheep were estimated to be grazing in the BLCA region (Jones et al. 2007). Shrublands of Gambel oak and vast areas of sagebrush have been seen largely as impediments to more productive land uses and the arid badlands of alkaline clay hills are widely viewed as wastelands that cannot be irrigated and made to produce forage. Yet these communities frequently harbor rare and endemic plants or provide crucial habitat for the region's wildlife (Barrell 1969, Johnston et al. 2001). Grazing has occurred at BLCA since its establishment in 1933. When park boundaries were expanded in 1984 and 1999, grazing was authorized on portions of those specific Park land (U.S Public Law 98-357, Section 3(c) in 1984 and P.L 106-76, Section 4(e) in 1989).

With settlement came suppression of naturally ignited fires, beginning in the 1940s. The combination of fire suppression and repeated spring and summer grazing pressure has contributed to near type-conversions of perennial sagebrush grasslands to monotypic and decadent mountain and Wyoming big sagebrush stands with invasive annual understories on the Colorado Plateau (Petersburg 2004). Human activities on the BLCA landscape over the past century have resulted in changes in the distribution and abundance of native vegetation and have contributed to invasions of native and nonnative plant species. In particular, livestock grazing and fire suppression have increased the frequency of big sagebrush species, rabbitbrush species, two-needle pinyon pine, Utah juniper, and cheatgrass and decreased the abundance of native grasses.

Fire suppression has also resulted in the increase and resulting encroachment of Utah juniper at lower elevations and may account for loss of some range of habitat for mountain and Wyoming

big sagebrush (Petersburg 2004). Pre-settlement lightning-ignited fires were estimated to return to this portion of the northern Colorado Plateau at 10-70 year intervals in big sagebrush / mixed grassland types and <35 years in two-needle pinyon pine – juniper stands (Petersburg 2004). Regular fire intervals prevented two-needle pinyon pine and Utah juniper from encroaching into the big sagebrush / mixed grassland habitat. Current fire management practices are designed to restore a more natural fire regime through use of prescribed fire and associated fire effects monitoring.

Previous Vegetation Studies

BLCA supports semiarid woodland, shrubland, and herbaceous vegetation within mountain and plateau topography deeply dissected by the Black and Red Rocks canyons. The juxtaposition of topography, geology, soils, hydrology and disturbance history results in a greater diversity of plant communities and species here than might be otherwise expected for an area of this size and elevation range. The vascular flora of BLCA includes 532 taxa that have been confirmed or reliably reported as occurring in the park (Hogan et al. 2009).

Hogan et al. (2009) wrote a thorough review of floristic and vegetation studies at BLCA, which are summarized here. The history of plant collection in the vicinity of BLCA began with visits by pioneer botanists C. A. Purpus in 1892 followed by E. B. Payon in 1917. A more systematic effort resulting in the first significant plant collections for the park occurred between 1959-1963 by W. D. Wetlaufer, W. A. Weber, Pat and Carol Miller, and J. M. Rominger (Hogan 2006). These studies raised the number of plant taxa known from within the park to 152. In 1983, William A. Weber resumed his research of the flora of Black Canyon in collaboration with Hans Beck, Don Kennedy, and Claudia Rector. These taxonomic works documented 64 families, 198 genera, and 347 species within BLCA (Weber 1983).Most species added to the park list since 1983 came from NCPN vegetation mapping efforts (2002) and focused inventories of exotic weeds (Dewey and Anderson 2005). The NCPN initiated a floristic study of BLCA with University of Colorado plant taxonomists in 2002, which was conducted in 2004 by Tim Hogan, Nan Lederer, Dina Clark, and Luke Tembrock (Hogan et al. 2005). An updated and verified vascular plant list for the Park resulted from this effort and was used for this report (Hogan et al. 2009).

Vegetation plots (262 total) were located and sampled on BLCA and CURE between the years 1993 through 1997 and evaluated by NatureServe classification ecologists for this project (Von Loh et al. 2002). These plots were recorded on Colorado Plateau Vegetation Advisory Committee (CPVAC) Vegetation Record forms and were variable in size ranging from approximately 30 m^2 to 4.0 ha. The CPVAC was formed to standardize a Colorado Plateau vegetation classification approach in relation to automated, GIS database requirements (Deshler 1993). A handbook entitled Colorado Plateau Vegetation Advisory Committee Delineation Manual (1992) was prepared to explain the methods and techniques for vegetation sampling. This handbook is based on the Brown, Lowe, and Pase (1979) vegetation classification system of climax plant dominants.

Exotic Plant Management

Presently, 73 of the 532 plant species (13.7%) known to occur within BLCA are non-native, and nineteen are considered noxious weeds by the State of Colorado (Hogan et al. 2009) (Figure 18). Some non-native species were imported accidentally by livestock, maintenance and construction

activities, and visitors. Other species were intentionally introduced for food (chicory (*Cichorium intybus*), burdock (*Arctium minus*)), forage (reed canarygrass), smooth brome (*Bromus inermis*), orchard grass), or bank/soil stabilization (crested wheatgrass (*Agropyron cristatum*), intermediate wheatgrass (*Thinopyrum intermedium*), yellow sweetclover (*Melilotus officianalis*)). Early settlers to the area arrived in the mid 1800s and established homesteads and ranches, introducing some of the first non-native plants to the area for livestock forage and food. More recently, development of roads, campgrounds, trails, picnic areas, visitor centers, etc. to accommodate increased visitation since the 1960s contributed to the establishment of non-native species.

Although no Exotic Plant Management Plan now exists for the park, BLCA manages for invasive species because of three concerns: (1) effects to native plant communities and the wildlife that use them; (2) effects to natural river processes and aquatic and riparian resources; and (3) concerns for downriver agricultural producers regarding increased invasions of nonnative forbs and grasses into irrigated pastures and other farmland. During the past decade, resource management staff at BLCA have mapped populations of and controlled via mechanical, manual, and chemical methods the non-native riparian shrubs tamarisk or salt-cedar, along with about 20 other non-native plant species throughout the Park (Bockus 2010).



Photo Credit: USU Weed Survey Crew

Figure 18. Three species of knapweed (*Centaurea* spp.) are listed as noxious weeds in BLCA.

Project Overview

General Approach and Timeline

The goals of this project were to inventory, describe, and map the existing vegetation at Black Canyon of the Gunnison National Park and its environs. The BLCA project is part of a larger effort undertaken by the NCPN to classify and map vegetation in all network parks. In order to facilitate coordination among network mapping projects, the NCPN developed standardized databases, mapping conventions, reporting standards, and naming conventions.

The NCPN vegetation classification and mapping program was launched in July 2001 at a scoping meeting among network park staff, NCPN staff, and potential project cooperators. Following this meeting, NCPN prepared a multi-year, multi-park project proposal to the USGS/NPS Vegetation Characterization Program to cost-share network I&M funding with the National Vegetation Characterization Program funding to complete vegetation maps for all network parks (Evenden 2001). Meetings to determine the BLCA project boundary, biophysical model parameters, supplemental fuels data, and park special mapping units were held in the spring of 2002. Table 3 is a timeline for the completion of major project components.

NCPN negotiated interagency agreements with the USDA Aerial Photography Field Office and the USDI Bureau of Reclamation Remote Sensing and Geographic Information Group to acquire aerial photography and digital orthophotography for each large park, including BLCA. Stereo aerial photography for BLCA was aquired during June 2002 overflight; orthophotography processing was complete in July 2003.

Table 3. Timeline for BLCA vegetation mapping project tasks.

TASK DESCRIPTION	2001	2002	2003	2004	2005	2006-2007	2008-10
Planning and Scoping	■	■					
Acquire Aerial Imagery	■	■					
Field Data Collection	■	■	■	■			
Photo Interpretation			■	■			
Vegetation Classification			■	■	■	■	
Local & Global Descriptions					■	■	■
Spatial Database			■	■	■	■	
Field Key to Plant Associations					■		■
Accuracy Assessment				■	■		
Final Report and Products							■

Vegetation plot and observation point data were collected by BLCA/CURE ecologists from 2001-2004, NCPN ecologists in 2003, and supplemented by e^2M ecologists in 2002. The field

sampling strategy was developed by the the BLCA ecologist, Ginger Bradshaw, guided by a gradsect polygon or biophysical unit coverage prepared by Michael Schindel of NatureServe. Vegetation plot data were entered into a MS Access database developed for the project and were analyzed during the fall of 2003. Analysis indicated that some vegetation types and sections of the Park were undersampled, prompting additional targeted vegetation sampling during the 2004 field season. These targeted field observations were tailored to meet the needs of photo-interpreters and they were less detailed than were plot or observation point data. These data were not entered into the plot database but typically were used to produce narrative descriptions of plant communities for the photo-interpreter. These data were also used to refine the final classification. All the data were analyzed by ecologists contracted by e^2M, who prepared local plant association descriptions based on preliminary vegetation classification during 2003 and 2004 and final local descriptions during 2004 following standardization of the process by NCPN, with minor revisions through 2010. Global plant association descriptions were completed by NatureServe ecologists in 2005. An illustrated field key to BLCA plant associations was developed by e^2M and NatureServe prior to map accuracy assessment (AA) for BLCA in 2004 and field tested during the initial stages of the AA.

Aerial photointerpretation (PI) and digital database development for the BLCA vegetation map was completed by the PI consultant and SEUG GIS Specialist during the fall and winter of 2003, and spring of 2004. The PI consultant met with BLCA ecologists during the 2003 and 2004 field season to conduct a reconnaissance of the mapping area, collect observation notes, and develop a general understanding of vegetation patterns at BLCA. Map classes were defined for the project. A traditional PI/transfer/attribute mapping approach was employed by SEUG, supported by head's-up interpretation on the computer screen. Polygon attribution followed standards developed by NCPN for all park mapping projects (Evenden 2004). A guide to the map classes was drafted in 2004 and revised in 2006 and 2008.

A draft map and spatial database were completed for BLCA in early summer 2004. Accuracy assessment (AA) data collection was completed by e^2M ecologists during the late summer months of 2004 for BLCA. AA data were entered into the BLCA project database and then analyzed, with results tabulated into a contingency matrix. An AA meeting was held at Colorado National Monument with project cooperators from NPS, NatureServe, and e^2M in March 2005 for BLCA to determine which map classes should be retained and which should be combined because they failed to meet the 80% accuracy standard. Final revisions were made to the vegetation classification, map, and spatial database during early 2010.

Primary Partners and Project Roles

Many individuals working for several agencies and organizations were involved in completing the BLCA Vegetation Mapping Project. The roles of each contributor are described below.

engineering-environmental Management, Inc.

- *Jim Von Loh, Senior Biologist* – prepared project work plan, helped prepare agendas and compile minutes for project meetings, managed AA field data collection, collected plot, observation point, and AA data, wrote draft field key and draft association local descriptions, contributed to final report
- *Travis Belote, Arne Buechling, Staff Ecologists* – collected and entered AA data
- *Dan Niosi, Staff Ecologist* – assisted with work plan development, production, and project meeting minutes, collected plot and observation point data

- *Paul Block, Ecologist* – collected AA data
- *Dr. Sharon Anderson* – assisted with work plan development, collected plot and observation point data
- *Jack Doria, Database Programmer* – developed the plots MS Access database
- *Frank (Buddy) Smith, Consulting Botanist* – collected plot, observation point, and AA data
- *Wanda Lafferty, Techincal Editor* – assisted with preparing and editing the workplan
- *Gerald Manis, Consulting GIS Specialist* – photointerpretation and attribution of map classes as a subcontractor selected by NPS

Colorado Natural Heritage Program

- *Karin Decker, Ecologist* – editor of the final report

National Park Service, Northern Colorado Plateau Network

- *Angie Evenden, Ph.D., Vegetation Program Manager* – overall project coordination and management, set NCPN project standards, organized project meetings, managed budgets, agreements and contracts
- *Janet Coles, Vegetation Ecologist* – editor and co-author of the final report; coordinated creation of final products
- *Amy Tendick, Biological Technician* – editor and co-author of the final report; coordinated creation of final products; assisted with photointerpretation and edits to the attribution of map classes
- *Margaret Beer, Data Manager* – project database development
- *Helen Thomas* – project database support, photo database development
- *Russ Den Bleyker* – project database support and QC
- *Bruce Condie, Sarah Topp, Biological Technicians* – collected plot and observation point data
- *Gery Wakefield, GIS Team Leader* – provided project boundary coverage, scanned and transferred PI work to a digital database, annotated polygons, assisted with final report, database,
- *Aneth Wight, GIS Technician* – produced geodatabase; plots database support, project metadata

National Park Service, Black Canyon of the Gunnison National Park

- *Ken Stahlnecker, Chief of Resources* – managed project ecologist and vegetation sampling team and reviewed draft report
- *Danguole Bockus, Ecologist* – managed project ecologist and vegetation sampling team, provided logistical support, and reviewed draft report
- *Sarah Beetch, GIS Specialist* – provided GIS support
- *Ginger Bradshaw, Ecologist* – directed the field sampling program, provided classification plot data collection, data entry, QA/QC, reviewed draft local descriptions, reviewed the field key to plant associations, provided draft report information
- *J. Blum, J. Divens, M. Hart, D. Hedesh, J. Miller, D. Osborn, S. Ragusa, M. Rice, T. Ritz, T. Root, M. Sawyer, D. Smith, K. Truax, Biological Technicians* – collected plot and observation point data, completed data entry and preliminary QC

U.S. Department of Agriculture Aerial Photography Field Office

- *Cindy Sessions, Contracting Officer* – procured aerial photography (9" x 9" stereo coverage)
- *Mark Cox, Photography Specialist* – provided QA/QC of photography, developed photo index

USDI Bureau of Reclamation Remote Sensing and Geographic Information Group

- *Alan Bell, Photography Specialist* – provided aerial photo contract specifications, subcontracted with Horizons, Inc. for aerial photography and production of color DOQQs for project area, provided QA/QC of orthoimagery
- *Janet Coles, Ecologist* – prepared preliminary photointerpretation, trained NPS ecologists in plot

sampling and photointerpretation techniques
- *Dan Cogan, Ecologist, GIS Manager* – provided preliminary photointerpretation and PI instruction
- *Kathy Fenton, GIS Manager* – prepared preliminary photointerpretation

U.S. Geological Survey Rocky Mountain Geographic Mapping Center
- *Tom Owens, Photography Specialist* – analyzed aerial photography, PI training, reviewed legacy data

NatureServe
- *Marion Reid, Senior Regional Ecologist* – project manager, reviewed classification
- *Janet Coles, Regional Ecologist* – prepared preliminary classification and assigned final NVC names, reviewed field key and draft local descriptions, wrote global descriptions, analyzed AA data
- *Keith Schulz, Regional Ecologist* – prepared global association descriptions, reviewed classification
- *Michael Schindel, TNC Oregon Ecologist* – generated gradsect sampling design
- *Mary Russo, Ecology Data Manager* – entered BLCA local and global descriptions into NatureServe's Biotics database, formatted descriptions, completed plant species crosswalk
- *Kristin Snow, Assistant Ecologist/Ecological Information Manager* – developed format for NCPN plant association local and global descriptions

U.S. Geological Survey – National Park Service National Vegetation Mapping Program
- *Mike Story, NPS Program Leader* – provided national level program oversight
- *Karl Brown, Ph.D., USGS Program Leader* – provided national level program oversight
- *Tammy Hamer, Vegetation Mapping Program Biologist* – facilitated generation of final products
- *Chris Lea, Ecologist* – collected AA data

Aerial Photography

High-quality aerial photography of an appropriate scale is an important part of all USGS-NPS National Vegetation Mapping Program projects. Orthophotography provides a base image for mapping vegetation in a digital format and is the basis for interpreting vegetation patterns. Stereo photographs acquired vertically from a fixed-wing aircraft, with adequate overlap, allow three-dimensional, high-resolution photointerpretation when viewed under a stereoscope (Avery 1978). At the beginning of the NCPN vegetation mapping program, network staff decided to acquire new stereo aerial photography, as well as orthorectified imagery at a 1:12,000 scale for eleven park units, including BLCA.

To maximize cost savings, the NCPN acquired aerial photography concurrently for several park units. In order to minimize shadow effects associated with canyon topography and maximize vegetative expression, the goal was to minimize the sun angle by flying as close as possible to noon on the summer solstice (June 21). True color aerial photography was chosen because it minimizes the effects of shadows in deep canyons. It was also determined that true color photography would best illustrate the vegetation patterns of the park units being mapped.

Stereoscopic Aerial Photo Coverage

NCPN contracted with the USDA - Farm Services Agency Aerial Photography Field Office (APFO) to acquire new 23 cm x 23 cm (9 in x 9 in) true color aerial photographs for BLCA. The imagery was acquired on June 18, 2002, by Blue Skies Consulting, LLC of Albuquerque, New Mexico. The photography was acquired at a nominal elevation of 1,829 m (6,000 ft) above

ground level in a Cessna T210N aircraft. A Wild RC10 camera with 15.2 cm (6 in) lens was used with Kodak Aerocolor negative film. The target scale for this photography was 1:12,000 (1 in = 1,000 ft). The mission was designed with approximately 30% sidelap between flight lines and 60% overlap between photos. The project encompassed both BLCA and Curecanti NRA The BLCA portion covered 610.3 linear km (379.3 miles) divided among 22 flight lines and 437 individual photos (Figure 19).

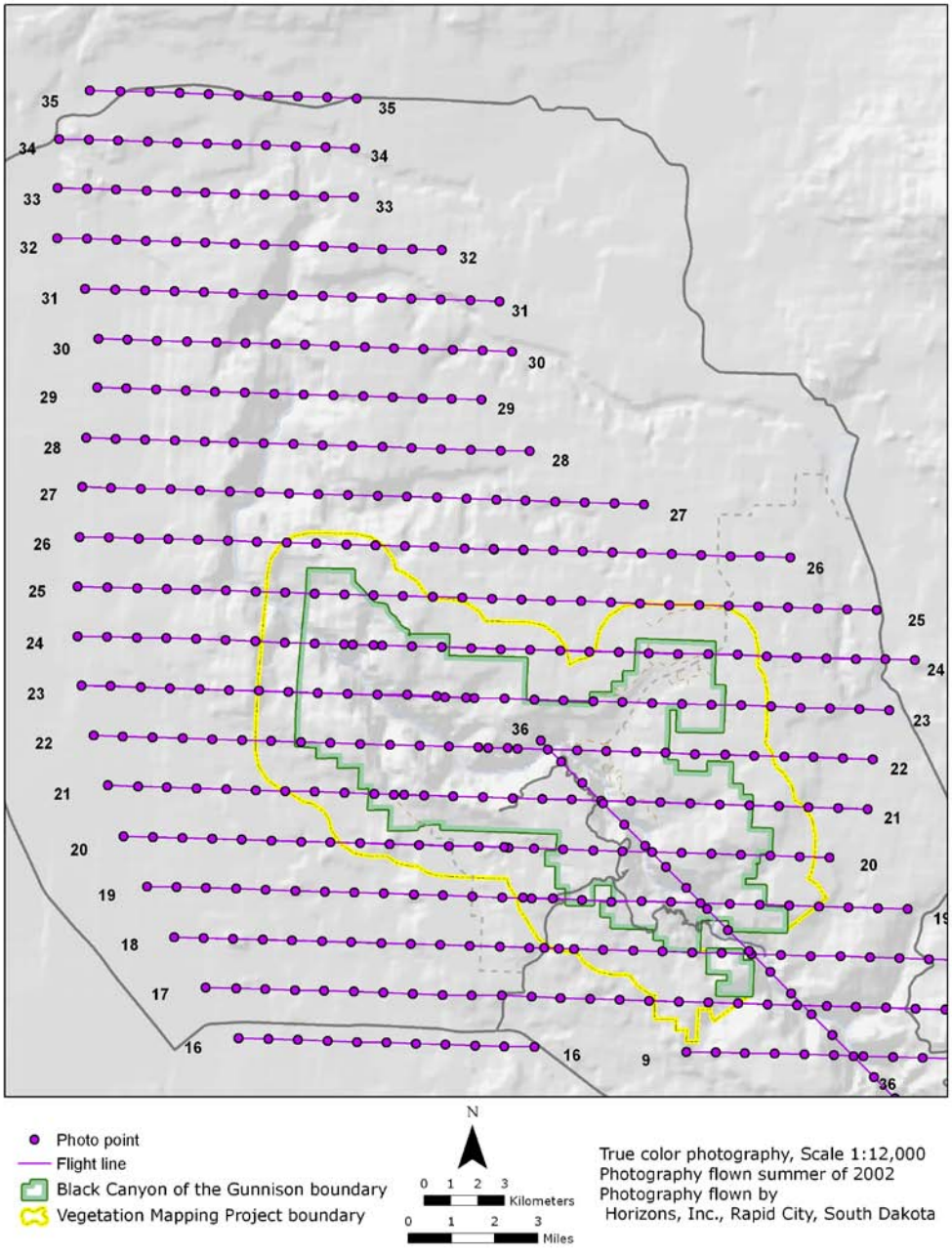


Figure 19. Flight lines for the 2002 stereo aerial photograph coverage of BLCA.

Figure 20 is an example of the 23 cm x 23 cm aerial stereo photographs for BLCA. These photographs were used for photo interpretation during the mapping phase of the project, as well as by field crews during plot data collection. The film negatives for this aerial photo coverage are permanently stored at the APFO in Salt Lake City, Utah. The APFO made two sets of color prints. One set was distributed to BLCA and the other is retained at the NCPN offices in Moab, Utah.

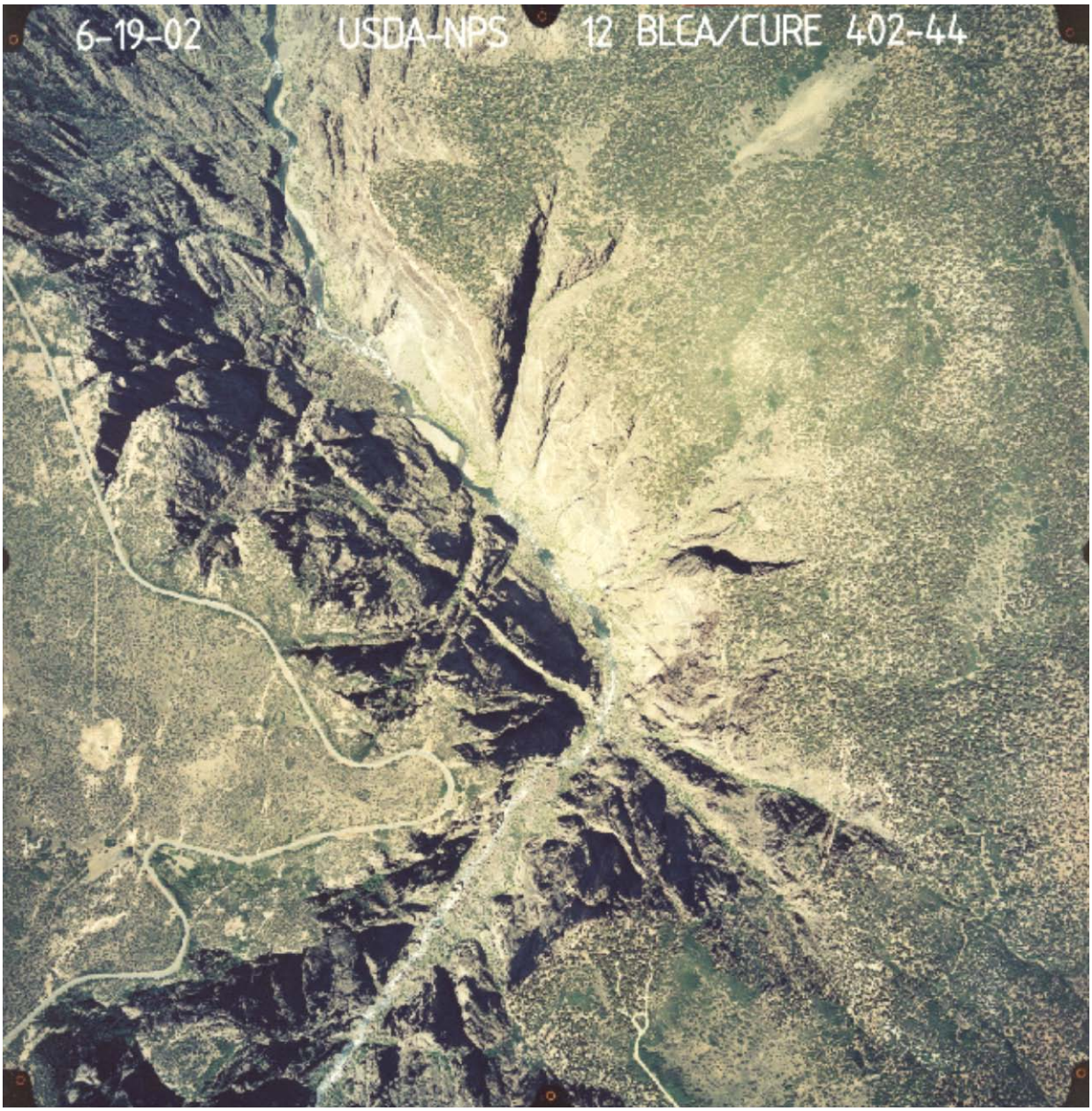


Figure 20. Example of a 9” x 9” stereo aerial photograph taken for the BLCA vegetation classification and mapping project.

Digital Orthophotos

The USBOR Remote Sensing and Geographic Information Group in Denver, Colorado, produced 1:12,000 scale digital orthophotography for BLCA from new imagery. This work was subcontracted to Horizons Inc. of Rapid City, South Dakota. The photography was flown on Jjune 18, 2002, at a mean above ground level elevation of 6,096 m (20,000 ft). Sidelap was approximately 40% and overlap about 60%. Airborne global positioning system (GPS) data were collected for each exposure. A Zeiss RMK 15/23 camera with a 15.2 cm (6 in) lens was used with AGFA100 film. Aerial coverage was similar to the stereo photo imagery (Figure 20).

The original film was scanned at 21 microns to create pixels of approximately 0.84 m. Horizons, Inc. created a photographic mosaic by extracting the high quality image from the center of each photograph and stitching them together digitally. The photographic mosaic was then magnified to a scale of 1:12,000 and corrected through a computational process that warps and stretches the image between known control points. The orthorectification process removes distortion caused by tilting of the camera and scale variation of the terrain. Control points for the orthorectification were obtained from USGS digital elevation model (DEM) 10 m data, aero triangulation data, and airborne GPS data. The X, Y, Z, omega, phi, and kappa for each photograph were calculated by Horizons, Inc. Final adjustments to the digital orthophoto database were solved using Erio Technologies ALBANY software. ALBANY is a simultaneous least squares bundle adjustment, which is designed for use with an airborne Global Positioning System. Color adjustment of the final orthophoto coverage was achieved by visually matching the tone, contrast, and brightness to the original film. Each scanned image was checked for missing data as the final quality assurance step.

The composite image covering the project area was inspected for tone balance and image distortion. In areas of image distortion, imagery from a slightly different angle on an adjacent photo was inserted where possible. The final orthophotos were visually inspected for accuracy and consistency. Some areas of the final orthophoto imagery remain blurred due to the extreme terrain and limitations of the USGS DEM data. Film negatives for BLCA 2002 color digital orthophotos are permanently archived in airtight containers at the USBOR offices in Denver, Colorado.

Project Boundary and Map Extent

A project environs adding a strip or buffer approximately 1.6 km (1 mile) wide around the park boundary was chosen by network and BLCA staff at the July, 2001 scoping meeting (Figure 2). As a result, the total project mapping area is 22,989 hectares (56,807 acres). Of this area, 12,632 ha (31,214 acres) are within the BLCA boundary and 10,357 ha (25,593 acres) are in the environs. The environs were delineated to provide data to support management coordination on adjacent private, NPS, USFS, and BLM managed lands.

Minimum Mapping Unit

A standard 0.5 ha (1.24 acres) minimum mapping unit (MMU) was employed in the BLCA vegetation mapping project. The major exception was that project photointerpreters attempted to delineate all wetland vegetation, regardless of patch size.

Ecological System Classification

The NCPN elected to use the ecological system (ES) classification structure developed by NatureServe (Comer et al. 2003, NatureServe 2003) as a framework for organizing and presenting plant community data. An ES is defined as a group of plant associations from two or more alliances that tend to co-exist in a given landscape due to similar ecologic processes, substrates, and/or environmental gradients. The ES classification was developed to provide larger scale classification units for application to resource management, mapping, and conservation. Current estimates are that Colorado contains more than 80 ecological systems (NatureServe Explorer 2008). This approach complements the NVC; the finer-scale vegetation alliances and plant associations provide a basis for interpreting larger-scale ES patterns and concepts. A description of each ecological system identified in BLCA appears in Appendix A.

The ecological system classification addresses natural landscapes. Land-use categories used to identify developed areas are described elsewhere in this report. Sixteen ES units are known to occur within the BLCA vegetation mapping project area (in alphabetic order with NatureServe identifying codes):

- Colorado Plateau Hanging Garden (CES304.764)
- Colorado Plateau Pinyon-Juniper Woodland (CES304.767)
- Inter-Mountain Basins Big Sagebrush Shrubland (CES304.777)
- Inter-Mountain Basins Greasewood Flat (CES304.780)
- Inter-Mountain Basins Mixed Salt Desert Scrub (CES304.784)
- Inter-Mountain Basins Montane Sagebrush Steppe (CES304.785)
- Inter-Mountain Basins Semi-Desert Grassland (CES304.787)
- Inter-Mountain Basins Semi-Desert Shrub-Steppe (CES304.788)
- Inter-Mountain Basins Shale Badland (CES304.789)
- Rocky Mountain Aspen Forest and Woodland (CES306.813)
- Rocky Mountain Cliff, Canyon and Massive Bedrock (CES306.815)
- Rocky Mountain Gambel Oak-Mixed Montane Shrubland (CES306.818)
- Rocky Mountain Lower Montane-Foothill Riparian Woodland and Shrubland (CES306.821)
- Rocky Mountain Lower Montane-Foothill Shrubland (CES306.822)
- Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland (CES306.823)
- Southern Rocky Mountain Montane-Subalpine Grassland (CES306.824)

Vegetation Classification and Description

Pre-Field Methods

Preliminary Classification List

NatureServe compiled a preliminary list of vegetation associations and alliances for BLCA in 2002. This list was developed by intersecting NVC associations and alliances with Bailey ecoregions (Bailey 2001). Previous vegetation classification work, floristic information for BLCA, the park's plant species list, and expert local knowledge were used to refine the list. This process resulted in a preliminary list of 206 plant associations for the vegetation mapping project area (Von Loh et al. 2002). This association list was a useful gauge for estimating and planning field work and for assigning provisional association names to vegetation plots and observation points.

Legacy Data Review

Existing vegetation data for BLCA were reviewed for possible use in the classification. The primary dataset contained data from 262 sites sampled in 1993, 1994, 1995, and 1997 under the provisions of the Colorado Plateau Vegetation Advisory Committee (CPVAC). These data were determined to be useful for vegetation classification (TNC 1996). The vegetation classification presented in this report was derived from the legacy data and new field data collected specifically for the BLCA vegetation mapping project.

Field Methods

The primary purpose of classification plot data was to document the composition and structure of BLCA vegetation and associated environmental conditions. These data became the basis for classifying the vegetation at the park. Field methods used in gathering new data for this project followed national program standards (e.g., TNC and ESRI 1994a, 1994b). Data gathered during this project also contribute to understanding vegetation relationships across broader landscapes beyond the boundaries of the Park. The plot dataset was enhanced by collecting observation point data, whose primary purpose was to describe small vegetation stands and to support photo interpretation.

In addition to the basic vegetation data collected at each plot, the NCPN and park staff defined fuels and summary data fields to meet needs of network managers. Plot forms and descriptions of individual data fields appear in Appendix B.

Field Sampling Approach

The sampling area included the entire Park as well as public lands in the environs. Private lands in the environs as well as private inholdings within the Park were only visited when landowners agreed to grant access when contacted by park staff. Because the project area is topographically complex and access can be difficult, the areas to be sampled were selected in advance of the field season. The selection was based on biophysical units (BPUs) designed to ensure that all major environmental settings were visited and a good spatial dispersion of sample plots was achieved.

The BPUs were constructed by layering geology, solar budget, precipitation gradient, and slope information. The result was a set of polygons representing unique combinations of these environmental factors. The "cost" (distance from road or trail multiplied by a factor accounting for steep slopes) of accessing each polygon was calculated, and the polygons deemed too

difficult to access were withdrawn. A random sample of polygons representing each combination of factors became the target areas for sampling, although field crews were encouraged to use their judgment and sample areas outside the BPUs if they contained new and/or unusual vegetation types.

Field crews were led by park ecologists trained by Vegetation Mapping Program and USBOR Remote Sensing and Geographic Information Group staff. The list of 206 potential plant associations provided a starting point for naming communities sampled in the field. The sampling goal was to collect between three and five plots in every vegetation association within the BLCA project area, including adjacent areas of CURE. However, some common associations were sampled more often to represent their range of variability, including among geologic substrates, and some rare types were sampled less often, as a result of difficulties encountering these types. An effort was made to achieve good spatial distribution of plots across the landscape and to capture the full range of variation of each association. Areas within BLCA that were not accessible for sampling included steep walled canyon sides, pinnacles and cliffs on mesas, Park locations that required access through private land where permission to cross was denied, and the Gunnison River corridor at the bottom of Black Canyon (due to high flows). Fortunately, Gunnison River levels were less than 300 cubic feet per second during the 2002 field season allowing field crews to survey the vegetation along some areas of the canyon bottom.

More than one hundred vegetation plots were sampled by BLCA natural resources staff in 2000 and 2001. Review of these data found that many were placed in ecotones, lacked identification to the species level, or had imprecise cover data and therefore did not meet the data standards of the USGS-NPS vegetation mapping program. Of the original 2000-2001 data set, only 25 plots were retained, mostly as observation points. Field data were collected following USGS-NPS protocols during the 2002 and 2003 field seasons. Fifty-eight plots and observation points were sampled in 2002 and 45 plots in 2003.

Plot Data Collection

Field crews located classification plots subjectively within BPUs in order to best represent the stand being sampled. Crews also had the option of locating plots outside of BPUs when distinct plant communities were encountered. Ecotones (areas where two or more plant communities intermix) were avoided after 2001, except for broad transitional areas between pinyon-juniper woodlands and Gambel oak shrublands. Highly disturbed areas were also avoided unless they covered several hectares. Plots were generally located in stands exceeding the minimum mapping unit (MMU) of 0.5 hectares. A few plots were sampled in smaller patches of distinctive vegetation or communities of rare species, including hanging gardens and riparian terraces, and a few plots, pre-August 2001, were sampled as larger rectangles (1,000 m²) in homogenous stands. Plot size and shape requirements were consistent with national Vegetation Mapping Program guidelines (TNC and ESRI 1994a). Plot size was determined by the physiognomy of the community being sampled (Table 4), and the shape was typically circular. BLCA plot shape was adjusted as needed to sample linear bands of vegetation in drainage bottoms. Plot size and shape were recorded for all plots.

Table 4. Plot sizes used for vegetation classification sampling at BLCA.

Vegetation Class	Area (m^2)	Radius (m)
Forest and Woodland	400	22.6
Shrubland	400	22.6
Herbaceous	100	11.3

Within each plot, field staff estimated and recorded an array of vegetation and environmental data using the field forms in Appendix B and data definitions in Appendix C. Four categories of data were collected for vegetation plots (Table 5):

- location and plot identifiers
- environmental description
- vegetation description
- other information

Location and Plot Identifiers. BLCA staff requested that the vegetation plot locations not be permanently marked. The bounds of each plot were marked temporarily using measuring tapes. The Universal Transverse Mercator (UTM) coordinates at the center of each plot were recorded (Zone 12, NAD83) on Trimble or Garmin hand-held GPS receivers. Other data fields documenting the location of each plot are listed in Table 5 and are described in detail in Appendix C. Locations were recorded on topographic maps during each field trip to avoid duplication of effort and to ensure good spatial distribution of sampling points within BLCA and the adjacent CURE.

Table 5. General plot data categories and specific data components collected at each vegetation classification plot.

Plot Data Category	Data Components
Location and Plot Identifiers	Plot code, park name, site name, state, county, quad name, BPU code, GPS unit, GPS file ID, UTM coordinates, UTM zone, GPS error, 3D differential, survey date, surveyor names, directions to plot, plot dimensions, photograph documentation
Environmental Description	Elevation, slope, aspect, topographic position, landform, geology, Cowardin wetland type, hydrologic regime, ground cover, soil texture, evidence of disturbance and animal use
Vegetation Description	Height and cover of all strata, cover by species, physiognomic type, provisional association name, plot representativeness
Other Information	Narrative description of the setting of the plot; describes adjacent communities, note unusual ecological processes, continue descriptions from other narrative fields

Environmental Description. The physical characteristics of each plot were documented in both categorical and narrative fields (Table 5; Appendix B). These characteristics included physical site features (elevation, slope, aspect, topography), hydrology, geology, and soils. Description of the ground surface included an estimate of the cover of rocks, sand, litter, bare soil, biological soil crust, moss, and lichen. A narrative field was provided for a general description of the plot setting and the influence of disturbance and environmental factors on the vegetation.

Vegetation Description. Every vascular plant species in each plot was assigned to one of 14 physiognomic strata (Appendix B). Within each stratum, the investigator recorded height and cover class for all species and by stratum using the cover class scales in Table 6a. Differences in cover class scales used for field sampling in 2000 versus those used between the years 2001-2003 were resolved in the database and are noted in Table 6b. Beginning in 2002, field crews also began recording percent canopy cover by species (this information was recorded for approximately 12% of all plots sampled in BLCA). Consistent and repeatable cover estimates were obtained by training field crews to relate the area occupied by an individual species to the area of the entire plot. When it was not possible to identify a species in the field, plant material was collected and pressed for later identification. All plant material collected for identification was destroyed in analysis. Provisional plant association names were assigned to each plot using the preliminary association list and professional judgment.

Other Information. Field crews were encouraged to record general observations on how well the plot represented the stand, the relationship of site conditions to vegetative patterns, adjacent vegetation, and site disturbance history. The overall character of the vegetation and features of each plot were recorded in two or more 35 mm color slide photographs.

Table 6a. Vegetation cover and height classes used in the BLCA vegetation mapping project.

Species and Strata Canopy Cover Classes				Strata Height Classes			
Code	***Range***	***Code***	***Range***	***Code***	***Range***	***Code***	***Range***
0	0 (outside plot)	03	5-25%	01	<0.5 m	06	10-15 m
T	<1%	04	25-50%	02	0.5-1 m	07	15-20 m
P	1-5%	05	50-75%	03	1-2 m	08	20-35 m
01-a	5-10%	06	75-100%	04	2-5 m	09	35-50 m
01-b	10-25%			05	5-10 m	10	> 50 m

Table 6b. Reconciled differences in cover classes used in 2000 vs. 2001-2003 in the BLCA vegetation mapping project.

Cover Code used in database	Range	2000 Code used on data sheets	2001-2003 Code used on data sheets
0	0 (outside plot)	n/a	n/a
T	<1%	n/a	01
P	1-5%	n/a	02
01-a	5-10%	01	n/a
01-b	10-25%	02	n/a
03	5-25%	n/a	03
04	25-50%	03 (25-60%)	04
05	50-75%	n/a	05
06	75-100%	04 (60-100%)	06

Data Processing and Analysis

One hundred and twelve vegetation plots were sampled within the mapping project area during the 2001 through 2003 field seasons (Figure 19). Plot data were manually entered into the BLCA Vegetation Mapping Project Database, developed by e²M and NCPN data management staff. This database is compatible with the data standards of the PLOTS Database System developed

for the USGS-NPS Vegetation Characterization Program by TNC (1997) and revised by NatureServe in 2002. The NCPN database offers greater flexibility in overall data management than does the NatureServe PLOTS database, and is designed to accommodate all project field data recorded in plots, observation points, and accuracy assessment points. Data standards were established by NCPN for all network vegetation mapping projects, allowing compatibility of data across network park units. Fields associated with the BLCA plots database are described in Appendix C.

Each 35 mm color slide associated with the project was scanned into digital format. The 1,667 digital images of vegetation plots, observation points, accuracy assessment points and landscape/scenery were stored in a photograph database. A unique identifier allows each photograph to be linked with the plots and spatial databases.

Observation Points

In addition to classification plots, field crews collected vegetation and environmental data at 16 observation points in 2000, 2001, and 2002 (Figure 21). Data collected at observation points reflected the vegetation of a loosely undefined area around the point (the "stand") rather than a measured plot (Appendix B). Overall conditions at each observation point were documented by one or more 35mm color slide photographs. These data were intended primarily to support modeling and interpretation of the aerial imagery, but were also used to help describe plant associations. Field crews could choose to sample an observation point instead of a classification plot when:

- they were sampling a type which had been thoroughly sampled by plot work, but perhaps not in a given area
- they were sampling in an environment not conducive to laying out tapes (i.e. on vertical cliffs)
- they wished to document special features as requested by park staff such as weed patches and prairie dog colonies

A thorough quality assessment and quality check (QA/QC) was performed on all plot and observation point data following entry to the MS Access database. Individual plot data records were reviewed with the individual field data sheets in hand. Additional QA/QC was performed using a set of queries designed to identify inconsistencies across data fields and check for missing data. NCPN technicians standardized the scientific names in the database and noted name changes on the field forms. The primary authority used for plant names for the BLCA vegetation mapping project and all other NCPN I&M projects was *A Utah Flora* (Welsh et al. 2003). Weber and Wittmann (2001) was the primary floristic key used in the field, but these names were converted to the corresponding Welsh names in the database. It is important to note that NatureServe, a primary project partner, follows Kartesz (1999) as its primary nomenclatural authority. As a result, nomenclature used in the body of this report follows Kartesz (1999), whereas nomenclature in the project database follows Welsh et al. (2003). Differences between the two nomenclatural authorities are reconciled in a crosswalk table (Appendix D).

Following completion of QA/QC procedures, the database was made available to e^2M and NatureServe ecologists for vegetation classification analysis. Slide labels were printed from the database. A GIS data layer (point data) was developed to document classification plot locations.

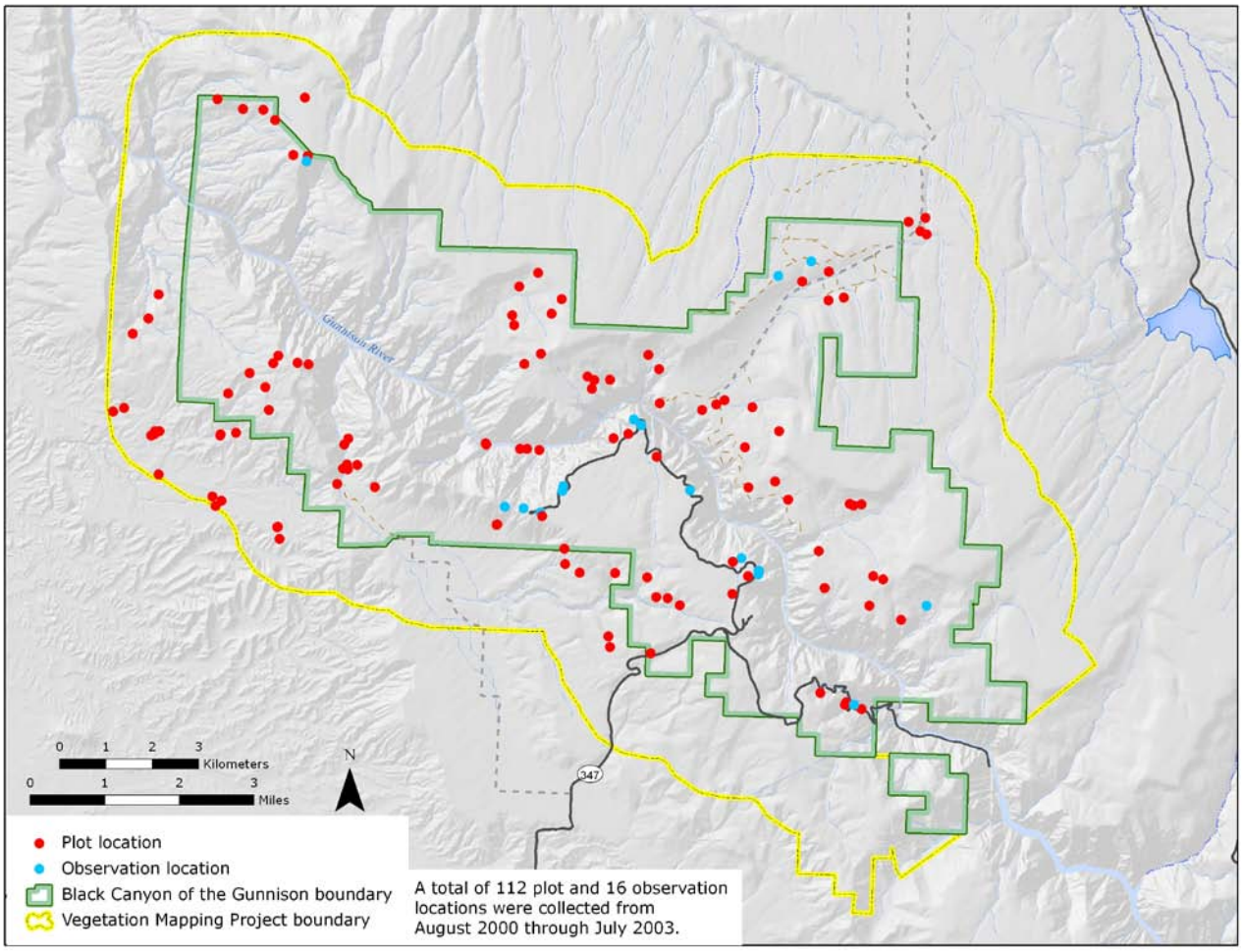


Figure 21. Vegetation plot and observation point locations in the BLCA mapping project area.

Classification Data Analysis

Vegetation classification was performed jointly for BLCA and CURE and was accomplished using a multivariate analysis of classification plot data augmented by observation point data. Two hundred and ninety-five classification plots containing 366 species were available for the preliminary classification (Coles 2003). Species cover data were exported into spreadsheet format from the MS Access database and arranged into a plot by species data matrix, then imported into PC-Ord (McCune and Mefford 1999). Midpoints of canopy cover classes were used in all data analysis procedures and species with less than 1% were removed from further analysis. This step resulted in 258 species for the preliminary analysis. Values for differing strata were combined for a single species. Three classification plots containing mat saltbush (*Atriplex corrugata*) on clay barrens were unique and were removed from the dataset because the five

species occurring in those plots did not occur in any other plots (Coles 2003). The entire dataset was re-analyzed following the 2003 field season using techniques used for the classification of vegetation at Natural Bridges National Monument and Arches National Park (Decker and Coles 2003).

2002 data set

Ordinations work best on relatively homogenous data sets. In order to reduce variability in the data set, we ran several preliminary analyses to identify plots that were artificially inflating the variability of the data. Outlier analysis (as run by PC-ORD v. 4.25) did not provide any useful information because the data were too heterogeneous (Coles 2003). Exploratory multivariate statistical analyses included predominantly Detrended Correspondence Analysis (DCA), which was used with the objective of summarizing the compositional and structural characteristics of the plant communities and assessing possible spatial patterns related to environmental gradients. Preliminary ordinations (DCA, Bray-Curtis) of the relativized data set clearly showed that the floodplain/swale/wetland (Figure 22a) and Douglas-fir plots (22b) were separate from the rest of the data. These plots were removed from the data set and analyzed separately. Subsequent ordinations of the remainder revealed additional outlier groups of plots: pinyon-juniper (22c), black sagebrush (22d) and quaking aspen (22e).

Each group of outlier plots was removed in turn and the remaining data set re-analyzed. After this procedure was repeated four times, no additional outlier groups could be identified, and the remaining 174 plots clumped well into identifiable groups (Figure 23). The few plots in the final diagram falling outside the final groups were assigned to a group based on their dominant species.

Bray-Curtis and DCA ordinations on the dataset produced 11 groups after the first ordination:

- Saltbush plots
- Floodplain plots
- Douglas-fir plots
- Black sagebrush plots
- Pinyon – juniper plots
- Quaking aspen plots
- Wyoming big sagebrush – Gambel oak plots
- Wyoming big sagebrush / Grass species plots
- Mountain big sagebrush plots
- Gambel oak – Serviceberry – Snowberry plots
- Grasslands and miscellaneous herbaceous plots

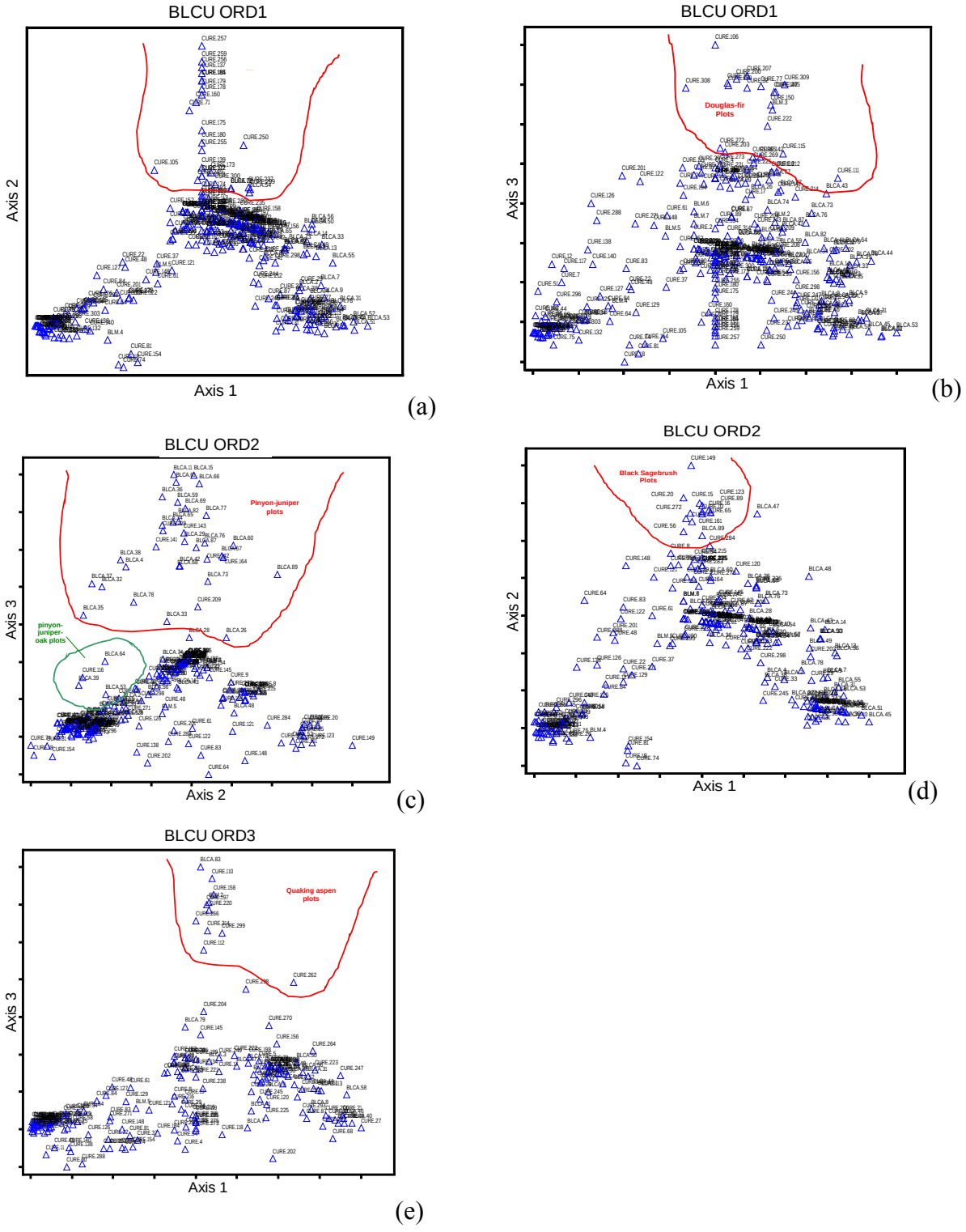


Figure 22. Bray-Curtis ordination of the 2002 relativized data matrix (292 plots, 253 species). These diagrams clearly show that the floodplain (a), Douglas-fir (b), pinyon-juniper (c), black sagebrush (d) and quaking aspen (e) plots (delineated by the red lines) are separate from the rest of the data.

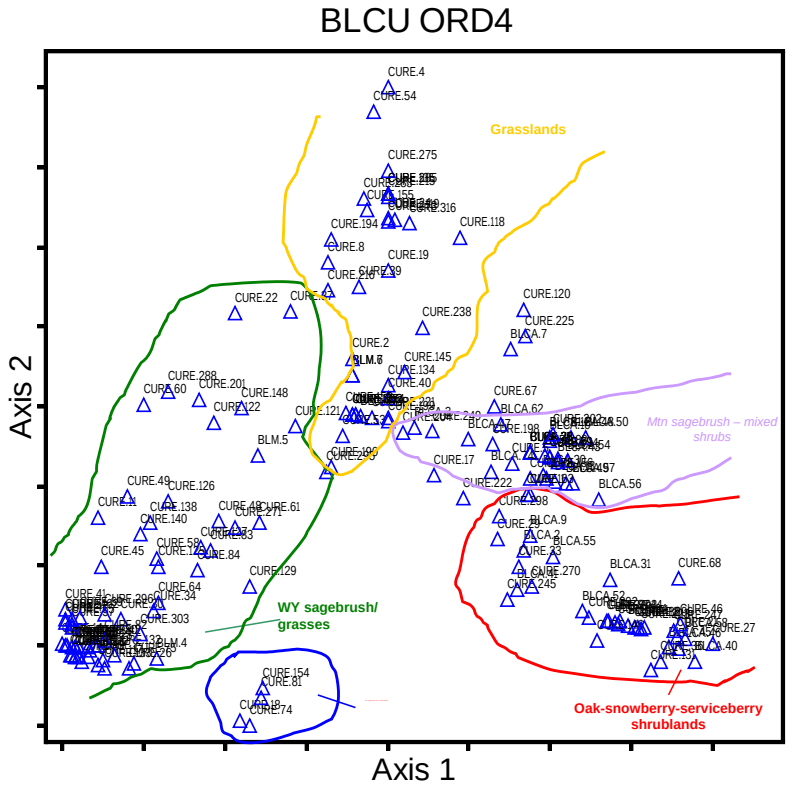


Figure 23. Detrended Correspondence Analysis of shrubland and grassland associations for BLCA/CURE.

2003 data set

Bray-Curtis and DCA ordinations on the full dataset produced uninterpretable results, with no separate groups evident as they were in 2002. Cluster analysis and Indicator Species Analysis (ISA) indicated the ideal "pruning point" of the dendrogram at 10 groups. Inspection of the data supported nine groups (Fig. 24), which corresponded very closely to groups that were detected in the first level of analysis of the 2002 data:

- Oak-Serviceberry plots
- Mountain sagebrush plots
- Quaking aspen plots
- Douglas-fir plots
- Pinyon-Juniper plots
- Black sagebrush plots
- Wyoming big sagebrush plots
- Grassland plots
- Riparian and Miscellaneous plots

To identify sub-groups, the nine groups resulting from the initial cluster analysis were analyzed with additional cluster, ISA, and ordination analyses. If the analysis indicated the presence of subgroups, these were inspected to determine whether they were supported by the data. For eight of the groups, this technique did not reveal any strong subgroups and the plots in these groups were assigned to plant associations without further review. The largest group (Riparian and Miscellaneous) clearly required additional work (129 plots, 387 species). The eight mat saltbush plots were removed, as these had few species in common with the rest of the dataset. Species cover values were relativized in the remaining plots (species cover / total plot cover) and then subjected to additional ordination, clustering and ISA analyses. Two subgroups were revealed by this analysis, corresponding closely to the Grassland / Miscellaneous and Floodplain / Narrowleaf Cottonwood groups discovered during the 2002 analysis.

Following initial analyses, TWINSPAN (Hill 1979) was used to identify plant associations within each group, using the default PC-ORD settings (Table 7). Unlike ordination, which groups plots based on their similarity or dissimilarity, TWINSPAN divides a group of plots based on the presence or absence of species. Each plot was provisionally assigned one of 104 association names and the entire dataset was then examined in detail by NatureServe ecologists, who attempted to fit the data to the NVC. Following development of the preliminary classification, a meeting was held in April 2003 between field crews, CNHP, BLCA/CURE, USBOR, and NatureServe ecologists to review the overall classification and discuss problem areas. An additional 96 classification plots sampled following the preliminary classification were analyzed manually by NatureServe ecologists during the winter of 2003. The initial analysis identified a total of 109 possible associations or groups of closely related associations.

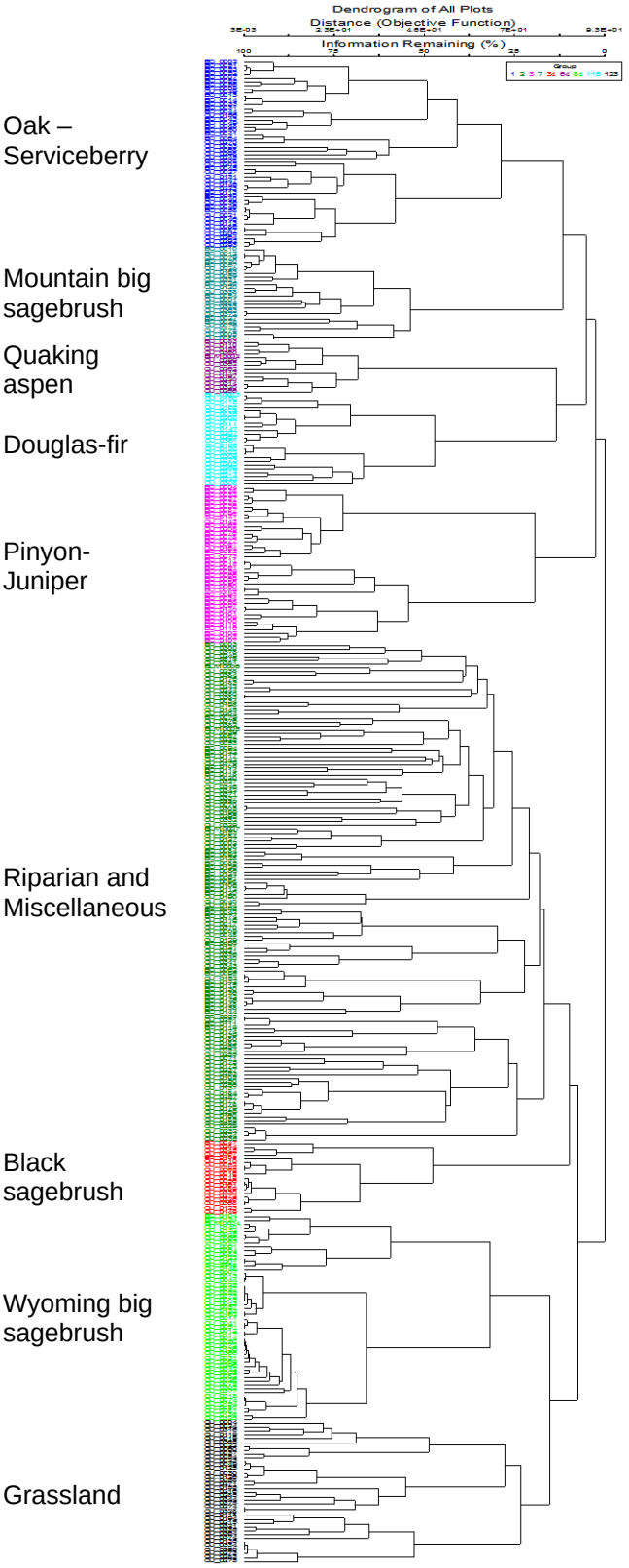


Figure 24. Cluster analysis dendrogram of BLCA/CURE plot data showing nine clusters.

Table 7. A summary of the ordination and Indicator Species Analysis results for the nine main groups identified in the BLCA/CURE cluster analysis (Figure 22).

Group	Ordination and ISA results
Oak - Serviceberry	This group is somewhat heterogeneous, because it includes several woodland plots that were included here because of sparse tree cover and dense shrub cover. In general, these plots represent the diversity of mixed mountain shrublands at BLCA-CURE. The plots were classified into six NVCS associations, one NVCS alliance, and one provisional association. The provisional association was created to describe a shrub herbaceous community dominated by Gambel oak and Thurber fescue. This type may also occur on the Uncompahgre Plateau and possibly in similar highland situations in the Colorado Plateau and northwestern Colorado. It is probably uncommon, since it seems to be related to ARTRV / FETH, a G3/G4 community reported from Colorado.
Mountain big sagebrush	This group of plots includes shrublands with only a minor element of mountain big sagebrush, as well as plots where mountain big sagebrush was dominant. Many of the plots were difficult to classify, in that at BLCA-CURE, mountain big sagebrush often co-occurs with shrub and grass species usually associated with drier, lower-elevation Wyoming big sagebrush. Hybrids of Wyoming-mountain big sagebrush are also common and for convenience had to be assigned to one species or the other (Bradshaw, personal communication). The plots were placed into twelve NVC associations, two NVC alliances, and five Johnston et al. associations.
Quaking aspen	There is tremendous diversity among the quaking aspen plots sampled at BLCA-CURE; the plots classified into ten NVC types. Most of the plots are mesic; five are xeric and only one is truly wet. The quaking aspen associations at BLCA-CURE show closer affinities to northwestern Colorado types than they do to either Rocky Mountain or Colorado Plateau associations.
Douglas-fir	These plots tended to be on steeper, north-facing slopes on rocky soils. Their affinities are again to Douglas-fir types found further north and west; the Douglas-fir-white fir mixed conifer types of the San Juan Mountains are missing here. The plots were placed in six NVC associations and one provisional type. One plot was unclassifiable; it could be thought of as a Wyoming big sagebrush / Douglas-fir wooded shrubland. The provisional type was representative of open Douglas-fir stands on rocky slopes with significant sagebrush cover.
Pinyon-Juniper woodlands	Johnston, et al. (2001) doesn't cover pinyon-juniper woodlands, since they are essentially absent from the Upper Gunnison Basin. The plots were therefore placed into eight NVC associations and three provisional association. The PJ-Holodiscus dumosus provisional association was named to describe a type described by the data collectors as "representative of a large area". The PJ-black sagebrush – saline wild rye provisional association matches a type that also occurs at Dinosaur National Monument. Another provisional association deals with plots where the native understory has been replaced by cheatgrass. It may also be worth considering a fourth new association, tentatively named Pinus edulis – (Juniperus spp.) / Amelanchier utahensis Woodland. Six of the pinyon-juniper plots would fit this type better than the associations in which they were placed (PIED-(JUNIPE) / ARTR2 or PIED-(JUNIPE / QUGA).
Riparian and miscellaneous	Saltbush Visual inspection of the plot data revealed two groups of NVC associations. The mat saltbush group fell into one association and one alliance; the shadscale group fell into two associations and one alliance. Narrowleaf Cottonwood This type tends to have poorly developed and/or highly disturbed understory layers at BLCA-CURE. It was therefore difficult to place many of the plots securely into associations described by Johnston, et al. (2001) , or the NVC. The plots were placed, with varying degrees of confidence, into seven NVC associations, one NVC alliance, two Johnston, et al. (2001) associations and two provisional types. The provisional types were needed to account for plots dominated by exotic species. Floodplain This type is similar to the narrowleaf cottonwood group in that at least one diagnostic layer tends to be poorly developed and/or highly disturbed. The

Table 7. A summary of the ordination and Indicator Species Analysis results for the nine main groups identified in the BLCA/CURE cluster analysis (Figure 22).

Group	Ordination and ISA results
	plots were placed, with varying degrees of confidence, into 17 NVC associations, three NVC alliances, and one semi-natural provisional type. One plot was unclassifiable.
Black sagebrush	These plots fit poorly into the associations described by the NVC and by Johnston et al., so they were all placed within the *Artemisia nova* Shrubland Alliance of the NVC.
Wyoming big sagebrush	This large group included all plots with significant Wyoming big sagebrush cover. The plots in this group were placed into 11 NVC associations, one NVC alliance, and six Johnston et al. (2001) associations. One major subgroup was plots with Wyoming big sagebrush and black sagebrush as co-dominants. Although these plots were grouped into the *Artemisia nova* Shrubland Alliance, they may merit consideration as a new association, as the type is widespread and predictable in the Upper Gunnison Basin.
Grassland	Additional ordinations of this heterogeneous group revealed seven smaller groups of plots: galleta grasslands, winterfat-Indian ricegrass shrub-herbaceous, needle-and-thread grasslands, blue grama grasslands, Great Basin wildrye grasslands, ponderosa pine woodlands, and cheatgrass-dominated grasslands. The remaining plots were analyzed individually and compared with descriptions of NVC and Johnston, et al. (2001) associations. Altogether, the plots in this heterogeneous group were placed into 19 NVC associations, nine NVC alliances, one Johnston, et al. association, and two provisional associations. One provisional association is a placeholder to account for a diverse group of plots that represent rocky, windswept ridge tops with sparse vegetation. This is a type that has not been described in any published classification scheme. The other provisional association covers cheatgrass-dominated plots.

Classification Results

The draft final classification for BLCA was issued by NatureServe in 2006, and underwent several revisions prior to release of the final classification in April 2010. Following accuracy assessment data collection in 2004, types not previously recognized from the park were analyzed for possible inclusion in the classification. Twenty-eight associations discovered during accuracy assessment were added to the BLCA final classification. Other revisions included amending local descriptions based on finding a rare association to be much more common during the accuracy assessment phase and updating assignments of associations to ecological systems.

The vegetation of the BLCA mapping project area is classified into 77 community types (Table 8). Of these, 76 are described at the plant association level; the other is described as ‘park special’ because it occurs only in small stands and appears to be unique to BLCA. Park specials are not assigned to NVC associations or alliances. Twenty-eight of the associations are documented in BLCA exclusively from data gathered during accuracy assessment (Appendix E). The vegetation of the mapping project area is moderately diverse, including 33 NVC alliances and 16 ecological systems. Pinyon-juniper woodlands and sagebrush shrublands dominate the vegetation, accounting for 32 associations.

Each association, alliance, or park special is represented by between at least one and as many as 95 samples (vegetation plot, observation point, or AA point). Types with only one plot may have been rare in the park, or were simply undersampled as a result of difficult access or the

limitations of the BPU sampling design. Many of the types that appeared to be rare after the initial sampling were found to be more common during accuracy assessment, including some types sampled in the adjacent CURE.

Table 8. Classified plant associations for the Black Canyon of the Gunnison National Park vegetation mapping project area, arranged by ecological system within each physiognomic group*.

NVCS Association	Common Name	Code†
UPLAND ASSOCIATIONS		
FORESTS		
Rocky Mountain Aspen Forest and Woodland (CES306.813)		
Populus tremuloides / Amelanchier alnifolia - Symphoricarpos oreophilus / Calamagrostis rubescens Forest	Quaking Aspen / Saskatoon Serviceberry - Mountain Snowberry / Pinegrass Forest	CEGL000567
Populus tremuloides / Quercus gambelii / Symphoricarpos oreophilus Forest	Quaking Aspen / Gambel Oak / Mountain Snowberry Forest	CEGL000598
Populus tremuloides / Symphoricarpos oreophilus / Thalictrum fendleri Forest	Quaking Aspen / Mountain Snowberry / Fendler's Meadowrue Forest	CEGL000616
Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland (CES306.823)		
Pseudotsuga menziesii / Carex geyeri Forest	Douglas-fir / Geyer's Sedge Forest	CEGL000430
Pseudotsuga menziesii / Mahonia repens Forest	Douglas-fir / Creeping Oregon-grape Forest	CEGL000442
Pseudotsuga menziesii / Quercus gambelii Forest	Douglas-fir / Gambel Oak Forest	CEGL000452
Pseudotsuga menziesii / Symphoricarpos oreophilus Forest	Douglas-fir / Mountain Snowberry Forest	CEGL000462
WOODLANDS		
Colorado Plateau Pinyon-Juniper Woodland (CES304.767)		
Juniperus osteosperma / Artemisia nova Woodland	Utah Juniper / Black Sagebrush Woodland	CEGL000728
Juniperus osteosperma / Artemisia tridentata ssp. wyomingensis Woodland	Utah Juniper / Wyoming Big Sagebrush Woodland	CEGL000730
Juniperus osteosperma / Bromus tectorum Semi-natural Woodland	Utah Juniper / Cheatgrass Semi-natural Woodland	CEGL002817
Juniperus osteosperma / Leymus salinus Woodland	Utah Juniper / Salinas Lyme Grass Woodland	CEGL003109
Pinus edulis - (Juniperus monosperma, Juniperus osteosperma) / Hesperostipa comata Woodland	Two-needle Pinyon - (One-seed Juniper, Utah Juniper) / Needle-and-Needle-and-thread Woodland	CEGL000797
Pinus edulis - (Juniperus spp.) / Holodiscus dumosus Woodland [Provisional]	Two-needle Pinyon - (Juniper species) / Glandular Oceanspray Woodland	CEGL002802
Pinus edulis - Juniperus osteosperma / Amelanchier utahensis Woodland	Two-needle Pinyon - Utah Juniper / Utah Serviceberry Woodland	CEGL002329
Pinus edulis - Juniperus osteosperma / Artemisia nova Woodland	Two-needle Pinyon - Utah Juniper / Black Sagebrush Woodland	CEGL002331

Table 8. Classified plant associations for the Black Canyon of the Gunnison National Park vegetation mapping project area, arranged by ecological system within each physiognomic group*.

NVCS Association	Common Name	Code†
Pinus edulis - Juniperus osteosperma / Atriplex spp. Woodland [Provisional]	Two-needle Pinyon - Utah Juniper / Saltbush species Woodland	CEGL002366
Pinus edulis - Juniperus osteosperma / Bromus tectorum Semi-natural Woodland	Two-needle Pinyon - Utah Juniper / Cheatgrass Semi-natural Woodland	CEGL002367
Pinus edulis - Juniperus osteosperma / Mixed Shrubs Talus Woodland	Two-needle Pinyon - Utah Juniper / Mixed Shrubs Talus Woodland	CEGL002328
Pinus edulis - Juniperus osteosperma / Sparse Understory Woodland	Two-needle Pinyon - Utah Juniper / Sparse Understory Woodland	CEGL002148
Pinus edulis - Juniperus spp. / Artemisia tridentata (ssp. wyomingensis, ssp. vaseyana) Woodland	Two-needle Pinyon - Juniper species / (Wyoming Big Sagebrush, Mountain Big Sagebrush) Woodland	CEGL000776
Pinus edulis - Juniperus spp. / Cercocarpus montanus - Mixed Shrubs Woodland	Two-needle Pinyon - Juniper species / Mountain-mahogany - Mixed Shrubs Woodland	CEGL000780
Pinus edulis - Juniperus spp. / Leymus salinus Woodland	Two-needle Pinyon - Juniper species / Salinas Lyme Grass Woodland	CEGL002340
Pinus edulis - Juniperus spp. / Poa fendleriana Woodland	Two-needle Pinyon - Juniper species / Muttongrass Woodland	CEGL000787
Pinus edulis - Juniperus spp. / Pseudoroegneria spicata Woodland	Two-needle Pinyon - Juniper species / Bluebunch Wheatgrass Woodland	CEGL000788
Pinus edulis - Juniperus spp. / Quercus gambelii Woodland	Two-needle Pinyon - Juniper species / Gambel Oak Woodland	CEGL000791
SHRUBLANDS AND SHRUB-HERBACEOUS VEGETATION		
Inter-Mountain Basins Big Sagebrush Shrubland (CES304.777)		
Artemisia tridentata / Pleuraphis jamesii Shrubland	Basin Big Sagebrush / James' Galleta Shrubland	CEGL001005
Artemisia tridentata ssp. wyomingensis / (Agropyron cristatum, Psathyrostachys juncea) Seeded Grasses Semi-natural Shrubland	Wyoming Big Sagebrush / (Crested Wheatgrass, Russian Wildrye) Seeded Grasses Semi-natural Shrubland	CEGL002185
Artemisia tridentata ssp. wyomingensis / Disturbed Understory Semi-natural Shrubland	Wyoming Big Sagebrush / Disturbed Understory Semi-natural Shrubland	CEGL002083
Artemisia tridentata ssp. wyomingensis / Hesperostipa comata Colorado Plateau Shrubland	Wyoming Big Sagebrush / Needle-and-Thread Colorado Plateau Shrubland	CEGL002761
Ericameria nauseosa Shrubland	Rubber Rabbitbrush Shrubland	CEGL002713
Inter-Mountain Basins Greasewood Flat (CES304.780)		
Sarcobatus vermiculatus Disturbed Shrubland	Black Greasewood Disturbed Shrubland	CEGL001357
Inter-Mountain Basins Mixed Salt Desert Scrub (CES304.784)		
Atriplex canescens - Artemisia tridentata Shrubland	Fourwing Saltbush - Basin Big Sagebrush Shrubland	CEGL001282

Table 8. Classified plant associations for the Black Canyon of the Gunnison National Park vegetation mapping project area, arranged by ecological system within each physiognomic group*.

NVCS Association	Common Name	Code†
Atriplex confertifolia Wyoming Basins Shrubland	Shadscale Wyoming Basins Shrubland	CEGL001293
Glossopetalon spinescens var. meionandrum - Atriplex confertifolia Shrubland	Utah Greasebush - Shadscale Shrubland	Park Special
Krascheninnikovia lanata / Achnatherum hymenoides Dwarf-shrubland	Winter-fat / Indian Ricegrass Dwarf-shrubland	CEGL001323
Inter-Mountain Basins Montane Sagebrush Steppe (CES304.785)		
Artemisia nova / Poa fendleriana Shrubland	Black Sagebrush / Muttongrass Shrubland	CEGL002698
Artemisia nova / Poa secunda Shrubland	Black Sagebrush / Curly Bluegrass Shrubland	CEGL001423
Artemisia tridentata (ssp. vaseyana, ssp. wyomingensis) - Amelanchier utahensis Shrubland	(Mountain Big Sagebrush, Wyoming Big Sagebrush) - Utah Serviceberry Shrubland	CEGL002820
Artemisia tridentata ssp. vaseyana / Achnatherum lettermanii Shrubland	Mountain Big Sagebrush / Letterman's Needlegrass Shrubland	CEGL002811
Artemisia tridentata ssp. vaseyana / Achnatherum pinetorum Shrubland	Mountain Big Sagebrush / Pine Needlegrass Shrubland	CEGL002806
Artemisia tridentata ssp. vaseyana / Balsamorhiza sagittata Shrubland	Mountain Big Sagebrush / Arrowleaf Balsamroot Shrubland	CEGL001020
Artemisia tridentata ssp. vaseyana / Hesperostipa comata Shrubland	Mountain Big Sagebrush / Needle-and-Thread Shrubland	CEGL002931
Artemisia tridentata ssp. vaseyana / Pascopyrum smithii Shrubland	Mountain Big Sagebrush / Western Wheatgrass Shrubland	CEGL001028
Artemisia tridentata ssp. vaseyana / Poa fendleriana Shrubland	Mountain Big Sagebrush / Muttongrass Shrubland	CEGL002812
Artemisia tridentata ssp. vaseyana / Poa (pratensis, compressa) Semi-natural Shrub Herbaceous Vegetation	Mountain Big Sagebrush / (Kentucky Bluegrass, Canada Bluegrass) Semi-natural Shrub Herbaceous Vegetation	CEGL002339
Inter-Mountain Basins Semi-Desert Shrub-Steppe (CES304.788)		
Ericameria parryi / Achnatherum hymenoides Shrubland	Parry's Rabbitbrush / Indian Ricegrass Shrubland	CEGL003751
Inter-Mountain Basins Shale Badland (CES304.789)		
Atriplex corrugata Dwarf-shrubland	Mat Saltbush Dwarf-shrubland	CEGL001437
Atriplex gardneri Dwarf-shrubland	Gardner's Saltbush Dwarf-shrubland	CEGL001438
Rocky Mountain Gambel Oak-Mixed Montane Shrubland (CES306.818)		
Amelanchier utahensis - Mixed Shrub / Carex geyeri Shrubland	Utah Serviceberry - Mixed Shrub / Geyer's Sedge Shrubland	CEGL001068
Quercus gambelii - Cercocarpus montanus / (Carex geyeri) Shrubland	Gambel Oak - Mountain-mahogany / (Geyer's Sedge) Shrubland	CEGL001113
Quercus gambelii - Holodiscus dumosus Shrubland	Gambel Oak - Glandular Oceanspray Shrubland	CEGL002341
Quercus gambelii / Amelanchier alnifolia Shrubland	Gambel Oak / Saskatoon Serviceberry Shrubland	CEGL001109

Table 8. Classified plant associations for the Black Canyon of the Gunnison National Park vegetation mapping project area, arranged by ecological system within each physiognomic group*.

NVCS Association	Common Name	Code†
Quercus gambelii / Amelanchier utahensis Shrubland	Gambel Oak / Utah Serviceberry Shrubland	CEGL001110
Quercus gambelii / Artemisia tridentata Shrubland	Gambel Oak / Basin Big Sagebrush Shrubland	CEGL001111
Quercus gambelii / Carex geyeri Shrubland [Provisional]	Gambel Oak / Geyer's Sedge Shrubland	CEGL005995
Quercus gambelii / Poa fendleriana Shrubland	Gambel Oak / Muttongrass Shrubland	CEGL002949
Quercus gambelii / Symphoricarpos oreophilus Shrubland	Gambel Oak / Mountain Snowberry Shrubland	CEGL001117
Rocky Mountain Lower Montane-Foothill Shrubland (CES306.822)		
Amelanchier (utahensis, alnifolia) - Cercocarpus montanus Shrubland	(Utah Serviceberry, Saskatoon Serviceberry) - Mountain-mahogany Shrubland	CEGL001070
Cercocarpus montanus Shale Shrubland [Provisional]	Mountain-mahogany Shale Shrubland	CEGL002798
HERBACEOUS		
Inter-Mountain Basins Semi-Desert Grassland (CES304.787)		
Bromus tectorum Semi-natural Herbaceous Vegetation	Cheatgrass Semi-natural Herbaceous Vegetation	CEGL003019
Erodium cicutarium Semi-natural Annual Herbaceous Vegetation	Redstem Stork's-bill Semi-natural Annual Herbaceous Vegetation	CEGL002085
Hesperostipa comata Great Basin Herbaceous Vegetation	Needle-and-Thread Great Basin Herbaceous Vegetation	CEGL001705
Pleuraphis jamesii Herbaceous Vegetation	James' Galleta Herbaceous Vegetation	CEGL001777
Inter-Mountain Basins Shale Badland (CES304.789)		
Achnatherum hymenoides Shale Barren Herbaceous Vegetation	Indian Ricegrass Shale Barren Herbaceous Vegetation	CEGL001651
Leymus salinus Shale Sparse Vegetation	Salinas Lyme Grass Shale Sparse Vegetation	CEGL002745
Southern Rocky Mountain Montane-Subalpine Grassland (CES306.824)		
Bromus inermis - (Pascopyrum smithii) Semi-natural Herbaceous Vegetation	Smooth Brome - (Western Wheatgrass) Semi-natural Herbaceous Vegetation	CEGL005264
Pascopyrum smithii Herbaceous Vegetation	Western Wheatgrass Herbaceous Vegetation	CEGL001577
Poa fendleriana Herbaceous Vegetation	Muttongrass Herbaceous Vegetation	CEGL001925
Poa pratensis - (Pascopyrum smithii) Semi-natural Herbaceous Vegetation	Kentucky Bluegrass - (Western Wheatgrass) Semi-natural Herbaceous Vegetation	CEGL005265
SPARSE/TALUS/BEDROCK		
Rocky Mountain Cliff, Canyon and Massive Bedrock (CES306.815)		
Holodiscus dumosus Rock Outcrop Sparse Vegetation	Glandular Oceanspray Rock Outcrop Sparse Vegetation	CEGL002801

Table 8. Classified plant associations for the Black Canyon of the Gunnison National Park vegetation mapping project area, arranged by ecological system within each physiognomic group*.

NVCS Association	Common Name	Code†
Pseudotsuga menziesii / Holodiscus dumosus Scree Woodland	Douglas-fir / Glandular Oceanspray Scree Woodland	CEGL000902
Pseudotsuga menziesii Scree Woodland	Douglas-fir Scree Woodland	CEGL000911
RIPARIAN, WETLAND AND MESIC ASSOCIATIONS		
RIPARIAN AND WETLAND WOODLANDS AND SHRUBLANDS		
Rocky Mountain Lower Montane-Foothill Riparian Woodland and Shrubland (CES306.821)		
Acer negundo / Disturbed Understory Woodland	Box-elder / Disturbed Understory Woodland	CEGL002693
Acer negundo / Quercus gambelii Woodland [Provisional]	Box-elder / Gambel Oak Woodland	CEGL002797
RIPARIAN AND WETLAND HERBACEOUS COMMUNITIES		
Colorado Plateau Hanging Garden (CES304.764)		
Aquilegia micrantha - Calamagrostis scopulorum Herbaceous Vegetation	Mancos Columbine - Ditch Reedgrass Herbaceous Vegetation	CEGL002592
Rocky Mountain Lower Montane-Foothill Riparian Woodland and Shrubland (CES306.821)		
Juncus balticus Herbaceous Vegetation	Baltic Rush Herbaceous Vegetation	CEGL001838
Phalaris arundinacea Western Herbaceous Vegetation	Reed Canarygrass Western Herbaceous Vegetation	CEGL001474

* Plant associations as determined from the vegetation plot, observation point and accuracy assessment point data. Associations are ordered by physiognomy and grouped by ES. Identification codes are provided for plant associations and ecological systems. Because ES units are not constrained by physiognomy, they may appear more than once in the table.

† NatureServe assigns CEGL codes to track NVC associations within their databases. Park Specials are not part of the NVC and therefore do not have a CEGL code.

‡ The NatureServe codes following each Ecological System unit name provide a means of tracking the evolution of the concept in NatureServe's Biotics Tracking Database.

Plant Community Descriptions

This section provides a summary of BLCA vegetation by physiognomic group. Appendix F provides detailed local and global descriptions of the 77 plant associations, alliances and park special vegetation types identified for BLCA. Local descriptions are based on vegetation plot, observation point, and AA point data from the park and environs, supplemented by input from knowledgeable park staff. Global descriptions characterize the association across its range and are based primarily on published and unpublished literature.

Most of the plant communities sampled at BLCA fit into existing NVC association concepts, or were considered significant enough to create new NVC associations. One vegetation type was considered unique to the park, and was designated as a Park Special. Nine of these associations were semi-natural types dominated by non-native species. Twenty-eight types were documented from AA data collected after the initial classification review by NatureServe was complete.

Shrublands are by far the most common physiognomic types in BLCA, and are dominated by big sagebrush subspecies (*Artemisia tridentata*) and/or Gambel oak (*Quercus gambelii*) and serviceberry (*Amelanchier* spp.). Nearly as prevalent are woodlands dominated by two-needle pinyon (*Pinus edulis*) and Utah juniper (*Juniperus osteosperma*).

Upland Forest Associations

Dense forests were rare within BLCA and limited to protected north-facing slopes. Forested vegetation types consist of blue spruce, quaking aspen, and Douglas-fir stands that occupy some of the relatively mesic slopes along the Gunnison River gorge and upland areas in the southeast corner of BLCA along the boundary with CURE. The upland forest associations of BLCA include (in alphabetical order):

- *Populus tremuloides / Amelanchier alnifolia - Symphoricarpos oreophilus / Calamagrostis rubescens* Forest
- *Populus tremuloides / Quercus gambelii / Symphoricarpos oreophilus* Forest
- *Populus tremuloides / Symphoricarpos oreophilus / Thalictrum fendleri* Forest
- *Pseudotsuga menziesii / Carex geyeri* Forest
- *Pseudotsuga menziesii / Mahonia repens* Forest
- *Pseudotsuga menziesii / Quercus gambelii* Forest
- *Pseudotsuga menziesii / Symphoricarpos oreophilus* Forest

Upland Woodland Associations

Woodland types are represented primarily by pinyon-juniper woodlands and are moderately diverse and common, occupying many available habitats within BLCA, including mesa tops (especially along the western half of the park), canyon rims, slopes of the Gunnison River gorge, shale badlands, and alluvial fans. The upland woodland associations of BLCA include:

- *Juniperus osteosperma / Artemisia nova* Woodland
- *Juniperus osteosperma / Artemisia tridentata* ssp. *wyomingensis* Woodland
- *Juniperus osteosperma / Bromus tectorum* Semi-natural Woodland
- *Juniperus osteosperma / Leymus salinus* Woodland
- *Pinus edulis - (Juniperus monosperma, Juniperus osteosperma) / Hesperostipa comata* Woodland
- *Pinus edulis - (Juniperus spp.) / Holodiscus dumosus* Woodland [Provisional]
- *Pinus edulis - Juniperus osteosperma / Amelanchier utahensis* Woodland
- *Pinus edulis - Juniperus osteosperma / Artemisia nova* Woodland

- *Pinus edulis - Juniperus osteosperma / Atriplex* spp. Woodland [Provisional]
- *Pinus edulis - Juniperus osteosperma / Bromus tectorum* Semi-natural Woodland
- *Pinus edulis - Juniperus osteosperma /* Mixed Shrubs Talus Woodland
- *Pinus edulis - Juniperus osteosperma /* Sparse Understory Woodland
- *Pinus edulis - Juniperus* spp. */ Artemisia tridentata (*ssp. *wyomingensis,* ssp. *vaseyana)* Woodland
- *Pinus edulis - Juniperus* spp. */ Cercocarpus montanus* - Mixed Shrubs Woodland
- *Pinus edulis - Juniperus* spp. */ Leymus salinus* Woodland
- *Pinus edulis - Juniperus* spp. */ Poa fendleriana* Woodland
- *Pinus edulis - Juniperus* spp. */ Pseudoroegneria spicata* Woodland
- *Pinus edulis - Juniperus* spp. */ Quercus gambelii* Woodland
- *Pseudotsuga menziesii / Holodiscus dumosus* Scree Woodland
- *Pseudotsuga menziesii* Scree Woodland

Woodlands within BLCA are sparse to relatively dense, depending on elevation and slope. At lower elevations and on rocky, xeric slopes, Utah juniper dominates most frequently. At middle and higher elevations of the Park, on gentle to moderate slopes of mesa sides, pinyon-juniper woodlands commingle with montane shrubs, which form tall, sometimes dense understories. There are generally no sharp boundaries between these woodlands and the tall shrublands dominated by Gambel oak and Utah or Saskatoon serviceberry. These communities instead form a broad ecotone where the trees are sparser and smaller, up to the nearly flat tops of the mesas, where tall montane shrublands dominate.

At higher elevations are older, denser stands of either pure two-needle pinyon or pinyon-juniper woodlands that comprise the oldest woodlands in the Park. More recently, these old-growth stands have become threatened by the pinyon pine beetle (*Ips* spp.).

Upland Shrubland Associations

Shrubland associations occupy much of BLCA. The most common shrubland types include those dominated by Gambel oak (*Quercus gambelii*) or by subspecies of big sagebrush (*Artemisia tridentata*). These shrublands occupy diverse ecological locations (e.g., mesic lowlands to xeric uplands and landslide deposits to alkaline shale). The upland shrubland associations of BLCA include:

- *Amelanchier (utahensis, alnifolia) - Cercocarpus montanus* Shrubland
- *Amelanchier utahensis* - Mixed Shrub */ Carex geyeri* Shrubland
- *Artemisia nova / Poa fendleriana* Shrubland
- *Artemisia nova / Poa secunda* Shrubland
- *Artemisia tridentata (*ssp. *vaseyana,* ssp. *wyomingensis) - Amelanchier utahensis* Shrubland
- *Artemisia tridentata / Pleuraphis jamesii* Shrubland
- *Artemisia tridentata* ssp. *vaseyana / Achnatherum lettermanii* Shrubland
- *Artemisia tridentata* ssp. *vaseyana / Achnatherum pinetorum* Shrubland
- *Artemisia tridentata* ssp. *vaseyana / Balsamorhiza sagittata* Shrubland
- *Artemisia tridentata* ssp. *vaseyana / Hesperostipa comata* Shrubland
- *Artemisia tridentata* ssp. *vaseyana / Pascopyrum smithii* Shrubland
- *Artemisia tridentata* ssp. *vaseyana / Poa fendleriana* Shrubland
- *Artemisia tridentata* ssp. *vaseyana / Poa (pratensis, compressa)* Semi-natural Shrub Herbaceous Vegetation
- *Artemisia tridentata* ssp. *wyomingensis / (Agropyron cristatum, Psathyrostachys juncea)* Seeded Grasses Semi-natural Shrubland
- *Artemisia tridentata* ssp. *wyomingensis /* Disturbed Understory Semi-natural Shrubland

- *Artemisia tridentata* ssp. *wyomingensis / Hesperostipa comata* Colorado Plateau Shrubland
- *Atriplex canescens - Artemisia tridentata* Shrubland
- *Atriplex confertifolia* Wyoming Basins Shrubland
- *Atriplex corrugata* Dwarf-shrubland
- *Atriplex gardneri* Dwarf-shrubland
- *Cercocarpus montanus* Shale Shrubland [Provisional]
- *Ericameria nauseosa* Shrubland
- *Ericameria parryi / Achnatherum hymenoides* Shrubland
- *Glossopetalon spinescens var. meionandrum - Atriplex confertifolia* Shrubland [Park Special]
- *Holodiscus dumosus* Rock Outcrop Sparse Vegetation
- *Krascheninnikovia lanata / Achnatherum hymenoides* Dwarf-shrubland
- *Quercus gambelii - Cercocarpus montanus / (Carex geyeri)* Shrubland
- *Quercus gambelii - Holodiscus dumosus* Shrubland
- *Quercus gambelii / Amelanchier alnifolia* Shrubland
- *Quercus gambelii / Amelanchier utahensis* Shrubland
- *Quercus gambelii / Artemisia tridentata* Shrubland
- *Quercus gambelii / Carex geyeri* Shrubland [Provisional]
- *Quercus gambelii / Poa fendleriana* Shrubland
- *Quercus gambelii / Symphoricarpos oreophilus* Shrubland
- *Sarcobatus vermiculatus* Disturbed Shrubland

Short shrublands dominated by sagebrush species are common within BLCA, and have grassy understories generally varying by elevation and moisture gradients. Some sagebrush shrublands have withstood alterations such as chaining and mowing as well as domestic livestock grazing and the introduction of invasive species including Kentucky bluegrass and cheatgrass. On lower mesa slopes tall shrublands of Gambel oak, serviceberry species, and mountain mahogany form a complex mosaic with big sagebrush. The clonal character of Gambel oak causes it to form clumps within other communities, with a distinct suite of species in the understory. At the lowest elevations and concentrated in the environs of the Park are the saltbush- and shadscale-dominated shrublands typical of alkaline clay soils. These communities are frequently species-poor but some harbor rare and endemic species such as clay-loving buckwheat (*Eriogonum pelinophilum*). These communities are also subject to degradation through grazing, off-highway vehicle (OHV) use, and invasion by annual weeds including cheatgrass and storksbill (*Erodium cicutarium*).

Upland Herbaceous Associations

Herbaceous associations are uncommon within BLCA and tend to occur in small patches. Many meadows are being invaded by shrubs and trees, resulting in shrub herbaceous and wooded herbaceous associations. Many of these patches are smaller than the MMU size of ½ hectare. However, larger expanses of herbaceous communities dominated by exotic cheatgrass and storksbill, have invaded where wildfires removed stands of pinyon-juniper woodland. Native graminoid associations occupy xeric mesa tops that have been affected by grazing livestock and wildlife (in rare instances burrowing wildlife) in addition to fire. The upland herbaceous associations of BLCA include:

- *Achnatherum hymenoides* Shale Barren Herbaceous Vegetation
- *Bromus inermis - (Pascopyrum smithii)* Semi-natural Herbaceous Vegetation
- *Bromus tectorum* Semi-natural Herbaceous Vegetation
- *Erodium cicutarium* Semi-natural Annual Herbaceous Vegetation

- *Hesperostipa comata* Great Basin Herbaceous Vegetation
- *Leymus salinus* Shale Sparse Vegetation
- *Pascopyrum smithii* Herbaceous Vegetation
- *Pleuraphis jamesii* Herbaceous Vegetation
- *Poa fendleriana* Herbaceous Vegetation
- *Poa pratensis - (Pascopyrum smithii)* Semi-natural Herbaceous Vegetation

Riparian Woodland Associations

Riparian woodlands are restricted in their distribution to the Gunnison River floodplain and its tributary canyons. They vary according to the availability of water. Boxelder woodlands dominate the riverside alluvium of the main canyon bottom, where a lack of flushing river flows allowed establishment of these trees with a weedy understory. Riparian woodland associations of BLCA include:

- *Acer negundo* / Disturbed Understory Woodland
- *Acer negundo / Quercus gambelii* Woodland

Riparian and Wetland Herbaceous Associations

Riparian grasslands are restricted in their distribution to the Gunnison River floodplain and small drainages of the mesa top. A mixed forb and graminoid herbaceous association is restricted to hanging gardens on cliffs. All are restricted to areas with water at or near the surface for at least part of the growing season. Diversity is high, but most occur in patches smaller than the MMU. Riparian and wetland herbaceous associations of BLCA include:

- *Juncus balticus* Herbaceous Vegetation
- *Phalaris arundinacea* Western Herbaceous Vegetation
- *Aquilegia micrantha - Calamagrostis scopulorum* Herbaceous Vegetation

Dense, monotypic stands of reed canary grass have become established, particularly along Red Rock Creek and the Gunnison River. The seeds of this species are thought to have originally been transported from irrigated agricultural land and backyard feeders by birds, as it is a common ingredient in bird seed.

Hanging gardens are a common but little-studied feature of the north-facing canyon walls. They occur perched on small seeping ledges and in cracks hundreds of feet above the canyon bottom, and support communities of unusual species generally restricted to these habitats, including Mancos columbine and ditch reed grass (*Calamagrostis scopulorum*).

Field Key Preparation

An illustrated dichotomous field key to plant associations of the BLCA mapping area was developed for this project (Appendix G). The key was designed to assist users in identifying vegetation associations in the field. The key has two levels; the first level is defined by the physiognomy of the vegetation, i.e., forest, woodland, tall shrubland, shrubland, dwarf-shrubland, graminoid, or forb. The second level focuses on the dominant species' canopy cover. Brief environmental descriptions are included with the floristic descriptions to aid in identifying plant associations. To increase the utility of the key, individual plant associations are cross-referenced to map classes.

The association field key was constructed from data collected during the classification phase of the mapping project and revised following accuracy assessment of the map. Because the key is based on a sample of the vegetation, it probably does not account for all associations occurring within BLCA, nor does it explain the full range of variation of all associations as they appear in the park.

The field key was tested by NatureServe using BLCA vegetation plot data prior to its use by accuracy assessment field crews. A NatureServe ecologist selected random plots representing each association, removed the association identifier from the data and attempted to run each plot through the key using information contained in the MS Access database. Additional testing of the key occurred in the field during the AA phase of this project. Areas where the key was confusing or unclear were identified and solutions proposed. The field key in Appendix G is the final version containing revisions based on these suggestions. It also contains the most important associations discovered during the AA phase of the project.

Assessment of Global Rarity

BLCA represents the more mesic eastern edge of the Colorado Plateau and as such is a unique landscape. Particularly rare are the plant species associated with hanging gardens and seeping ledges that occur where there is contact between impervious rock layers or bedrock cracks and seeps emerge. Few plant associations at BLCA are considered globally imperiled (NatureServe 2008); however not enough is known about many of the associations present to evaluate global rarity.

The Nature Conservancy and the Natural Heritage Network assess plant communities as to rarity and degree of imperilment by applying a global conservation status rank. The global scale for ranking ranges from 1 to 5, with a rank of "1" indicating critical emperilment due to rarity, endemism, and/or threats, and a rank of "5" indicating little or no risk of extirpation or elimination of the plant community. No plant associations occurring within BLCA are considered critically imperiled (G1). There are five associations considered imperiled (G2): *Achnatherum hymenoides* Shale Barren Herbaceous Vegetation, *Amelanchier (utahensis, alnifolia)* - *Cercocarpus montanus* Shrubland, *Amelanchier utahensis* - Mixed Shrub / *Carex geyeri* Shrubland, *Pascopyrum smithii* Herbaceous Vegetation, and *Pinus edulis* - *(Juniperus monosperma, Juniperus osteosperma) / Hesperostipa comata* Woodland (Figure 25). Thirty-eight associations are ranked vulnerable to secure (G3, G4, and G5) and the remainder (34 associations) are not yet ranked or are new to the NVCS.

Almost all vegetation communities within BLCA are subject to change over time. Major agents of change in this region include drought, flood, and fire. Riparian and wetland plant communities within BLCA are particularly threatened due to non-native plant species introductions and other effects of a managed hydrologic system. This threat is heightened because non-native plant species invade mesic habitats to a larger degree than dry, upland habitats (except recent burns, which are invaded by cheatgrass).



Photo Credit: NPS/NCPN

Figure 25. The globally imperiled *Achnatherum hymenoides* Shale Barren Herbaceous Vegetation association at BLCA.

Fuels Data Collection

Natural and prescribed fires are an established element of the BLCA ecosystem. Under the current fire management plan, all fires are managed intensively, and suppressed if the prescribed conditions are not present (NPS 2006a). The proximity of private land, ranching operations, and developments adjacent to the Park boundary increases the concern associated with any fire. Information on stand structure and canopy characteristics is needed to model the potential for crown fire behavior. This information is of great importance for making fire management decisions. Fire fuels data were collected as part of the BLCA vegetation mapping project, and along with new digital orthophotography, these data will assist managers with regional fire planning and management. The attributes described below were selected using the NCPN fuels protocols established for Dinosaur National Monument to supplement the vegetation plot data and map class attributes in providing a complete picture of fire fuels for BLCA. These data were entered in the BLCA MS Access database. Fuels data were not analyzed as part of this project.

Fuels Data

Beginning with the 2002 sampling season, field crews began collecting data to characterize woody fuels and woodland and forest canopy structure, following the forms and methods used for the Dinosaur National Monument vegetation mapping project (Coles et al. 2008), with some exceptions. In order to better characterize the structure of all woodland and forest types, height, diameter, canopy measurements and tree structure stage were estimated and recorded in some deciduous and riparian conifer stands, whereas the Dinosaur National Monument methods called for collecting these data only in pinyon-juniper, ponderosa pine and Douglas-fir stands. Quantitative fuels data collected in tree-dominated vegetation plots (except pinyon-juniper) at BLCA included:

- trunk diameter at breast height (DBH)
- tree height (for deciduous species and riparian conifers)
- crown base height
- crown ratio
- structural stage (position in the canopy)
- litter and duff measurements

Different variables were measured in pinyon-juniper woodland plots. Fuels data gathered for each stem or tree greater than 1.4 m (4.5 ft) in height included:

- stem diameter at root crown (DRC)
- crown base height (used primarily)
- crown height (used for 10 plots in place of crown base height)
- tree height
- crown width
- litter and duff measurements (taken only in some woodland stands and in all forest stands dominated by other species, i.e. Douglas-fir, ponderosa pine, etc.)

Field crews also collected qualitative information to support fuels categorization at each plot. Each pinyon-juniper woodland plot was placed in one of four age class categories (invasive,

young, mature, or old-growth). Fuel conditions for each forest, woodland or shrubland plot were characterized by comparing the site to a photo series depicting different fuel loading conditions (USFS 2008, Ottmer et al. 2000a, Ottmer et al. 2000b, Fischer 1981) and recording the most representative photo number. Since a fuels photo series for quaking aspen or Gambel oak was not available at the time of data collection, an experienced field technician used plot photos and compared them to the fuels photo series to assign a fuels photo number. The technician also checked the pinyon-juniper fuels series data and filled in any missing data where possible. Notes describing ancillary information, including trees with dead crowns, twinning of the crown, etc. were recorded. In addition, a density attribute was applied to all sagebrush, Gambel oak, woodland, and forest polygons during the interpretation and digitizing process. Photographs taken to document conditions at all classification plots and observation points can support added fire fuels analyses. Field forms, protocols, and definitions for collecting fuels data appear in Appendix B.1 and Appendix B.3.

Vegetation Mapping

Methods

The process of mapping vegetation and land use in the BLCA project area followed four steps:

1. Field reconnaissance
2. Map class development
3. Mapping
4. Spatial database development

Each step built upon the previous one. Field reconnaissance was intended to familiarize the photointerpreters with the Park, patterns of vegetation distribution, and environmental factors useful for developing mapping models. Map class development followed this reconnaissance and was based on intensive review of the aerial imagery in concert with data from the first year of vegetation plot sampling. The mapping phase applied the map class concepts in order to draw consistent, homogenous polygons on the base orthoimagery. The draft polygon set was digitized and given additional attributes (spatial database development).

Field Reconnaissance and Map Class Development

Field reconnaissance by the BLCA plant ecologist and NCPN photointerpreter was conducted following vegetation/classification plot data collection during the summer and fall of 2003. The lead project ecologist joined the photointerpreter to familiarize him with BLCA vegetation and local ecological relationships during two field sessions in the spring of 2004. Reconnaissance sessions focused on comparing site-based vegetation conditions with signatures on the project aerial photography, examining the accuracy of preliminary linework produced by the USBOR remote sensing staff, understanding environmental factors that influence vegetation patterns, and identifying what signatures could be accurately interpreted from the project imagery. Prior to visiting the park, paper plots of the orthoimagery were created for use in fieldwork, along with the original color stereo photography prints mounted with Mylar overlays for recording notes. Field notes were written directly on these plots and photograph overlays and were used for guidance during the interpretation, polygon attribution, and digital database process. Additional field reconnaissance data were collected during the 2004 field season that were tailored to meet the need of the photointerpreter and used to produce narrative descriptions of plant communities.

The goal of map class development was to identify easily recognized units to represent existing vegetation and land uses for the BLCA vegetation mapping project area. Map classes specific to this project were developed to characterize distinctive vegetation within the Park and the environs. Standard land-use map classes (Anderson et al. 2002) were used to map developed parts of the mapping area such as park facilities and roads. In unvegetated portions of the project area, map classes were defined by the geologic substrate. The same map classes were used within the Park and in the environs.

Interpretation and attribution of vegetation map classes addressed all types meeting the 0.5-hectare MMU. The mapping standard for the USGS-NPS Vegetation Mapping Program projects is to map to the association level of the NVC. Meeting this standard, however, is limited by the skill and experience of the photointerpreter, the quality of the available imagery, and the quantity and quality of supporting information. In practice, relationships between map classes and plant

associations within a project area are complex. Distinguishing floristic relationships on aerial photography is often difficult and as a result similar plant associations may be grouped into a single map class. Map classes for the BLCA project were developed by the photointerpreter in consultation with the BLCA plant ecologist. A preliminary set of map classes was developed in the fall of 2003 using the results of the initial vegetation classification by NatureServe ecologists. Some map classes were represented by single plant associations and others were represented by groups of plant associations. Map class definitions and concepts were adjusted throughout the project as more information became available.

Polygon Attributes

In order to facilitate use of vegetation maps and mapping data across multiple parks, the NCPN adopted a convention for naming and presenting map classes. For each map class representing an NVC plant association, the NatureServe common name (e.g., Pinyon - Juniper / Gambel Oak Woodland) was used. Names for map classes representing complexes of associations followed the convention of using the unifying botanic and environmental factors, e.g., Quaking Aspen / Tall Shrubs Forest.

To facilitate tracking and management of vegetation map class information, NCPN developed a map class coding system. Photointerpreters tend to assign a unique number to each map class as a shorthand for labeling polygons. These numeric codes have been retained within the spatial database and map class guide (Appendix J). NCPN developed a five-letter alphacode system for map classes to be used in all park vegetation mapping projects. Each alphacode begins with the first letter of the corresponding NVC Class (F = Forest, W = Woodland, S = Shrubland, H = Herbaceous, N = nonvascular, and C = Complex). The subsequent four letters generally abbreviate the scientific or common names forming the map class name. For example, the Gambel Oak / Mixed Montane Shrubland map class is represented by the alphacode “S-QUMX.” For map classes representing coarser levels of the NVC, geologic exposures, and other non-vegetated features, generic names incorporating vegetation and landscape features were used. Geologic exposures were given the prefix G = geology and developed sites the prefix L = land cover/land use.

Photo interpretation and polygon labeling and attribution procedures were standardized for all NCPN vegetation mapping projects (Evenden 2004). After a map class was assigned to each polygon, the polygon was assigned attributes to characterize vegetation structure (density, pattern, height; Table 9), land use and disturbance. All map polygons were assigned to a land cover / land use type (Anderson et al. 2002; Appendix H). In addition, all polygons were assigned to higher levels of the NVC hierarchy, with the exception of non-vegetated map classes, which were coded as ‘unclassified’ or ‘unvegetated’ in the NVC columns.

Table 9. Physiognomic attributes of polygons. In some cases, these attributes were assigned to individual polygons. Otherwise, they were assigned to an entire map class.

Category	Attribute	Description
Vegetation Canopy Density (Applied to forest, woodland, and shrub-dominated map classes)	A	Closed Tree Canopy/Continuous (> 60% cover)
	B	Open Tree Canopy/Discontinuous (25- 60% cover)
	C	Dispersed – Sparse Tree Canopy (10-25% cover)
	D	Dense Shrub Canopy (> 40% cover)
	E	Light Shrub Canopy (10 – 40% cover)
Vegetation Pattern (Applied to all vegetation map classes)	1	Clumped/Bunched
	2	Linear
	3	Gradational/Transitional
	4	Regularly Alternating
	5	Homogenous
Vegetation Height (Applied to woody terrestrial vegetation map classes only)	F	Forest and Woodlands > 30 meters tall
	G	Forest and Woodlands 15 – 30 meters
	H	Forest and Woodlands 5 – 15 meters
	I	Forest and Woodlands 1 – 5 meters
	J	Forest and Woodlands < 0.5 meters
	K	Shrublands 1 – 5 meters
	L	Shrublands 0.5 – 1 meters
	M	Shrublands 0 – 0.5 meters

NCPN photointerpretation standards (Evenden 2004) defined a suite of polygon modifiers to describe altered vegetation, landforms, transportation and utilities, and other situations. Table 10 is a list of the modifiers used in the BLCA project.

Table 10. Modifiers used to provide additional information for map polygons in the BLCA vegetation mapping project area.

Category	Code	Name	Description
Vegetation Modifiers	a	Altered	Applies when some alteration is present, but the type is visually indistinguishable from unaltered stands
	d	Chained	Applies to systems disturbed by chaining
	i	Invasive	Applies to systems invaded or dominated by exotic plant species
	g	Greasewood	Homogenous stands of *Sarcobatus vermiculatus*
	m	Older Burned	Applies to systems disturbed by burns more than one year old (as seen in photography).
	n	Mesic Meadows	Applies to meadows and drainageways where water is at or near the surface most of the year and supports mesic species of rush and/or sedge

Table 10. Modifiers used to provide additional information for map polygons in the BLCA vegetation mapping project area.

Category	Code	Name	Description
Vegetation Modifiers	p	Prairie dog activity	Applies to systems disturbed by prairie dogs.
	q	Bare talus and rockfall	Rock fragments, usually large and angular, derived from and lying at the base of cliffs or steep rocky slopes.
Landform Modifiers	r	Bare exposed rock/sandstone cliff	Bedrock outcrops forming flat expanses, ledges, and hills, and vertical exposures of sedimentary rock.
	s	Sandbar	Cobble, gravel, sand and/or silt
	t	Treed	Shrublands or grasslands where there is a component of tree cover (wooded shrublands or wooded grasslands)
Transportation Modifiers	u	Gravel/dirt Road	A transportation corridor (travel lanes, borrw ditches, and right-of-way) consisting of a roadbed of imported gravel or graded native soil and subsoil. Cut and fill slopes associated with construction may or may not be present.
	v	Paved Road	A transportation corridor (travel lanes, median strips, interchanges, shoulders, borrw ditches and right-of-way) consisting of a roadbed overtopped by an asphalt or concrete surface. Right-of-way typically extends to the limit of cut and fill slopes associated with construction.

Mapping

The mapping component of the BLCA project used a combination of methods to interpret and delineate vegetation polygons. Initial line work was prepared by USBOR photointerpreters who delineated the most contrasting signatures, e.g., water bodies, exposed shoreline, unvegetated geology, land use types, and vegetation at the physiognomic level. The project photo interpreter used this baseline mapping and refined it by examining digital orthophotos in stereo. The stereo photography was used as needed to distinguish fine scale vegetation patterns. Ancillary datasets such as plot and observation point data and classification and local descriptions of plant associations were used by the photointerpreter to assist with map class definitions and manual delineations. Polygons were drawn on Mylar overlays of printed orthophotos that were later scanned, or were drawn digitally on a computer screen. Heads-up digitizing consisted of delineating map class polygons on an electronic version of the digital orthophotos at a computer workstation. Digitizing was performed using vector editing in ArcGIS. The line work was refined and finalized by the SEUG GIS Specialist and the map class and other descriptive

attributes for each polygon were assigned. The park and the environs were interpreted and mapped to the same level of detail.

Spatial Database Development

Each polygon was assigned a map class number, alpha code, and name, Anderson land use class, and vegetation density, pattern, and height attributes. In order to improve the utility of the map and related data, the spatial database was moved into a geodatabase format, the general structure of which is illustrated in Figure 26. This format allows text and image information to be incorporated and linked to spatial coordinates. A more detailed description of the geodatabase and its component data fields appears in Appendix C.

Map Classes

The original set of mapping concepts developed for BLCA was based on the preliminary vegetation classification developed by NatureServe from 2000-2003 plot data. The intent was to map individual associations, if possible, through photointerpretation or ecological modeling. In practice, the set of map classes was reduced throughout the mapping phase of the project, as the photointerpreter and project ecologists realized that many associations were difficult to recognize consistently on the imagery. These associations were combined into complex or mosaic map classes based on ecological and morphological similarity. Changes to the map classes made following the 2004 accuracy assessment are discussed in a later section of this report.

The final map legend for BLCA consists of thirty-five map classes (Table 11). Of these, 24 are vegetation map classes and 11 are land-use map classes. Of the 24 vegetation map classes, two have no vegetation associations assigned to them, one is represented by points only and 4 represent single NVC plant associations. The remaining 17 vegetation map classes represent polygons delineating multiple plant associations.

Ecological systems (Comer et al. 2003) are used to organize the vegetation map classes (see discussion in the Project Overview section and Appendix A). They were developed by NatureServe to complement the NVC by creating a mappable classification unit representing groups of biologic communities in similar environments and shaped by similar ecologic processes. Ecological systems typically occur in patches of tens to thousands of hectares and are expected to persist for 50 or more years. The timeframe allows successional dynamics to be integrated into the concept of each ecological system.

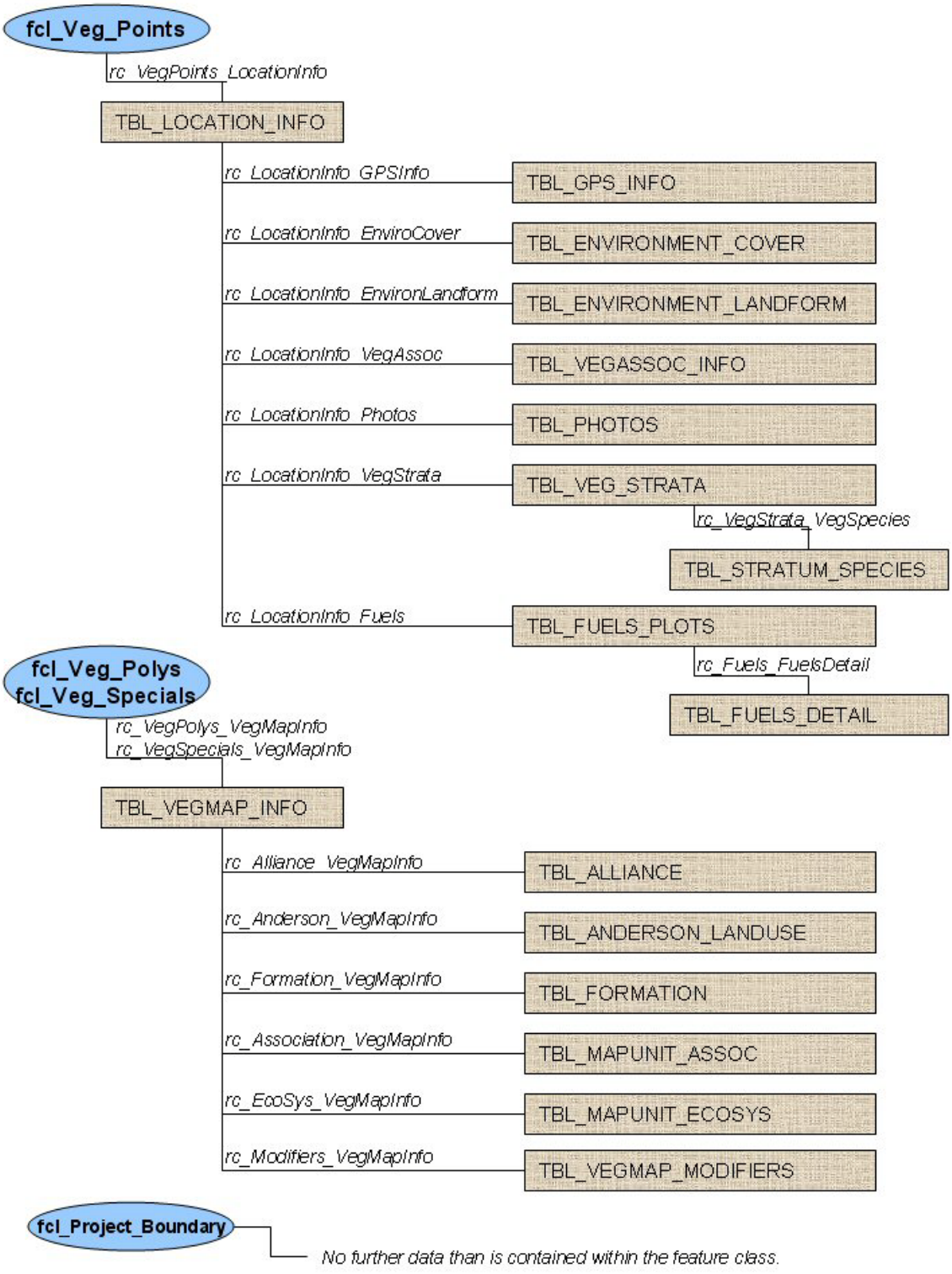


Figure 26. Structure of the BLCA geodatabase.

Results

Table 11 shows the relationship of vegetation map classes to ecological systems, ordered roughly by physiognomy: upland forests, woodlands, riparian forests/woodlands, shrublands, grasslands, and sparse vegetation. Appendix A provides summary descriptions of each ecological system. The Anderson land use map classes could not be placed within the ecological system classification.

Map Class Descriptions

Appendix J provides detailed descriptions of all vegetation map classes used in the final version of the BLCA vegetation mapping project. Each map class description includes:

- a summary of the ecological concept of the map class. Reference is made to the abundance and distribution of the map class within the park as well as the entire project area
- a list of plant associations and common plant species occurring within the map class
- a qualitative description of the photographic signature along with representative samples from the orthophotography
- ground photographs
- statistics and accuracy assessment results

Map Polygons

The BLCA vegetation map consists of 3,270 polygons totaling 22,989 hectares (56,807 acres). Average polygon size is 7.0 ha (17.4 acres). Lands within the Park make up 12,632 ha (31,214 acres) or 55% of the total project area. Of the total, 3,104 polygons (95%) represent natural or semi-natural vegetation map classes covering 96.5% of the mapping project area. Map classes representing non-vegetated rock outcrops and developed or other land use areas account for the remaining 166 polygons (5% of polygons and 3.5% of the area).

The polygon count includes adjacent polygons that have the same map code but different density or pattern attributes. The most common map class is Gambel Oak / Mixed Montane Shrubland (S-QUMX) with 554 polygons covering 28.6% of the mapping area. The largest average polygon size belongs to the Gunnison River map class (L-RIVE) with 2 polygons averaging 37.1 ha (91.7 acres) each. Of the natural vegetated types, the Mancos Shale Badlands Complex map class (C-SHAL) has the largest average polygon size at 30.7 ha (75.9 acres) per polygon

Hanging gardens at BLCA occupy vertical sites on cliff faces or alcoves under cliff overhangs and are generally not visible on aerial imagery. All stands of this community within the Park are also much smaller than the 0.5 ha MMU. This vegetation type was therefore mapped as a point layer based on field observations.

Figure 27 is a map of BLCA vegetation created from the GIS spatial database. Because a geodatabase format was used to store and organize spatial information, there are far more data in the spatial database than can be conveyed in a two-dimensional map. Maps can be produced with vegetation polygons labeled in many different ways at different levels of resolution. Table 12 provides summary statistics for BLCA vegetation map polygons.

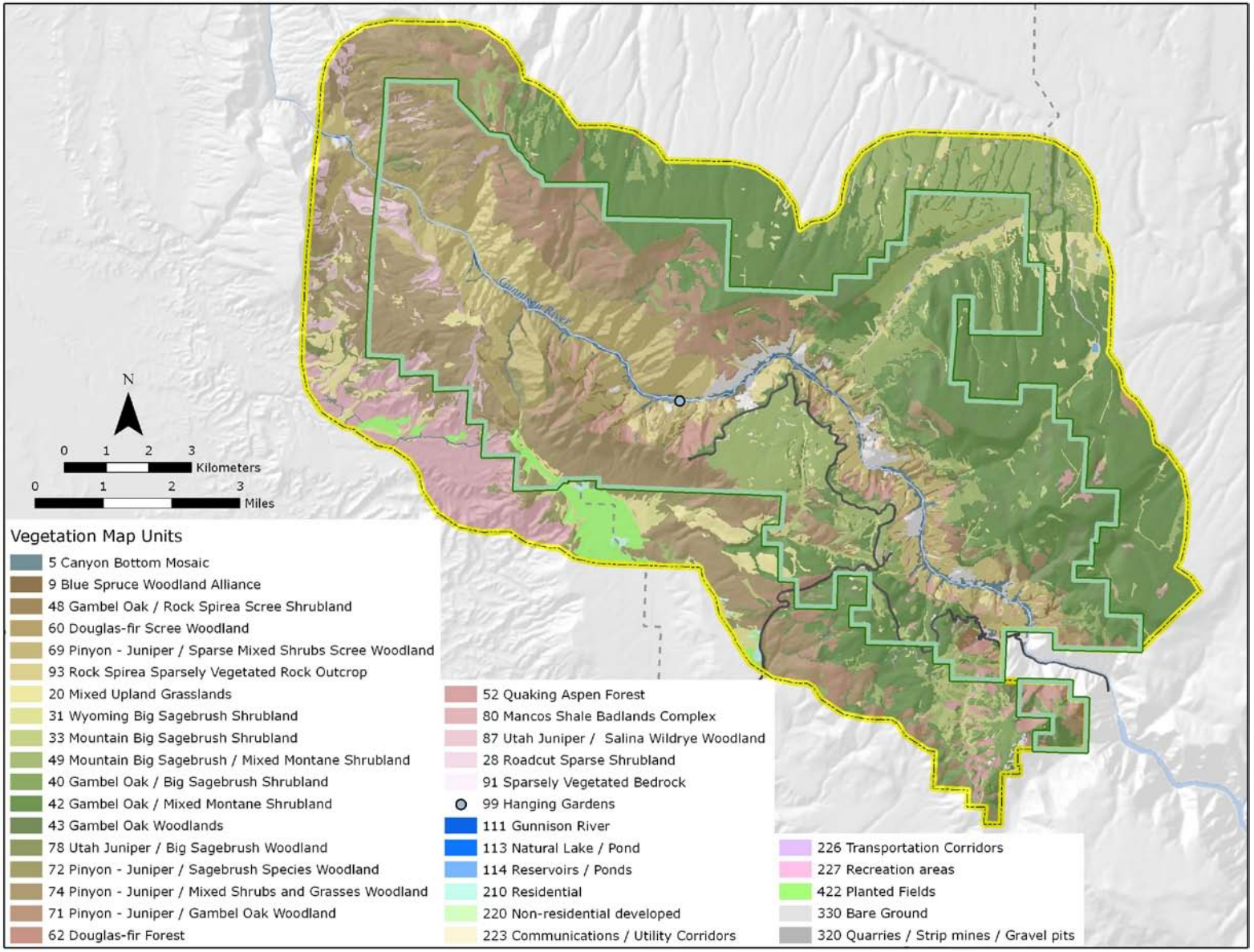


Figure 27. The BLCA vegetation map.

Table 11. Map classes used in the final BLCA vegetation map, with map class number, code and name, crosswalk to NVC association, and the relationship of map class to plant associations. BLCA vegetation map classes are arranged using the NatureServe ecological systems classification.

Map Class #	Map Class Code	Map Class Name	Description or Associations Assigned to Map Class	Relation
Rocky Mountain Aspen Forest and Woodland (CES306.813)				
52	F-POTR	Quaking Aspen Forest	Populus tremuloides / Amelanchier alnifolia - Symphoricarpos oreophilus / Calamagrostis rubescens Forest Populus tremuloides / Symphoricarpos oreophilus / Thalictrum fendleri Forest Populus tremuloides / Quercus gambelii / Symphoricarpos oreophilus Forest	1 : many
Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland (CES306.823)				
62	F-PSME	Douglas-fir Forest	Pseudotsuga menziesii / Carex geyeri Forest Pseudotsuga menziesii / Mahonia repens Forest Pseudotsuga menziesii / Quercus gambelii Forest Pseudotsuga menziesii / Symphoricarpos oreophilus Forest	1 : many
Colorado Plateau Pinyon-Juniper Woodland (CES304.767)				
69	W-PJSC	Pinyon - Juniper / Sparse Mixed Shrubs Scree Woodland	Pinus edulis - (Juniperus monosperma, Juniperus osteosperma) / Hesperostipa comata Woodland Pinus edulis - Juniperus spp. / Cercocarpus montanus - Mixed Shrub Woodland Pinus edulis – (Juniperus spp.) / Holodiscus dumosus Woodland Pinus edulis - Juniperus osteosperma / Sparse understory Woodland	1 : many
71	W-PJQU	Pinyon - Juniper / Gambel Oak Woodland	Pinus edulis - Juniperus spp. / Quercus gambelii Woodland	1 : 1
72	W-PJAR	Pinyon - Juniper / Sagebrush Species Woodland	Pinus edulis - Juniperus osteosperma / Artemisia nova Woodland Pinus edulis - Juniperus spp. / Artemisia tridentata (ssp. wyomingensis, ssp. vaseyana) Woodland Juniperus osteosperma / Artemisia nova Woodland	1 : many

Table 11. Map classes used in the final BLCA vegetation map, with map class number, code and name, crosswalk to NVC association, and the relationship of map class to plant associations. BLCA vegetation map classes are arranged using the NatureServe ecological systems classification.

Map Class #	Map Class Code	Map Class Name	Description or Associations Assigned to Map Class	Relation
74	W-PJMX	Pinyon - Juniper / Mixed Shrubs and Grasses Woodland	Juniperus osteosperma / Bromus tectorum Semi-natural Woodland Pinus edulis - Juniperus osteosperma / Bromus tectorum Semi-natural Woodland Pinus edulis - Juniperus osteosperma / Mixed Shrubs Talus Woodland Pinus edulis - Juniperus osteosperma / Sparse Understory Woodland Pinus edulis - Juniperus spp. / Amelanchier utahensis Woodland Pinus edulis - Juniperus spp. / Cercocarpus montanus - Mixed Shrub Woodland Pinus edulis - Juniperus spp. / Leymus salinus Woodland Pinus edulis - Juniperus spp. / Pseudoroegneria spicata Woodland Pinus edulis - Juniperus spp. / Poa fendleriana Woodland	1 : many
78	W-JUAR	Utah Juniper / Big Sagebrush Woodland	Juniperus osteosperma / Artemisia tridentata ssp. wyominensis Woodland Juniperus osteosperma / Bromus tectorum Semi-natural Woodland	1 : 1
87	W-JULE	Utah Juniper / Salina Wildrye Woodland	Pinus edulis - Juniperus osteosperma / Atriplex spp. Woodland Pinus edulis - Juniperus spp. / Leymus salinus Woodland Juniperus osteosperma / Leymus salinus Woodland	1 : many
Rocky Mountain Lower Montane-Foothill Riparian Woodland and Shrubland (CES306.821)				
5	C-CANY	Canyon Bottom Mosaic	Acer negundo / Disturbed Understory Woodland Acer negundo / Quercus gambelii Woodland Phalaris arundinacea Western Herbaceous Vegetation	1 : many
Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland (CES306.825)				
9	W-PICE	Blue Spruce Woodland Alliance	N/A	1 : 1
Inter-Mountain Basins Semi-Desert Shrub-Steppe (CES304.788)				
28	S-ROAD	Roadcut Sparse Shrubland	Ericameria parryi / Achnatherum hymenoides Shrubland Ericameria nauseosa Shrubland	1 : many

Table 11. Map classes used in the final BLCA vegetation map, with map class number, code and name, crosswalk to NVC association, and the relationship of map class to plant associations. BLCA vegetation map classes are arranged using the NatureServe ecological systems classification.

Map Class #	Map Class Code	Map Class Name	Description or Associations Assigned to Map Class	Relation
Multiple Ecological Systems: Colorado Plateau Mixed Low Sagebrush Shrubland (CES304.762) Inter-Mountain Basins Big Sagebrush Shrubland (CES304.777)				
31	S-ARWY	Wyoming Big Sagebrush Shrubland	Artemisia nova / Poa fendleriana Shrubland Artemisia nova / Poa secunda Shrubland Artemisia tridentata / Pleuraphis jamesii Shrubland Artemisia tridentata ssp. wyomingensis / (Agropyron cristatum, Elymus junceus) Seeded Grasses Semi-natural Shrubland Artemisia tridentata ssp. wyomingensis / Disturbed Understory Shrubland Artemisia tridentata ssp. wyomingensis / Hesperostipa comata Shrubland Ericameria nauseosa Shrubland	1 : many
Inter-Mountain Basins Montane Sagebrush Steppe (CES304.785)				
33	S-ARVA	Mountain Big Sagebrush Shrubland	Artemisia tridentata ssp. vaseyana / Achnatherum lettermanii Shrubland Artemisia tridentata ssp. vaseyana / Achnatherum pinetorumShrubland Artemisia tridentata ssp. vaseyana / Balsamorhiza sagittata Shrubland Artemisia tridentata ssp. vaseyana / Hesperostipa comata Shrubland Artemisia tridentata ssp. vaseyana / Pascopyrum smithii Shrubland Artemisia tridentata ssp. vaseyana / Poa fendleriana Shrubland Artemisia tridentata ssp. vaseyana / Poa (pratensis, compressa) Semi-natural Shrub Herbaceous Vegetation	1 : many
Rocky Mountain Gambel Oak-Mixed Montane Shrubland (CES306.818)				
40	S-QUAR	Gambel Oak / Big Sagebrush Shrubland	Quercus gambelii / Artemisia tridentata Shrubland	1 : 1
43	S-QUSY	Gambel Oak Woodlands	Quercus gambelii / Amelanchier alnifolia Shrubland Quercius gambelii / Carex geyeri Shrubland Quercus gambelii / Symphoricarpos oreophilus Shrubland	1 : many
48	S-QUHO	Gambel Oak / Rock Spirea Scree Shrubland	Quercus gambelii - Holodiscus dumosus Shrubland	1 : 1

Table 11. Map classes used in the final BLCA vegetation map, with map class number, code and name, crosswalk to NVC association, and the relationship of map class to plant associations. BLCA vegetation map classes are arranged using the NatureServe ecological systems classification.

Map Class #	Map Class Code	Map Class Name	Description or Associations Assigned to Map Class	Relation
Multiple Ecological Systems: **Rocky Mountain Gambel Oak-Mixed Montane Shrubland (CES306.818)** **Rocky Mountain Lower Montane-Foothill Shrubland (CES306.822)**				
42	S-QUMX	Gambel Oak / Mixed Montane Shrubland	Amelanchier utahensis - Mixed Shrub / Carex geyeri Shrubland Amelanchier (utahensis, alnifolia) - Cercocarpus montanus Shrubland Cercocarpus montanus Shale Shrubland Quercus gambelii / Amelanchier utahensis Shrubland Quercus gambelii - Cercocarpus montanus / (Carex geyeri) Shrubland Quercius gambelii / Carex geyeri Shrubland Quercus gambelii / Poa fendleriana Shrubland [Provisional]	1 : many
Multiple Ecological Systems: **Inter-Mountain Basins Montane Sagebrush Steppe (CES304.785)** Rocky Mountain Gambel Oak-Mixed Montane Shrubland (CES306.818)				
49	S-MXMO	Mountain Big Sagebrush / Mixed Montane Shrubland	Amelanchier utahensis - Mixed Shrub / Carex geyeri Shrubland Artemisia tridentata (ssp. vaseyana, ssp. wyomingensis) - Amelanchier utahensis Shrubland Artemisia tridentata ssp. vaseyana / Hesperostipa comata Shrub Herbaceous Artemisia tridentata ssp. vaseyana / Poa (pratensis, compressa) Semi-natural Shrub Herbaceous	1 : many
Multiple Ecological Systems: **Inter-Mountain Basins Mixed Salt Desert Scrub (CES304.784)** **Inter-Mountain Basins Semi-Desert Grassland (CES304.787)** **Rocky Mountain Lower Montane-Foothill Shrubland (CES306.822)** **Southern Rocky Mountain Montane-Subalpine Grassland (CES306.824)**				
20	H-MXHE	Mixed Upland Grasslands	Achnatherum hymenoides Shale Barren Herbaceous Vegetation Bromus inermis - (Pascopyrum smithii) Semi-natural Herbaceous Vegetation Bromus tectorum Semi-natural Herbaceous Vegetation Erodium cicutarium Semi-natural Annual Herbaceous Vegetation Juncus balticus Herbaceous Vegetation Hesperostipa comata Great Basin Herbaceous Vegetation Pascopyrum smithii Herbaceous Vegetation Pleuraphis jamesii Herbaceous Vegetation Poa fendleriana Herbaceous Vegetation Poa pratensis - (Pascopyrum smithii) Semi-natural Herbaceous Vegetation	1 : many

Table 11. Map classes used in the final BLCA vegetation map, with map class number, code and name, crosswalk to NVC association, and the relationship of map class to plant associations. BLCA vegetation map classes are arranged using the NatureServe ecological systems classification.

Map Class #	Map Class Code	Map Class Name	Description or Associations Assigned to Map Class	Relation
Multiple Ecological Systems: Inter-Mountain Basins Shale Badland (CES304.789) Inter-Mountain Basins Mixed Salt Desert Scrub (CES304.784) Inter-Mountain Basins Shale Badland (CES304.789) Inter-Mountain Basins Greasewood Flat (CES304.780)				
80	C-SHAL	Mancos Shale Badlands Complex	Atriplex canescens - Artemisia tridentata Shrubland Atriplex confertifolia Wyoming Basins Shrubland Atriplex corrugata Dwarf-shrubland Atriplex gardneri Dwarf-shrubland Glossopetalon spinescens var. meionandrum - Atriplex confertifolia Shrubland [Park Special] Krascheninnikovia lanata / Achnatherum hymenoides Dwarf-shrubland Leymus salinus Shale Sparse Vegetation Sarcobatus vermiculatus Shrubland	1 : many
Rocky Mountain Cliff, Canyon and Massive Bedrock (CES306.815)				
93	S-HODU	Rock Spirea Sparsely Vegetated Rock Outcrop	Holodiscus dumosus Rock Outcrop Sparse Vegetation Cercocarpus montanus Shale Shrubland	1 : 1
60	W-PSHO	Douglas-fir Scree Woodland	Pseudotsuga menziesii / Holodiscus dumosus Scree Woodland Pseudotsuga menziesii Scree Woodland	1 : many
Not Assigned to an Ecological System				
91	G-SPAR	Sparsely Vegetated Bedrock	N/A	1 : 1
Colorado Plateau Hanging Garden (CES304.764)				
99	H-HANG	Hanging Garden Vegetation	Aquilegia micrantha - Calamagrostis scopulorum Herbaceous Vegetation	1 : 1

Table 11. Map classes used in the final BLCA vegetation map, with map class number, code and name, crosswalk to NVC association, and the relationship of map class to plant associations. BLCA vegetation map classes are arranged using the NatureServe ecological systems classification.

Map Class #	Map Class Code	Map Class Name	Description or Associations Assigned to Map Class	Relation
LAND USE MAP CLASSES				
111	L-RIVE	Gunnison River	Streams and rivers	N/A
113	L-POND	Natural Ponds / Lakes	Natural Ponds / Lakes	N/A
114	L-RESV	Reservoirs / Ponds	Reservoirs and stock ponds	N/A
210	L-RESI	Residential	Residential	N/A
220	L-RESD	Non-residential developed	Non-residential developed	N/A
223	L-COMM	Communications / Utility Corridors	Communications and utilities	N/A
226	L-CORR	Transportation Corridors	Transportation (road and ditch/roadbank introduced/altered vegetation)	N/A
227	L-CAMP	Recreation areas	Entertainment and Recreation (Camping areas or other facilites.)	N/A
320	L-QUAR	Quarries / Strip mines / Gravel pits	Quarries, strip mines, and gravel pits	N/A
330	L-BARE	Bare Ground	Bare rock or substrate (including bedrock, sandbars, talus, etc.)	N/A
422	L-CROP	Planted Fields	Cultivated Grasses, Pasture / Hay, Irrigated Pasture / Hay	N/A

Table 12. Summary statistics for polygons of each map class developed for the BLCA vegetation mapping project.

Map Code	Map Class Common Name	Polygons			Area (hectares)		
		Park	Environs	Total Area*	Park	Environs	Total Area
Rocky Mountain Aspen Forest and Woodland (CES306.813)							
F-POTR	Quaking Aspen / Tall Shrubs Forest	28	36	64	51.4	102.5	153.9
	Subtotal	*28*	*36*	*64*	*51.4*	*102.5*	*153.9*
Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland (CES306.823)							
F-PSME	Douglas-fir Forest	88	18	106	344.6	30.2	374.8
	Subtotal	*88*	*18*	*106*	*344.6*	*30.2*	*374.8*
Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland (CES306.825)							
W-PICE	Blue Spruce Woodland Alliance	39	2	41	46.4	1.4	47.7
	Subtotal	*39*	*2*	*41*	*46.4*	*1.4*	*47.7*
Colorado Plateau Pinyon-Juniper Woodland (CES304.767)							
W-PJSC	Pinyon - Juniper / Sparse Mixed Shrubs Scree Woodland	59	19	78	1,356.7	172.4	1,529.0
W-PJQU	Pinyon - Juniper / Gambel Oak Woodland	77	60	137	881.0	443.5	1,324.4
W-PJAR	Pinyon - Juniper / Sagebrush Species Woodland	30	54	84	116.8	300.6	417.5
W-PJMX	Pinyon - Juniper / Mixed Shrubs and Grasses Woodland	267	281	548	2,170.9	1,507.1	3,678.0
W-JUAR	Utah Juniper / Big Sagebrush Woodland	5	32	37	31.4	84.5	115.9
W-JULE	Utah Juniper / Salina Wildrye Woodland	9	19	28	40.6	819.9	860.5
	Subtotal	*447*	*465*	*912*	*4,597.4*	*3,328.0*	*7,925.3*
Rocky Mountain Lower Montane-Foothill Riparian Woodland and Shrubland (CES306.821)							
C-CANY	Canyon Bottom Mosaic	76	10	86	174.9	17.8	192.7
	Subtotal	*76*	*10*	*86*	*174.9*	*17.8*	*192.7*

Table 12. Summary statistics for polygons of each map class developed for the BLCA vegetation mapping project.

Map Code	Map Class Common Name	Polygons			Area (hectares)		
		Park	Environs	Total Area*	Park	Environs	Total Area
Inter-Mountain Basins Semi-Desert Shrub-Steppe (CES304.788)							
S-ROAD	Roadcut Sparse Shrubland	11	-	11	13.4	-	13.4
	Subtotal	*11*	*-*	*11*	*13.4*	*-*	*13.4*
Multiple Ecological Systems: Colorado Plateau Mixed Low Sagebrush Shrubland (CES304.762) Inter-Mountain Basins Big Sagebrush Shrubland (CES304.777)							
S-ARWY	Wyoming Big Sagebrush Shrubland	19	25	44	133.6	110.9	244.5
	Subtotal	*19*	*25*	*44*	*133.6*	*110.9*	*244.5*
Inter-Mountain Basins Montane Sagebrush Steppe (CES304.785)							
S-ARVA	Mountain Big Sagebrush Shrubland	101	55	156	193.8	187.5	381.3
	Subtotal	*101*	*55*	*156*	*193.8*	*187.5*	*381.3*
Rocky Mountain Gambel Oak-Mixed Montane Shrubland (CES306.818)							
S-QUAR	Gambel Oak / Big Sagebrush Shrubland	29	31	60	107.0	168.1	275.1
S-QUSY	Gambel Oak Woodlands	152	123	275	410.7	198.2	608.9
S-QUHO	Gambel Oak / Rock Spirea Scree Shrubland	50	4	54	94.8	1.7	96.5
	Subtotal	*231*	*158*	*389*	*612.5*	*368.0*	*980.5*
Multiple Ecological Systems: Rocky Mountain Gambel Oak-Mixed Montane Shrubland (CES306.818) Rocky Mountain Lower Montane-Foothill Shrubland (CES306.822)							
S-QUMX	Gambel Oak / Mixed Montane Shrubland	288	266	554	2,885.3	3,696.1	6,581.4
	Subtotal	*288*	*266*	*554*	*2,885.3*	*3,696.1*	*6,581.4*

Table 12. Summary statistics for polygons of each map class developed for the BLCA vegetation mapping project.

Map Code	Map Class Common Name	Polygons			Area (hectares)		
		Park	Environs	Total Area*	Park	Environs	Total Area
Multiple Ecological Systems: Inter-Mountain Basins Montane Sagebrush Steppe (CES304.785) Rocky Mountain Gambel Oak-Mixed Montane Shrubland (CES306.818)							
S-MXMO	Mountain Big Sagebrush / Mixed Montane Shrubland	87	123	210	1,403.6	1,225.4	2,629.1
	Subtotal	*87*	*123*	*210*	*1,403.6*	*1,225.4*	*2,629.1*
Multiple Ecological Systems: Inter-Mountain Basins Shale Badland (CES304.789) Inter-Mountain Basins Mixed Salt Desert Scrub (CES304.784) Inter-Mountain Basins Shale Badland (CES304.789) Inter-Mountain Basins Greasewood Flat (CES304.780)							
C-SHAL	Mancos Shale Badlands Complex	9	19	28	40.6	819.9	860.5
	Subtotal	*9*	*19*	*28*	*40.6*	*819.9*	*860.5*
Rocky Mountain Cliff, Canyon and Massive Bedrock (CES306.815)							
S-HODU	Rock Spirea Sparsely Vegetated Rock Outcrop	64	3	67	1,153.5	39.4	1,192.9
W-PSHO	Douglas-fir / Rock Spirea Scree Woodland	71	1	72	269.7	3.2	272.9
	Subtotal	*135*	*4*	*139*	*1,423.2*	*42.6*	*1,465.8*
Multiple Ecological Systems: Inter-Mountain Basins Mixed Salt Desert Scrub (CES304.784) Inter-Mountain Basins Semi-Desert Grassland (CES304.787) Rocky Mountain Lower Montane-Foothill Shrubland (CES306.822) Southern Rocky Mountain Montane-Subalpine Grassland (CES306.824)							
H-MXHE	Mixed Upland Grasslands	124	175	299	169.0	569.6	738.6
	Subtotal	*124*	*175*	*299*	*169.0*	*569.6*	*738.6*
Colorado Plateau Hanging Garden (CES304.764)							
H-HANG	Hanging Garden Vegetation	N/A	N/A	N/A	N/A	N/A	N/A

Table 12. Summary statistics for polygons of each map class developed for the BLCA vegetation mapping project.

Map Code	Map Class Common Name	Polygons			Area (hectares)		
		Park	Environs	Total Area*	Park	Environs	Total Area
Not Assigned to an Ecological System							
G-SPAR	Sparsely Vegetated Bedrock	13	18	31	8.8	17.6	26.4
	Subtotal	*13*	*18*	*31*	*8.8*	*17.6*	*26.4*
UNVEGETATED AND ANDERSON LAND USE MAP CLASSES							
L-RIVE	Streams and rivers	1	1	2	66.8	7.4	74.3
L-POND	Natural Ponds / Lakes	2	2	4	0.1	0.1	0.1
L-RESV	Reservoirs and stock ponds	15	32	47	1.4	5.5	6.8
L-RESI	Residential	-	14	14	-	24.9	24.9
L-RESD	Non-residential developed	2	-	2	0.4	-	0.4
L-COMM	Communications and utilities	2	1	3	0.3	0.7	1.0
L-CORR	Transportation (road and ditch/roadbank introduced/altered vegetation)	4	10	14	64.5	38.8	103.4
L-CAMP	Entertainment and Recreation (Camping areas or other facilites.)	2	-	2	4.6	-	4.6
L-QUAR	Quarries, strip mines, and gravel pits	-	1	1	-	1.9	1.9
L-BARE	Bare rock or substrate (including bedrock, sandbars, talus, etc.)	101	55	156	193.8	187.5	381.3
L-CROP	Cultivated Grasses, Pasture / Hay, Irrigated Pasture / Hay	34	2	36	223.0	11.8	234.8
	Subtotal	*135*	*58*	*281*	*416.8*	*201.2*	*833.5*
	Total All Map Classes	**1,785**	**1,485**	**3,270**	**12,632**	**10,357**	**22,989**

* Note: Total polygon area may be less in the full mapping project area because of cumulative rounding error.

Discussion

Mapping the parks of the Colorado Plateau, including BLCA, is made more challenging by the sheer cliffs that are a common landscape feature. The cliffs make field access difficult, confound the generation of slope and aspect data, and create problematic shadows on the aerial and orthophotography. The mapping process, although largely successful, revealed opportunities for improvement, which are discussed below.

Things that worked well: The division of photointerpretation into preliminary (completed by a contractor before field data were available) and final (completed by NPS staff with access to field data) stages worked reasonably well, in that it helped speed the photointerpretation process and identified sites for field crews to visit in order to clarify difficult photo signatures. Good communication between the photointerpreters in each stage was essential.

Quality base data is essential to high quality scientific work. For the vegetation mapping at BLCA, high quality orthophotography allowed for both confident manual interpretation and a solid source for deriving physiognomic classes and vegetation density.

Areas for Improvement: Mapping the vegetation of BLCA/CURE presented challenges common to many western national parks, which required the application of special techniques to overcome. Successes and shortcomings are briefly discussed below.

One of the greatest problems encountered in both plot and AA field data collection was the undersampling or incomplete sampling of certain vegetation types and of whole sections of the Park due to a variety of accessibility issues and constraints. Elevation was not considered in the gradsect analysis, which may have resulted in undersampling at the highest and lowest elevations. These areas were also excluded by the cost-surface analysis because they were inaccessible due to rough, roadless and trailless terrain or because of private property constraints. The inner canyon, including river terraces and canyon walls, was excluded from gradsect analysis due to difficult access and time constraints. This meant that riparian vegetation types along the Gunnison River and the vegetation communities occupying canyon walls and slopes (including *Picea*) were undersampled, poorly described, and not accuracy assessed. Sampling in the environs and in remote areas within NPS boundaries but accessed through private lands was hampered by difficulty accessing private property. Permission was generally forthcoming once contact was made; however, it was very time-consuming to make contact with all affected landowners when many were busy running their ranching operations or were absentee landowners. Several gaps in plot data collection were filled in by field crews collecting AA data, except for the river corridor and inner canyon and the whole southeastern corner of the Park. These areas remain unsampled and park ecologists and future efforts may choose to target these areas for sampling and/or remapping efforts.

Undersampling presented one difficulty in creating a good classification for BLCA; another challenge was presented by the data. The cover classes used during legacy plot data collection were too broad. Most of the common species occurring in a plot fell into the 5-25% cover class (03), which made it difficult to determine the truly dominant species in each sampled community and therefore created difficulties in assigning plots to the correct NVC association. For example, in mixed montane shrub communities, the NVC requires a minimum of 10% Gambel oak cover

to classify a plot as a Gambel oak-dominated association. Plot photographs were usually little help in determining which species were dominant.

All of these challenges resulted in multiple revisions to the classification, including after the map classes were determined and again after the accuracy assessment. Classification revisions by NatureServe ecologists during the proccess meant that map attributes had to be assigned more than once, and clouded the validity of the accuracy assessment. This experience reinforced the desirability of having a complete and final classification in hand before mapping begins.

Accuracy Assessment

Methods

Introduction

Accuracy assessment (AA) is a statistical test of how well polygon map class attributes represent vegetation on the ground. The AA compares field observations with the map class assignment of the sampled polygon. Errors occur when mapped polygon labels differ from field observations. Results of the AA allow users to evaluate the utility of the vegetation mapping data for particular applications. Accuracy assessment results come in two forms (Hop et al. 2005): "producer's accuracy" (the probability that an AA point was mapped correctly, also referred to as "errors of omission"), and "user's accuracy" (the probability that the map represents what was found on the ground, also referred to as "errors of commission"). High producer's accuracy combined with low user's accuracy indicates that the map class is under-mapped. Conversely, low producer's accuracy combined with high user's accuracy indicates that a type is over-mapped. Ideally, a map has both high user and producer accuracy.

Sampling Design

A stratified random sampling approach was used to determine AA sampling locations. The AA included most vegetation map classes and was limited to lands within the BLCA boundary; private and federal lands outside of the Park were not included in the accuracy evaluation. Sample sizes for each evaluated map class were selected using the USGS-NPS Vegetation Mapping Program guidelines (ESRI and TNC 1994):

Scenario A: The class is abundant. It covers more than 50 ha (124 acres) and consists of at least 30 polygons. The recommended sample size is 30.

Scenario B: The class is relatively abundant. It covers more than 50 ha, but consists of fewer than 30 polygons. The recommended sample size is 20. The rationale for reducing the sample size for this type of class is that sample sites are more difficult to find because of the lower frequency of the class.

Scenario C: The class is relatively rare. It covers less than 50 ha but consists of more than 30 polygons. The recommended sample size is 20. The rationale for reducing the sample size is that the class occupies a small area. At the same time, however, the class consists of a considerable number of distinct polygons that are possibly widely distributed. The number of samples therefore remains relatively high because of the high frequency of the class.

Scenario D: The class is rare. It has more than five but fewer than 30 polygons and covers less than 50 ha. The recommended number of samples is five. The rationale for reducing the sample size is that the class consists of small polygons and the frequency of the polygons is low. Specifying more than five sample sites will likely result in multiple samples within the same (small) polygon. Collecting five samples will allow accuracy to be estimated, although the estimate will not be very precise.

Scenario E: The class is very rare. It has fewer than five polygons and occupies less than 50 ha. In this case, it is recommended that the existence of the class be confirmed by a visit to each polygon. The rationale for the recommendation is that with fewer than five sample sites

(assuming one site per polygon), no estimate of level of confidence can be established for the sample and the accuracy of the class can only be confirmed through a field census.

All but three of the original vegetated map classes were included in the accuracy assessment. One excluded map class (H-HANG) represents hanging gardens and was not interpreted because it occurs on near-vertical cliff faces or beneath cliff overhangs that are invisible on the aerial imagery. Instead, this type was documented by point data derived from the plots database. Two additional map classes were not accuracy assessed due to access constraints; one type (W-PICE) occurred exclusively on slopes too steep to sample and was masked out due to slope angle, and the other type (S-QUAR) occurred only in one section of the park that was inaccessible due to denial of access by adjacent private property landowners. eleven land-use map classes (L-XXXX) were excluded because they are essentially unvegetated or occur exclusively outside of the park boundary.

Accuracy assessment sampling points were selected for each vegetation map class using guidelines A–E. The primary set of AA evaluation sites included 973 points. 184 AA points on the South Rim and 23 AA points on the North Rim were inaccessible due to denial of access. New AA points could not be selected to replace these points because the associations that were inaccessible represented unique map classes not represented in other areas of the Park. An additional four AA points were inaccessible due to steep cliffs and were thrown out, resulting in a new total for BLCA AA points of 762. Secondary and tertiary sets of points were generated in case some of the points in the primary set could not be accessed safely. A 12.5 m interior buffer from polygon edges was generated for the map coverage to help ensure that 0.5 ha sampling points would fall cleanly within the polygon. The 12.5 m buffer worked in most situations; however, for small or linear polygons the buffer was reduced or eliminated. Sheer cliffs and steep talus were excluded from the AA point selection pool due to poor or dangerous access. Location (UTM) coordinates for all AA points were downloaded to GPS receivers for field sampling.

Field Data Collection

Accuracy assessment point data were collected at BLCA during the late summer and fall of 2004. Field crews used GPS receivers and topographic maps to navigate precisely to each pre-selected AA point. They used paper maps of the sample point locations and polygon boundaries (without polygon labels) on an orthoimage base to help locate and determine the representativeness of each AA point. The crews evaluated an area approximately 5,000 m^2 centered on the AA point coordinates (Appendix B). Environmental data collected in the field included elevation, slope, aspect, topographic position, landform, unvegetated surface elements, and descriptive comments. Vegetation data included leaf type and physiognomic class, as well as height and canopy cover for the dominant species in each stratum. The illustrated field key was used to identify the plant association that best described the vegetation in the plot. In most cases, only one plant association name was recorded. When vegetation relationships were less clear, a secondary or tertiary plant association name was also recorded. Plant associations occurring within 50 m of the AA point boundary, but within the same polygon, were recorded if they differed from the plant association within the sampling area. One or more 35 mm color slides were taken at each AA point to provide visual documentation of the site.

The field team collected data at 762 AA points (Figure 28). AA point data were manually entered into the plots database and a thorough quality assessment/quality check (QA/QC) was performed on the data prior to analysis. Nomenclature standards and other data management procedures were the same as for the classification plot data (see Vegetation Classification and Description section). Photographic slides were converted to digital format and catalogued in the same database as the classification plot photographs.

Data Analysis

All but nine of the 762 AA data points collected in 2004 were used in the data analysis. These nine points were excluded from AA data analysis because they were inaccessible to field crews and were not properly sampled. The field data were converted into a spatial data layer with coordinates and attributes. The first step in the AA analysis intersected the AA point data with the map polygon data. The primary, secondary and tertiary plant association names, and, if listed, the association name within 50 m, assigned in the field to each AA point were compared to the map class code for that polygon. If any of these names agreed with the labeled map class for a given polygon, the point was considered correct. All other points were considered mismatches and marked incorrect.

The results of the initial analysis were arrayed in a preliminary contingency table in which producer's and user's accuracy were calculated for each map class. Producer's accuracy is computed by dividing the number of samples that agreed with the corresponding map class by the total number of samples in that class. User's accuracy was calculated by dividing the number of samples that agreed with the corresponding map class by the total number of samples with field calls belonging to that category.

The primary photointerpreter and project ecologists met to analyze the map errors revealed in the preliminary contingency table. Each AA point mismatch (disagreement between field call and polygon label) was evaluated for the type of error (true or false). Sources of "false" error include GPS receiver positional error, questionable field determinations, edge error, and inclusions (small patches of vegetation within larger map polygons). Mismatches were corrected when a false error was identified. All other mismatches were deemed true errors. Patterns of error were analyzed and possible solutions for raising map class accuracy formulated (Appendix I).

In March, 2005, a meeting was held among the Park staff and project cooperators to complete the AA process. Participants discussed the alternative solutions developed during the analysis, and decided on the best solution for the purposes of natural resource management. In some cases, meeting participants recommended combining certain map classes to achieve higher levels of accuracy and more meaningful vegetation map classes. In other cases, the group recommended retaining map classes with lower accuracy, discussed below. Following the meeting, the original photointerpreter, and later an additional photointerpreter, made multiple edits to the final vegetation map based on field data calls, revised map class concepts, and general quality control issues discovered during the map editing process. After several iterations, a final contingency table was produced by project cartographers (Table 13). The spatial database was revised to reflect the final combinations of map classes. The original set of 57 vegetated map classes was ultimately reduced to 24 by consensus among project participants.

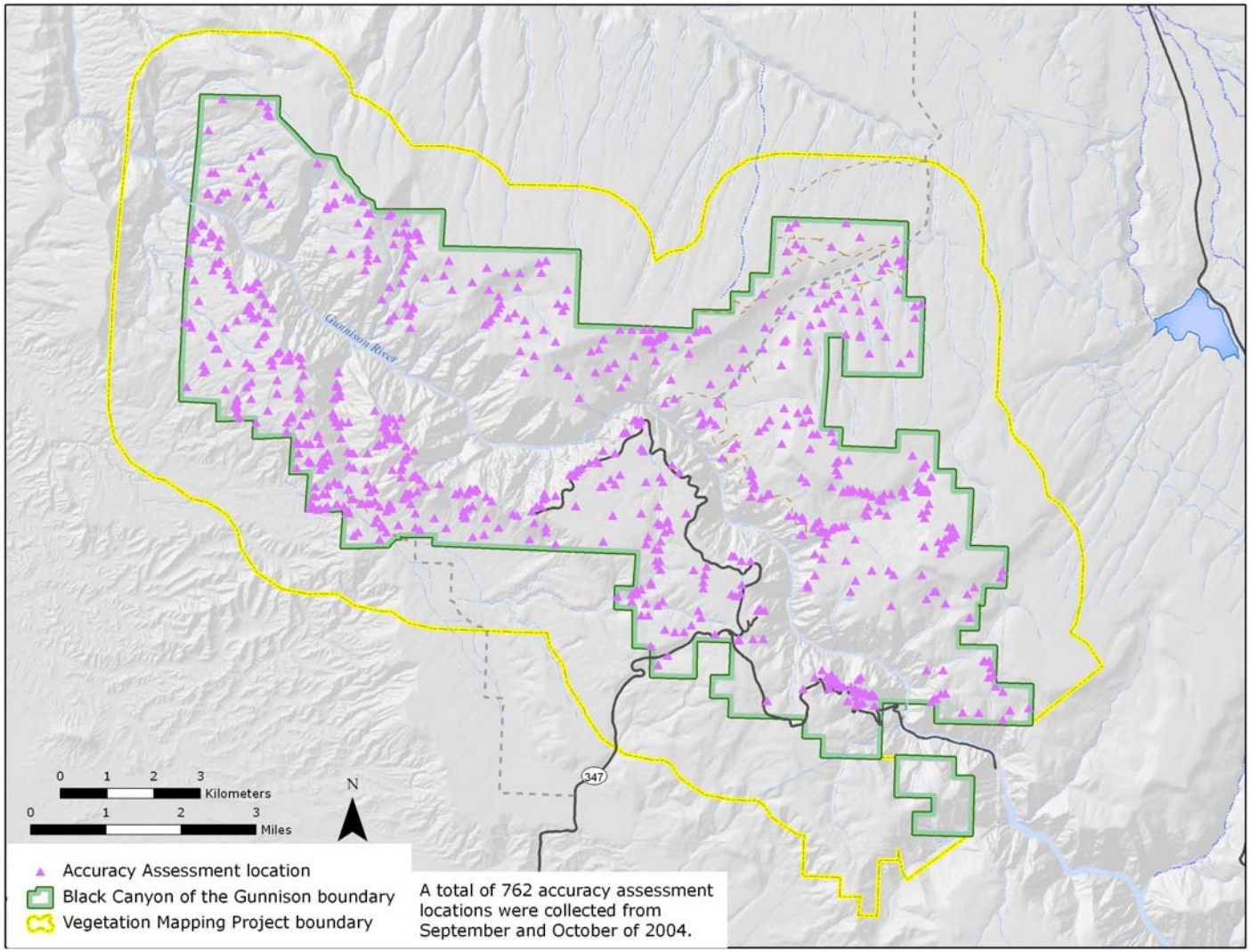


Figure 28. Location of accuracy assessment points sampled within BLCA. The accuracy of the map outside of the park boundary was not assessed.

Table 13. Final contingency table for BLCA. This table represents the 22 polygon map classes retained following accuracy assessment and revision whose accuracy was assessed.

Shaded boxes indicate the number of AA points that agree with the assigned map class. To read the table, columns represent the map class observed in the field, while the rows represent the map class assigned by the photointerpreter. Overall accuracy is 83.8% (Kappa statistic = 82.2%). User's and producer's accuracy values with 90% confidence intervals for each map class appear in Tables 14, 15, and 16.

Map Unit	5	20	28	31	33	40	42	43	48	49	52	60	62	69	71	72	74	78	80	87	91	93	# Points	Prod. Acc	90% C.I. -	90% C.I. +
5	11																						11	100%	95%	105%
20	1	44		3	2	2	1											2	2				57	77%	67%	87%
28			4		1																		5	80%	41%	119%
31		1		18			1																20	90%	76%	104%
33		1		4	44	2	1			1	1												54	81%	72%	91%
40						5																	5	100%	90%	110%
42						11	102	8			1				1		2						125	82%	75%	88%
43						2	11	41															54	76%	65%	86%
48							1		4							1							6	67%	27%	107%
49				1	1	1	6			19			1										29	66%	49%	82%
52											12												12	100%	96%	104%
60												6	1		1		1						9	67%	35%	98%
62							1	1					31										33	94%	86%	102%
69							1							37	1	1	3	2					45	82%	72%	93%
71	1				1		1	1							68	3	6					1	82	83%	75%	90%
72										1						18	1	3					23	78%	62%	95%
74															4	1	108	1					114	95%	91%	99%
78																		10					10	100%	95%	105%
80																			17				17	100%	97%	103%
87							1										7		2	20			30	67%	51%	82%
91																					5		5	100%	90%	110%
93																						7	7	100%	93%	107%
# Points	13	46	4	26	49	23	127	51	4	21	14	6	33	37	75	24	128	18	21	20	5	8				
User's Acc	85%	96%	100%	69%	90%	22%	80%	80%	100%	90%	86%	100%	94%	100%	91%	75%	84%	56%	81%	100%	100%	88%	**753 total points = 83.8 % accuracy**			
90% C.I. -	64%	90%	88%	52%	82%	5%	74%	70%	88%	78%	67%	92%	86%	99%	84%	58%	79%	34%	64%	98%	90%	62%				
90% C.I. +	105%	102%	113%	86%	98%	38%	87%	91%	113%	103%	105%	108%	102%	101%	97%	92%	90%	78%	97%	103%	110%	113%				

Results and Discussion

The map classes shown in tables and figures in this section represent those that remained or were created following adjustments to improve BLCA vegetation map thematic accuracy. Appendix I provides the complete analysis of original map classes used in the draft map and evaluated during AA. Final overall map accuracy is 83.8% (Kappa correction = 82.2%). Individual map class producer's and user's accuracy values and 90% confidence intervals are presented in the following tables. The width of each confidence interval is affected by sample size; larger sample sizes result in narrower confidence intervals. Individual map class accuracy ranges from 22% to 100% (Tables 14, 15, and 16).

Table 14. Final BLCA vegetation map classes that met or exceeded the 80% program standard for both user's and producer's accuracy.

Map Class	Map Class #	Map Class Name	Producer's Accuracy (±90% CI)	User's Accuracy (±90% CI)
C-CANY	5	Canyon Bottom Mosaic	100%	85% ± 21%
S-ROAD	28	Roadcut Sparse Shrubland	80% ± 39%	100%
S-ARVA	33	Mountain Big Sagebrush Shrubland	81% ± 10%	90% ± 8%
S-QUMX	42	Gambel Oak / Mixed Montane Shrubland	82% ± 7%	80% ± 7%
F-POTR	52	Quaking Aspen / Tall Shrubs Forest	100%	86% ± 19%
F-PSME	62	Douglas-fir Forest	94% ± 8%	94% ± 8%
W-PJSC	69	Pinyon - Juniper / Sparse Mixed Shrubs Scree Woodland	82% ± 11%	100%
W-PJQU	71	Pinyon - Juniper / Gambel Oak Woodland	83% ± 8%	91% ± 7%
W-PJMX	74	Pinyon - Juniper / Mixed Shrubs and Grasses Woodland	95% ± 4%	84% ± 6%
C-SHAL	80	Mancos Shale Badlands Complex	100%	81% ± 17%
C-SPAR	91	Sparsely Vegetated Bedrock	100%	100%
S-HODU	93	Rock Spirea Sparsely Vegetated Rock Outcrop	100%	88% ± 26%

Table 15. BLCA vegetation map classes where either the user's or producer's accuracy did not meet the 80% program standard.

Map Class Code	Map Class #	Map Class Name	Producer's Accuracy (±90% CI)	User's Accuracy (±90% CI)	Confused with Map Class #
H-MXHE	20	Mixed Upland Grasslands	77% ± 10%	96% ± 6%	31, 33, 40, 78, 80
S-ARWY	31	Wyoming Big Sagebrush Shrubland	90% ± 14%	69% ± 17%	20, 33
S-QUAR	40	Gambel Oak / Big Sagebrush Shrubland	100%	22% ± 17%	42
S-QUSY	43	Gambel Oak Woodlands	76% ± 10%	80% ± 11%	42, 49
S-QUHO	48	Gambel Oak / Rock Spirea Scree Shrubland	67% ± 40%	100%	42, 72
S-MXMO	49	Mountain Big Sagebrush / Mixed Montane Shrubland	66% ± 17%	90% ± 13%	42

Table 15. BLCA vegetation map classes where either the user's or producer's accuracy did not meet the 80% program standard.

Map Class Code	Map Class #	Map Class Name	Producer's Accuracy (±90% CI)	User's Accuracy (±90% CI)	Confused with Map Class #
W-PSHO	60	Douglas-fir / Rock Spirea Scree Woodland	67% ± 31%	100%	62, 71, 74
W-JUAR	78	Utah Juniper / Big Sagebrush Woodland	100%	56% ± 22%	31, 69, 72
W-JULE	87	Utah Juniper / Salina Wildye Woodland	67% ± 16%	100%	74, 80

As shown in Table 15, nine map classes were retained in the final vegetation map for BLCA when either user's or producer's accuracy did not meet the 80% program standard. In most cases, the 90% confidence interval includes 80%; park staff therefore deemed the results to be acceptable. In some cases, park staff accepted a lower accuracy because the map class was rare and the accuracy was based on a small number of points. In all other cases, park staff accepted less than 80% accuracy either because the map classes were ecologically significant and therefore useful even with low accuracy, or because the errors were with closely related map classes or were a matter of a few percent cover of a diagnostic species.

One map class did not achieve the 80% standard for either user's or producer's accuracy (Table 16). Map class 72 was not reliably distinguished from a similar map class (78) by the project photointerpreter. This map class was retained because of the ecological significance of sagebrush species (*Artemisia* spp.) as a dominant understory in pinyon-juniper woodlands, and was distinguished from map class 78 as having higher tree cover with two-needle pinyon dominant to co-dominant in the canopy. There was also confusion with map class 71, but all the errors fell in one polygon that had patchy Gambel oak and mountain big sagebrush cover in the pinyon-juniper understory.

Table 16. BLCA vegetation map classes where neither the user's or producer's accuracy met the 80% program standard.

Map Class Code	Map Class #	Map Class Name	Producer's Accuracy (±90% CI)	User's Accuracy (±90% CI)	Confused with Map Class #
W-PJAR	72	Pinyon - Juniper / Sagebrush species Woodland	78% ± 17%	75% ± 17%	71, 78

Map class 9 (Blue Spruce Woodland Alliance) was not accuracy assessed because it was entirely inaccessible to field sampling. Blue spruce (*Picea pungens*) and vegetation associations defined by it were never documented by field crews in BLCA over the course of the entire field effort (2000-2004), but this species and this map class were documented by field crews in CURE and it is assumed that this type also occurs in BLCA. One map class (99) was mapped only as points (hanging gardens) and therefore, was not accuracy assessed.

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Appendix A. Ecological Systems of Black Canyon of the Gunnison National Park

Introduction

This appendix contains summary descriptions of 16 terrestrial and riparian/wetland ecological system (ES) units (NatureServe 2003b, Comer et al. 2003) occurring at Black Canyon of the Gunnison National Park. Each ecological system represents one or more National Vegetation Classification (NVC) plant associations or alliances (Table 8 within the main report). Map classes were also crosswalked to ES units (Table 11 within the main report).

The ecological systems classification was developed in consultation with many individuals and agencies and incorporates information from a variety of publications and other classifications. One purpose of ecological systems is to provide a coarse-scale mapping unit that can be applied across management boundaries.

UPLAND ECOLOGICAL SYSTEMS

CES304.767 COLORADO PLATEAU PINYON-JUNIPER WOODLAND
Division 304 (Inter-Mountain Basins); Forest and Woodland

Spatial Scale & Pattern: Matrix
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland
Diagnostic Classifiers: Montane [Lower Montane]; Lowland [Foothill]; Mesa; Ridge/Summit/Upper Slope; Sedimentary Rock; Temperate Xeric; Aridic; *Pinus edulis, Juniperus osteosperma*
Concept Summary: This ecological system occurs in dry mountain slopes, mesas, plateaus, and ridges of the Colorado Plateau region including the Western Slope of Colorado to the Wasatch Range, south to the Mogollon Rim and the northwestern corner of New Mexico. It is typically found at lower elevations (1500-2440 m). Severe climatic events occurring during the growing season, such as frosts and drought, are thought to limit the distribution of pinyon-juniper woodlands to relatively narrow altitudinal belts on mountainsides. Soils supporting this system vary in texture ranging from stony, cobbly, gravelly sandy loams to clay loam or clay. *Pinus edulis* and/or *Juniperus osteosperma* dominate the tree canopy. In northern Arizona and northwestern New Mexico, *Juniperus monosperma* and hybrids of *Juniperus* spp. may dominate or codominate the tree canopy. *Juniperus scopulorum* may codominate or replace *Juniperus osteosperma* at higher elevations. Understory layers are variable and may be dominated by shrubs, graminoids, or be absent. Associated species include *Arctostaphylos patula, Artemisia tridentata, Cercocarpus intricatus, Cercocarpus montanus, Coleogyne ramosissima, Purshia stansburiana, Purshia tridentata, Quercus gambelii, Bouteloua gracilis, Pleuraphis jamesii*, or *Poa fendleriana*. This system occurs at higher elevations than Great Basin Pinyon-Juniper Woodland (CES304.773) and Colorado Plateau shrubland systems.
Range: Occurs on dry mountains and foothills of the Colorado Plateau region from the Western Slope of Colorado to the Wasatch Range, south to the Mogollon Rim. It is typically found at elevations ranging from 1500-2440 m.
Subnations: AZ, CO, NM, UT

CES304.777 INTER-MOUNTAIN BASINS BIG SAGEBRUSH SHRUBLAND
Division 304 (Inter-Mountain Basins); Shrubland

Spatial Scale & Pattern: Matrix
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland
Diagnostic Classifiers: Lowland; Shrubland; Toeslope/Valley Bottom; Deep Soil; Aridic; *Artemisia tridentata* ssp. *tridentata*
Concept Summary: This ecological system occurs throughout much of the western U.S., typically in basins, plains and foothills between 1500 and 2300 m elevation. Soils are typically deep, well-drained and non-saline. These shrublands are dominated by *Artemisia tridentata ssp. tridentata* and/or *Artemisia tridentata ssp. wyomingensis*. Scattered *Juniperus* spp., *Sarcobatus vermiculatus*, and *Atriplex* spp. may be present in some stands. *Ericameria nauseosa, Chrysothamnus viscidiflorus, Purshia tridentata*, or *Symphoricarpos oreophilus* may codominate disturbed stands. Perennial herbaceous components typically contribute less than 25% vegetative

cover. Common graminoid species include *Achnatherum hymenoides, Bouteloua gracilis, Elymus lanceolatus, Festuca idahoensis, Hesperostipa comata, Leymus cinereus, Pleuraphis jamesii, Pascopyrum smithii, Poa secunda*, or *Pseudoroegneria spicata*. Some semi-natural communities are included that often originate on abandoned agricultural land or on other disturbed sites.
Range: Occurs throughout much of the western U.S., typically in broad basins between mountain ranges, plains and foothills between 1500-2300 m elevation.
Subnations: CA, CO, ID, MT, NV, OR, UT, WA, WY

CES304.780 INTER-MOUNTAIN BASINS GREASEWOOD FLAT
Division 304 (Inter-Mountain Basins); Mixed Upland and Wetland

Spatial Scale & Pattern: Large patch
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland; Wetland
Diagnostic Classifiers: Lowland; Shrubland; Toeslope/Valley Bottom; Alkaline Soil; Deep Soil; Xeromorphic Shrub
Concept Summary: This ecological system occurs throughout the intermountain basins of the western U.S. and extends onto the western Great Plains. It typically occurs on stream terraces and flats associated with drainages or it may form rings around sparsely vegetated playas. Sites typically have saline soils, a shallow water table and flood intermittently, but remain dry for most growing seasons. The water table remains high enough to maintain vegetation, despite salt accumulations. This system usually occurs as a mosaic of multiple communities, with open to moderately dense shrublands dominated or codominated by *Sarcobatus vermiculatus*. *Atriplex canescens, Atriplex confertifolia*, or *Krascheninnikovia lanata* may be present to codominant. Occurrences are often surrounded by mixed salt desert scrub. The herbaceous layer, if present, is usually dominated by graminoids. There may be inclusions of *Sporobolus airoides, Distichlis spicata* (where water remains ponded the longest), or *Eleocharis palustris* herbaceous types.
Range: Occurs throughout much of the western U.S. in Intermountain basins and extends onto the western Great Plains.
Subnations: AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY

CES304.784 INTER-MOUNTAIN BASINS MIXED SALT DESERT SCRUB
Division 304 (Inter-Mountain Basins); Shrubland

Spatial Scale & Pattern: Large patch
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland
Diagnostic Classifiers: Lowland; Shrubland; Alluvial flat; Alkaline Soil; Calcareous; Silt Soil Texture; Clay Soil Texture; Xeromorphic Shrub; Dwarf-Shrub; *Atriplex* spp.
Concept Summary: This ecological system includes open-canopied shrublands of typically saline basins, alluvial slopes and plains across the Intermountain U.S. This type also extends in limited distribution into the southern Great Plains. Substrates are often saline and calcareous, medium- to fine-textured, alkaline soils, but include some coarser-textured soils. The vegetation is characterized by a typically open to moderately dense shrubland composed of one or more *Atriplex* species such as *Atriplex confertifolia, Atriplex canescens, Atriplex polycarpa*, or *Atriplex spinifera*. Other shrubs present to codominant may include *Artemisia tridentata ssp.*

wyomingensis, Chrysothamnus viscidiflorus, Ericameria nauseosa, Ephedra nevadensis, Grayia spinosa, Krascheninnikovia lanata, Lycium spp., *Picrothamnus desertorum*, or *Tetradymia* spp. *Sarcobatus vermiculatus* is generally absent, but if present is not dominant. The herbaceous layer varies from sparse to moderately dense and is dominated by perennial graminoids such as *Achnatherum hymenoides, Bouteloua gracilis, Elymus lanceolatus ssp. lanceolatus, Pascopyrum smithii, Pleuraphis jamesii, Pleuraphis rigida, Poa secunda*, or *Sporobolus airoides*.
Range: Intermountain western U.S., extending into the southern Great Plains.
Subnations: AZ, CA, CO, ID, MT, NM, NV, OR, UT, WA, WY

CES304.785 INTER-MOUNTAIN BASINS MONTANE SAGEBRUSH STEPPE
Division 304 (Inter-Mountain Basins); Steppe/Savanna

Spatial Scale & Pattern: Matrix
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland
Diagnostic Classifiers: Montane [Upper Montane]; Montane [Montane]; Montane [Lower Montane]; Woody-Herbaceous
Concept Summary: This ecological system includes sagebrush communities occurring in foothills to montane and subalpine elevations across the western U.S. from 1000 m to over 3000 m in the southern Rockies. Climate is cool, semi-arid to subhumid. This system primarily occurs on deep-soiled to stony flats, ridges, nearly flat ridgetops, and mountain slopes. In general, this system shows an affinity for mild topography, fine soils, some source of subsurface moisture or more mesic sites, zones of higher precipitation and areas of snow accumulation. Across its range of distribution, this is a compositionally diverse system. It is composed primarily of *Artemisia tridentata* ssp. *vaseyana, Artemisia cana* ssp. *vsicidula*, and related taxa such as *Artemisia tridentata* ssp. *spiciformis*. *Purshia tridentata* may codominate or even dominate some stands. Other common shrubs include *Symphoricarpos* spp., *Amelanchier* spp., *Ericameria nauseosa, Peraphyllum ramosissimum, Ribes cereum,* and *Chrysothamnus viscidiflorus. Artemisia tridentata* ssp. *wyomingensis* may be present to codominant if the stand is clearly montane as indicated by montane indicator species such as *Festuca idahoensis, Leuocopoa kingii,* or *Danthonia intermedia*. Most stands have an abundant herbaceous layer (over 25% cover, in many cases over 50% cover), but this system also includes *Artemisia tridentata* ssp. *vaseyana* shrublands. Common graminoids include *Danthonia intermedia, Festuca arizonica, Festuca idahoensis, Hesperostipa comata, Poa fendleriana, Elymus trachycaulis, Bromus carinatus, Poa secunda, Leucopoa kingii, Deschampsia caespitosa, Calamagrostis rubescens,* and *Pseudoroegneria spicata*. Species of *Achnatherum* are common. In many areas, wildfires can maintain an open herbaceous-rich steppe condition, although at most sites, shrub cover can be unusually high for a steppe system (>40%), with the moisture providing equally high grass and forb cover.
Range: This system is found at montane and subalpine elevations across the western U.S. from 1000 m to over 3000 m in the southern Rockies. This system occurs in mapzone 20 on the Rocky Mountain island ranges and on the western edge with mapzone 19.
Subnations: CA, CO, ID, MT, NM, NV, OR, UT, WA, WY

CES304.787 INTER-MOUNTAIN BASINS SEMI-DESERT GRASSLAND
Division 304 (Inter-Mountain Basins); Herbaceous

Spatial Scale & Pattern: Large patch
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland
Diagnostic Classifiers: Lowland Foothill; Herbaceous; Temperate Xeric; Alkaline Soil; Aridic; Graminoid
Concept Summary: This widespread ecological system occurs throughout the intermountain western U.S. on dry plains and mesas, at approximately 1450 to 2320 m (4750-7610 feet) elevation. These grasslands occur in lowland and upland areas and may occupy swales, playas, mesatops, plateau parks, alluvial flats, and plains, but sites are typically xeric. Substrates are often well-drained sandy or loamy-textured soils derived from sedimentary parent materials but are quite variable and may include fine-textured soils derived from igneous and metamorphic rocks. When they occur near foothill grasslands they will be at lower elevations. The dominant perennial bunch grasses and shrubs within this system are all very drought-resistant plants. These grasslands are typically dominated or by *Achnatherum hymenoides, Aristida* spp., *Bouteloua gracilis, Hesperostipa comata, Muhlenbergia* sp., or *Pleuraphis jamesii* and may include scattered shrubs and dwarf-shrubs of species of *Artemisia, Atriplex, Coleogyne, Ephedra, Gutierrezia*, or *Krascheninnikovia lanata*.
Range: Occurs throughout the Intermountain western U.S. on dry plains and mesas, at approximately 1450 to 2320 m (4750-7610 feet) in elevation.
Subnations: AZ, CA, CO, ID, MT?, NM, NV, OR, UT, WA, WY

CES304.788 INTER-MOUNTAIN BASINS SEMI-DESERT SHRUB-STEPPE
Division 304 (Inter-Mountain Basins); Steppe-Savanna

Spatial Scale & Pattern: Large Patch
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland
Diagnostic Classifiers: Lowland [Foothill]; Woody-Herbaceous; Temperate Xeric; Alkaline Soil; Aridic; Very Short Disturbance Interval; G-Landscape/High Intensity; Graminoid
Concept Summary: This ecological system occurs throughout the arid intermountain western U.S., typically at lower elevations on alluvial fans and flats with moderate to deep soils, and extends into south-central Montana between the Pryor and Beartooth ranges where a distinct rainshadow effect occurs. This semi-arid shrub-steppe is typically dominated by graminoids (>25% cover) with an open to moderately dense shrub layer. The most widespread (but not always dominant) species is *Pseudoroegneria spicata*, which occurs from the Columbia Basin to the northern Rockies. Other characteristic grasses include *Achnatherum hymenoides, Bouteloua gracilis, Distichlis spicata, Poa secunda, Poa fendleriana, Sporobolus airoides*, *Hesperostipa comata, Pleuraphis jamesii*, and *Leymus salinus*. The woody layer is often a mixture of shrubs and dwarf-shrubs, although it may be dominated by a single species. Characteristic species include *Atriplex canescens, Artemisia tridentata, Chrysothamnus greenei, Chrysothamnus viscidiflorus, Ephedra* spp., *Ericameria nauseosa, Gutierrezia sarothrae*, and *Krascheninnikovia lanata*. *Artemisia tridentata* or *Atriplex canescens* may be present but does not dominate. Annual grasses, especially the exotics *Bromus japonicus* and *Bromus tectorum*, may be present to abundant. Forbs are generally of low importance and are highly variable across the range but may be diverse in some occurrences. The general aspect of occurrences may be either open

shrubland with patchy grasses or patchy open herbaceous layers. Disturbance may be important in maintaining the woody component. Microphytic crust is very important in some stands.
Range: This system occurs throughout the intermountain western U.S., typically at lower elevations, and extends into Wyoming and Montana across the Great Divide Basin. It barely gets as far north into north-central Montana (mapzone 20) but is unlikely to be mapped.
Subnations: AZ, CA, CO, ID, MT, NM, NV, OR, UT, WY

CES304.789 INTER-MOUNTAIN BASINS SHALE BADLAND
Division 304 (Inter-Mountain Basins); Barren

Spatial Scale & Pattern: Large patch
Required Classifiers: Natural/Semi-natural; Vegetated (<10% vasc.); Upland
Diagnostic Classifiers: Lowland; Badlands; Alkaline Soil; Shale and Mudstone; Silt Soil Texture; Clay Soil Texture
Concept Summary: This widespread system of the intermountain western U.S. is composed of barren and sparsely vegetated substrates (<10% plant cover) typically derived from marine shales but also from siltstones and mudstones (clay). Landforms are typically rounded hills and plains that form a rolling topography. The harsh soil properties and high rate of erosion and deposition are driving environmental variables supporting sparse dwarf-shrubs, e.g., *Atriplex corrugata, Atriplex gardneri, Artemisia pedatifida,* and herbaceous vegetation.
Range: This system is found in the intermountain western U.S. It is confirmed by Oregon and Washington review to not occur in either of those states.
Subnations: AZ, CA, CO, ID, MT, NM, NV, UT, WY

CES306.813 ROCKY MOUNTAIN ASPEN FOREST AND WOODLAND
Division 306 (Rocky Mountain); Forest and Woodland

Spatial Scale & Pattern: Large patch
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland
Diagnostic Classifiers: Forest and Woodland (Treed); Long Disturbance Interval; F-Patch/Medium Intensity; F-Landscape/Medium Intensity; Broad-Leaved Deciduous Tree; Populus tremuloides
Concept Summary: This widespread ecological system is more common in the southern and central Rocky Mountains but occurs in the montane and subalpine zones throughout much of the western U.S. and north into Canada. An eastern extension occurs along the Rocky Mountain foothills front. Elevations generally range from 1525 to 3050 m (5000-10,000 feet), but occurrences can be found at lower elevations in some regions. Distribution of this ecological system is primarily limited by adequate soil moisture required to meet its high evapotranspiration demand. Secondarily, it is limited by the length of the growing season or low temperatures. These are upland forest and woodlands dominated by *Populus tremuloides* without a significant conifer component (<25% relative tree cover). The understory structure may be complex with multiple shrub and herbaceous layers, or simple with just an herbaceous layers. The herbaceous layer my be dense or sparse, dominated by graminoids or forbs. Associated shrub species include *Symphoricarpos* spp., *Rubus parviflorus, Amelanchier alnifolia,* and *Arctostaphylos uva-ursi.* Occurences of this system originate and are maintained by stand-replacing disturbances such as

avalanches, crown fire, insect outbreak, disease and windthrow, or clearcutting by man or beaver, within the matrix of conifer forests.
Range: This system is more common in the central and southern Rocky Mountains extending south to the Sacramento Mountains, however, it occurs in the montane and subalpine zones throughout much of the western U.S. and north into Canada, as well as west into California. Elevations generally range from 1525 to 3050 (5000-10,000 feet), but occurrences can found at lower elevations in some regions. Very small occurrences may be found in a few scattered locations of the Trans-Pecos of Texas.
Subnations: AZ, CA, CO, ID, MT, NM, NV, OR, SD, TX, UT, WA, WY

CES306.815 ROCKY MOUNTAIN CLIFF, CANYON AND MASSIVE BEDROCK
Division 306 (Rocky Mountain); Barren

Spatial Scale & Pattern: Large patch
Required Classifiers: Natural/Semi-natural; Upland
Diagnostic Classifiers: Canyon; Cliff (Landform); Ridgetop bedrock outcrop; Talus (Substrate); Rock Outcrops/Barrens/Glades; Oligotrophic Soil; Very Shallow Soil; Landslide
Concept Summary: This ecological system of barren and sparsely vegetated landscapes (generally <10% plant cover) is found from foothill to subalpine elevations on steep cliff faces, narrow canyons, and smaller rock outcrops of various igneous (intrusives), sedimentary, and metamorphic bedrock types. It is located throughout the Rocky Mountains and northeastern Cascade Ranges in North America. Also included are unstable scree and talus slopes that typically occur below cliff faces. In general these are the dry sparsely vegetated places on a landscape. The biota on them reflect what is surrounding them, unless it is an extreme parent material. There may be small patches of dense vegetation, but it typically includes scattered trees and/or shrubs. Characteristic trees include species from the surrounding landscape, such as *Pseudotsuga menziesii, Pinus ponderosa, Pinus flexilis, Populus tremuloides, Abies concolor, Abies lasiocarpa,* or *Pinus edulis* and *Juniperus* spp. at lower elevations. There may be scattered shrubs present, such as species of *Holodiscus, Ribes, Physocarpus, Rosa, Juniperus,* and *Jamesia Americana, Mahonia repens, Rhus trilobata,* or *Amelanchier alnifolia.* Soil development is limited, as is herbaceous cover.
Range: This system is located throughout the Rocky Mountain, including the isolated island ranges of central Montana, and northeastern Cascade Ranges in North America.
Subnations: AZ, CO, ID, MT, NM, OR, TX, UT, WA, WY

CES306.818 ROCKY MOUNTAIN GAMBEL OAK-MIXED MONTANE SHRUBLAND
Division 306 (Rocky Mountain); Shrubland

Spatial Scale & Pattern: Large patch
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland
Diagnostic Classifiers: Shrubland; Shallow Soil; Mineral w/ A-Horizon <10 cm; Loam Soil Texture; Sand Soil Texture; Ustic; Unconsolidated; Intermediate Disturbance Interval [Periodicity/Polycyclic Disturbance]; Broad-Leaved Deciduous Shrub
Concept Summary: This ecological system occurs in the mountains, plateaus, and foothills in the southern Rocky Mountains and Colorado Plateau, including the Uinta and Wasatch ranges

and the Mogollon Rim. These shrublands are commonly found on dry foothills, lower mountain slopes, and at the edge of the western Great Plains from approximately 2000 to 2900 m in elevation, and are often situated above pinyon-juniper woodlands. Substrates include soil types ranging from calcareous, fine-grained loams to sandy loams, gravelly loams, clay loams, deep alluvial sand, or coarse gravel. The vegetation is typically dominated by *Quercus gambelii* alone or with *Amelanchier alnifoliah, Amelanchier utahensis, Artemisia tridentata, Cercocarpus montanus, Prunus virginiana, Purshia stansburiana, Purshia tridentata, Robinia neomexicana, Symphoricarpos oreophilus*, or *Symphoricarpos rotundifolius*. There may be inclusions of other mesic montane shrublands with *Quercus gambelii* absent or as a minor component. This ecological system intergrades with the lower montane-foothills shrubland system and shares many of the same site characteristics. Density and cover of *Quercus gambelii* and *Amelanchier* spp. often increase after fire.
Range: Occurs in the mountains, plateaus and foothills in the southern Rocky Mountains and Colorado Plateau including the Uinta and Wasatch ranges and the Mogollon Rim.
Subnations: AZ, CO, NM, UT, WY

CES306.822 ROCKY MOUNTAIN LOWER MONTANE-FOOTHILL SHRUBLAND
Division 306 (Rocky Mountain); Shrubland

Spatial Scale & Pattern: Large patch
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland
Diagnostic Classifiers: Montane [Lower Montane]; Lowland [Foothill]; Shrubland (Shrub-dominated); Very Shallow Soil; Aridic; Intermediate Disturbance Interval [Periodicity/Polycyclic Disturbance]
Concept Summary: This ecological system is found in the foothills, canyon slopes and lower mountains of the Rocky Mountains and on outcrops and canyon slopes in the western Great Plains. It ranges from southern New Mexico, extending north into Wyoming, and west into the InterMountain West region. These shrublands occur between 1500 and 2900 m elevation and are usually associated with exposed sites, rocky substrates and dry conditions, which limit tree growth. It is common where *Quercus gambelii* is absent, such as the northern Colorado Front Range and in drier foothills and prairie hills. This system is generally drier than Rocky Mountain Gambel Oak-Mixed Montane Shrubland (CES306.818) but may include mesic montane shrublands where *Quercus gambelii* does not occur. *Cercocarpus montanus* dominates pure stands in parts of Wyoming and Colorado. Scattered trees or inclusions of grassland patches or steppe may be present, but the vegetation is typically dominated by a variety of shrubs, including *Amelanchier utahensis, Cercocarpus montanus, Purshia tridentata, Rhus trilobata, Ribes cereum, Symphoricarpos oreophilus,* or *Yucca glauca.* Grasses are represented as species of *Muhlenbergia, Bouteloua, Hesperostipa,* and *Pseudoroegneria spicata*. Fires play an important role in this system as the dominant shrubs usually have a severe die-back, although some plants will stump sprout. *Cercocarpus montanus* requires a disturbance such as fire to reproduce, either by seed sprout or root-crown sprouting. Fire suppression may have allowed an invasion of trees into some of these shrublands, but in many cases sites are too xeric for tree growth.
Range: This system is found in the foothills, canyon slopes and lower mountains of the Rocky Mountains and on outcrops and canyon slopes in the western Great Plains. It ranges from

southern New Mexico, extending north into Wyoming, and west into the Intermountain West Region.
Subnations: CO, MT, NM, SD, WY

CES306.823 SOUTHERN ROCKY MOUNTAIN DRY-MESIC MONTANE MIXED CONIFER FOREST AND WOODLAND
Division 306 (Rocky Mountain); Forest and Woodland

Spatial Scale & Pattern: Matrix
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland
Diagnostic Classifiers: Montane [Montane]; Montane [Lower Montane]; Forest and Woodland (Treed); Aridic; Intermediate Disturbance Interval; F-Patch/Medium Intensity; F-Landscape/Medium Intensity; Needle-Leaved Tree; RM Montane Mesic Mixed Conifer; Moderate (100-150 yrs) Persistence
Concept Summary: This is a highly variable ecological system of the montane zone of the Rocky Mountains. It occurs throughout the soutehr Rockies, north and west into Utah, Nevada, Wyoming and Idaho. These are mixed-conifer forests occurring on all aspects at elevations ranging from 1200 to 3300 m. Rainfall averages less than 75 cm per year (40-60 cm), with summer "monsoons" during the growing season contributing substantial moisture. The composition and structure of the overstory are dependent upon the temperature and moisture relationships of the site and the successional status of the occurrence. *Pseudotsuga menziesii* and *Abies concolor* are most frequent, but *Pinus ponderosa* may be present to codominant. *Pinus flexilis* is common in Nevada. *Pseudotsuga menziesii* forestsoccupy drier sites, and *Pinus ponderosa* is a common codominant. *Abies concolor*-dominated forests occupy cooler sites, such as upper slopes at higher elevations, canyon sideslopes, ridgetops, and north- and east-facing slopes which burn somewhat infrequently. *Picea pungens* is most often found in cool, moist locations, often occurring as smaller patches within a matrix of other associations. As many as seven conifers can be found growing in the same occurrence, and there are a number of cold-deciduous shrub and graminoid species common, including *Arctostaphylos uva-ursi, Mahonia repens, Paxistimia myrsinites, Symphoricarpos oreophilus, Jamesia americana, Quercus gambelii,* and *Festuca arizonica.* This system was undoubtedly characterized by a mixed-severity fire regime in its "natural condition," characterized by a high degree of variability in lethality and return interval.
Range: This system occurs throughout the southern Rockies, north and west into Utah, Nevada, eastern Wyoming (very southern in Laramie Range and possibly on Sheep Mountain) and Idaho. Although not common, it does occur in southeastern Oregon but does not extend farther west into the Cascades.
Subnations: AZ, CO, ID, NM, NV, OR, UT, WY

CES306.824 SOUTHERN ROCKY MOUNTAIN MONTANE-SUBALPINE GRASSLAND
Division 306 (Rocky Mountain); Herbaceous

Spatial Scale & Pattern: Large patch
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.); Upland

Diagnostic Classifiers: Herbaceous; Acidic Soil; Mineral: W/ A-Horizon >10 cm; Loam Soil Texture; Silt Soil Texture; Aridic; Short Disturbance Interval; Graminoid; Cool-season bunch grasses
Concept Summary: This Rocky Mountain ecological system typically occurs between 2200 and 3000 m elevation on flat to rolling plains and parks on lower sideslopes that are dry, but it may extend up to 3350 m on warm aspects. Soils resemble prairie soils in that the A-horizon is dark brown, relatively high in organic matter, slightly acidic, and usually well-drained. An occurrence usually consists of a mosaic of two or three plant associations with one of the following dominant bunch grasses: *Danthonia intermedia, Danthonia parryi, Festuca idahoensis, Festuca arizonica, Festuca thurberi, Muhlenbergia filiculmis,* or *Pseudoroegneria spicata.* The subdominants include *Muhlenbergia montana, Bouteloua gracilis,* and *Poa secunda.* These large-patch grasslands are intermixed with matrix stands of spruce-fir, lodgepole pine, ponderosa pine, and aspen forests. In limited circumstances (e.g. South Park in Colorado), they form the "matrix" of high-elevation plateaus.
Range: This system occurs between 2200 and 3000 m elevation in the Colorado Rockies. Where it transitions in Wyoming to Northern Rocky Mountain Subalpine-Upper Montane Grassland (CES306.806) still needs to be clarified.
Subnations: AZ, CO, NM, UT, WY

RIPARIAN AND WETLAND ECOLOGICAL SYSTEMS

CES306.821 ROCKY MOUNTAIN LOWER MONTANE RIPARIAN WOODLAND AND SHRUBLAND

Division 306 (Rocky Mountain); Woody Wetland

Spatial Scale & Pattern: Linear
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.)
Diagnostic Classifiers: Lower Montane; Riverine / Alluvial; Mineral: W/ A-Horizon <10 cm; Unconsolidated; Short (<5 yrs) Flooding Interval; Short (50-100 yrs) Persistence
Concept Summary: This system is found throughout the Rocky Mountain and Colorado Plateau regions within a broad elevation range from approximately 900 to 2800 m. This system often occurs as a mosaic of multiple communities that are tree-dominated with a diverse shrub component. This system is dependent on a natural hydrologic regime, especially annual to episodic flooding. Occurrences are found within the flood zone of rivers, on islands, sand or cobble bars, and immediate streambanks. They can form large, wide occurrences on mid-channel islands in larger rivers or narrow bands on small, rocky canyon tributaries and well-drained benches. It is also typically found in backwater channels and other perennially wet but less scoured sites, such as floodplains swales and irrigation ditches. Dominant trees may include *Acer negundo, P. angustifolia, P. balsamifera, P. deltoides, P. fremontii, Pseudotsuga menziesii, Picea pungens, Salix amygdaloides*, or *Juniperus scopulorum*. Dominant shrubs include *Acer glabrum, Alnus incana, Betula occidentalis, Cornus sericea, Crataegus rivularis, Forestiera pubescens, Prunus virginiana, Rhus trilobata, Salix monticola, Salix drummondiana, Salix exigua, Salix irrorata, Salix lucida, Shepherdia argentea*, or *Symphoricarpos* spp. Exotic trees of *Elaeagnus angustifolia* and *Tamarix* spp. are common in some stands. Generally, the upland vegetation surrounding this riparian system is different and ranges from grasslands to forests.

Range: Found throughout the Rocky Mountain and Colorado Plateau regions within a broad elevation range from approximately 900 to 2800 m.
Subnations: AZ, CO, ID, MT, NM, NV, OR, SD, UT, WY

CES304.764 COLORADO PLATEAU HANGING GARDEN
Division 304 (Inter-Mountain Basins); Herbaceous Wetland

Spatial Scale & Pattern: Small patch
Required Classifiers: Natural/Semi-natural; Vegetated (>10% vasc.)
Diagnostic Classifiers: Montane, Lower Montane; Cliff; Sedimentary Rock; Temperate Xeric; Seepage-Fed Sloping; Forb; Fern; Graminoid; Saturated Soil
Concept Summary: Hanging gardens in the Colorado Plateau region are surrounded by an arid environment and associated with canyon country. These highly localized environments include canyons with perennial seeps forming pocketed wetlands and draping vegetation across wet cliff faces. Three main garden types exist: alcove, terrace, or windowblind. Each is determined by the nature of the geological formation and the presence or absence of joint systems. They tend to occur on all exposures, but they are always shaded for much of each day. Temperature and humidity are stable compared to surrounding habitats. Most hanging gardens are dominated by herbaceous plants, a number of which are endemic to this region. Common species include *Adiantum capillus-veneris, Adiantum pedatum, Mimulus eastwoodiae, Mimulus guttatus, Sullivantia hapemanii, Cirsium rydbergii,* and several species of *Aquilegia*.
Range: Colorado Plateau.
Subnations: AZ, CO, NV?, UT

Appendix B. Plot, Observation Point, Accuracy Assessment Point Instructions and Data Forms

Introduction

This appendix contains the forms and instruction manuals used in collecting field data for the Vegetation Mapping Project at Black Canyon of the Gunnison National Park. Two types of data were collected: vegetation plot (or observation point for larger, undefined plot area) and accuracy assessment point. Vegetation plots were used primarily in developing the NVC classification for the park. They were also used by photointerpreters to help recognize aerial photo signatures. Observation points were used primarily for assisting with photointerpretation, and secondarily for supporting NVC association descriptions and documenting non-standard vegetation types. Accuracy assessment data were used primarily for testing the thematic accuracy of the vegetation map and secondarily to support NVC association descriptions.

B.1. Plot and Observation Point Field Sampling Manual

2003/2004 SAMPLING AT NORTHERN COLORADO PLATEAU NETWORK PARKS

Black Canyon National Park / Curecanti National Recreation Area

A Basic Guide for Field Work
Modified for the 2001- 2005 Field Seasons, USGS/NPS Vegetation Mapping Program

This document is intended to give you general instructions and guidelines for conducting your field work at Black Canyon National Park and Curecanti National Recreation Area. Detailed, field-by-field coding conventions for the primary form you'll be completing in the field (the Plot Survey form) are provided in the 'cheat sheet' at the back of this guide. You will also be taking Observation Points on a form reduced from and similar to the Plot Survey form, it will be provided in the field. An Accuracy Assessment Point form—another form reduced from and similar to the Plot Survey form, will also be provided in the field.

OVERVIEW
The data that you collect this year will be used to create a relatively fine-scale delineation of vegetation pattern in this Northern Colorado Plateau Network (NCPN) park and its environs. The range of habitats and the corresponding diversity of vegetation types, found in this park are complex. The understanding of finer-scale, ecologically distinct vegetation types that you will help create may be used by the park to plan appropriate management activities, monitor the results of these activities, track long-term changes in vegetation, direct searches for rare species, model fire behavior, and portray the wealth of natural diversity on park lands to the public.

Establishing a field sampling strategy that captures sufficient data on all the distinct vegetation types in Black Canyon National Park and Curecanti National Recreation Area, areas that are very diverse and rugged, is a challenge. To make the sampling as efficient as possible, the key environmental variables thought to be driving vegetation pattern were identified. These included factors such as geology, soils, aspect, hydrology, elevation, and land use/fire history (see TNC 1998).

Initially, sampling will be conducted using aerial photographs, geology maps, and topographic maps in addition to overlays of the three data sources to adequately and thoroughly sample the vegetation using standard vegetation plots and ancillary observation points. A classification based on this sampling will result in interpretation of aerial photos to produce a vegetation map that will be assessed for accuracy the following field season. The photo interpreters will supply digital orthophotos with polygons delineated for accuracy assessment work. A combination of manual and electronic delineation and digitizing approaches, as well as on-screen and automated photo interpretation techniques, will be used for Black Canyon National Park and Curecanti National Recreation Area to delineate polygons and label the vegetation types. The vegetation "types" the photo interpreters will choose to name their polygons are those included in the preliminary classification of the parks vegetation created using the U.S. National Vegetation Classification System (Grossman et al. 1998).

The field crew will evaluate the field data, assign a preliminary vegetation type based on a list of potential vegetation types developed from the existing literature, and update the tally of vegetation types by number of plots still needed. The goal is to use your time as efficiently as possible: we are trying our best to avoid oversampling of some types and undersampling of others. Deciding where to sample to capture the full range of diversity throughout the park is going to be very much an iterative process as the field

season goes along!

GETTING THERE
You will have a Digital Ortho Quarter Quad (DOQQ) print and a copy of the 1:12,000-scale aerial photography to guide you. You and your partner will navigate towards each selected photo-signature using your park road and trail map, USGS 7.5 mm. topographic map, the DOQQ, and/or GPS. The DOQQ's will have roads and trails highlighted on them to help you as well.

Before you leave…check that you have all the materials needed to complete your field work (Please see the checklist and 'considerations for mission planning" at the end of this document to help you).

Every single morning…check your GPS receiver to make sure it is set to NAD 83.

Along the way...look around. The goal of this field work is to sample all the different vegetation types that occur in Black Canyon National Park and Curecanti National Recreation Area. If, on the way to one vegetation type, you see an assemblage of plants that seems unique and that is not included on the list of vegetation types, please sample if time allows. In this park, these undescribed vegetation types are more likely various pinyon – juniper woodland understories, herbaceous types, or shrublands. You will be better able to recognize these undescribed vegetation types as the season progresses and you become more familiar with the vegetation types and how they can look on the ground.

ONCE THERE
Establishing a Plot
1) Figure out where to place your plot. This is a subjective process. You'll want to place your plots in areas that seem to be both relatively **homogenous** and **representative** of the vegetation of the signature as a whole. In other words, avoid areas where the vegetation appears to be transitioning from one type to another (ecotones) and areas with anomalous or heterogeneous structure or species composition. Look at *all* the vegetation strata to determine if the area is structurally and floristically uniform and generally try to place your plots at least 30 m from what you see as the 'boundary' between this vegetation type and any neighboring, distinctly different types. During the training period this step will be emphasized and discussed in detail. However, the rule-of-thumb is to conduct a reconnaissance of the plot area if time and topography allows.

Note: In cases where a signature is very heterogeneous, more than one plot or a plot and observation points may be needed. Again, look around, use that human perception.

2) Using your GPS (Global Positioning System) receiver, record the UTM (Universal Transverse Mercator) coordinates in the center of the plot under the Field UTM X and Field UTM Y on the field form. Also mark and label the location of the plot on a USGS 7.5 min. topographic map and/or on an aerial photo. If you cannot obtain a GPS reading, estimate UTMs from the USGS topographic map and note on the form that you had to resort to this method. Plots may be circular, rectangular or square. Note shape and dimensions on the field form. If the plot is rectangular or square, record the azimuth of the long side (any side if square) to help relocate the plot. It may make more sense to establish rectangular plots in linear vegetation types (e.g. riparian or ridgeline types). Standard plot sizes should be as follows:

If you're in a ...	**You should usually make your plot…**	**Giving you a plot area of…**
Forest (i.e., trees have their crowns	11.3 m radius OR	400 m^2

overlapping, usually forming 60-100% cover)	20 m x 20 m	400 m^2
Woodland (i.e., open stands of trees with crowns usually not touching. Canopy tree cover is 25-60% OR exceeds shrub, dwarf-shrub, herb, and nonvascular cover).	11.3 m radius OR 20 m x 20 m	400 m^2 400 m^2
Shrubland (i.e., shrubs greater than 0.5 m tall are dominant, usually forming more than 25% cover OR exceeding tree, dwarf shrub, herb, and nonvascular cover)	11.3 m radius OR 20 m x 20 m	400 m^2 400 m^2
Dwarf-shrubland (heath) (i.e., Shrubs less than 0.5 m tall are dominant, usually forming more than 25% cover OR exceeding tree, shrub, herb, and nonvascular cover).	5.65 m radius OR 10 m x 10 m	100 m^2 100 m^2
Herbaceous (i.e., Herbs dominant usually forming more than 25 percent cover OR exceeding tree, shrub, dwarf-shrub, and nonvascular cover).	5.65 m radius OR 10 m x 10 m	100 m^2 100 m^2
Nonvascular (i.e., nonvascular cover dominant usually forming more than 25% cover).	2.82 m radius OR 5 m x 5 m	25 m^2 25 m^2

Note: You can deviate from the standard plot *shapes* where that makes sense, but the total plot *area* encompassed by the boundaries should be as listed above for each major class of vegetation. For example, forested riparian vegetation may be sampled in a more linear 10 x 40 m (400 m^2) plot; herbaceous riparian or ridgeline vegetation in a 2 x 50 m (100m^2) plot. You may also increase the size of the plot to the next standard size if necessary to sample the heterogeneity of the vegetation. Forests, woodlands, and shrublands can be increased to 1000 m^2. Please make a note on plot form.

3) Once the plot is established, it is generally a good time to fill out the **Identifiers/Locators** part of your Plot Survey Form (see the cheat sheet) and take the plot photos.

Taking photographs

Two color photos will be taken of each plot using slide film. The purpose is to obtain a good representation of the vegetation of the plot, not individual species. A piece of paper (or a chalk board or dry erase board) should be placed in the plot, with the plot number recorded on it, so that the photo includes the plot number. Preprinted plot numbers could be printed or copied onto colored paper (white has such strong contrast as to be unreadable in the photo) and attached to the back of a clipboard. This saves having to write plot numbers in the field. Take the photograph looking across the contour if plot is steep. Record roll #, frame #, and azimuth on plot form.

Data Collection

Environmental Description

See the coding instructions at the end of this document for guidance on the specific fields.

Vegetation Description
For guidance on the specific fields on the second page of the form, see the coding instructions.

As you begin to collect the species, DBH (diameter at breast height – 4.5'), and cover information, keep these rules in mind they will speed your data collection considerably:

1) Except in very diverse plots, don't spend more than **20 minutes** looking for new and different species to record. Remember that these plot data are to be used to classify the overall vegetation of the Park, not to make a complete species list for it. And if you had to spend much more than 20 minutes *to find* a species, it probably isn't going to be important in characterizing the vegetation type. For diverse plots with over 25 taxa you may take up to 30 minutes on the listing process.

2) If you can't identify a plant to species, record it on your form as "unknown species 1,' "unknown species 2,' "*Carex* unknown sp. I", etc. Record associated cover class and other data for the unknown as you would for any other species. Then do one of two things:

If you need the species identified right away because it appears to be dominant or diagnostic (you're seeing it all over the place or you're seeing much more in this particular vegetation type than in others), take a sample of the species with as much of the plant as possible, especially intact sexual parts (flowers and fruits), if present. Place the sample in a baggie, and label the baggie (or specimen) with the plot code and the name you gave it on the data form.

If you don't need the plant keyed right away, press it. Mark the pressed specimen with the plot code and the name you gave it on the data form.

Store specimens in a cool, dry place. Bagged specimens will keep fresh longer in the refrigerator or ice chest until pressed or identified. You can, of course, key some of these out yourself if you want to, but don't let plant keying get in the way of your primary responsibility: field data *collection.* No one expects you to identify every plant but you should make an effort to learn at least the common species that keep recurring in plots. A quick prioritization of what to key and what to press may be made based on the recurrence of the species in samples and on the cover-class estimate of the species in a particular plot. If the species has a high cover value (>1%) it is more of a priority to identify. Field crews should mark the specimen tag with its cover class estimate as well as its unique identifying number for the vegetation sample.

Observation Point Form
When you have sampled one particular vegetation type thoroughly, but want to further define its distribution or when you encounter small but unique vegetation patches that are below the minimum mapping unit in size (<1.5 ha), record the site on an Observation Point form. This is an abbreviated Plot Survey form and usually takes about 15 minutes to fill in the data. The major difference is that an Observation Point is unbounded and includes an area roughly equal to that of the minimum mapping unit (40 m radius around the observer) or it encompasses the entirety of a small but unique vegetation patch. The data fields are the same as those on the Plot Survey form, so use the above instructions. Minor differences in the Observation Point form from the Plot Survey form include the elimination of some data fields, more general cover classes for ground cover estimates, and only the dominant or diagnostic species are recorded. Also, only one photo is taken to record the Observation Point plant community.

Accuracy Assessment Point Form
You will navigate to pre-selected coordinates within polygons, scout out the polygon briefly to get a feel for what it is like, and record some general data to characterize it on an Accuracy Assessment Point form. This is also an abbreviated version of the Plot Survey form, much like the Observation Point form, and the same cheat sheet can be used to help with filling it out. A sample completed Accuracy Assessment Point form is provided at the end of this document.

INSTRUCTIONS FOR FILLING OUT FIELDS IN THE PLOT AND OBSERVATION POINT SURVEY FORMS

PLOT DESCRIPTION

Plot Code
Code indicating the specific plot within the vegetation polygon. For the 2003 field season, the codes will be in the following format "PARK ACRONYM.XXX" (i.e., "Black Canyon National Park or Curecanti National Recreation Area = BLCA or CURE.XXX"). Begin with BLCA or CURE.00l and go from there. If another team is working, decide with them which plot numbers each team will use to identify the data they gather. For example, if a second team is working one week at Black Canyon National Park / Curecanti National Recreation Area and approximately 100 plots have already been collected, they may sample plots BLCA.150 or CURE.200 through BLCA.175 or CURE.225.

Provisional Community Name
Using the provisional classification of the parks with which you've been provided, assign the name of the vegetation type that most closely resembles this type. Enter the finest level of the classification possible. In fact, *none* of the names may be a good fit; you may have found a new type. If that is the case, create a provisional name with the dominant and diagnostic species. The 'provisional community name' that is assigned will be used to update the tally of types x number of plots needed.

State CO

Park Name BLCA or CURE

Park Site Name
Provisional name assigned by field worker that describes where the data were collected. It should represent an identifiable feature on a topographic or park map.

Quad Name
Appropriate name/scale from survey map used; use 7.5-minute quadrangle if possible.

Quad Code
Code of quadrangle map.

Field UTM X
Use GPS, but if you can't obtain a GPS reading, estimate coordinates from a topographic map and note on the form that this method was used.

Field UTM Y

Use GPS, but if you can't obtain a GPS reading, estimate coordinates from a topographic map and note on the form that this method was used.

GPS Error
Note the error in the GPS reading off the unit.

Survey Date
Date the survey was taken; year, month, day.
Surveyors
Names of surveyors, with principal surveyor (usually the Lead Ecologist) listed first.

Directions to Plot
Precise directions to the site using a landmark (e.g., a named point on the topographic map, a major highway, using park naming conventions for roads) readily locatable on a 7.5 minute topographic or park map as the starting point. Use clear sentences that will be understandable to someone who is unfamiliar with the area and has only your directions to follow. Give distances as closely as possible to the 0.1 mile and use compass directions. Give additional directions to the plot within the site. Do not take more than a couple of minutes to fill this out.

Plot Length and Plot Width
Enter diameter for circular plots and width and length dimensions for square or rectangular plots. Choose the appropriate plot size based on the following:

Vegetation Class	Standard Plot Dimensions	PLOT AREA
Forest	11.3 m radius or 20 m x 20 m	400 m^2
Woodland	11.3 m radius or 20 m x 20 m	400 m^2
Shrubland	11.3 m radius or 20 m x 20 m	400 m^2
Dwarf-shrubland	5.65 m radius or 10 m x 10m	100 m^2
Herbaceous	5.65 m radius or 10 m x 10 m	100 m^2
Nonvascular	2.82 m radius or 5 m x 5 m	25 m^2

Plot Photos/ Roll Number/Frame Numbers
Indicate (Y or N) if photos of the plot have been taken at the time of sampling, and the roll and frame numbers of any photos. Also record azimuth of the photo if not taken in the standard direction.

Plot Permanent (if/when applicable)
Check off that the plot has been permanently marked.

Plot Representativeness
Does this plot represent the full variability of the photo signature? If not, were additional plots taken? Note additional species not seen in the plot in the space provided below. Note: we distinguish in this section the plot's ability to represent the stand or polygon you are sampling as one component and the ability of this sample to represent the range of variability of the association in the entire mapping area. The former comment may be ascertained by reconnaissance of the stand. The latter comment comes only after some familiarity with the vegetation type throughout the mapping area and may be left blank if you have no opinion at this time.

ENVIRONMENTAL DESCRIPTION

Elevation

Elevation of the plot. Specify whether in feet or meters (this will depend on the units used on the GPS or on the topographic map being used). In general, we have determined that the reading you get from a topographic map, provided you are certain where you are, is more accurate than the average reading from the GPS unit. Thus, please attempt to estimate your elevation with the topographic map.

Slope

Measure the slope in degrees using a clinometer.

Aspect

Measure the slope aspect using a compass (be sure to correct for the magnetic declination). Note: all compasses should be pre-set to an average declination for the park and thus, readings from the compasses carried by the field crews may be directly noted.

Topographic Position

Topographic position of the plot. Choose one:

INTERFLUVE (crest, summit, ridge). Linear top of ridge, hill, or mountain; the elevated area between two fluves (drainageways) that sheds water to the drainageways.

HIGH SLOPE (shoulder slope, upper slope, convex creep slope). Geomorphic component that forms the uppermost inclined surface at the top of a slope. Includes the transition zone from backslope to summit. Surface is dominantly convex in profile and erosional in origin.

HIGH LEVEL (mesa). Level top of a plateau.

MIDSLOPE (transportational midslope, middle slope). Intermediate slope position.

BACKSLOPE (dipslope). Subset of midslopes that are steep, linear, and may include cliff segments (fall faces).

STEP IN SLOPE (ledge, terraeette). Nearly level shelf interrupting a steep slope, rock wall, or cliff face.

LOWSLOPE (lower slope, foot slope, colluvial footslope). Inner gently inclined surface at the base of a slope. Surface profile is generally concave and a transition between midslope or backslope, and toeslope.

TOESLOPE (alluvial toeslope). Outermost gently inclined surface at base of a slope. In profile, commonly gentle and linear and characterized by alluvial deposition.

LOW LEVEL (terrace). Valley floor or shoreline representing the former position of an alluvial plain, lake, or shore.

CHANNEL WALL (bank). Sloping side of a channel.

CHANNEL BED (narrow valley bottom, gully, arroyo, wash). Bed of single or braided watercourse commonly barren of vegetation and formed of modern alluvium.

BASIN FLOOR (depression). Nearly level to gently sloping, bottom surface of a basin.

Landform
Enter the landform that describes the site where the plot was taken. Note on the code sheet the landform choices are listed at different scales. Thus, one can select more than one for plot if appropriate (e.g., mountain could be macro and ridge could be meso scale). You can develop your own list for BLCA/CURE. Please be consistent so we can analyze by landform.

Surficial Geology
Note the geologic substrate influencing the plant community (bedrock or surficial materials). Accurately recording the geology at the plot is especially important if the plot is on an inclusion in the type on the geology map. The list in the cheat sheet below provides types from the BLCA/CURE geology map.

Cowardin System
If the system is a wetland, check off the name of the USFWS system which best describes its hydrology and landform. Indicate "upland" if the system is not a wetland.

Assess the hydrologic regime of the plot using the descriptions below (adapted from Cowardin et al. 1979).

SEMIPERMANENTLY FLOODED - Surface water persists throughout growing season in most years except during periods of drought. Land surface is normally saturated when water level drops below soil surface. Includes Cowardin's Intermittently Exposed and Semipermanently Flooded modifiers.

SEASONALLY FLOODED - Surface water is present for extended periods during the growing season, but is absent by the end of the growing season in most years. The water table after flooding ceases is very variable, extending from saturated to a water table well below the ground surface. Includes Cowardin's Seasonal, Seasonal-Saturated, and Seasonal-Well Drained modifiers.

SATURATED - Surface water is seldom present, but substrate is saturated to surface for extended periods during the growing season. Equivalent to Cowardin's Saturated modifier.

TEMPORARILY FLOODED - Surface water present for brief periods during growing season, but water table usually lies well below soil surface. Often characterizes flood-plain wetlands. Equivalent to Cowardin's Temporary modifier.

INTERMITTENTLY FLOODED - Substrate is usually exposed, but surface water can be present for variable periods without detectable seasonal periodicity. Inundation is not predictable to a given season and is dependent upon highly localized rain storms. This modifier was developed for use in the arid West for water regimes of playa lakes, intermittent streams, and dry washes but can be used in other parts of the U.S. where appropriate. This modifier can be applied to both wetland and non-wetland situations. Equivalent to Cowardin's Intermittently Flooded modifier.

PERMANENTLY FLOODED - Water covers the land surface at all times of the year in all years. Equivalent to Cowardin's "permanently flooded."

UNKNOWN - The water regime of the area is not known. The unit is simply described as a non-tidal wetland.

Environmental Comments
Enter any additional noteworthy comments on the environmental setting. This field can be used to describe site history such as fire events (date since last fire or evidence of severity) as well as other disturbance or reproduction factors.

Unvegetated Surface
Estimate the approximate percentage of the *total* surface area covered by each category. Only include categories with over 5 percent cover.

SOIL TEXTURE KEY

(Brewer and McCann 1982)

Soil primarily organic:
0a. Soil is black, is saturated with water, and often smells of rotten eggs ...……..**muck**
0b. Soil is dark brown, usually saturated, and consists of clearly identifiable plant parts …….**peat**

Soil primarily mineral:
1a. Soil does not remain in a ball when squeezed, leaves your fingers clean ..…….....**sand**
1b. Soil remains in a ball when squeezed ……..…….....2

Squeeze the ball between your thumb and forefinger, attempting to make a ribbon that you push up over your finger.

2a. Soil makes no ribbon but leaves your fingers dirty …….……**loamy sand**
2b. Soil makes at least a very short ribbon .....……...3

3a. Ribbon extends less than 1 inch before breaking …….…….....4
3b. Ribbon extends 1 inch or more before breaking ……..…….....5

4a. Add excess water to small amount of soil. Soil feels at least slightly gritty
……..……..…**loam or sandy loam**
4b. Soil feels smooth....…….... **silt loam**

5a. Soil makes a ribbon that breaks when 1-2 inches long; cracks if bent into a ring 6
5b. Soil makes a ribbon 2+ inches long; does not crack when bent into a ring ……..…7

6a. Add excess water to small amount of soil; soil feels at least slightly gritty
…… **sandy clay loam**
6b. Soil feels smooth..……..... **silty clay loam**

7a. Add excess water to a small amount of soil; soil feels at least slightly gritty
…….…….. **sandy clay**
7b. Soil feels smooth.....…….……..... **silty clay or clay**

Soil Drainage

The soil drainage classes are defined in terms of (l) actual moisture content (in excess of field moisture capacity) and (2) the extent of the period during which excess water is present in the plant-root zone. It is recognized that permeability, level of groundwater, and seepage are factors affecting moisture status. However, because these are not easily observed or measured in the field, they cannot generally be used as criteria of moisture status. It is further recognized that soil profile morphology, for example mottling, normally, but not always, reflects soil moisture status. Although soil morphology may be a valuable field indication of moisture status, it should not be the overriding criterion. Soil drainage classes cannot be based solely on the presence or absence of mottling. Topographic position and vegetation as well as soil morphology are useful field criteria for assessing soil moisture status.

RAPIDLY DRAINED - The soil moisture content seldom exceeds field capacity in any horizon except immediately after water addition. Soils are free from any evidence of gleying throughout the profile. Rapidly drained soils are commonly coarse textured or soils on steep slopes.

WELL DRAINED - The soil moisture content does not normally exceed field capacity in any horizon (except possibly the C) for a significant part of the year. Soils are usually free from mottling in the upper 3 feet, but may be mottled below this depth. B horizons, if present, are reddish, brownish, or yellowish.

MODERATELY WELL DRAINED - The soil moisture in excess of field capacity remains for a small but significant period of the year. Soils are commonly mottled (chroma <2) in the lower B and C horizons or below a depth of 2 feet. The Ae horizon, if present, may be faintly mottled in fine-textured soils and in medium-textured soils that have a slowly permeable layer below the solum. In grassland soils the B and C horizons may be only faintly mottled and the A horizon may be relatively thick and dark.

SOMEWHAT POORLY DRAINED - The soil moisture in excess of field capacity remains in subsurface horizons for moderately long periods during the year. Soils are commonly mottled in the B and C horizons; the Ac horizon, if present, may be mottled. The matrix generally has a lower chroma than in the well-drained soil on similar parent material.

POORLY DRA1NED - The soil moisture in excess of field capacity remains in all horizons for a large part of the year. The soils are usually very strongly gleyed. Except in high-chroma parent materials the B, if present and upper C horizons usually have matrix colors of low chroma. Faint mottling may occur throughout.

VERY POORLY DRAINED - Free water remains at or within 12 inches of the surface most of the year. The soils are usually very strongly gleyed. Subsurface horizons usually are of low chroma and yellowish to bluish hues. Mottling may be present but at the depth in the profile. Very poorly drained soils usually have a mucky or peaty surface horizon.

VEGETATION DESCRIPTION

Leaf Phenology

Select the value which best describes the leaf phenology of the dominant stratum. The dominant stratum is the uppermost stratum that contains at least 10% cover.

EVERGREEN - Greater than 75% of the total woody cover is never without green foliage.

COLD DECIDUOUS - Greater than 75% of the total woody cover sheds its foliage in connection with an unfavorable season mainly characterized by winter frost.

MIXED EVERGREEN - COLD DECIDUOUS - Evergreen and deciduous species generally contribute 25-75% of the total woody cover. Evergreen and cold-deciduous species admixed.

PERENNIAL - Herbaceous vegetation composed of more than 50% perennial species.

ANNUAL - Herbaceous vegetation composed of more than 50% annual species.

Leaf Type
Select one value which best describes the leaf form of the dominant stratum. The dominant stratum is the uppermost stratum that contains at least 10% cover.

BROAD-LEAVED - Woody vegetation primarily broad-leaved (generally contributes greater than 50 percent of the total woody cover).

NEEDLE-LEAVED - Woody vegetation primarily needle-leaved (generally contributes greater than 50 percent cover).

MICROPHYLLOUS - Woody cover primarily microphyllous.

GRAMINOID - Herbaceous vegetation composed of more than 50 percent graminoid/stipe leaf species.

FORB (BROAD-LEAF-HERBACEOUS) - Herbaceous vegetation composed of more than 50% broad-leaf forb species.

PTERIDOPHYTE - Herbaceous vegetation composed of more than 50 percent species with frond or frond-like leaves.

Physiognomic Class Choose one:

Forest: Trees with their crowns overlapping (generally forming 60-100% cover).

Woodland: Open stands of trees with crowns not usually touching (generally forming 25-60% cover). Canopy tree cover may be less than 25% in cases where it exceeds shrub, dwarf-shrub, herb, and nonvascular cover, respectively.

Shrubland: Shrubs generally greater than 0.5 m tall with individuals or clumps overlapping to not touching (generally forming more than 25% cover, trees generally less than 25% cover). Shrub cover may be less than 25% where it exceeds tree, dwarf-shrub, herb, and nonvascular cover, respectively. Vegetation dominated by woody vines is generally treated in this class.

Dwarf-shrubland: Low-growing shrubs usually under 0.5 m tall. Individuals or clumps overlapping to not touching (generally forming more than 25% cover, trees and tall shrubs

generally less than 25% cover). Dwarf-shrub cover may be less than 25% where it exceeds tree, shrub, herb, and nonvascular cover, respectively

Herbaceous: Herbs (graminoids, forbs, and ferns) dominant (generally forming at least 25% cover; trees, shrubs, and dwarf-shrubs generally with less than 25% cover). Herb cover may be less than 25% where it exceeds tree, shrub, dwarf-shrub, and nonvascular cover, respectively.

Nonvascular: Nonvascular cover (bryophytes, non-crustose lichens, and algae) dominant (generally forming at least 25% cover). Nonvascular cover may be less than *25%* where it exceeds tree, shrub, dwarf-shrub, and herb cover, respectively.

Sparse Vegetation: Abiotic substrate features dominant. Vegetation is scattered to nearly absent and generally restricted to areas of concentrated resources (total vegetation cover is typically less than 25% and greater than 0%).

Strata/Lifeform, Height, Cover, Diagnostic Species
Visually divide the community into vegetation layers (strata). Indicate the average height class of the stratum in the first column, using the Height Scale on the form. Enter the average percent cover class of the whole stratum in the second column, using the Cover Scale on the form. Height and Cover classes are also listed below.

Trees are defined as single-stemmed woody plants, generally 5 m in height or greater at maturity and under optimal growing conditions. Shrubs are defined as multiple-stemmed woody plants generally less than 5 m in height at maturity and under optimal growing conditions.

Herbaceous layers are: Ht = total, H1 = Graminoids (grass, sedge, rush), H2 = Forbs (Dicot herbaceous), H3 = Ferns and Fern allies, and H4 = tree seedlings. List the dominant species in each stratum. If a species present is known to be diagnostic of a particular vegetation type, list these as well, marking them with an asterisk.

Cover Scale for Strata		**Height Scale for Strata**	
01	<1%	01	<0.5 m
02	1-5%	02	0.5-1 m
03	5-25%	03	l-2 m
04	25-50%	04	2-5 m
05	50-75%	05	5-10 m
06	75-100%	06	l0-l5 m
		07	15-20 m
		08	20-35 m
		09	35-50 m
		10	>50 m

Animal Use Evidence
Comment on any evidence of use of the plot/polygon by non-domestic animals (i.e., tracks, scat, gopher or prairie dog mounds, etc.). Notes on domestic animals should be made in the field below.

Natural and Anthropogenic Disturbance
Comment on any evidence of natural or anthropogenic disturbance and specify the source.

Other Comments
Any other comments.

Species/DBH/Percent Cover Table
Starting with the uppermost stratum, list all the species present and cover class (using the 12 point scale) and percent cover of each species in that particular stratum. Indicate strata in the left-hand columns. If in the tree layer (single-stemmed woody plants, generally 5 m in height or greater at maturity), note in the "T" column if Tl (emergent tree), T2 (tree canopy), or T3 (tree sub-canopy). If in the shrub layer, note in the "5', column if S1 (tall shrub,> 2m), S2 (short shrub, <2m), or S3 (dwarf-shrub <0.5m). If in the ground layer, note in the "G" column if H1 (herbaceous - graminoid), H2 (herbaceous - forb), H3 (herbaceous - fern), H4 (tree seedlings) N (nonvascular other than ferns), V (vine/liana), or F (epiphyte).

*For plots with trees, estimate cover of seedlings, saplings, mature (all others), and total cover for each tree species. Use a separate line for each and assign the most appropriate strata class (by height). Seedlings are generally less than 1.5 m, but that may vary by species.

Also record the DBH (in cm) of all trees above 5 cm diameter. Separate the measurements with a comma. For plots with very high tree density DBH measurements will be done in a subplot. If the number of trees with a DBH greater than 5 cm is more than about 25, divide the plot into quarters and measure the DBH of trees in the southeast quadrant, or the quadrant nearest southeast. CLEARLY NOTE on the form that this is what you've done.

CONSIDERATIONS FOR PLANNING

Planning for the day:

1. Safety and sustenance: Plenty of food, water, first-aid kit, raingear, sunscreen.
2. Field communications:
   a. Develop a plan with other team(s) for radio check-in time.
   b. Do you have a radio and are batteries charged? If you have a walkie talkie, do you have extra batteries for it? Does park staff know the area in which you will be working?
3. Make sure you have the right maps and photos.
4. Check your GPS (Datum set to NAD83? Needs new batteries?).
5. Plan the day's mission before departing using a) USGS quads, b) aerial photo, c) park/BLM maps.
6. Considerations for mission planning:
   a. Plan travel based on topography, best access routes, density and complexity of vegetation (more time for forest and woodland plots, less for herbaceous and scrub).
   b. Plan data collection based on priority needs; new types get higher priority.
   c. Communicate with the other team(s) to make sure you aren't duplicating effort.

Planning for the Week (do this on the first day of the trip)

1. Do you have all appropriate maps, photos?
2. Develop a reasonable estimate of the number of plots for each team broken up by day and based on an estimate of individual team's travel logistics for the week.
3. Develop plan of attack for the week to capture all essential associations in the work area.
4. Balance points two and three above with the expected work schedule of the teams and ensure adequate time-off and reduce over-time concerns.
5. Do you have all necessary information and backups for the week's planning? E.g., blank field forms, film, plenty of AA batteries.

Wrapup (Do this on the last day of the trip, after you have returned to base)

1. Clean, recharge and repair equipment.
2. Hold brief meeting to discuss data collection issues, things that came up during the work week, and plan for next work hitch.
3. Edit field forms and file them systematically. File observation points separately.
4. Re-file the aerial photos and maps.
5. Send exposed roles of film to be developed.
6. Key unknown plants.
7. Enter edited data into database.

Communicate among teams / Topics for wrap-up meetings.

1. What were your questions about the polygons visited during the week?
2. Do you have any questions about the forms or fields?
3. What was accomplished, what was not accomplished?
4. Pass on developments and questions after every trip. Don't let them build up. For example, should we sample the new types we saw? Were there problems with interpreting the aerial photos, or are there personnel issues, problems in consistency in interpreting the forms, or with park-related logistics?

Vegetation Plot Sampling Materials Checklist

- Park research permit
- Topo maps
- Park and BLM maps for general navigation
- Maps of BPU locations
- Geology map
- Aerial photos
- DBH tape and 2 tape measure(s)
- Trowel or U-dig-it, soil water bottle
- Compass with adjustable declination
- Clinometer
- GPS unit
- Plenty of AA batteries for GPS and walkie talkie
- Radio or walkie talkie and/or cell phone
- 35 mm camera & film (allow at least 2 exposures per plot plus general and scenic photos)
- Baggies for temporary storage of unknown plants, and masking tape for labeling
- Plant press & paper
- Plant Keys / Flora(s)
- Pens / sharpies / dry erase marker
- Forms: plot survey (both pages) and observation point
- Clipboard/forms holder and clear page protector sleeve
- Pens, pencils, pencil lead, chalk (for slate board), and chalkboard eraser
- Stapler and extra staples
- Most recent version of provisional classification of the park, with the number of plots still needed per type (updated approx. every 2 weeks)
- All ancillary information (cheat sheet, species list, floras, sampling priority list for zone, main sampling protocol).
- First aid kit, personal gear (food, water, rain gear, etc.)

BLACK CANYON/CURECANTI CHEATSHEET

LANDFORM

Alluvial fan
Alluvial flat
Alluvial terrace
Arroyo
Badlands
Bajada
Bank
Basin
Bench
Butte
Canyon
Channel
Cinder cone
Cliff
Colluvial Slope
Debris slide
Depression
Drainage
Dune
Escarpment
Floodplain
Foothills
Gap
Gorge
Hill
Hogback
Interfluve
Lake
Landslide
Lowland
Mid slope
Mountain
Mud flat
Noseslope
Piedmont
Plain
Plateau
Ravine
Ridge
Rim
River
Rockfall
Saddle
Scree slope
Seep
Shoreline
Sinkhole
Slide
Slope
Slough
Soil creep slope
Stream terrace
Streambed

LANDFORM

Swale
Talus slope
Toe slope
Terrace
Valley floor
Valley side
Wash

ASPECT

Flat
Azimuth (deg.)
Variable

PLOT SIZE

400m^2 (11.3m r):
Forests
Woodlands
Shrublands

100m^2 (5.6 m r):
Dwarf Shrublands
Shrub-Herbaceous
Herbaceous

25m^2 (2.8m r):
Non vascular

You may adapt plot size and shape to fit the situation; but never choose a plot size **smaller** than listed here.

TOPOGRAPHIC POSITION

Designation	Synonym(s)
Interfluve	crest, summit, ridge
High slope	shoulder slope, upper slope, convex creep slope
High level	mesa, plateau
Midslope	transportational midslope,
Backslope	dipslope, cliff
Step in slope	ledge, terracette, bench
Lowslope	lower slope, foot slope, colluvial footslope
Toeslope	alluvial toeslope
Low level	terrace, valley floor, floodplain

SEE ALSO THE DIAGRAM OTHER SIDE

VEGETATIVE STRATA

T1 = emergent tree
T2 = tree canopy
T3 = tree sub-canopy.
S1 = tall shrub, > 2m
S2 = short shrub, < 2m
S3 = dwarf shrub. < 0.5m
H1 = graminoid
H2 = forb
H3 = fern or fern ally
H4 = Tree seedlings
N = nonvascular other than ferns
V = vine/liana
E = epiphyte

Physiognomic Class

Forest: Crowns touching
Woodland: Trees>25%, crowns not touching
Shrubland: Shrubs> grass, forbs or trees
Dwarf Shrubland: Shrubland <0.5 m tall
Shrub Herbaceous: Shrubs = Forbs/grasses
Herbaceous: Grass/forbs > trees or shrubs

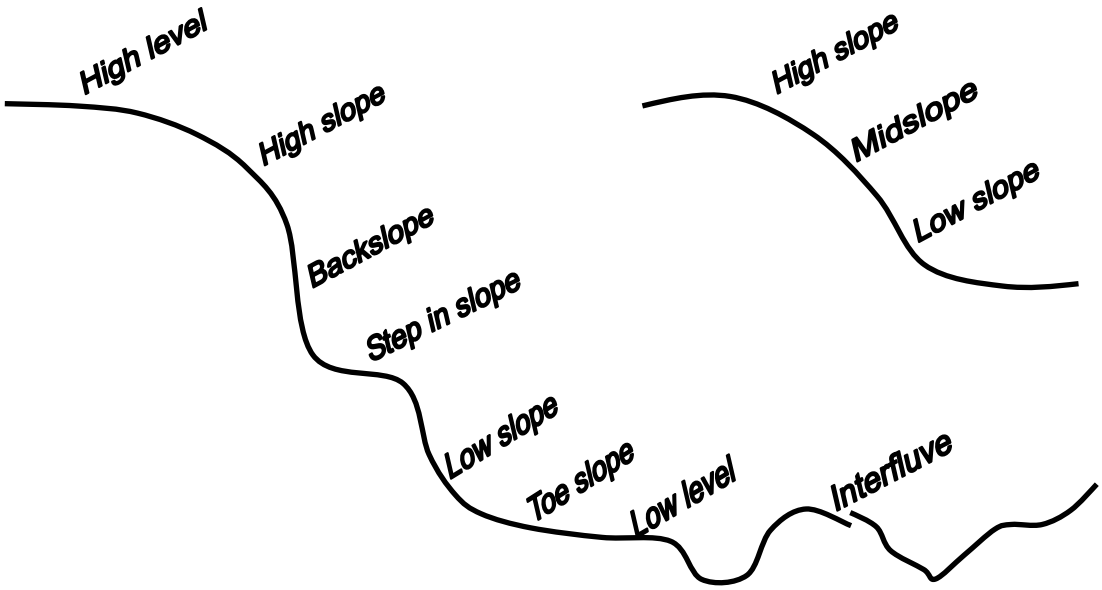
SOIL TEXTURE

Sand: clean, no ball
Loamy sand: ball, no ribbon
Sandy loam: gritty weak ribbon
Silt loam: smooth weak ribbon
Clay loam: long ribbon, no ring
Clay: smooth ribbon/ring, edible
Sandy Clay; gritty ribbon & ring
Silty Clay: smooth ribbon/ring
Peat: still has plant parts
Muck: smelly black ooze

SURFICIAL GEOLOGY

Amphibolite
Blue Mesa Tuff
Carpenter Ridge Tuff
Cimarron Ridge Tuff
Dakota Sandstone
Diabise Dikes
Dillon Mesa Tuff
Diorite or quartz diorite
Dubois Greenstone
Entrada Sandstone
Eolian Sands
Fan Deposits
Fault Zone
Fish Canyon Tuff
Frontier Sandstone
Fruiteland formation
Gabbro
Gartra Member/Shinarump
Granite of the South Beaver Creek
Hinsdale Formation
Humbug/Doughnut Shale
Lake Fork Formation
Layered quartzitic gneiss
Madison Limestone
Mancos Shale
Massive quartzittic gneiss
Mesosoic Sandstone
Mesosoic Shale
Metamorhpic/Granitic
Mica Schist
Migmattic gneiss
Morrison Formation
Mowry Shale
Nepheline Syenite
New Alluvium
Obscured by Soil
Old Alluvium
Park City Formation
Pegmatite
Pictured Cliffs Sandstone
Powderhorn Granitic
Pyroxenite
Quartzite
Rat Creek Tuff
Schist and gneiss
Talus/Colluvium/Landslide
Wanakah Formation
West Elk Breccia

TOPOGRAPHIC POSITION - CHEAT SHEET



B.2. Accuracy Assessment Point Field Sampling Manual

Black Canyon National Park / Curecanti National Recreation Area

This manual documents accuracy assessment (AA) data collection procedures for Black Canyon National Park / Curecanti National Recreation Area (BLCA/CURE). This project is directed by the Northern Colorado Plateau Network (NCPN) with assistance from engineering-environmental Management, Inc. (e^2M) and NatureServe.

Overview

The primary purpose of accuracy assessment (AA) fieldwork is to supply data that will test the accuracy of vegetation maps. It is also a continuation of the sampling of vegetation communities. The main uses of the AA data are:

- Verify accuracy of polygons drawn on the map (map units)
- Verify relationships between associations and mapping units
- Verify that field key works well to classify vegetation to association
- Check for classification completeness – undescribed associations not sampled during inventory
- Clarify concepts and augment descriptions of existing associations and possibly develop new associations

There are a number of factors that contribute to error on a vegetation map and some of these are listed below. It is important for the field investigator to be aware of these situations and to take actions to minimize error when at all possible.

- Locational error (when it is not possible to acquire reliable UTM coordinates, the AA point data collected may look like it is in another polygon, or if the polygons are small/narrow and the GPS receiver isn't working well, it may be difficult to know which polygon is supposed to be sampled).
- Field key is difficult to use, leading the investigator to assign the point to the wrong association.
- Field key does not include all plant associations in the park, also leading to confusion in which association to assign to a point.
- Field data error- either by mis-identifying diagnostic species, or by not reading the key carefully, resulting in a bad field call when the map attribute is accurate.
- AA point falls within an ecotone, which is impossible to classify but still has to be mapped as something.
- Relationships between plant associations and map units (modeling) are flawed.
- The polygon is heterogenous, including patches of varying vegetation that are too small to map individually. The AA point may happen to fall in a part of the polygon with a different community than observed by the photo interpreter in the bigger picture.

Navigating to a Point

The field investigator will navigate to each selected AA point using a handheld GPS receiver and map consisting of a digital orthophoto (DOQQ) base overlaid with AA point locations, mapped vegetation polygons, and USGS 7.5 minute topographic quadrangle maps.

- The DOQQ map will identify the location of the AA points, as well as the location, size and shape of the polygons.
- Topographic maps are useful in identifying the landscape when navigating to a point, and in determining the elevation of a point. They are also helpful for obtaining names of topographic features used for assigning site names.
- GPS receivers indicate the direction and the distance (as the crow flies) to the AA point. This can obviously lead to trouble if one were to navigate as the crow flies to AA points, not being aware of

canyons or other obstacles in the way. Use the DOQQ and topo maps to plan the route! ***Note***: *In very homogenous terrain, acquire the UTM coordinates of the field vehicle so one can find their way back!*

Use the GPS receiver to locate the point within 1 m of the UTM coordinates, but do not spend a lot of time trying to be exact. A 5000m^2 area around each AA point will be evaluated, which is the size of the project Minimum Mapping Unit (MMU = 0.5 ha). The MMU is the smallest area that the photo interpreters are required to map to vegetation class. (However, mappers can choose to delineate smaller polygons if the map class is distinctive). Typically the AA plot will be circular in shape (40 m radius), however, in some situations the plot shape will need to be varied to accommodate the map unit being sampled (e.g. a long-narrow riparian area).

At each AA point the investigator will key the vegetation to plant association using the field key. The MMU is a relatively large area - approximately the size of a football field with endzones (50m x100m rectangle, 71m x71m square, 80m diameter circle). The shape of the MMU may need to vary depending on the shape of the mapping polygon, but for large polygons, an 80m diameter circle may be easiest. If the polygon is smaller than the MMU, evaluate the whole polygon

Along the way... Identify the mapping polygons where the target AA points are located and if possible walk through part of the polygons on the way to the points, noting polygon boundaries. Is the map polygon uniform or variable? Is the AA point representative of the polygon? Record these observations on the AA form upon arrival at the point.

A word about safety… As with all fieldwork, navigation will occur through rough terrain, often off-trail, to reach the destination. However, particularly in AA work, there is a desire to reach as many points as possible in a day, and to get as close to each point as feasible. No AA point is worth risking one's health or life! Use good judgment. Alternate points will be provided in case an AA point cannot be reached due to difficult terrain or other reasons. If this happens, PLEASE document that the point was not reachable so that the effort is not repeated by someone else.

Occasionally the AA point will fall on the edge of two vegetation types or at the edge of a polygon. In these instances the field crew member will need to use judgment on how to record the data. If two distinct plant associations are present on a site record separate species lists for each of the communities on the field form. In addition, both types would be keyed and recorded on the field form. There will be many times where the point falls at the edge of a polygon. In selecting AA points, a 25 m buffer from the polygon edge is used to ensure that most AA points fall cleanly with the polygon boundaries. However, in some cases the AA point will partially include some of the adjacent polygon. In this situation the field crew member will need to clearly describe in the comments fields the situation and be clear about what is represented within and outside the polygon targeted for sampling.

AA Point Form Instructions

This section documents field by field instructions for AA point data collection and serves as guidance for completing the AA Point Data Form. Upon arrival at an AA point location, the field investigator will take a waypoint with the GPS receiver. Please make sure the GPS receiver is set for NAD83, and that the WAAS is on (see 3D differential, below). UTM coordinates and other locational data will be recorded manually to serve as a backup in case of GPS receiver failure. Park-specific cheatsheets are provided at the end of this section to assist ecologists with AA point data collection.

IDENTIFIERS / LOCATORS SECTION

AA Point Code:

AA point codes are derived from the codes assigned to points on the DOQQ photo map, with "_AA." inserted between the 4-letter park alphacode and point number. The four-letter park code for this project is BLCA or CURE. An example of an AA point would be BLCA_AA.0003 or CURE_AA.0101. Please note that park-specific datasheets already have the parkcode and '_AA.' delimiter listed. The field investigator will only need to record the 4-digit AA point number on the form.

Quad Name:
Record the full name of the 7.5 minute quadrangle.

County:
Enter county in which AA point occurs, e.g., Gunnison County.

State:
Enter state in which AA point occurs, e.g., CO.

Park Site Name:
This is best determined from the topographic map. Select a nearby feature that is an obvious waypoint, such as the name of a canyon, road, pinnacle, etc. This name does not need to be unique. If a number of AA points are sampled in a small area the same site name may be used for all of them.

Survey Date:
Enter the date the AA point was sampled. Please use the format Month – Day - Year.

Surveyor(s):
Full last name(s) of the field team member(s) collecting data.

AA Point Shape:
Select one of the following choices to describe the AA plot shape: circular or other. In the case of other please provide dimensions and comments in the classification comments field below.

GPS File:
Enter the name given to the waypoint when the AA point was marked in the GPS receiver. It would be useful to assign a name that incorporates the AA point number.

Field UTM X, Field UTM Y
Record the UTM easting and northing coordinates saved as a waypoint in the GPS receiver. Please double check to make sure the easting is six digits and the northing is seven digits.

In deep canyon country it is often difficult to obtain UTM coordinates (the GPS receiver has to be able to 'see' at least three or four satellites). If it is not possible to acquire UTM coordinates, or if the PDOP is greater than 8 (or EPE is greater than ±50m), first try to obtain a signal from a higher point nearby (but still close to) the AA point. If that fails then estimate the UTM coordinates from the digital orthophoto (NAD83), and manually enter them into the GPS receiver.

GPS Receiver:
Record the name and model of the GPS receiver being used to record data for the AA point. If a GPS receiver was not used to determine UTM coordinates record 'none' here and be sure to complete the 'GPS Comments' field below.

GPS Error
Note the "Estimated Position Error" (EPE) displayed on the GPS receiver. The lower the number the more accurate the reading.

3D Differential?

3D differential is obtained when the GPS receiver can "see" a satellite that does nothing but correct the tiny errors in the positioning or clocks of other GPS satellites. This satellite broadcasts a real-time differential correction so that the location coordinates are as accurate as possible. It is in geosynchronous orbit in the southern sky, so if the southern sky is visible, one will generally be able to acquire 3D differential. This system is known as the Wide-Area Augmentation System, or WAAS. Please make sure that WAAS is **always** on.

GPS Receiver Comments:

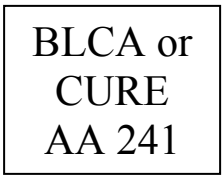
VERY IMPORTANT: If the field investigator resorted to estimating the AA point location, UTM coordinates on the digital orthophoto, note that in this field. If the investigator had to leave the point to acquire a reading from a higher site, record that here, along with the compass bearing and distance of the GPS location from the point center.

Camera:

Circle the appropriate camera name and model, or enter it next to "other" if it is not on the datasheet.

Taking Photographs:

Expose one color slide of each AA point. The purpose is to acquire a good representation that accurately captures the vegetative stand of the AA point. If the area is heterogeneous please represent this in the photo. Try to include a little sky, approximately 10% sky, for perspective. Use a chalkboard to record the point number and the direction the photo is exposed. Thus, for AA point 241, the board in the photo taken from the SE facing NW across the point will read "BLCA or CURE AA.0241, →NW". Take the photographs looking across the contour if the AA point is on a steep slope. In addition, a photograph log for all photos not taken at AA points will need to be maintained. It is not anticipated that crews would routinely take additional photos, however, if a crew member finds a new vegetation type not previously described it would be good to document this situation with a photograph.



Photos: Type/Roll Number/Frame Number/Photographer/Direction and Comments

For the photo taken at the AA point record the following: *Roll number*: record roll number (Roll numbers should be a team member's initials plus a sequential number, which are written on the film before it goes into the camera.) *Frame number*: record frame number of photo. *Photographer*: record last name of person taking photograph. *Directions/Comments*: record the direction the photos were exposed from and towards (SE→NW) and any other comments to clarify contents of the photo.

ASSOCIATION INFORMATION SECTION

Primary Name, Secondary Name, Tertiary Name:

Fill out this section last, after all the vegetation information has been collected. Using the environmental, stratum and cover data, key the vegetation in the half-hectare area around the AA point to association. Choose carefully! Write the name of the association in the primary association field. If the situation is borderline between two associations (e.g., some sagebrush, but also some muttongrass), write other association name in the secondary association field. A tertiary name field has also been provided for the

few occasions where a third call is needed. If vegetation near the AA point does not key well, make the best effort to fit it into one or two of the associations listed in the manual, then make detailed comments in the "Classification Comments" field to justify the selection and/or reasoning. If vegetation near the AA point does not fit the plant association key at all then create a new name using the dominant species of each strata (as would be done for a plot). Provide information to characterize the new association in the comments field.

Is Primary/Secondary/Tertiary Name a New Association?

If the investigator encountered a new vegetation type and applied a new name (not in the field key) then please check the 'box' to the right of the name indicating that the name is a new association. Please be sure to provide comments in the classification comments field.

Other Vegetation Associations Within 50 m:

List other associations that are within 50m of the outside border of the half-hectare AA point being evaluated.

Representativeness of AA point:

Because the AA points are randomly located within a polygon, there is no guarantee that they will land in a spot that is representative of either the polygon or of the plant associations included within the polygon's map unit. The point could easily land in a small gully or an inclusion that is too small to map, or an ecotone where trees are invading a shrubland, for instance. Because of this, it is important that the investigator pay attention not only to the vegetation within the ½ hectare sample area, but the larger area as well. For the primary plant association call please rank the representativeness of this AA point for the polygon (Good, Fair, Poor or Unknown). Please note in the Classification Comments field if the AA point falls in an ecotone or inclusion, or in an anomalous situation such as in a gully or on a rock outcrop. If the polygon is extremely large and the observer is unable to make an assessment then please use the 'unknown' field.

Fit of plant association to description in the key:

The key being used does not provide a lot of descriptive information for each association, and is likely not to contain all the associations that may be encountered. Rank the representativeness of the AA point's association to the description in the key (Good, Fair, Poor). It would also be helpful to note specific suggestions on how to make the key work better. It will provide information for improving the key for the final report.

ENVIRONMENTAL DESCRIPTION SECTION

Elevation:

Record the elevation of the AA point from the GPS receiver in feet/meters. Specify on the data sheet whether the measurement is in feet or meters, and whether it was obtained from a GPS receiver or a map.

Slope:

Measure the slope in degrees using a clinometer. The degree scale is the left-hand scale when looking through the clinometer. If the slope varies at the point then estimate an average. If the point is on rolling microtopography, enter "variable." Further information may be provided in the Environmental Comments section.

Aspect:

Measure aspect in degrees using a compass (set for local magnetic declination, which is given in the lower left hand corner of every USGS topo map). If the slope is flat, enter "n/a" for aspect. If the point

wraps around different aspects on a slope, enter “variable” and describe further in the Environmental Comments section.

Topographic Position:

This is the position of the point on its related landform. Determining this requires the investigator to think of the landform in cross-section, which is roughly diagramed on the back of the cheat sheet. One of the terms listed below **must** be used:

Interfluve (crest, summit, ridge). Linear top of ridge, hill, or mountain; the elevated area between two drainages that sheds water to the drainages.
High slope (shoulder slope, upper slope, convex creep slope). The uppermost inclined surface at the top of a slope. Includes the transition zone from backslope to summit. Surface is dominantly convex in profile and erosional in origin.
High level (mesa, summit). Level top of a plateau.
Midslope (transportational midslope). Intermediate slope position.
Backslope (dipslope). Subset of midslopes that are steep, linear, and may include cliff segments.
Step in slope (ledge, terracette). Nearly level shelf interrupting a steep slope, rock wall, or cliff face.
Lowslope (lower slope, foot slope, colluvial footslope). Inner gently inclined surface at the base of a slope. Surface profile is generally concave and a transition between midslope or backslope, and toeslope.
Toeslope (alluvial toeslope). Outermost gently inclined surface at base of a slope. In profile, usually gentle, linear and characterized by alluvial deposition.
Low level (terrace). Valley floor or shoreline representing the former position of an alluvial plain, lake, or shore.

Landform:

Enter the landform that best describes the site where the AA point is located. Referring to the topo map for the landscape context may help the investigator determine what landform(s) to choose. Note that the landform choices may describe different scales, or that a landform feature can be described by more than one term. For example, the AA point may be on a ledge on the rim of a canyon. A suggested list of landforms and definitions is provided in Appendix A. *Note: The topographic position selected above should relate to the scale of the landform chosen here.*

Surficial Geology:

List the primary geologic substrate where the AA point occurs. A list of geologic types is provided on a cheatsheet at the end of this document. The geology map should help, but if one is unable to decipher the geology, then provide a general description (e.g., coarse sandstone, green shale, aeolian sands or obscured by soils).

Environmental Comments:

Enter comments on the environmental setting and its effect on the vegetation. Examples include: "stunted trees due to shallow soils", "vegetation only where pockets of soil occur", or "large colluvial boulders and small rocks litter surface of soil". This field can also be used to describe site history such as fire events. This is an extremely important field for crews to document so please take the time to do a good job. Information from this field is used to prepare local descriptions of the plant communities, and to help assign AA points to associations not previously recorded in the park.

Unvegetated Surface:

This field is an ocular estimate of ground cover for the following: bedrock; litter/duff; wood (>1cm); large rocks (cobbles, boulders >10cm); small rocks (gravel 0.1-10 cm); sand (0.1-2mm); bare soil; other (please specify). For this estimation use the cover classes listed on the form. If an unvegetated surface category is not present in the observation point area, leave the corresponding line blank.

VEGETATION DESCRIPTION SECTION

Leaf Phenology:

Select the best description for the leaf phenology of the **dominant** stratum. The dominant stratum is the tallest stratum that contains at least 10% cover. Leave blank for non-vascular plant-dominated AA points.

Evergreen. Greater than 75% of the total woody cover is never without green foliage. (Some tricky examples: most *Artemisia, Ephedra,* and all *Atriplex* except *A. canescens*, all *Chrysothamnus*).
Cold deciduous. Greater than 75% of the total woody cover sheds its foliage in connection with an unfavorable season mainly characterized by winter frost (tricky ones: *Sarcobatus vermiculatus, Tamarix* spp.).
Mixed evergreen – Cold deciduous. Evergreen and deciduous species are mixed within the type and generally contribute 25-75% of the total woody cover.
Perennial. Herbaceous vegetation composed of more than 50% perennial species.

Annual. Herbaceous vegetation composed of more than 50% annual species.

Leaf Type:

Select the best description for the leaf form of the dominant stratum. The dominant stratum is the uppermost stratum that contains at least 10% total coverage. Within that dominant stratum, the species that makes up greater than 50% of cover defines the leaf type.

Broad-leaved. Woody vegetation that is primarily broad-leaved (sagebrush, oak, mountain mahogany).
Needle-leaved. Woody vegetation that is primarily needle-leaved (juniper, pinyon, tamarisk).

Microphyllous. Woody cover that is primarily microphyllous (*Ephedra*).
Graminoid. Herbaceous vegetation composed of more than 50 percent graminoid species (grasses, sedges, rushes, etc).
Forb (broad-leaf-herbaceous). Herbaceous vegetation composed of more than 50% broad-leaf forb species (*Phlox, Astragalus, Erigeron*, etc).
Pteridophyte. Herbaceous vegetation composed of more than 50 percent ferns or fern allies (scouring rushes).
Non-vascular. Dominated by lichens or mosses.
Mixed. As with leaf phenology, the dominant stratum may be composed approximately equally of species with several different leaf types. Describe the mix briefly or circle leaf types that apply.

Physiognomic Class:

This represents what is seen at the AA point when looking across at the vegetation. The following definitions can be used as guidelines, but may not always apply in desert locales. For example, areas with scattered pinyon and juniper may not fit the cover classes below but they would best be described as a woodland.

Forest. Trees with their crowns overlapping (generally forming 60-100% cover).

Woodland. Open stands of trees with crowns not usually touching (generally forming 10-60% cover). Canopy tree cover may be less than 10% in cases where it exceeds shrub, dwarf-shrub, herb, and nonvascular cover, respectively.
Shrubland. Shrubs generally greater than 0.5 m tall with individuals or clumps overlapping to not touching (generally forming more than 25% cover, trees generally less than 10% cover). Shrub cover may be less than 25% where it exceeds tree, dwarf-shrub, herb, and nonvascular cover, respectively. Vegetation composed of woody vines is included this class.
Dwarf-shrubland. Low-growing shrubs usually under 0.5 m tall. Individuals or clumps overlapping to not touching (generally forming more than 25% cover, trees and tall shrubs generally less than 10% cover). Dwarf-shrub cover may be less than 25% where it exceeds tree, shrub, herb, and nonvascular cover, respectively.
Shrub Herbaceous. Low or taller shrubs forming approximately equal cover with a grass or forb component. Individuals or clumps of shrubs generally not touching and usually forming more than 25% cover; trees less than 10% cover. Spaces between shrubs are generally mostly occupied by grasses and/or forbs.
Wooded Herbaceous. Trees forming approximately equal cover with a grass or forb component.
Herbaceous. Perennial or annual herbs (graminoids or forbs) dominant (generally forming at least 25% cover; trees, shrubs, and dwarf-shrubs generally with less than 10% cover). Herb cover may be less than 25% where it exceeds tree, shrub, dwarf-shrub, and nonvascular cover, respectively.
Nonvascular. Nonvascular cover (bryophytes, lichens, and algae) dominant (generally forming at least 25% cover). Nonvascular perennial vegetation cover may be less than 25%, as long as it exceeds tree, shrub, dwarf-shrub, and herb cover.
Sparsely Vegetated. Abiotic substrate features dominant. Perennial vegetation is scattered to nearly absent and generally restricted to areas of concentrated resources. Total vegetation cover is typically less than 5-7% and greater than 2%. Badlands or sand dunes supporting communities of annual plants should be included in this category, regardless of cover.

DOMINANT PLANT SPECIES LIST

[Record information on ***dominant species only***.]

Strata: Species names will be recorded within the appropriate stratum. It is important that all crew members are consistent in assignment of species to strata throughout this project. Following are some guidelines to use in determining strata.

Begin by assessing the strata at the AA point . Trees are defined as single-stemmed woody plants, generally 5 m in height or greater at maturity and under optimal growing conditions. Shrubs are defined as multiple-stemmed woody plants generally less than 5 m in height at maturity and under optimal growing conditions. The exception is mature pinyon and juniper plants, which are considered trees regardless of their height.

T1 Emergent, T2 Canopy, T3 Subcanopy: A uniform stand of pine or cottonwood trees would be a good example of T2"canopy", but where they are absent then begin with the shrub stratum, or herbaceous stratum if no shrubs are present. If the tree crowns at the AA point are mostly touching and similar in height, but a given tree species is much taller that species would be a T1"emergent.” As another example, a sample area may be characterized by several tall scattered cottonwoods and then shorter scattered junipers. In this case, the cottonwoods would be the "canopy" and the junipers would be the "subcanopy". There may also be cottonwoods listed in the “subcanopy” layer, if there are a number of short saplings in addition to mature tall trees.

The remaining vegetative strata are (remember to check **with plant list for consistency):**

S1 Tall Shrub: >2 meters tall. For example, *Fraxinus anomala* and *Amelanchier utahensis.*
S2 Short Shrub: <2 meters tall. For example, *Artemisia,* all *Atriplex* except *gardneri* (which are dwarf).
S3 Dwarf-shrub: <0.5 meters tall. For example, *Gutierrezia, Opuntia polycantha.*
H Herbaceous: All herbaceous species including graminoids, forbs, ferns, and fern allies.
H4 Tree Seedlings: Seedlings are trees with vertical stems < 1.5 m tall, but that may vary by species (e.g. does not always apply to pinyon – juniper).
N Nonvascular: This is mainly dark cyanobacteria, mosses and lichens.

Height can be used to define strata, but is not how species should be placed in strata. **Species characteristically belong to one stratum or another** (e.g., pinyon and juniper are canopy (T2), Utah serviceberry is a tall shrub (S1), sagebrush is a short shrub (S2), snakeweed is a dwarf-shrub (S3), etc.), **EVEN when unusual environmental circumstances dictate that the plants have an unusually tall** (e.g., response of some plants to fire) **or unusually short growth form**. So even if the junipers growing in cracks are only 1.5 m tall, as long as they are mature trees, they are placed in the T2 category. About the only rule regarding height should be that the tree layer is (usually) higher than the tall shrub layer that is taller than the short shrub layer, etc.

The second thing is to avoid splitting species between strata. If a few mountain mahogany have been browsed to <1m tall, but most are 2m tall, they all are rolled into the tall shrub stratum. There are two exceptions: (1) each height class covers more than 10% of a point , or (2) there is a reproductive layer of baby shrubs or young trees.

The third thing is how to define some of the "borderline/confusing" species. What we want to avoid is having some crew members calling *Leptodactylon* a forb and some calling it a dwarf-shrub. Same for snakeweed, *Eriogonum microthecum*, fringed sagewort, *Brickellia* spp. and any number of other species. Consult the master plant species lists when in doubt. Crew members should keep the master plant list and strata assignments updated.

Completing the Species/Strata Table:

Dominant Species. List the dominant plant species using **full scientific name** by the strata listed below for each AA point. In some cases, due to severe drought conditions of recent years, a dominant species on the site may have experienced severe levels of mortality. In this case please record 'DEAD' in front of the scientific name and enter the cover value, independent of any live cover value for the same species. During data entry back in the office there will be a check field to use for 'DEAD'. It is also important to document these relationships in the comments field.

T1	Emergent	S3	Dwarf-shrub
T2	Canopy	H	Herbaceous
T3	Sub-canopy	H4	Tree Seedlings
S1	Tall Shrub	N	Non-vascular
S2	Short Shrub		

Diagnostic Species. Mark species that characterize the stand with an '*'.

Height Class. Use the height class code from the list below that best describes the overall height of each plant species within a given stratum.

01	<0.5 m	06	10-15 m
02	0.5-1 m	07	15-20 m
03	1-2 m	08	20-35 m
04	2-5 m	09	35-50 m
05	5-10 m	10	>50 m

Cover Class. For each plant species use the cover class codes listed below to estimate overall canopy cover for each species listed on the form.

T	<1%	04	36-45%
P	1-5%	05	46-55%
1a	6-10%	06	56-65%
1b	11-15%	07	64-75%
02	16-25%	08	76-85%
03	26-35%	09	86-95%

Percent (%) Cover. Estimate the percent aerial cover (T-100%) for each plant species recorded in the far right hand column on the form.

If the point is on the border between two types… (and both types are at least MMU-size) Make two species lists, one for each type, on the back of the AA point form. These will both be entered into the database for that AA point.

Accuracy Assessment Materials Checklist

- Park research permit
- Topo maps
- Park and BLM maps for general navigation
- DOQQ photos of AA point locations
- Geology map
- Compass with adjustable declination
- Clinometer
- GPS unit
- Extra AA batteries for walkie talkie
- Radio or walkie talkie and/or cell phone
- 35 mm camera & slide film (allow at least 2 exposures per AA point)
- Baggies for temporary storage of unknown plants, and masking tape for labeling
- Plant press & paper
- Plant Keys / Flora(s)
- Pencils / sharpies
- Forms: AA point and observation point
- Clipboard/forms holder
- Pens, pencils, pencil lead, slate board, chalk, and chalkboard eraser or supply of clean rags
- Key to the plant associations of the park
- All ancillary information (cheat sheet, species list, floras, sampling priority list for zone, main sampling protocol).
- First aid kit, personal gear (food, water, rain gear, etc.)

APPENDIX: Landform Glossary

(excerpted from http://soils.usda.gov/technical/handbook/detailedtoc.html#629**)**

alluvial cone - A semi-conical type of alluvial fan with very steep slopes; it is higher, narrower, and steeper (e.g., > 40% slopes) than a fan, and composed of coarser, and thicker layers of material deposited by a combination of alluvial episodes and to a much lesser degree, landslides (e.g., debris flow).

alluvial fan - A low, outspread mass of loose materials and/or rock material, commonly with gentle slopes, shaped like an open fan or a segment of a cone, deposited by a stream (best expressed in semiarid regions) at the place where it issues from a narrow mountain or upland valley; or where a tributary stream is near or at its junction with the main stream. It is steepest near its apex which points upstream and slopes gently and convexly outward (downstream) with a gradual decrease in gradient.

alluvial flat (a) (colloquial: western US) A level, graded, alluvial surface in bolsons and semi-bolsons which commonly does not manifest traceable channels, terraces or floodplain levels. (b) (**not preferred**) A general term for a small flood plain bordering a river, on which alluvium is deposited during floods.

alluvial plain - (a) A large assemblage of fluvial landforms (braided streams, terraces, etc.,) that form low gradient, regional ramps along the flanks of mountains and extend great distances from their sources (e.g., High Plains of North America. SW (b) (not recommended, use flood plain.) An general, informal term for a broad flood plain or a low-gradient delta.

alluvial plain remnant - An erosional remnant of an alluvial plain which retains the surface form and alluvial deposits of its origin but was not emplaced by, and commonly does not grade to a present-day stream or drainage network.

alluvial terrace - (not preferred) refer to stream terrace.

alluvium - Unconsolidated, clastic material subaerially deposited by running water, including gravel, sand, silt, clay, and various mixtures of these.

anticline - (a) A unit of folded strata that is convex upward and whose core contains the stratigraphically oldest rocks, and occurs at the earth's surface. In a single anticline, beds forming the opposing limbs of the fold dip away from its axial plane. (b) A fold, at any depth, generally convex upward whose core contains the stratigraphically older rocks.

arroyo - (colloquial: southwest A.) The channel of a flat-floored, ephemeral stream, commonly with very steep to vertical banks cut in unconsolidated material; sometimes called a wash. It is usually dry but can be transformed into a temporary watercourse or torrent after heavy rain within the watershed. Where arroyos intersect zones of ground-water discharge, they are better classed as intermittent stream channels.

artificial levee - An artificial embankment constructed along the bank of a watercourse or an arm of the sea, to protect land from inundation or to confine streamflow to its channel.

backslope - The hillslope profile position that forms the steepest and generally linear, middle portion of the slope. In profile, backslopes are commonly bounded by a convex shoulder above and a concave footslope below. They may or may not include cliff segments (i.e. free faces). Backslopes are commonly erosional forms produced by mass movement, colluvial action, and running water.

badlands - A landscape which is intricately dissected and characterized by a very fine drainage network with high drainage densities and short, steep slopes with narrow interfluves. Badlands develop on surfaces with little or no vegetative cover, overlying unconsolidated or poorly cemented materials (clays, silts, or in some cases sandstones) sometimes with soluble minerals such as gypsum or halite.

bajada - (colloquial: southwestern US.) A broad, gently inclined, alluvial piedmont slope extending from the base of a mountain range out into a basin and formed by the lateral coalescence of a series of alluvial

fans. Typically it has a broadly undulating transverse profile, parallel to the mountain front, resulting from the convexities of component fans. The term is generally restricted to constructional slopes of intermontane basins. Synonym - coalescent fan piedmont.

ballena - (colloquial: western US.) A fan remnant having a distinctively-rounded surface of fan alluvium. The ballena's broadly-rounded shoulders meet from either side to form a narrow summit and merge smoothly with concave sideslopes and then concave, short pediments which form smoothly-rounded drainageways between adjacent ballenas. A partial ballena is a fan remnant large enough to retain some relict fan surface on a remnant summit.

bar - A general term for a ridge-like accumulation of sand, gravel, or other alluvial material formed in the channel, along the banks, or at the mouth of a stream where a decrease in velocity induces deposition; e.g. a channel bar or a meander bar.

barchan dune - A crescent-shaped dune with tips extending leeward (downwind), making this side concave and the windward (upwind) side convex. Barchan dunes tend to be arranged in chains extending in the dominant wind direction.

base slope - A geomorphic component of hills consisting of the concave to linear slope (perpendicular to the contour) which, regardless of the lateral shape is an area that forms an apron or wedge at the bottom of a hillside dominated by colluvial and slope wash processes and sediments (e.g., colluvium and slope alluvium). Distal base slope sediments commonly grade to, or interfinger with, alluvial fills, or gradually thin to form pedisediment over residuum.

basin - (a) Drainage basin; (b) A low area in the Earth's crust, of tectonic origin, in which sediments have accumulated. (c) (colloquial: western US) A general term for the nearly level to gently sloping, bottom surface of an intermontane basin (bolson). Landforms include playas, broad alluvial flats containing ephemeral drainageways, and relict alluvial and lacustrine surfaces that rarely, if ever, are subject to flooding. Where through-drainage systems are well developed, flood plains are dominant and lake plains are absent or of limited extent. Basin floors grade mountainward to distal parts of piedmont slopes.

basin floor - A general term for the nearly level, lower-most part of intermontane basins (i.e. bolsons, semi-bolsons). The floor includes all alluvial, eolian, and erosional landforms below the piedmont slope.

basin-floor remnant - (colloquial: western US) A flat erosional remnant of any former landform of a basin floor that has been dissected following the incision of an axial stream.

bench - (not preferred) refer to structural bench.

beveled base - The lower portion of a canyon wall or escarpment marked by a sharp reduction in slope gradient from the precipitous cliff above, and characteristically composed of thinly mantled colluvium (e.g. < 1 m) and / or carapaced with a thin surficial mantle of large rock fragments from above, which overly residuum of less resistant rock (e.g., shale) whose thin strata intermittently outcrop at the surface; a zone of erosion and transport common in the canyonlands of the semi-arid, southwestern US.

blowout - A saucer-, cup-, or trough-shaped depression formed by wind erosion on a preexisting dune or other sand deposit, especially in an area of shifting sand, loose soil, or where protective vegetation is disturbed or destroyed; the adjoining accumulation of sand derived from the depression, where recognizable, is commonly included. Commonly small, some blowouts may be kilometers in diameter.

bluff - (a) A high bank or bold headland, with a broad, precipitous, sometimes rounded cliff face overlooking a plain or body of water, especially on the outside of a stream meander; ex. a river bluff. (b) (not preferred) use cliff. Any cliff with a steep, broad face.

borrow pit - An excavated area from which earthy material has been removed typically for construction purposes offsite; also called barrow pit.

bottomland - (not recommended) use flood plain. An obsolete, informal term loosely applied to varying portions of a flood plain.

box canyon - a) A narrow gorge or canyon containing an intermittent stream following a zigzag course, characterized by high, steep rock walls and typically closed upstream by a similar wall, giving the impression, as viewed from its bottom, of being surrounded or "boxed in" by almost vertical walls. b) A steep-walled canyon heading against a cliff a dead-end canyon.

braided stream - A channel or stream with multiple channels that interweave as a result of repeated bifurcation and convergence of flow around inter-channel bars, resembling (in plan view) the strands of a complex braid. Braiding is generally confined to broad, shallow streams of low sinuosity, high bedload, non-cohesive bank material, and a steep gradient. At bank-full discharge, braided streams have steeper slopes and shallower, broader, and less stable channel cross sections than meandering streams.

breaks - (colloquial: western US) A landscape or large tract of steep, rough or broken land dissected by ravines and gullies and marks a sudden change in topography as from an elevated plain to lower hilly terrain, or a line of irregular cliffs at the edge of a mesa or a river (e.g., the Missouri River breaks).

butte - An isolated, generally flat-topped hill or mountain with steep slopes and talus or cliffs and characterized by summit width that is less than the height of bounding escarpments, commonly topped by a caprock of resistant material and representing an erosion remnant carved from flat-lying rocks.

canyon - A long, deep, narrow, very steep-sided valley cut primarily in bedrock with high and precipitous walls in an area of high local relief (e.g., mountain or high plateau terrain), often with a perennial stream at the bottom; similar to but larger than a gorge. **canyon bench** - One of a series of relatively narrow, flat landforms occurring along a canyon wall and caused by differential erosion of alternating strong and weak horizontal strata; a type of structural bench.

canyonlands - A deeply and extensively dissected landscape composed predominantly of relatively narrow, steep-walled valleys with small flood plains or valley floors; commonly with considerable outcrops of hard bedrock on steep slopes, ledges, or cliffs, and with broader summits or interfluves than found in badlands. Sideslopes exhibit extensive erosion, active back-wearing, and sparse vegetation.

channel - (a) The hollow bed where a natural body of surface water flows or may flow. The deepest or central part of the bed of a stream, containing the main current and occupied more or less continuously by water. (b) (colloquial: western US.) The bed of a single or braided watercourse that commonly is barren of vegetation and is formed of modern alluvium. Channels may be enclosed by banks or splayed across and slightly mounded above a fan surface and include bars and mounds of cobbles and stones. (c) Small, trough-like, arcuate or sinuous channels separated by small bars or ridges, caused by fluvial processes; common to flood plains and young alluvial terraces; a constituent part of *bar and channel* topography.

cliff - Any high, very steep to perpendicular or overhanging face of rock or earth; a precipice.

climbing dune - A dune formed by the piling-up of sand by wind against a cliff or mountain slope; very common in arid regions with substantial local relief and strong winds.

closed depression - A generic name for an enclosed area that has no surface drainage outlet and from which water escapes only by evaporation or subsurface drainage; an area of low ground indicated on a topographic map by a hachured contour line forming a closed loop.

collapse sinkhole - A type of sinkhole that is formed by collapse of a cave within the underlying soluble bedrock (e.g., limestone, gypsum, salt).

colluvium - Unconsolidated, unsorted material being transported or deposited on sideslopes and/or at the base of slopes by mass movement (e.g. direct gravitational action) and by local, unconcentrated runoff.

complex landslide - A category of mass movement processes, associated sediments (complex landslide deposit) or resultant landforms characterized by a composite of several mass movement processes none of

which dominates or leaves a prevailing landform. Numerous types of complex landslides can be specified by naming the constituent processes evident (e.g. a complex earth spread - earth flow landslide).

crest - (a) The commonly linear, narrow top of a ridge, hill, or mountain. It is appropriately applied to elevated areas where retreating backslopes are converging such that these high areas are almost exclusively composed of convex shoulders; (b) (not preferred) Sometimes used as an alternative for the hillslope component *summit*.

cuesta - An asymmetric, homoclinal ridge capped by resistant rock layers of slight to moderate dip (less than 15 percent); produced by differential erosion of interbedded resistant and weak rocks. A cuesta has a long, gentle slope on one side (dip slope), that roughly parallels the inclined beds, and on the other side has a relatively short and steep or cliff-like slope (scarp) that cuts through the tilted rocks.

cuesta valley - A low relief, low angle, asymmetrical depression which lies parallel to the strike of underlying strata; a type of strike valley. It's formed by the differential erosion of weaker strata interbedded with more resistant bedrock. It may or may not contain a local drainage network and commonly lies above and is not connected to the regional drainage system.

debris fall - The process, associated sediments (debris fall deposit) or resultant landform characterized by a rapid type of *fall* involving the relatively free, downslope movement or collapse of detached, unconsolidated material which falls freely through the air (lacks an underlying slip face); sediments have substantial proportions of both fine earth and coarse fragments; common along undercut stream banks.

debris flow - The process, associated sediments (debris flow deposit) or landform resulting from a very rapid type of *flow* dominated by a sudden downslope movement of a mass of rock, soil, and mud (more than 50% of the particles are > 2mm), and whether saturated or comparatively dry, behaves much as a viscous fluid when moving.

deflation basin - A topographic basin excavated and maintained by wind erosion which removes unconsolidated material and commonly leaves a rim of resistant material surrounding the depression. Unlike a blowout, a deflation basin does not include adjacent deposits derived from the basin.

depression - Any relatively sunken part of the Earth's surface; especially a low-lying area surrounded by higher ground. A closed depression has no natural outlet for surface drainage. An open depression has a natural outlet for surface drainage.

desert pavement - A natural, residual concentration or layer of wind-polished, closely packed gravel, boulders, and other rock fragments, mantling a desert surface. It is formed where wind action and sheetwash have removed all smaller particles or where coarse fragments have migrated upward through sediments to the surface. It usually protects the underlying, finer-grained material from further deflation. The coarse fragments commonly are cemented by mineral matter.

dip - A geomorphic component (characteristic piece) of flat plains (e.g., lake plain, low coastal plain, low-relief till plain) consisting of a shallow and typically closed depression that tends to be an area of focused groundwater recharge but not a permanent water body and that lies slightly lower and is wetter than the adjacent talf, and favors the accumulation of fine sediments and organic materials.

ditch - An open and usually unlined channel or trench excavated to convey water for drainage or irrigation to or from a landscape; smaller than a canal; some ditches are modified natural waterways.

divide - (a) The line of separation; (b) The summit area, or narrow tract of higher ground that constitutes the watershed boundary between two adjacent drainage basins; it divides the surface waters that flow naturally in one direction from those that flow in the opposite direction.

drainageway - (a) A general term for a course or channel along which water moves in draining an area. (b) a term restricted to relatively small, roughly linear or arcuate depressions that move concentrated water at some time, and either lack a defined channel (e.g. head slope, swale) or have a small, defined channel (e.g. low order streams).

draw - A small, natural watercourse cut in unconsolidated materials, generally more open with a broader floor and more gently sloping sides than an arroyo, ravine or gulch, and whose present stream channel may appear inadequate to have cut the drainageway that it occupies.

dune - A low mound, ridge, bank or hill of loose, windblown, subaerially deposited granular material (generally sand), either barren and capable of movement from place to place, or covered and stabilized with vegetation, but retaining its characteristic shape. (See barchan dune, parabolic dune, parna dune, shrub-coppice dune, seif dune, transverse dune).

dune field - An assemblage of moving and/or stabilized dunes, together with sand plains, interdune areas, and the ponds, lakes, or swamps produced by the blocking of steams by the sand. See dune lake.

earthflow - The process, sediments (earthflow deposit) or resultant landforms characterized by slow to rapid types of flow dominated by downslope movement of soil, rock, and mud (more than 50% of the particles are < 2 mm), and whether saturated or not, behaves as a viscous fluid when moving.

eolian deposit - Sand, silt or clay-sized clastic material transported and deposited primarily by wind, commonly in the form of a dune or a sheet of sand or loess. Conventionally, primary volcanic deposits (e.g. tephra) are handled separately.

eolian sands - Sand-sized, clastic material transported and deposited primarily by wind, commonly in the form of a dune or a sand sheet.

ephemeral stream - Generally a small stream, or upper reach of a stream, that flows only in direct response to precipitation. It receives no protracted water supply from melting snow or other sources and its channel is above the water table at all times.

eroded fan remnant - All, or a portion of an alluvial fan that is much more extensively eroded and dissected than a fan remnant; sometimes called an *erosional fan remnant*. It consists primarily of a) eroded and highly dissected sides (*eroded fan-remnant sideslopes*) dominated by hillslope positions (shoulder, backslope, etc.), and b) to a lesser extent an intact, relatively planar, relict alluvial fan "summit" area best described as a tread.

eroded fan-remnant sideslope - A rough margin of an *eroded fan remnant* highly dissected by ravines and gullies that can be just a fringe or make up a large part of an eroded alluvial fan; its bounding escarpments, originally formed by inset channels, have become highly dissected and irregular such that terrace components (tread and riser) have been consumed or modified and replaced by hillslope positions and components (shoulder, backslope, footslope, etc.); sometimes referred to as *fan remnant sideslopes*.

escarpment - A continuous, steep slope or cliff produced by erosion or faulting and that topographically interrupts or breaks the general continuity of more gently sloping land surfaces . The term is most commonly applied to cliffs produced by differential erosion. Synonym = scarp.

falling dune - An accumulation of sand that is formed as sand is blown off a mesa top or over a cliff face or steep slope, forming a solid wall, sloping at the angle of repose of dry sand, or a fan extending downward from a re-entrant in the mesa wall.

fan - (a) A gently sloping, fan-shaped mass of detritus forming a section of a low-angle cone commonly at a place where there is a notable decrease in gradient; specifically an alluvial fan.

fan apron - A sheet-like mantle of relatively young alluvium and soils covering part of an older fan piedmont (and occasionally alluvial fan) surface, commonly thicker and further down slope (e.g., mid-fan or mid-fan piedmont) than a fan collar. It somewhere buries an older soil that can be traced to the edge of the fan apron where the older soil emerges as the land surface, or relict soil. No buried soils should occur within a fan-apron mantle itself.

fan collar - A landform comprised of a thin, short, relatively young mantle of alluvium along the very upper margin (near the proximal end or apex) of a major alluvial fan. The young mantle somewhere

buries an older soil that can be traced to the edge of the collar where the older soil emerges at the land surface as a relict soil.

fan remnant - A general term for landforms that are the remaining parts of older fan-landforms, such as alluvial fans, fan aprons, inset fans, and fan skirts, that either have been dissected (erosional fan-remnants) or partially buried (nonburied fan-remnants). An erosional fan remnant must have a relatively flat summit that is a relict fan-surface. A nonburied fan-remnant is a relict surface in its entirety.

fan skirt - The zone of smooth, laterally-coalescing, small alluvial fans that issue from gullies cut into the fan piedmont of a basin or that are coalescing extensions of the inset fans of the fan piedmont, and that merge with the basin floor at their toeslopes. These are generally younger fans which onlap older fan surfaces.

fault-line scarp - A steep slope or cliff formed by differential erosion along a fault line, as by the more rapid erosion of soft rock on one side of a fault as compared to more resistant rock on the other side; e.g. the east face of the Sierra Nevada in California.

finger ridge - One in a group of small, tertiary spur ridges that form crudely palmate extensions of erosional remnants along the flanks or nose of larger ridges.

flat - (a) (adjective) Said of an area characterized by a continuous surface or stretch of land that is smooth, even, or horizontal, or nearly so, and that lacks any significant curvature, slope, elevations, or depressions. (b) (noun) An informal, generic term for a level or nearly level surface or small area of land marked by little or no local relief. (c) (not recommended) A nearly level region that visibly displays less relief than its surroundings.

flood plain - The nearly level plain that borders a stream and is subject to inundation under flood-stage conditions unless protected artificially. It is usually a constructional landform built of sediment deposited during overflow and lateral migration of the streams.

foothills - A steeply sloping upland composed of hills with relief of 30 up to 300 meters and fringes a mountain range or high-plateau escarpment.

footslope - The hillslope profile position that forms the concave surface at the base of a hillslope. It is a transition zone between upslope sites of erosion and transport (shoulder, backslope) and downslope sites of deposition (toeslope).

free face - A geomorphic component of hills and mountains consisting of an outcrop of bare rock that sheds rock fragments and other sediments to, and commonly stands more steeply than the angle of repose of, the colluvial slope immediately below; most commonly found on shoulder and backslope positions, and can comprise part or all of a nose slope or side slope.

gorge - (a) A narrow, deep valley with nearly vertical, rocky walls, smaller than a canyon, and more steep-sided than a ravine; especially a restricted, steep-walled part of a canyon. (b) A narrow defile or passage between hills or mountains.

graben - An elongate trough or basin bounded on both sides by high-angle, normal faults that dip towards the interior of the trough. It is a structural form, it may be geomorphically expressed as a rift valley.

gravel pit - A depression, ditch or pit excavated to furnish gravel for roads or other construction purposes; a type of borrow pit.

ground soil - Any soil at the present-day land surface and actively undergoing pedogenesis,

gulch - (colloquial: western US.; not preferred - refer to ravine) A small stream channel, narrow and steep-sided in cross section, and larger than a gully, cut in unconsolidated materials. = Ravine.

gully - A small channel with steep sides caused by erosion and cut in unconsolidated materials by concentrated but intermittent flow of water usually during and immediately following heavy rains or ice /

snow melt. A gully generally is an obstacle to wheeled vehicles and too deep (e.g., > 0.5 m) to be obliterated by ordinary tillage; (a rill is of lesser depth and can be smoothed over by ordinary tillage).

hanging valley - A tributary valley whose floor at the lower end is notably higher than the floor of the main valley in the area of junction.

head slope - A geomorphic component of hills consisting of a laterally concave area of a hillside, especially at the head of a drainageway, resulting in converging overland water flow (e.g. sheet wash); head slopes are dominated by colluvium and slope wash sediments (e.g., slope alluvium); contour lines form concave curves. Slope complexity (downslope shape) can range from simple to complex. Headslopes are comparatively moister portions of hillslopes and tend to accumulate sediments (e.g., cummulic profiles) where they are not directly contributing materials to channel flow.

headwall - A steep slope at the head of a valley; e.g. the rock cliff at the back of a cirque.

hill - A generic term for an elevated area of the land surface, rising at least 30 m (100 ft.) to as much as 300 meters (approx. 1000 ft.) above surrounding lowlands, usually with a nominal summit area relative to bounding slopes, a well-defined, rounded outline and slopes that generally exceed 15 percent. A hill can occur as a single, isolated mass or in a group. A hill can be further specified based on the magnitude of local relief: *low hill* (30 - 90 m) or *high hill* (90 - 300 m). Informal distinctions between a hill and a mountain are often arbitrary and dependent on local convention.

hillock - A generic name for a small, low hill, generally between 3 - 30 m in height and slopes between 5 and 50% (e.g., bigger than a mound but smaller than a hill); commonly considered a microfeature.

hillslope - A generic term for the steeper part of a hill between its summit and the drainage line, valley flat, or depression floor at the base of the hill.

hogback - A sharp-crested, symmetric (homoclinal) ridge formed by highly tilted resistant rock layers; produced by differential erosion of interlayered resistant and weak rocks with dips greater than about 25 degrees (45 percent).

hoodoo - A column, pinnacle, or pillar of rock produced by differential weathering or erosion in a region of sporadically heavy rainfall. Formation is facilitated by joints and layers of varying hardness.

horst - An elongate block that is bounded on both sides by normal faults that dip away from the interior of the horst. It is a structural form and may or may not be expressed geomorphically.

hummock - (a) (not preferred - see hillock). An imprecise, general term for a rounded or conical mound or other small elevation. (b) (not preferred) A slight rise of ground above a level surface.

impact crater - a) A generally circular or elliptical depression formed by hypervelocity impact of an experimental projectile or ordinance into earthy or rock material. b) (not recommended - use meteorite crater) A generally circular crater formed by the impact of an interplanetary body (projectile) on a planetary surface.

inset fan - (colloquial; western US) The flood plain of an ephemeral stream that is confined between fan remnants, ballenas, basin-floor remnants, or closely-opposed fan toeslopes of a basin.

interdune - The relatively flat surface, whether sand-free or sand-covered, between dunes.

interfluve - A landform composed of the relatively undissected upland or ridge between two adjacent valleys containing streams flowing in the same general direction. An elevated area between two drainageways that sheds water to those drainageways.

intermittent stream - A stream, or reach of a stream, that does not flow year-round (commonly dry for 3 or more months out of 12) and whose channel is generally below the local water table; it flows only when it receives a) base flow (i.e. solely during wet periods), or b) ground-water discharge or protracted contributions from melting snow or other erratic surface and shallow subsurface sources.

island - (a) Land completely surrounded by water; (b) An elevated area of land surrounded by swamp, or marsh, or isolated at high water or during floods.

knob - (a) A rounded eminence, a small hill or mountain; especially a prominent or isolated hill with steep sides, commonly found in the Southern United States. (b) A peak or other projection from the top of a hill or mountain. Also, a boulder or group of boulders or an area of resistant rocks protruding from the side of a hill or mountain.

knoll - A small, low, rounded hill rising above adjacent landforms.

landslide - A general, encompassing term for most types of mass movement landforms and processes involving the downslope transport and outward deposition of soil and rock materials, caused by gravitational forces and which may or may not involve saturated materials. Names of landslide types generally reflect the dominant process and/or the resultant landform. The main operational categories of mass movement are *fall* (rockfall, soil fall, topple), *slide* (rotational landslide, block glide, debris slide, lateral spread), *flow* [rock fragment flow (especially rockfall avalanche), debris avalanche, debris flow (e.g., lahar), earthflow, (creep, mudflow)], and *complex landslides*.

ledge - (a) A narrow shelf of rock, much longer than wide, formed on a rock wall or cliff face, as along a coast by differential wave action on softer rocks; erosion is by combined biological and chemical weathering. (b) A rocky outcrop; solid rock. (c) A shelf-like quarry exposure or natural rock outcrop.

levee - An artificial or natural embankment built along the margin of a watercourse or an arm of the sea, to protect land from inundation or to confine streamflow to its channel.

longitudinal dune - A long, narrow sand dune, usually symmetrical in cross profile, oriented parallel to the prevailing wind direction ; it is wider and steeper on the windward side but tapers to a point on the lee side. It commonly forms behind an obstacle in an area where sand is abundant and the wind is strong and constant. Such dunes can be a few meters high and up to 100 km long.

low hill - A generic name for an elevated, generally rounded land surface with low local relief, rising between 30 meters (100 ft.) to as much as 90 m (approx. 300 ft.) above surrounding lowlands.

lowland - (a) A generic, imprecise term for low-lying land or an extensive region of low-lying land, especially near a coast and including the extended plains or country lying not far above tide level. (b) (not preferred) A generic, imprecise term for a landscape of low, comparatively level ground of a region or local area, in contrast with the adjacent higher country. (c) (not recommended - use valley, bolson, etc.) A generic term for a large valley.

marsh - Periodically wet or continually flooded areas with the surface not deeply submerged. Covered dominantly with sedges, cattails, rushes, or other hydrophytic plants.

meander belt - The zone within which migration of a meandering channel occurs; the flood-plain area included between two imaginary lines drawn tangential to the outer bends of active channel loops. Landform components of the meander-belt surface are produced by a combination of gradual (lateral and down-valley) migration of meander loops and avulsive channel shifts causing abrupt cut-offs of loop segments. Landforms flanking the sinuous stream channel include: point bars, abandoned meanders, meander scrolls, oxbow lakes, natural levees, and flood-plain splays. Meander belts may not exhibit prominent natural levee or splay forms. Flood plains of broad valleys may contain one or more abandoned meander belts in addition to the zone flanking the active stream channel.

meander scar - (a) A crescent-shaped, concave or linear mark on the face of a bluff or valley wall, produced by the lateral erosion of a meandering stream which impinged upon and undercut the bluff; if it's no longer adjacent to the modern stream channel it indicates an abandoned route of the stream; (b) (not recommended - refer to oxbow) An abandoned meander, commonly filled in by deposition and vegetation, but still discernable.

meander scroll - (a) One of a series of long, parallel, close fitting, crescent-shaped ridges and troughs formed along the inner bank of a stream meander as the channel migrated laterally down-valley and toward the outer bank. (b) (not recommended; refer to oxbow lake) - A small, elongate lake on a flood plain in a well-defined part of an abandoned stream channel.

mesa - A broad, nearly flat-topped, and usually isolated landmass bounded by steep slopes or precipitous cliff and capped by layers of resistant, nearly horizontal, rocky summit width greater than the height of bounding escarpments. (Colloquial: western US; not preferred) Also used to designate broad structural benches and alluvial terraces that occupy intermediate levels in stepped sequences of platforms bordering canyons and valleys.

monocline - (a) A unit of folded strata that dips from the horizontal in one direction only, is not part of an anticline or syncline, and occurs at the earth's surface.. This structure is typically present in plateau areas where nearly flat strata locally assume steep dips caused by differential vertical movements without faulting. (b) - A local steepening in an otherwise uniform gentle dip.

mountain - A generic term for an elevated area of the land surface, rising more than 300 meters above surrounding lowlands, usually with a nominal summit area relative to bounding slopes and generally with steep sides (greater than 25 percent slope) with or without considerable bare-rock exposed. A mountain can occur as a single, isolated mass or in a group forming a chain or range. Mountains are primarily formed by tectonic activity and/or volcanic action and secondarily by differential erosion.

natural levee - A long, broad low ridge or embankment of sand and coarse silt, built by a stream on its flood plain and along both sides of its channel, especially in time of flood when water overflowing the normal banks is forced to deposit the coarsest part of its load. It has a gentle slope away from the river and toward the surrounding floodplain, and its highest elevation is closest to the river bank.

open depression - A generic name for any enclosed or low area that has a surface drainage outlet whereby surface water can leave the enclosure; an area of lower ground indicated on a topographic map by contour lines forming an incomplete loop or basin indicating at least one surface exit.

overbank deposit - Fine-grained sediments (silt and clay) deposited from suspension on a flood plain by floodwaters that cannot be contained within the stream channel.

overflow stream channel - A watercourse that is generally dry but conducts flood waters that have overflowed the banks of a river, commonly from large storms or annual meltwater.

parabolic dune - A sand dune with a long, scoop-shaped form, convex in the downwind direction so that its horns point upwind, whose ground plan approximates the form of a parabola.

peak - Sharp or rugged upward extension of a ridge chain, usually at the junction of two or more ridges; the prominent highest point of a summit area.

pediment - A gently sloping erosional surface at the foot of a receding hill or mountain slope. The surface may be essentially bare, exposing earth material that extends beneath adjacent uplands; or it may be thinly mantled with alluvium and colluvium, ultimately in transit from upland front to basin or valley lowland. In hill-foot slope terrain the mantle is designated “pedisediment.” The term has been used in several geomorphic contexts: Pediments may be classed with respect to (a) landscape positions, for example, intermontane-basin piedmont or valley-border footslope surfaces (respectively, apron and terrace pediments); (b) type of material eroded, bedrock or regolith; or (c) combinations of the above.

perennial stream - A stream or reach of a stream that flows continuously throughout the year and whose surface is generally lower than the water table adjacent to the region adjoining the stream.

plain - A general term referring to any flat, lowland area, large or small, at a low elevation. Specifically, any extensive region of comparatively smooth and level gently undulating land. A plain has few or no prominent hills or valleys but sometimes has considerable slope, and usually occurs at low elevation

relative to surrounding areas. Where dissected, remnants of a plain can form the local uplands. A plain may be forested or bare of trees and may be formed by deposition or erosion.

plateau - A comparatively flat area of great extent and elevation; specifically an extensive land region considerably elevated (more than 100 meters) above adjacent lower-lying terrain, and is commonly limited on at least one side by an abrupt descent, has a flat or nearly level surface. A comparatively large part of a plateau surface is near summit level.

playa - The usually dry and nearly level lake plain occupying the lowest parts of closed depressions, such as those occurring on intermontane basin floors. Temporary flooding occurs primarily in response to precipitation-runoff events. Playa deposits are fine grained and may or may not have high water table and saline conditions.

point bar - One of a series of low, arcuate ridges of sand and gravel developed on the inside of a growing meander by the migration of the channel toward the outer bank.

pond - (a) A natural body of standing fresh water occupying a small surface depression, usually smaller than a lake and larger than a pool. (b) A small artificial body of water, used as a source of water.

pool - A small, natural body of standing water, usually fresh; e.g. a stagnant body of water in a marsh, or a transient puddle in a depression following a rain.

quarry - Excavation areas, open to the sky, usually for the extraction of stone.

ravine - A small stream channel; narrow, steep-sided, commonly V-shaped in cross section and larger than a gully, cut in unconsolidated materials. General synonym (not preferred) - gulch.

reef - (a) A ridge-like or mound-like structure, layered or massive, built by sedentary calcareous organisms, especially corals, and consisting mostly of their remains; it is wave-resistant and stands above the surrounding contemporaneously deposited sediment. Also, such a structure built in the geologic past and now enclosed in rock, commonly of differing lithology.

ridge - A long, narrow elevation of the land, usually sharp crested with steep sides and forming an extended upland between valleys. The term is used in areas of both hill and mountain relief.

rill - A very small channel with steep sides caused by erosion and cut in unconsolidated materials by concentrated but intermittent flow of water, usually during and immediately following moderate rains or after ice/snow melt. Generally, a rill is not an obstacle to wheeled vehicles and is shallow enough to be obliterated by ordinary tillage.

rim - The border, margin, edge, or face of a landform, such as the curved brim surrounding the top part of a crater or caldera; specifically the rimrock of a plateau or canyon.

rise - (refer to lake plain) (a) A general term for a slight increase in slope and elevation of the land surface, usually with a broad summit and gently sloping sides. (b) same as (a) but the term is restricted to microfeatures in areas of very low relief such as lake plains or coastal plains.

river - (a) A general term for a natural, freshwater surface stream of considerable volume and generally with a permanent base flow, moving in a defined channel toward a larger river, lake, or sea.

river valley - an elongate depression of the Earth's surface carved by a river during its development.

rockfall - The process, associated sediments (rockfall deposit) or resultant landform characterized by a very rapid type of *fall* dominated by downslope movement of detached rock bodies which fall freely through the air or by leaps and bounds (lacks an underlying slip face); also spelled rock fall.

rock pediment - An erosion surface of low relief, cut directly into and across bedrock and composed of either bare rock or thinly veneered pedisediment or residuum (e.g. < 1.5 m) over bedrock; it occurs along the flanks of mountain fronts, or at the base of mountains or high hills. Its surface grades to the

backwearing mountain slopes or hillslopes above, and generally grades down to and merges with a lower-lying alluvial plain, piedmont slope or valley floor below.

rotational slide - The process, associated sediments (rotational landslide deposit) or resultant landforms characterized by an extremely slow to moderately rapid type of slide, composed of comparatively dry and largely soil-rock materials, portions of which remain largely intact and in which movement occurs along a well-defined, concave shear surface and resulting in a backward rotation of the displaced mass. The landform may be single, successive (repeated up and down slope), or multiple (as the number of slide components increase).

rubble - An accumulation of loose angular rock fragments, commonly overlying outcropping rock; the unconsolidated equivalent of a breccia.

saddle - A low point on a ridge or interfluve, generally a divide (pass, col) between the heads of streams flowing in opposite directions.

sandhills - A region of semi-stabilized sand dunes or sandy hills, either covered with vegetation or bare, as in north-central Nebraska and the midlands of the Carolinas.

sand plain - (a) A sand-covered plain which may originate by deflation of sand dunes, and who's lower limit of erosion is governed by the ground-water level. Also spelled *sandplain*. (b) (not preferred - refer to *sandy* outwash plain) A small outwash plain composed chiefly of sand deposited by meltwater streams flowing from a glacier.

sand ramp - A sand sheet blown up onto the lower slopes of a bedrock hill or mountain and forming an inclined plane, sometimes filling small mountain-side valleys and even crossing low passes.

sand sheet - A large, irregularly shaped, commonly thin, surficial mantle of eolian sand, lacking the discernible slip faces that are common on dunes.

scarp - An escarpment, cliff, or steep slope of some extent along the margin of a plateau, mesa, terrace, or structural bench. A scarp may be of any height.

scarp slope - The relatively steeper face of a cuesta, facing in a direction opposite to the dip of the strata.

scree - A collective term for an accumulation of coarse rock debris mantling a slope. Scree is not a synonym of talus, as scree includes loose, coarse fragment material on slopes without cliffs.

scree slope - A portion of a hillside or mountain mantled by scree and lacking an upslope rockfall source.

seep - (noun) An area, generally small, where water or oil percolates slowly to the land surface. For water, it may be considered as a seepage spring, but it is used by some for flows too small to be considered as springs.

shoulder - The hillslope profile position that forms the convex, erosional surface near the top of a hillslope. If present, it comprises the transition zone from summit to backslope.

shrub-coppice dune - A small, streamlined dune that forms around brush and clump vegetation.

side slope - A laterally planar area of a hillside, resulting in predominantly parallel overland water flow (e.g., sheet wash); contour lines generally form straight lines. Side slopes are dominated by colluvium and slope wash sediments. Slope complexity (downslope shape) can range from simple to complex. The slope bounding a drainageway and lying between the drainageway and the adjacent interfluve. It is generally linear along the slope width.

slide - (a) Mass movement processes, associated sediments (slide deposit) or resultant landforms (e.g., rotational, translational, and snow slide) characterized by a failure of earth, snow, or rock under shear stress along one or several surfaces that are either visible or may reasonably be inferred. The moving mass may or may not be greatly deformed, and movement may be rotational (rotational slide) or planar (translational slide). A slide can result from lateral erosion, lateral pressure, weight of overlying material,

accumulation of moisture, earthquakes, expansion owing to freeze-thaw of water in cracks, regional tilting, undermining, fire, and human agencies. (b) The track of bare rock or furrowed earth left by a slide. (c) The mass of material moved by or deposited by a slide.

slip face - The steeply sloping surface of a dune, standing at or near the angle of repose of loose sand, and advancing downwind by a succession of slides wherever that angle is exceeded.

slope - (also called slope gradient or gradient) The inclination of the land surface from the horizontal. Percent slope is the vertical distance divided by the horizontal distance, then multiplied by 100.

slope alluvium - Sediment gradually transported down mountain or hill slopes primarily by non-channel alluvial processes (i.e., slope wash processes) and characterized by particle sorting. Lateral particle sorting is evident on long slopes. In a profile sequence, sediments may be distinguished by differences in size and/or specific gravity of coarse fragments and may be separated by stone lines. Sorting of pebbles or cobbles and burnished peds distinguish these materials from unsorted colluvial deposits.

slope wash - A collective term for non-fluvial, incipient alluvial *processes* (e.g. overland flow, minor rills) that detach, transport, and deposit sediments down hill and mountain slopes. Related sediments (*slope alluvium*) exhibit nominal sorting or rounding of particles, peds, etc., and lateral sorting downslope on long slopes; stratification is crude and intermittent and readily destroyed by pedoturbation and frost action. Also called *slope wash processes*.

slot canyon - A long, narrow, deep and tortuous channel or drainageway with sheer rock walls eroded into sandstone or other sedimentary rocks, especially in the semi-arid western US (e.g. Colorado Plateau); subject to flash flood events; depth to width ratios exceed 10:1 over most of its length and can approach 100:1; commonly containing unique ecological communities distinct from the adjacent, drier uplands.

strath terrace - A type of stream terrace, formed as an erosional surface cut on bedrock and thinly mantled with stream deposits (alluvium).

stream - (a) A body of running water that moves under gravity to progressively lower levels, in a relatively narrow but clearly defined channel on the ground surface, in a subterranean cavern, or beneath or in a glacier. It is a mixture of water and dissolved, suspended, or entrained matter. (b) A term used in quantitative geomorphology interchangeably with channel.

stream terrace - One or a series of platforms in a stream valley, flanking and more or less parallel to the stream channel, originally formed near the level of the stream, and representing the remnants of an abandoned flood plain, stream bed, or valley floor (i.e., currently very rarely or never floods; inactive cut and fill and/or scour and fill processes). Erosional surfaces cut into bedrock and thinly mantled with stream deposits (alluvium) are called “strath terraces.” Remnants of constructional valley floors thickly mantled with alluvium are called alluvial terraces.

strike valley - A subsequent valley eroded in, and developed parallel to the strike of, underlying weak strata; such as a cuesta; a valley that often, but not necessarily contains a strike valley.

structural bench - A platform-like, nearly level to gently inclined erosional surface developed on resistant strata in areas where valleys are cut in alternating strong and weak layers with an essentially horizontal attitude. Structural benches are bedrock controlled, and in contrast to stream terraces, have no geomorphic implication of former, partial erosion cycles and base-level controls, nor do they represent a stage of flood-plain development following an episode of valley trenching.

summit - (a) The topographically highest position of a hillslope profile with a nearly level (planar or only slightly convex) surface. (b) A general term for the top, or highest area of a landform such as a hill, mountain, or tableland. It usually refers to a high interfluve area of relatively gentle slope that is flanked by steeper slopes, e.g., mountain fronts or tableland escarpments.

swale - (a) A shallow, open depression in unconsolidated materials which lacks a defined channel but can funnel overland or subsurface flow into a drainageway. Soils in swales tend to be more moist and thicker

(cummulic) compared to surrounding soils. (b) A small, shallow, typically closed depression in an undulating ground moraine formed by uneven glacial deposition; (c) (not preferred; refer to interdune) A long, narrow, generally shallow, trough-like depression between two beach ridges, and aligned roughly parallel to the coastline.

syncline - (a) A unit of folded strata that is concave upward whose core contains the stratigraphically younger rocks, and occurs at the earth's surface. In a single syncline, beds forming the opposing limbs of the fold dip toward its axial plane. (b) A fold, at any depth, generally concave upward whose core contains the stratigraphically younger rocks.

tableland - A term for a broad upland with an extensive, nearly level or undulating summit area and steep side slopes descending to surrounding lowlands.

talus - Rock fragments of any size or shape (usually coarse and angular) derived from and lying at the base of a cliff or very steep rock slope. The accumulated mass of loose broken rock formed chiefly by falling, rolling, or sliding.

talus cone - A small, steep, cone-shaped landform at the base of a cliff or escarpment, that heads in a relatively small declivity or ravine, and composed of poorly sorted rock and soil debris that has accumulated primarily by episodic rockfall or, to a lesser degree, by slope wash. Not to be confused with an *alluvial cone*; a similar feature but of fluvial origin, composed of better stratified and more sorted material, and that tapers up into a more extensive drainageway.

talus slope - a portion of a hillslope or mountainslope mantled by talus and lying below a rock source.

tank - (colloquial: southwestern US) A natural depression or cavity in impervious rocks in which water collects and remains for the greater part of the year.

terrace - A step-like surface, bordering a valley floor or shoreline, that represents the former position of a flood plain, or lake or sea shore. The term is usually applied to both the relatively flat summit surface (tread), cut or built by stream or wave action, and the steeper slope (scarp, riser), descending to a lower level. Practically, terraces are considered to be generally flat alluvial areas above the 100 yr. flood stage.

terracettes - Small, irregular step-like forms on steep hillslopes, especially in pasture, formed by creep or erosion of surficial materials that may be induced or enhanced by trampling of livestock such as sheep or cattle. Synonyms (not preferred) - catstep, sheep or cattle track.

toeslope - The hillslope position that forms the gently inclined surface at the base of a hillslope. Toeslopes in profile are commonly gentle and linear, and are constructional surfaces forming the lower part of a hill-slope continuum that grades to valley or closed-depression floors.

translational slide - A category of mass movement processes, associated sediments (translational slide deposit) or resultant landforms characterized by the extremely slow to moderately rapid downslope displacement of comparatively dry soil-rock material on a surface (slip face) that is roughly parallel to the general ground surface, in contrast to falls, topples, and rotational slides. The term includes such diverse *slide* types as translational debris slides, translational earth slide, translational rock slide, block glides, and slab or flake slides.

valley - An elongate, relatively large, externally drained depression of the Earth's surface that is primarily developed by stream erosion or glacial activity.

valley floor - A general term for the nearly level to gently sloping, lowest surface of a valley. Landforms include axial stream channels, the flood plain, flood-plain steps, and, in some areas, low terrace surfaces.

valley side - The sloping to very steep surfaces between the valley floor and summits of adjacent uplands. Well-defined, steep valley sides have been termed valley walls (not recommended). Note: Scale, relief, and perspective may require use of closely related terms such as hill slope or mountain slope.

wash (dry wash) - (colloquial: western US.) The broad, flat- floored channel of an ephemeral stream, commonly with very steep to vertical banks cut in alluvium. Note: When channels reach intersect zones of ground-water discharge they are more properly classed as “intermittent stream” channels.

zibar - A small, low-relief sand dune that lacks discernible slip faces and commonly occurs on sand sheets, in interdune areas, or in corridors between larger dunes. Zibar spacing can range from 50-400 m with local relief < 10 m. Unlike coppice dunes, zibars are unrelated to deposition around vegetation. Generally dominated by coarser sands.

B.3. Example of a Vegetation Plot Data Form

BLCA.82 MB 10/24/02

NATIONAL PARK SERVICE VEGETATION MAPPING PROGRAM: MODIFIED RELEVE FORM
(Modified from TNC and WICA FORMS for BLCA/CURE) *mod_releve 6/29/02*

INDENTIFIERS AND LOCATORS

Plot Code W3131C Aerial Photo/Polygon _____ Digital Polygon _____ Associated Releve _____

Provisional Association Name Pinus edulis/Amelanchier utahensis Woodland

State CO Park BLM Location Name South Rim, SE of Warner & Sunset Points

Survey Date 2 Sept 02 Surveyors SA, JD

Directions to plot and town, range, section information *(especially if no GPS is available)*:

Quad Name Grizzly Ridge Plot Dimensions 20x20m Plot Shape Square

GPS File Name XD902171A Field UTM: 262982.08 m East(X), 4270290.07 m North(Y)

ArcView File Name Plot_loc 9-07-02 Corrected UTM: 262980.771 m East(X), 4270283.894 m North(Y)

Photo Roll#/Frame # no photos Camera _____ Film Type _____

ENVIROMENTAL DESCRIPTION *(see instruction booklet for definitions and additional positions and landforms)*

Elevation 8091' (2481 M) Slope 58% Aspect 107°

Topographic Position (ridgetop, mesa, toeslope, midslope, etc) toeslope just above upland ravine

Landform (active slope, floodplain, crest, gorge, etc) ridge

Cowardin System (check one) ✓Upland __Riverine __Palustrine __Lacustrine

Hydrological Regime (check one) __Semipermanently Flooded __Seasonally Flooded __Saturated __Temporarily Flooded __Intermittently Flooded __Permanently Flooded

Soil Survey (circle one): Gunnison (Paonia) Montrose Soil Texture Sandy loam

Soil Taxon NULL

Environmental Comments Large burned area on opposing hillface and to S on same slope as polygon.

Composition of **UNVEGETATED** Surface *(estimate exact percent- total=100%)*

45	Bedrock
35	Large rocks (cobbles, boulders > 10cm)
14	Small rocks (gravel, 0.2 – 10 cm)
0	Sand (0.1 – 2 mm)
15	Litter
2	Wood
8	Bare soil
0	Other

VEGETATION DESCRIPTION

Leaf Type (of dominant stratum)	Leaf Phenology (of dominant stratum)	Physiognomic Class	Cover Scale (for veg and unvegetated)	Height Scale for Vegetation
__Broad-leaved	✓Evergreen	__Forest	Code % cover	Code meters
✓Needle-leaved	__Cold-deciduous	✓Woodland	01 <1	01 <0.5
__Microphyllus	__Drought-deciduous	__Shrubland	02 1 – 5	02 0.5 – 1
__Graminoid	__Mixed evergreen/cold-deciduous	__Dwarf Shrubland	03 5 – 25	03 1 – 2
__Forb	__Mixed evergreen/ drought deciduous	__Herbaceous	04 25 – 50	04 2 – 5
		__Nonvascular	05 50 – 75	05 5 – 10
		__Sparsley vegetated	06 75 – 100	06 10 – 15
				07 15 – 20
				08 20 – 35
				09 35 – 50
				10 > 50

Strata Descriptions: T1-Emergent T2-Canopy T3-Sub-canopy S1-Tall shrub S2-Short shrub S3-Dwarf shrub H-Herbaceous N-Non-vascular *(biotic crusts, lichens, etc.)* V-Vine/Liana E-Epiphyte

On the following page(s), list the stratum code, species, height and covercode for each stratum. Use the codes provided above. List all species, if possible, or at least all species with 5% or greater cover, in each strata in which it occurs. Put an asterisk next to any known diagnostic species. Check the box if a specimen was collected. Indicate whether collected specimens were identified in the field ('F') or office ('O') or awaiting identification ('W') or initials if an expert makes a positive ID. Fill in the page number and total number of pages at the bottom of each form used.

more sun, w. end, 30-70%, mst/gran.

NATIONAL PARK SERVICE VEGETATION MAPPING PROGRAM: OBSERVATION POINT FORM

(Modified from TNC and WICA FORMS for BLCA/CURE)

Plot Code W313C Aerial Photo/Polygon _____ Digital Polygon _____ Associated Releve _____
State CO Park BLM Location South Rim, SE of Warner & Sunset Points
Survey Date 25 Sept 2002 Surveyor(s) SA, JD

Stratum (beginning with uppermost)	Height Code	Cover Code	Species Code	Species Name	Notes on unknowns		Collect ID	Exp Freq
T2	05	03	6m	Pinus edulis	PIED	20		
T3	04	03	4m	Pinus edulis	PIED	5		
T3	04	02	3-4m	Juniperus osteosperma	JUOS	1		
S2	02		0.5-1	Fendlera rupicola	FERU	<1		
S1	03	02	1.5-2	Pinus edulis	PIED	2		
S1	03	02	1.5-2	Juniperus osteosperma	JUOS	1		
S1	03	02	1.5-2	Amelanchier utahensis	AMUT	3		
S2	01	02	<0.5	Symphoricarpos rotundifolius	SYRO	1		
S2	02	02	0.5-1	Amelanchier utahensis	AMUT	4-5		
S2	01	01	<0.5	Pinus edulis	PIED	<1		
S2	02	01	0.5-1	Ribes inerme	RIIN2	<1		
S2	01	02	<0.5	Artemisia tridentata vaseyana	ARTRV	1		
S3	01	01		Echinocereus trichoglochidiatus	ECTR	<1		
S3	01	01		Pediocactus simpsonii	PESI	<1		
S3	01	01		Opuntia fragilis	OPFR	<1		
S3	01	01		Mahonia repens	MAREI	<1		
H	01	02		Heterotheca villosa	HEVI4	2		
	01	02		Poa fendleriana	POFE	2		
	01	02		Bromus tectorum	BRTE	1		
	01	01		Artemisia ludoviciana	ARLU	<1		
	01	01		Erigeron concinnus	ERCO27	<1		
	01	01		Arabis crendelliii	ARCR5	<1		
	01	01		Pinus edulis	PIED	<1		
	01	01		Achnatherum hymenoides	ACHY	<1		
↓	01	01		Erigeron capitatum	ERCA14	<1		
H	01	01		Artemisia michauxiana	ARMI4	<1		
N		02		Moss		2		
N		02	"	Lichen		3		

General Comments (dominance, differences from type norm, wildlife signs)
T2 - 20% S1 - 6% S3 - 1%
T3 - 6% S2 - 7% H - 6%

Page ___ of ___

2 Sept 02 SA, JD Custom Plot Code W3131C

Tree DBH and Fuels Form Units in cm & m / in & ft (circle one) Subplot? (Y / N) PLOTS Code CURE/BLCA: 82

Record the diameter at root crown (DRC---PIED & JUNIP) or diameter at breast height (DBH---PIPO & PSME) of all stems of live trees more than 4.5 feet tall.
Record duff depth and other tree crown characteristics only in Douglas-fir and ponderosa pine plots.

Fuels Photo Guides

Series	Page/Photo #
Ponderosa/Douglas-fir	
Pinyon-Juniper	pg 28/ p509
Sagebrush	
Other understory	

P-J age class

- ___ Not P-J
- ___ Old-growth
- ✓ Mature
- ___ Young
- ___ Invasive

PIPO/DF Litter & Duff Loading

	Location	Litter Depth	Duff Depth
	Origin	1.5cm	0
down	10m N	0	0
down	10m E	0	0
up	10 m S	1cm	0
up	10m W	2cm	0

Canopy and Fuel Loading Characteristics

DBH or DRC (PJ)	Species	Height (m)	Crown Ratio or Crown Diameter (PJ) (m)	Crown Base Height or Crown Height (PJ) (m)	*Tree Structure Stage	**Comments	DBH or DRC (PJ)	Species	Height	Crown Ratio or Crown Diameter (PJ)	Crown Base Height or Crown Height (PJ)	*Tree Structure Stage	**Comments
14.7	Pied	3.5	4.5	0	A								
9.7	Pied	2	1.5	0	B								
9.4	Pied	4	4	0	B								
14.2	Pied	5.5	4.5	0	B								
6.5	Pied	2	1.5	0	B								
16.0	Pied	4.5	3	0	B								
14.5	Pied	7m?	7m	0.5	B	same tree? (Procumbens scars							
23.6	Pied			0.5	B	measured ~2½ ft from ground							
12.7	Pied			0.5	B	(Rock on uphill side of base)							
7.7	Pied	4m	0.5m	1m	D								
12.1	Pied	4.5m	1.5m	0	C								
19.4	Pied	5.5m	4m	0	B								
10.0	Pied	3.5	4m	0	B								
11.6	Pied	3	1.5	0	C								
20.2	Pied	4	4	0.5	C	ladder fuel							
23.6	Pied	6m	6m	0	B								
12.6	Pied	4m	4.5m	0.5	C								
10.5	Juos	3	1	0.5	D								
23.9	Pied	5m	4.5	1.0	B								
3.5	Pied	2	1.0	1.0	D	Brown needles at top							
17.8	Pied	6	5	0	B								
15.5	Pied	1.5	4.5	0	D	top broken off, lay fallen tree [illegible] to it							
10.3	Pied	4	3.5	0	C								
11.0	Pied	3.5	3.5	0	C								

*Tree structure stage: a = dominant, b = codominant, c = intermediate, d = suppressed
**Comments: dead top, twinned, ladder fuels, diseased, recent dead with foliage, etc

B.4. Example of an Accuracy Assessment Data Form

ACCURACY ASSESSMENT POINT FORM

IDENTIFIERS/LOCATORS

Field Point Code BLCA. 417 Database Point Code _____

State: CO Park Name: BLCA Park Site Name NORTH RIM

Quad Name GRIZZLY Quad Code _____

GPS file name _____ GPS Unit: GARMIN 12

Field UTM X 2 6 7 8 9 1 m E Field UTM Y 4 2 7 2 2 7 3 m N GPS Error 5.0 m

Field Photo Notes: Camera: OLYMPUS

Roll: CL6 Frame: 8 Photographer: AB Comments: W → E

Roll: 11 Frame: 9 Photographer: 11 Comments: S → N

please do not complete the following information when in the field

Corrected UTM X _____ m ECorrected UTM Y _____ m N UTM Zone _____

Survey Date 29.09.04 Surveyors BURCHLING

Primary Name Veg Assoc: AMELANCHIER UTAHENSIS - MIXED SHRUBS / CAREX GEYERI

Secondary Name Veg Assoc: QUERCUS GAMBELII - AMELANCHIER UTAHENSIS

Other Veg Assoc within 50 m: 1) _____ 2) _____

3) _____ Other Map Unit within 50m _____

Classification Comments: CAREX GEYERI WAS NOT OBSERVED. CHEAT GRASS IS DENSE.

ENVIRONMENTAL DESCRIPTION

Elevation 2582m Slope 28° Aspect 206°

Topographic Position MIDSLOPE

Landform HILLSIDE

Environmental Comments (including hydrology):

ABUNDANT CHEAT GRASS INDICATES PREVIOUS DISTURBANCE SUCH AS FIRE OR GRAZING.

Unvegetated Surface: *(please use the cover scale below)*

0 Bedrock
03 Litter, duff
01 Wood (> 1 cm)
03 Large rocks (cobbles, boulders > 10 cm)
01 Small rocks (gravel, 0.2-10 cm)
0 Sand (0.1-2 mm)
06 Bare soil
0 Other: _____

VEGETATION DESCRIPTION

Leaf phenology (of dominant stratum)	Leaf Type (of dominant stratum)	Physiognomic class	HEIGHT (M) SCALE	COVER SCALE
Trees and Shrubs	✓ Broad-leaved	___Forest	01 -<0.5	T-<1%
___Evergreen	___Needle-leaved	___Woodland	02 - 0.5-1	01-1-5%
✓ Cold-deciduous	___Mixed broad-lvd/Needle-lvd	✓ Shrubland	03 - 1-2	02-6-15%
___Drought-deciduous	___Microphyllous	___Dwarf-shrubland	04 - 2-5	03-16-25%
___Mixed evergreen - cold-deciduous	___Graminoid	___Herbaceous	05 - 5-10	04-26-35%
___Mixed everg. - drought-deciduous	___Forb	___Nonvascular	06 - 10-15	05-36-45%
Herbs	___Pteridophyte	___Sparsely Vegetated	07 - 15-20	06-46-55%
___Annual			08 - 20-35	07-56-65%
___Perennial			09 - 35-50	08-65-75%
			10 ->50	09-76-85%
				10-86-95%
				11-96-100%

Strata	Height Class	Cover Class	Dominant species (mark any known diagnostic species with a *)	Cover % (Actual)
T1 Emergent				
T2 Canopy				
T3 Sub-canopy				
S1 Tall shrub	04	03	* AMELANCHIER UTAHENSIS	16
S2 Short Shrub	03	02	QUERCUS GAMBELII	8
			CERCOCARPUS MONTANUS	3
S3 Dwarf-shrub	01	T	MAHONIA FREMONTII	<1
H Herbaceous	01	04	BROMUS TECTORUM	30
			POA FENDLERIANA	<1
			ELYMUS ELYMOIDES	<1
			BALSAMORHIZA SAGITTATA	<1
N Non-vascular				
V Vine/liana				
E Epiphyte				

Appendix C. Database Documentation

C.1 Plots Database Documentation

Background

This database, designed for data resulting from fieldwork related to vegetation mapping projects, was developed by the Northern Colorado Plateau Network (NCPN). The Plots Database System, developed by The Nature Conservancy, was the starting point for this database. From this starting point, NCPN normalized the data structure, added fields and lookup tables, and developed an extensive user interface. Similar versions of this database, subsequently referred to as the BLCA VegMapDB, have been used for all vegetation mapping projects conducted by NCPN. BLCA VegMapDB contains plot, observation point, and accuracy assessment data collected during project field work.

Two database files are required to use BLCA VegMapDB:

- *BLCA_PlotsAA_XP.mdb.* This "frontend" file contains all queries, forms, reports, associated modules and Visual Basic code.
- *BLCA_PlotsAA_XP_be.mdb*. This "backend" file contains the database tables.

The frontend/backend file structure allows multiple users to enter data in a network environment, and allows for easy backup and transfer of the data tables. Users typically launch the frontend file, and a utility will prompt them to establish a link to the backend file. The contents of the backend file, however, can be used independently of the frontend.

Entity Relationship Diagram

The primary tables and relationships from the backend file (BLCA_PlotsAA_XP_be.mdb) are illustrated below. The database follows the design structure of the National Park Service Natural Resource Database Template, which is based on a location record, one or more related event records, and observation data elements linked to each event.

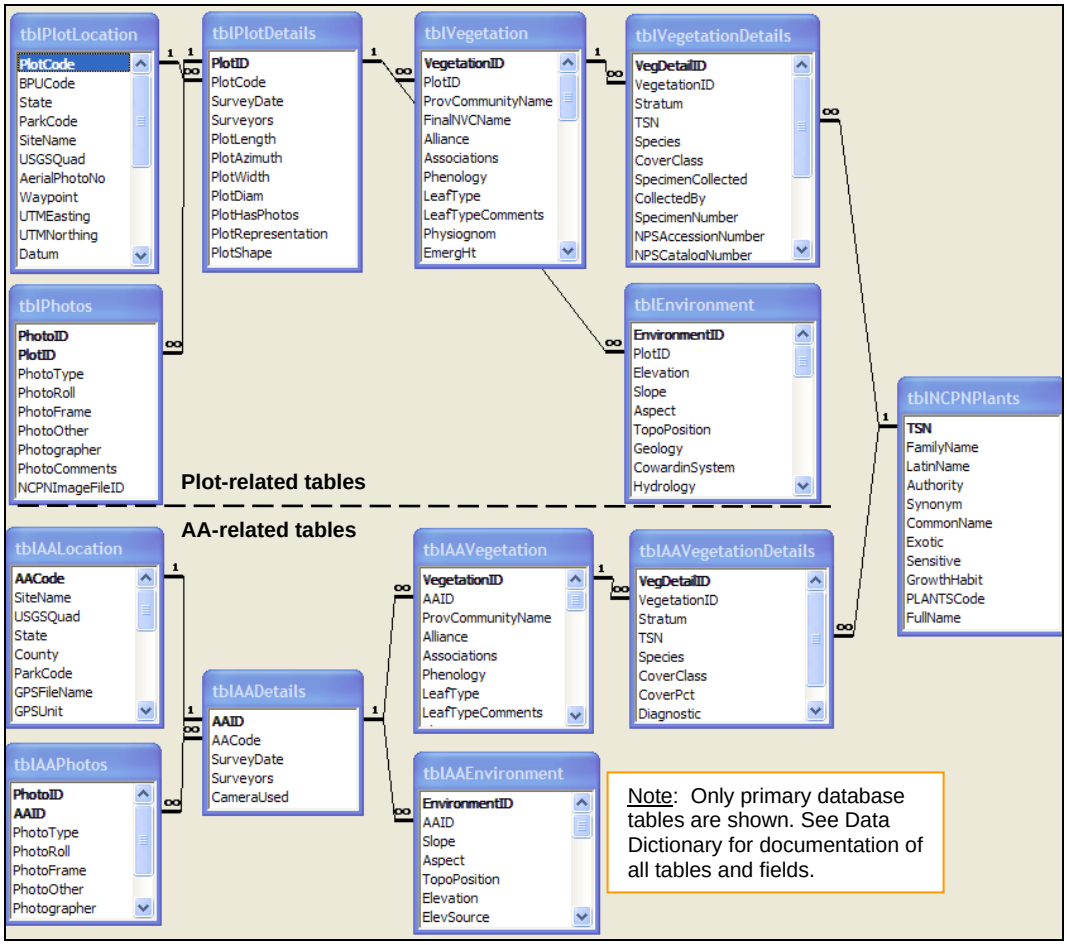


Figure 1. Entity Relationship Diagram for BLCA VegMapDB

Data Dictionary

The database consists of three types of tables: plot data, accuracy assessment data, and lookup tables that provide a standardized list of values to be used for certain data fields. Tables appear in alphabetical order within each of these three categories.

Plot-related tables

Table Name: tblDataMgmtLog
Description: Table containing a log of data set manipulations or database object alterations.

Field Name	Field Description	Field Type	Field Width
ActionDate	The date on which the data set was massaged or manipulated.	dbDate	8
ActionMonth	If ActionDate known to month only, use this field and the ActionYear field.	dbText	50
ActionYear	If ActionDate known to year only, use this field.	dbText	50
Action	What was done with the data set. How was it altered, massaged, manipulated, etc. Include changes to data and changes to database objects or structures.	dbMemo	0
Who	The name of the person who performed the action with the data set.	dbText	50

Table Name: tblEnvironment

Description: Table containing values on environmental features and conditions of plot or observation point.

Field Name	Field Description	Field Type	Field Width
EnvironmentID	Unique record identifier	dbLong	4
PlotID	Foreign key; links record to tblPlotDetails	dbLong	4
Elevation	Elevation of plot in meters as estimated from either map or GPS unit	dbLong	4
Slope	Slope of plot measured in degrees	dbLong	4
Aspect	Aspect of plot	dbText	50
TopoPosition	Topographic position of plot; value selected from tlkpTopography	dbText	50
Landform	Landform on which plot is located, any landform could be entered by crew.	dbText	50
Geology	Geologic substrate influencing the plant community; value selected from tlkpGeology	dbText	75
CowardinSystem	If the plot is in a wetland system, select term that best describes its hydrology; value selected from tlkpCowardin	dbText	12
Hydrology	Select value that best describes hydrology of plot from tlkpHydrology	dbText	50
EnvironmentalComments	Comments on environmental setting and its effect on the vegetation; also comments on any disturbance or reproduction factors	dbMemo	0
BareSoil	Estimate to the nearest percentage of bare soil ground cover	dbText	3
Bedrock	Estimate to the nearest percentage of bedrock ground cover	dbText	3
Sand	Estimate to the nearest percentage of sand (particle size 0.1-2mm) ground cover	dbText	3
Moss	Estimate to the nearest percentage of moss ground cover	dbText	3
Other	Estimate to the nearest percentage of other type of ground cover	dbText	3
OtherPctDesc	Description of the other type of ground cover components in the previous column	dbText	255
Litter	Estimate to the nearest percentage of litter ground cover	dbText	3
Rocks	Estimate to the nearest percentage of rocks >10cm wide ground cover	dbText	3
Lichen	Estimate to the nearest percentage of lichen ground cover	dbText	3
Wood	Estimate to the nearest percentage of wood >1cm ground cover	dbText	3
Gravel	Estimate to the nearest percentage of rocks <10cm wide ground cover	dbText	3
Water	Estimate to the nearest percentage of water ground cover	dbText	3
Cryptogam	Estimate to the nearest percentage of cryptogram ground cover	dbText	3
SoilTexture	Assessment of average soil texture from sample taken a few inches below the surface; values selected from tlkpSoilTexture	dbText	50
SoilDrainage	Soil drainage class based on actual moisture content	dbText	30

Field Name	Field Description	Field Type	Field Width
	and extent period; values selected from tlkpSoilDrainage		
AnimalUseComments	Comments on evidence of use by non-domestic animals in plot area	dbMemo	0
DisturbanceComments	Comments on evidence of natural or anthropogenic disturbance in plot area, severity and effects on vegetation	dbMemo	0
OtherComments	Other general comments	dbMemo	0
LandscapeComments	Description of landscape context of plot, including any important landscape features influencing the community	dbMemo	0
SoilTaxonDesc	Field used for either identifying soils keyed, or to describe if large rocks or outcrops are present on the surface	dbText	255
LiveVegLitter	Estimate to the nearest percentage of live veg litter ground cover	dbText	3
LiveVegWood	Estimate to the nearest percentage of live veg wood ground cover	dbText	3
LichenRocks	Estimate to the nearest percentage of lichen covering rocks	dbText	3
LichenGround	Estimate to the nearest percentage of lichen ground cover (on the soil, associated with cryptogams)	dbText	3
MossPct	Estimate to the nearest percentage of moss ground cover	dbText	3
DarkCyanobacteria	Estimate to the nearest percentage of dark cyanobacteria ground cover	dbText	3
TotalPct	Total ground cover pct - used for QC check.	dbInteger	2

Table Name: tblEnvironmentDetails
Description: Table containing values on environmental features and conditions of plot or observation point.

Field Name	Field Description	Field Type	Field Width
EnvDetailID	Unique record identifier	dbLong	4
EnvironmentID	Foreign key; links to tblEnvironment	dbLong	4
Landform	One or more landform values corresponding to plot location; any value may be entered by crew	dbText	50

Table Name: tblFinalAssociationNamesAA
Description: Table containing final Association Names (AA points) assigned by NatureServe.

Field Name	Field Description	Field Type	Field Width
PlotCode	Identifier of AA record; assigned by field crew	dbText	255
ELC_Code	Unique ID assigned by NatureServe	dbText	255
Association_Name	Association Name assigned by NatureServe	dbText	255

Table Name: tblFinalAssociationNamesPlots
Description: Table containing final Association Names (plots) assigned by NatureServe.

Field Name	Field Description	Field Type	Field Width
PlotCode	Identifier assigned to plot by survey crew	dbText	255
ELC_Code	Unique ID assigned by NatureServe	dbText	255
Association_Name	Association Name assigned by NatureServe	dbText	255

Table Name: tblFuels
Description: Table containing details on fuels characteristics of plot.

Field Name	Field Description	Field Type	Field Width
FuelsID	Unique record ID	dbLong	4
PlotID	Foreign key; links to tblPlotDetails	dbLong	4
GOPhotoGuide	For Gambel oak plots, the page number of the photo that most closely resembles the plot in terms of vegetation structure and down fuel.	dbText	3
ASPPhotoGuide	For aspen plots, the page number of the photo that most closely resembles the plot in terms of vegetation structure and down fuel.	dbText	3
PPDFPhotoGuide	For ponderosa pine and Douglas-fir plots, the page number of the photo that most closely resembles the plot in terms of vegetation structure and down fuel. Ref: W.C. Fischer 1981.	dbText	3
PJPhotoGuide	For pinyon-juniper plots, the page number of the photo that most closely resembles the plot in terms of vegetation structure and down fuel. Ref: Ottmar et al. 2000.	dbText	3
SBPhotoGuide	For sagebrush plots, the page number of the photo that most closely resembles the plot in terms of vegetation structure and down fuel. Ref: Ottmar et al. 2000.	dbText	3
PJAgeClass	If plot contains pinyon and/or juniper, enter value that best describes the age class of the stand; values stored in tlkpPJAge	dbText	15
LitterOrigin	Litter thickness at plot center	dbText	3
LitterNorth	Litter thickness 20m north of plot center	dbText	3
LitterEast	Litter thickness 20m east of plot center	dbText	3
LitterSouth	Litter thickness 20m south of plot center	dbText	3
LitterWest	Litter thickness 20m west of plot center	dbText	3
DuffOrigin	Duff thickness at plot center	dbText	3
DuffNorth	Duff thickness 20m north of plot center	dbText	3
DuffEast	Duff thickness 20m east of plot center	dbText	3
DuffSouth	Duff thickness 20m south of plot center	dbText	3
DuffWest	Duff thickness 20m west of plot center	dbText	3
IsSubplot	Indicate if measurements are for subplot (if plot has >25 trees, one quadrant (subplot) of plot can be measured for fuels	dbBoolean	1
FuelsComments	Comments about fuels characteristics	dbMemo	0

Table Name: tblFuelsDetails
Description: Details on stems, height, crown width, and other attributes of trees within plot.

Field Name	Field Description	Field Type	Field Width
FuelsDetailID	Unique identifier for record	dbLong	4
FuelsID	Foreign key, links to tblFuels	dbLong	4
StemCount	Number of stems measured. Value will be 1 if forest species; >=1 if woodland species.	dbInteger	2
StemDiameter	diameter in cm of stem(s). If stem count =1 for a forest species, diameter represents dbh. If stem count is >1 for a woodland species, diameter represents the average diameter of all stems measured at crown base.	dbDouble	8
TSN	Taxonomic Serial Number - unique taxon identifier	dbDouble	8

Field Name	Field Description	Field Type	Field Width
	assigned by ITIS		
WoodlandCrownBaseHeight	Estimate of height, in meters, of crown base of woodland tree.	dbDouble	8
WoodlandTotalHeight	Estimate of height for woodland tree (not height of crown base), in meters.	dbDouble	8
WoodlandCrownWidth	Width, in meters, of woodland tree crown	dbDouble	8
WoodlandCrownHeight	Height, in meters, of woodland tree	dbDouble	8
WoodlandCrownRatio	Crown ratio was collected in lieu of crown diameter on some woodland plots or on plots with mixed woodland and forest species.	dbDouble	8
ForestCrownBaseHeight	Height, in meters, of crown base of forest tree	dbDouble	8
ForestTotalHeight	Estimate of height for forest tree (not height of crown base), in meters.	dbDouble	8
ForestCrownHeight	Height, in meters, of forest tree (PP or DF)	dbDouble	8
CrownRatio	For ponderosa pine and Douglas-fir plots, the ratio of live tree crown to overall tree height	dbText	12
StructureStage	Stage of tree; values selected from tlkpStructureStages	dbText	12
Comments	Brief comments (e.g., dead top, twinned, ladder fuels, diseased)	dbText	255

Table Name: tblPhotos
Description: Details on individual photos taken of plot or observation point.

Field Name	Field Description	Field Type	Field Width
PhotoID	Unique record identifer	dbLong	4
PlotID	Foreign key, links to tblPlotDetails	dbLong	4
PhotoType	Type of photo being referenced.	dbText	16
PhotoRoll	Reference number for film roll of photo.	dbText	12
PhotoFrame	Frame number of photo within roll.	dbText	50
PhotoOther	Other unique identifier or reference number for digital photo or name of movie file.	dbText	12
Photographer	Name of photographer.	dbText	50
PhotoComments	Brief description of photo.	dbText	255
NCPNImageFileID	Cross-reference for NCPN Photo Database field, NCPNImageFileID	dbText	50

Table Name: tblPlotCodeLink
Description: Table used to map plot identifiers from previously-assigned variable-length format to new 4-digit format.

Field Name	Field Description	Field Type	Field Width
NewPlotCode	Plot identifier in 4-digit format	dbText	20
OldPlotCode	Plot identifier in old, variable-length format	dbText	20
TempCode	Temporary field for plot identifier	dbText	50

Table Name: tblPlotDetails
Description: Information on a plot that is specific to a visit.

Field Name	Field Description	Field Type	Field Width
PlotID	Unique identifier for record	dbLong	4
PlotCode	Foreign key, links to tblPlotLocation	dbText	10

Field Name	Field Description	Field Type	Field Width
SurveyDate	Date plot was visited and data collected	dbDate	8
Surveyors	Names of persons collecting data at plot (last names)	dbText	75
PlotLength	Length of plot, in meters	dbText	5
PlotAzimuth	Azimuth of plot; synonymous with aspect. One or the other, or both, can be used	dbText	5
PlotWidth	Width of plot, in meters	dbText	5
PlotDiam	Diameter of plot, in meters, if plot is circular	dbText	5
PlotHasPhotos	Yes if photos are taken of plot	dbBoolean	1
PlotRepresentation	Description or discussion of representativeness of plot in stand, and in comparison to associations outside the park (if known)	dbMemo	0
PlotShape	Shape of plot	dbText	15

Table Name: tblPlotLocation
Description: Basic and unchanging information on plot or observation point location.

Field Name	Field Description	Field Type	Field Width
PlotCode	Identifier assigned to plot by survey crew	dbText	10
BPUCode	Biophysical unit code where plot is located.	dbText	10
State	State where plot is located	dbText	2
ParkCode	Park unit where plot is located	dbText	4
SiteName	Short, descriptive name of site where plot is located	dbText	100
USGSQuad	USGS quadrangle (1:24K) where plot is located	dbText	50
AerialPhotoNo	Aerial photo number corresponding to plot location	dbText	10
Waypoint	Garmin plot code	dbText	50
UTMEasting	UTM easting of plot	dbDouble	8
UTMNorthing	UTM northing of plot	dbDouble	8
Datum	Datum of UTM coordinates	dbText	10
UTMZone	UTM zone of coordinates	dbText	4
UTM Error	error, in meters, of location data (based on reading from Garmin GPS unit)	dbText	5
DiffCorrected	Indicate if coordinates have been differentially corrected	dbText	3
DirectionsToPlot	Precise directions to plot	dbMemo	0
County	County where plot is located.	dbText	50
GPSUnit	Manufacturer and model of GPS unit (e.g., Trimble GeoExplorer 3)	dbText	25
GPSComments	Any brief comments on GPS data collection at plot.	dbMemo	0
InPark	Select Yes if plot is within park boundaries.	dbBoolean	1
IsObservationPt	Yes if observation point.	dbBoolean	1

Table Name: tblVegetation
Description: Overall vegetation characteristics of a plot or observation point.

Field Name	Field Description	Field Type	Field Width
VegetationID	Unique record ID	dbLong	4
PlotID	Foreign key, links to tblPlotDetails	dbLong	4
ProvCommunityName	Community name (provisional) assigned by field crews by following naming protocols as described in field manual and training 04/04.	dbText	120
Alliance	Alliance corresponding to provisional community name	dbText	100
Associations	Association corresponding to provisional community	dbText	100

Field Name	Field Description	Field Type	Field Width
	name		
FinalNVCName	Final association name as provided by NatureServe. Links to tbl_final_classification	dbText	240
Phenology	Leaf phenology of the dominant stratum. Field is blank for non-vascular plots	dbText	35
LeafType	Leaf form of the dominant stratum.	dbText	35
LeafTypeComments	If Leaf Type is "mixed," this field describes the multiple leaf types found in the dominant stratum.	dbText	255
Physiognom	Physiognomic class of plot (from tllkPhysiogClass)	dbText	20
EmergHt	Height class of emergent stratum (tlkpHeightClass)	dbText	2
EmergCovTot	Cover class of emergent stratum (tlkpCover)	dbText	2
CanHt	Height class of canopy stratum (tlkpHeightClass)	dbText	2
CanCovTot	Cover class of canopy stratum (tlkpCover)	dbText	50
SubHt	Height class of subcanopy stratum (tlkpHeightClass)	dbText	2
SubCovTot	Cover class of subcanopy stratum (tlkpCover)	dbText	5
TallShHt	Height class of Tall shrub stratum (tlkpHeightClass)	dbText	2
TallShCovTot	Cover class of tall shrub stratum (tlkpCover)	dbText	5
ShrubHt	Height class of shrub stratum (tlkpHeightClass)	dbText	2
ShrubCovTot	Cover class of shrub stratum (tlkpCover)	dbText	5
DwarfHt	Height class of dwarf shrub stratum (tlkpHeightClass)	dbText	2
DwarfCovTot	Cover class of dwarf shrub stratum (tlkpCover)	dbText	5
HerbHt	Height class of herbaceous (total) stratum (tlkpHeightClass)	dbText	2
HerbCovTot	Cover class of herbaceous (total) stratum	dbText	5
GramHt	Height class of graminoid stratum (tlkpHeightClass)	dbText	2
GramCovTot	Cover class of graminoid stratum (tlkpCover)	dbText	5
ForbHt	Height class of forb stratum (tlkpHeightClass)	dbText	2
ForbCovTot	Cover class of forb stratum (tlkpCover)	dbText	5
FernHt	Height class of fern stratum (tlkpHeightClass)	dbText	2
FernCovTot	Cover class of fern stratum (tlkpCover)	dbText	5
SeedlHt	Height class of tree seedling stratum (tlkpHeightClass)	dbText	2
SeedlCovTot	Cover class of tree seedling stratum (tlkpCover)	dbText	5
NonvasHt	Height class of nonvascular stratum (tlkpHeightClass)	dbText	2
NonvasCovTot	Cover class of nonvascular stratum (tlkpCover)	dbText	5
VineHt	Height class of vine stratum (tlkpHeightClass)	dbText	2
VineTotCov	Cover class of vine stratum (tlkpCover)	dbText	5
EpiHt	Height class of epiphyte stratum (tlkpHeightClass)	dbText	2
EpiTotCov	Cover class of epiphyteb stratum (tlkpCover)	dbText	5
TotalPct	Total veg cover pct - used for QC check.	dbInteger	2
CoverRelative	Yes indicates species cover percentages are relative.	dbBoolean	1

Table Name: tblVegetationDetails
Description: Species and strata-specific data related to a plot or observation point.

Field Name	Field Description	Field Type	Field Width
VegDetailID	Unique record ID	dbLong	4
VegetationID	Foreign key; links to tblVegetation	dbLong	4
Stratum	Strata class from tlkpStrata	dbText	2
TSN	Taxonomic Serial Number - unique taxon identifier assigned by ITIS	dbDouble	8

Field Name	Field Description	Field Type	Field Width
Species	Latin name of species, from tblNCPNPlants	dbText	100
CoverClass	Cover class to describe species and strata (from tlkpCover)	dbText	5
PercentCover	Actual percentage of cover for this species	dbInteger	2
Diagnostic	Check yes if the species is known to be diagnostic of the vegetation type.	dbBoolean	1
SpecimenCollected	Check yes if a specimen of the species was collected.	dbBoolean	1
CollectedBy	Name of person collecting specimen	dbText	75
NPSAccessionNumber	Accession number corresponding to all collections made under research permit; provided by park curator	dbText	50
NPSCatalogNumber	Unique reference number for individual specimen; numbers provided by park curator	dbText	50
SpecimenNumber	Enter the collector's reference number for the specimen collected.	dbText	50
SpecimenLocality	Brief description of collection location, suitable for specimen label	dbText	240
SpecimenHabitat	Brief description of collection habitat, suitable for specimen label	dbText	240
SpecimenAssocSpecies	Brief description of associated species in collection area, suitable for specimen label	dbText	240

Accuracy assessment-related tables

Table Name: tblAADetails
Description: Information on an AA point that is specific to a visit.

Field Name	Field Description	Field Type	Field Width
AAID	Unique identifier for record	dbLong	4
AACode	Identifier of AA record; assigned by field crew	dbText	13
SurveyDate	Date AA point was visited and data was collected	dbDate	8
Surveyors	Name(s) of persons who collected data at an AA point (Last name and first initial)	dbText	75
CameraUsed	Make and model of camera used to photograph plot	dbText	50

Table Name: tblAAEnvironment
Description: Table containing values on environmental features and conditions of an AA point.

Field Name	Field Description	Field Type	Field Width
EnvironmentID	Unique record identifier	dbLong	4
AAID	Foreign key; links to tblAADetails	dbLong	4
Slope	Slope of AA point measured in degrees	dbText	50
Aspect	Aspect of AA point	dbText	50
TopoPosition	Topographic position of AA point; value selected from tlkpTopography	dbText	50
Elevation	Elevation of AA point in meters as estimated from either map or GPS unit	dbLong	4
ElevSource	How elevation was derived in the field (GPS or Quad Map)	dbText	50
EnvironmentalComments	Comments on environmental setting and its effect on the vegetation; also comments on any disturbance or	dbMemo	0

Field Name	Field Description	Field Type	Field Width
	reproduction factors		
BareSoil	Estimate to the nearest percentage of bare soil ground cover	dbText	3
Bedrock	Estimate to the nearest percentage of bedrock ground cover	dbText	3
Sand	Estimate to the nearest percentage of sand (particle size 0.1-2mm) ground cover	dbText	3
Moss	Estimate to the nearest percentage of moss ground cover	dbText	3
Other	Estimate to the nearest percentage of other type of ground cover	dbText	3
OtherPctDesc	Description of "other" category in previous column	dbText	255
Litter	Estimate to the nearest percentage of litter ground cover	dbText	3
Rocks	Estimate to the nearest percentage of rocks >10cm wide ground cover	dbText	3
Lichen	Estimate to the nearest percentage of lichen ground cover	dbText	3
Gravel	Estimate to the nearest percentage of gravel <10cm wide ground cover	dbText	3
LiveVegLitter	Estimate to the nearest percentage of live veg litter ground cover	dbText	3
LiveVegWood	Estimate to the nearest percentage of live veg wood ground cover	dbText	3
Wood	Estimate to the nearest percentage of wood >1cm ground cover	dbText	3
LichenRocks	Estimate to the nearest percentage of lichen covering rocks	dbText	3
LichenGround	Estimate to the nearest percentage of lichen covering ground (associated with biocrust)	dbText	3
DarkCyanobacteria	Estimate to the nearest percentage of dark cyanobacteria ground cover	dbText	3
Water	Estimate to the nearest percentage of water ground cover	dbText	3
Geology	Geology	dbText	75
BBareSoil	Estimate to the nearest percentage of bare soil ground cover (field added 2/8/2006 to split out BLCA and CURE cover)	dbText	3
BBedrock	Estimate to the nearest percentage of bedrock ground cover (field added 2/8/2006 to split out BLCA and CURE cover)	dbText	3
BSand	Estimate to the nearest percentage of sand (particle size 0.1-2mm) ground cover (field added 2/8/2006 to split out BLCA and CURE cover)	dbText	3
BOther	Estimate to the nearest percentage of other type of ground cover (field added 2/8/2006 to split out BLCA and CURE cover)	dbText	3
BLitter	Estimate to the nearest percentage of litter ground cover (field added 2/8/2006 to split out BLCA and CURE cover)	dbText	3
BRocks	Estimate to the nearest percentage of rocks >10cm wide ground cover (field added 2/8/2006 to split out	dbText	3

Field Name	Field Description	Field Type	Field Width
	BLCA and CURE cover)		
BGravel	Estimate to the nearest percentage of gravel <10cm wide ground cover (field added 2/8/2006 to split out BLCA and CURE cover)	dbText	3
BWood	Estimate to the nearest percentage of wood >1cm ground cover (field added 2/8/2006 to split out BLCA and CURE cover)	dbText	3

Table Name: tblAAEnvironmentDetails
Description: Table containing values on environmental features and conditions of an AA point.

Field Name	Field Description	Field Type	Field Width
EnvDetailID	Unique record identifier	dbLong	4
EnvironmentID	Foreign key; provides link to tblEnvironment	dbLong	4
Landform	One or more landform values corresponding to AA point location; any value may be entered by crew	dbText	50

Table Name: tblAALocation
Description: Basic and unchanging information on AA point location.

Field Name	Field Description	Field Type	Field Width
AACode	Identifier assigned to AA point by survey crew	dbText	13
SiteName	Short, descriptive name of site where point is located	dbText	100
State	State where point is located	dbText	2
County	County where plot is located.	dbText	50
ParkCode	Park unit where point is located	dbText	4
GPSFileName	Name of corresponding GPS file	dbText	50
GPSUnit	Manufacturer and model of GPS unit (e.g., Trimble GeoExplorer 3)	dbText	25
UTMEasting	UTM easting of point	dbDouble	8
UTMNorthing	UTM northing of point	dbDouble	8
UTMZone	UTM zone of coordinates	dbText	4
DiffCorrected	Indicate if coordinates have been differentially corrected	dbText	3
Datum	Datum of UTM coordinates	dbText	10
PDOP	satellite Precision Dilution of Position (based on reading from Trimble GPS unit)	dbText	50
UTM Error	error, in meters, of location data (based on reading from Garmin GPS unit)	dbText	5
InPark	Select Yes if plot is within park boundaries.	dbBoolean	1
GPSComments	Any brief comments on GPS data collection.	dbText	255
RepresentPWP	Representativeness of point within polygon.	dbText	7
RepresentATD	Representativeness of association to description.	dbText	4
ClassificationComments	Classification comments.	dbMemo	0
PlotShape	Plot shape.	dbText	10
USGSQuad	USGS Quad map name.	dbText	50

Table Name: tblAAPhotos
Description: Details on individual photos taken of an AA point.

Field Name	Field Description	Field Type	Field Width

Field Name	Field Description	Field Type	Field Width
PhotoID	Unique record identifier	dbLong	4
AAID	Foreign key; provides link to tblAADetails	dbLong	4
PhotoType	Type of photo being referenced.	dbText	16
PhotoRoll	Reference number for film roll of photo.	dbText	12
PhotoFrame	Frame number of photo within roll.	dbText	50
PhotoOther	Other unique identifier or reference number for digital photo or name of movie file.	dbText	25
Photographer	Name of photographer.	dbText	50
PhotoComments	Brief description of photo.	dbText	255
NCPNImageFileID	Corresponds to the NCPN Photodatabase image file ID	dbText	50

Table Name: tblAAVegAssociation
Description: Vegetation association at AA location.

Field Name	Field Description	Field Type	Field Width
VegAssocID	Unique record identifier	dbLong	4
AAID	Foreign key; provides link to tblAADetails	dbLong	4
VegAssocCode	Identification code of vegetation association; provided by NatureServe	dbText	25
VegAssocRank	Rank of vegetation association (primary, secondary, tertiary)	dbText	15
FieldKey	Was name obtained from field key?	dbBoolean	1
NewName	New classification name?	dbBoolean	1
Post_Field_Name	Post-field name?	dbBoolean	1
OtherAssocCode	Other associations within 50 m	dbText	255

Table Name: tblAAVegetation
Description: Overall vegetation characteristics of an AA point.

Field Name	Field Description	Field Type	Field Width
VegetationID	Unique record identifier	dbLong	4
AAID	Foreign key; provides link to tblAADetails	dbLong	4
ProvCommunityName	Community name (provisional) assigned by field crews by following naming protocols as described in field manual and training 04/04.	dbText	120
Alliance	Alliance corresponding to provisional community name	dbText	100
Associations	Association corresponding to provisional community name	dbText	100
Phenology	Leaf phenology of the dominant stratum.	dbText	35
LeafType	Leaf form of the dominant stratum.	dbText	35
LeafTypeComments	Leaf form of the dominant stratum.	dbText	255
Physiognom	Physiognomic class of plot (from tllkPhysiogClass)	dbText	20
EmergHt	Height class of emergent stratum (tlkpHeightClass)	dbText	2
EmergCovTot	Cover class of emergent stratum (tlkpCoverAA)	dbText	15
EmergCovPercent	[not used]	dbText	50
CanHt	Height class of canopy stratum (tlkpHeightClass)	dbText	2
CanCovTot	Cover class of canopy stratum (tlkpCoverAA)	dbText	15
CanCovPercent	[not used]	dbText	50
SubHt	Height class of subcanopy stratum (tlkpHeightClass)	dbText	2
SubCovTot	Cover class of subcanopy stratum (tlkpCoverAA)	dbText	15
SubCovPercent	[not used]	dbText	50

Field Name	Field Description	Field Type	Field Width
TallShHt	Height class of tall shrub stratum (tlkpHeightClass)	dbText	2
TallShCovTot	Cover class of tall shrub stratum (tlkpCoverAA)	dbText	15
TallShCovPercent	[not used]	dbText	50
ShrubHt	Height class of shrub stratum (tlkpHeightClass)	dbText	2
ShrubCovTot	Cover class of shrub stratum (tlkpCoverAA)	dbText	15
ShrubCovPercent	[not used]	dbText	50
DwarfHt	Height class of dwarf shrub stratum (tlkpHeightClass)	dbText	2
DwarfCovTot	Cover class of dwarf shrub stratum (tlkpCoverAA)	dbText	15
DwarfCovPercent	[not used]	dbText	50
HerbHt	Height class of herbaceous stratum (tlkpHeightClass)	dbText	2
HerbCovTot	Cover class of herbaceous stratum (tlkpCoverAA)	dbText	15
HerbCovPercent	[not used]	dbText	50
NonvasHt	Height class of nonvascular stratum (tlkpHeightClass)	dbText	2
NonvasCovTot	Cover class of nonvascular stratum (tlkpCoverAA)	dbText	15
NonvasCovPercent	[not used]	dbText	50
VineHt	Height class of vine stratum (tlkpHeightClass)	dbText	2
VineTotCov	Cover class of vine stratum (tlkpCoverAA)	dbText	15
VineTotPercent	[not used]	dbText	50
EpiHt	Height class of epiphyte stratum (tlkpHeightClass)	dbText	2
EpiTotCov	Cover class of epiphyte stratum (tlkpCoverAA)	dbText	15
EpiTotPercent	[not used]	dbText	50
GramHt	Height class of graminoid stratum (tlkpHeightClass)	dbText	2
GramCovTot	Cover class of graminoid stratum (tlkpCoverAA)	dbText	15
GramCovPercent	[not used]	dbText	50
ForbHt	Height class of forb stratum (tlkpHeightClass)	dbText	2
ForbCovTot	Cover class of forb stratum (tlkpCoverAA)	dbText	15
ForbCovPercent	[not used]	dbText	50
FernHt	Height class of fern stratum (tlkpHeightClass)	dbText	2
FernCovTot	Cover class of fern stratum (tlkpCoverAA)	dbText	15
FernCovPercent	[not used]	dbText	50
SeedlHt	Height class of tree seedling stratum (tlkpHeightClass)	dbText	2
SeedlCovTot	Cover class of tree seedling stratum (tlkpCoverAA)	dbText	15
SeedCovPercent	[not used]	dbText	50
OutsidePlotHt	Height class of species occurring outside plot (tlkpHeightClass)	dbText	50
OutsidePlotTotCov	Cover class of species occurring stratum (tlkpCoverAA)	dbText	50
OutsidePlotTotPercent	[not used]	dbText	50
HTotalHt	Height class of total herbaceous stratum (tlkpHeightClass)	dbText	2
HTotalCover	Cover class of total herbaceous stratum (tlkpCoverAA)	dbText	15
HTotalCoverPercent	[not used]	dbText	50
H4Ht	Height class of tree seedling stratum (tlkpHeightClass)	dbText	2
H4Cover	Cover class of tree seedling stratum (tlkpCoverAA)	dbText	15
H4CoverPercent	[not used]	dbText	50
PlantSpeciesComments	Comments on plant species list	dbMemo	0
ClassificationComments	Old style form - moved to main page, but not deleted because it contains data.	dbMemo	0
MultipleAssoc	List represents more than one association.	dbBoolean	1
BEmergCovTot	Cover class of emergent stratum - BLCA	dbText	15
BCanCovTot	Cover class of canopy stratum - BLCA	dbText	15

Field Name	Field Description	Field Type	Field Width
BSubCovTot	Cover class of subcanopy stratum - BLCA	dbText	15
BTallShCovTot	Cover class of tall shrub stratum - BLCA	dbText	15
BShrubCovTot	Cover class of shrub stratum - BLCA	dbText	15
BDwarfCovTot	Cover class of dwarf shrub stratum - BLCA	dbText	15
BHerbCovTot	Cover class of herbaceous stratum - BLCA	dbText	15
BNonvasCovTot	Cover class of nonvascular stratum - BLCA	dbText	15
BVineTotCov	Cover class of vine stratum - BLCA	dbText	15
BEpiTotCov	Cover class of epiphyte stratum - BLCA	dbText	15
BSeedlCovTot	Cover class of tree seedling stratum - BLCA	dbText	15
BHTotalCover	Cover class of total herbaceous stratum - BLCA	dbText	15
BH4Cover	Cover class of tree seedling stratum - BLCA	dbText	15
CEmergCovTot	Cover class of emergent stratum - CURE	dbText	15
CCanCovTot	Cover class of canopy stratum - CURE	dbText	15
CSubCovTot	Cover class of subcanopy stratum - CURE	dbText	15
CTallShCovTot	Cover class of tall shrub stratum - CURE	dbText	15
CShrubCovTot	Cover class of shrub stratum - CURE	dbText	15
CDwarfCovTot	Cover class of dwarf shrub stratum - CURE	dbText	15
CHerbCovTot	Cover class of herbaceous stratum - CURE	dbText	15
CNonvasCovTot	Cover class of nonvascular stratum - CURE	dbText	15
CVineTotCov	Cover class of vine stratum - CURE	dbText	15
CEpiTotCov	Cover class of epiphyte stratum - CURE	dbText	15
CSeedlCovTot	Cover class of tree seedling stratum - CURE	dbText	15
CHTotalCover	Cover class of total herbaceous stratum - CURE	dbText	15
CH4Cover	Cover class of tree seedling stratum - CURE	dbText	15

Table Name: tblAAVegetationDetails
Description: Species and strata-specific data related to an AA point.

Field Name	Field Description	Field Type	Field Width
VegDetailID	Unique record ID	dbLong	4
VegetationID	Foreign key; links to tblAAVegetation	dbLong	4
Stratum	Strata class from tllkStrata	dbText	2
TSN	Taxonomic Serial Number - unique taxon identifier assigned by ITIS	dbDouble	8
Species	Latin names of species, from tblNCPNPlants	dbText	100
CoverClass	Cover class to describe species and strata (from tllkCover)	dbText	5
CoverPct	Percent cover observed for that species in the field.	dbText	5
Diagnostic	Diagnostic?	dbBoolean	1
Dead	Dead?	dbBoolean	1

Lookup tables

Table Name: tblNCPNPlants
Description: Master look-up table for plant species names and taxonomic information. Derived from ITIS (Integrated Taxonomic Information System).

Field Name	Field Description	Field Type	Field Width
TSN	Taxonomic Serial Number - unique taxon identifier assigned by ITIS	dbDouble	8
FamilyName	Family name of taxon	dbText	255

Field Name	Field Description	Field Type	Field Width
LatinName	Latin name of taxon	dbText	255
Authority	Authority of Latin name	dbText	255
Synonym	Accepted synonyms of taxon	dbText	255
CommonName	Locally accepted common name for taxon	dbText	255
Exotic	Check yes if species is exotic	dbBoolean	1
Sensitive	check yes if species is threatened, endangered, or sensitive	dbBoolean	1
GrowthHabit	Select GrowthHabit for species -- habit can vary based on region; edit as needed to reflect habit in park	dbText	255
PLANTSCode	Code for taxonomic unit assigned by USDA PLANTS	dbText	255
FullName	temporary field; concatenation of Latin name and authority	dbText	255

Table Name: tlkpAAVegAssociation
Description: Lookup of vegetation association codes (CEGL codes from NatureServe) and vegetation association name.

Field Name	Field Description	Field Type	Field Width
VegAssocCode	NVCElCode	dbText	255
VegAssocName	NVCFinalAssociationName	dbText	255

Table Name: tlkpAAVegAssocRanks
Description: Rank of vegetation association (primary, secondary, tertiary).

Field Name	Field Description	Field Type	Field Width
VegAssocRank	Indicates whether the vegetation association represents a primary, secondary, or tertiary collection by field crews	dbText	255

Table Name: tlkpAlliances
Description: Look-up of provisional community names.

Field Name	Field Description	Field Type	Field Width
Alliance	Alliance name from NatureServe classification	dbText	100

Table Name: tlkpAssociations
Description: Look-up of association names.

Field Name	Field Description	Field Type	Field Width
Associations	Association names from NatureServe classification	dbText	125

Table Name: tlkpCamera
Description: Lookup of Camera make/models used for plot photos.

Field Name	Field Description	Field Type	Field Width
CameraType	Model and make of camera used for photographs of plot	dbText	50
CameraComments	Additional comments on camera, including default focal length	dbText	50

Table Name: tlkpCover
Description: Look-up of cover classes assigned to species and strata in VegetationDetails.

Field Name	Field Description	Field Type	Field Width
CoverClass	Cover class code: 0, T, P, 01-a, 01-b, 03, 04, 05, 06	dbText	50
CoverClassDesc	Cover class description: 0=0 (outside plot), T=<1%, P=1-5%, 01-a=1-10%, 01-b=10-25%, 03=5-25%, 04=25-50%, 05=50-75%,	dbText	255

Field Name	Field Description	Field Type	Field Width
	06=75-100%		

Table Name: tlkpCoverAA
Description: Look-up of cover classes assigned to species and strata in VegetationDetails.

Field Name	Field Description	Field Type	Field Width
CoverClass	T=<1%, 01=1-5%, 02=6-15%, 03=16-25%, 04=26-35%, 05=36-45%, 06=46-55%, 07=56-65%, 08=66-75%, 09=76-85%, 10=86-95%, 11=96-100%	dbText	50

Table Name: tlkpCowardin
Description: Look-up of Cowardin system catergories for Environment descriptions.

Field Name	Field Description	Field Type	Field Width
CowardinSystem	Cowardin system descriptors for environmental description of plot.	dbText	50

Table Name: tlkpElevSource
Description: Lookup table of options for source of elevation data.

Field Name	Field Description	Field Type	Field Width
ElevSource	Source of elevation data entered on field forms	dbText	50

Table Name: tlkpGeology
Description: Look-up of geology types to describe substrate of plot.

Field Name	Field Description	Field Type	Field Width
Geology	Geology types used to describe substrate of plot or observation point	dbText	75

Table Name: tlkpHeightClass
Description: Look-up of height classes assigned to strata in VegetationDetails.

Field Name	Field Description	Field Type	Field Width
HeightClass	01=<0.5m, 02=0.5-1m, 03=1-2m, 04=2-5m, 05=5-10m, 06=10-15m, 07=15-20m, 08=20-35m, 09=35-50m, 10=>50	dbText	2

Table Name: tlkpHydrology
Description: Look-up of hydrology types from Cowardin et al. 1979.

Field Name	Field Description	Field Type	Field Width
Hydrology	Hydrology descriptors for plots that are in a wetland or upland with intermittent flooding (dry wash).	dbText	50

Table Name: tlkpLandform
Description: Look-up of landforms in Veg Mapping Manual (from http://soils.usda.gov/technical/handbook/detailedtoc.html#629).

Field Name	Field Description	Field Type	Field Width
Landform	landforms from appendix 1 of field manual	dbText	50

Table Name: tlkpLeafPhen
Description: Look-up of phenology types to describe dominant stratum (from Veg Mapping Manual).

Field Name	Field Description	Field Type	Field Width

Field Name	Field Description	Field Type	Field Width
Phenology	Leaf phenology descriptors to describe dominant stratum	dbText	40

Table Name: tlkpLeafType
Description: Look-up of leaf form of dominant stratum (from Veg Mapping Manual).

Field Name	Field Description	Field Type	Field Width
LeafType	Leaf form description of the dominant stratum	dbText	35

Table Name: tlkpParks
Description: Look-up of parks in the Northern Colorado Plateau network of I&M.

Field Name	Field Description	Field Type	Field Width
ParkCode	Four-letter abbreviation for park code	dbText	4
ParkName	Full name of park where data were collected	dbText	50

Table Name: tlkpPhotoComments
Description: Lookup table of photo comments

Field Name	Field Description	Field Type	Field Width
PhotoComments	Photograph comments.	dbText	50

Table Name: tlkpPhotographer
Description: Lookup table of photographer names

Field Name	Field Description	Field Type	Field Width
Photographer	Photographer name.	dbText	50

Table Name: tlkpPhotoTypes
Description: Look-up of types of photos taken during data collection.

Field Name	Field Description	Field Type	Field Width
PhotoType	Type of photo taken, associated with plot.	dbText	50

Table Name: tlkpPhysiogClass
Description: Look-up of physiognomic types to describe each plot or observation point.

Field Name	Field Description	Field Type	Field Width
Physiognom	Physiognomic class used to describe plot	dbText	50

Table Name: tlkpPJAge
Description: Look-up of Pinyon-Juniper age classes.

Field Name	Field Description	Field Type	Field Width
PJAgeClass	Pinyon- Juniper age class, if plot contains either of these two species.	dbText	15

Table Name: tlkpPlotShapes
Description: Look-up of shapes of plots.

Field Name	Field Description	Field Type	Field Width
PlotShape	Shapes of plots	dbText	15

Table Name: tlkpSoilDrainage
Description: Look-up of soil drainage classes to describe plot or observation point.

Field Name	Field Description	Field Type	Field Width
SoilDrainage	Soil drainage classes used to describe soil where plot is located	dbText	30

Table Name: tlkpSoilTexture
Description: Look-up of soil textures based on Bowker 2003 field key for CANY, ARCH, and NABR.

Field Name	Field Description	Field Type	Field Width
SoilTexture	Look-up of soil textures based on Bowker 2003 field key for CANY, ARCH, and NABR.	dbText	15

Table Name: tlkpStates
Description: Look-up of all states in the USA.

Field Name	Field Description	Field Type	Field Width
StateCode	Two-letter abbreviation for each state	dbText	2
StateName	Full name of each state in the USA	dbText	50

Table Name: tlkpStrata
Description: Look-up of strata classes in VegetationDetails (from Veg Mapping Manual).

Field Name	Field Description	Field Type	Field Width
Stratum	T1=Emergent T2=Canopy T3=Subcanopy S1=Tall Shrub S2=Short Shrub S3=Dwarf Shrub H1=Graminoid H2=Forb H3=Fern H4=Tree Seedl N=Nonvasc V=Vine E=Epiphyte	dbText	3

Table Name: tlkpStructureStages
Description: Look-up of vegetation structure stages.

Field Name	Field Description	Field Type	Field Width
StructureStage	Standard fuel model classes for forest and woodland trees indicating their position in the canopy	dbText	12

Table Name: tlkpSurveyors
Description: Look-up of names of data collection individuals for BLCA/CURE data collection.

Field Name	Field Description	Field Type	Field Width
SurveyorName	Last names of crew members on each data collection team.	dbText	75

Table Name: tlkpTopography
Description: Look-up of topographic positions to describe where plot or observation point is located on its related landform.

Field Name	Field Description	Field Type	Field Width
TopoPosition	Topographic positions used to describe where plot or observation point is located on its related landform.	dbText	50

Table Name: tlkpUSGS_Quad
Description: Look-up of all 7.5 minute USGS quads for BLCA/CURE.

Field Name	Field Description	Field Type	Field Width
USGSQuad	Names of all 7.5 minute USGS quads for BLCA/CURE	dbText	50
USGSQuadCode	n/a for BLCA	dbText	7

Table Name: tlkpUTMZone
Description: Look-up for UTM zone of BLCA/CURE.

Field Name	Field Description	Field Type	Field Width
UTMZone	UTM zone where all BLCA/CURE plots were collected	dbText	5

C.2 Geodatabase Documentation

Background

The geodatabase was designed to consolidate all spatial and non-spatial (i.e., tabular) data from the BLCA vegetation mapping project. In the geodatabase, feature classes were created for the spatial datasets, including plots, observation points, AA points, and polygons. These feature classes were then linked to the tables in the Plots database via relationship classes.

Entity Relationship Diagram

The primary tables and relationships for the geodatabase are illustrated below.

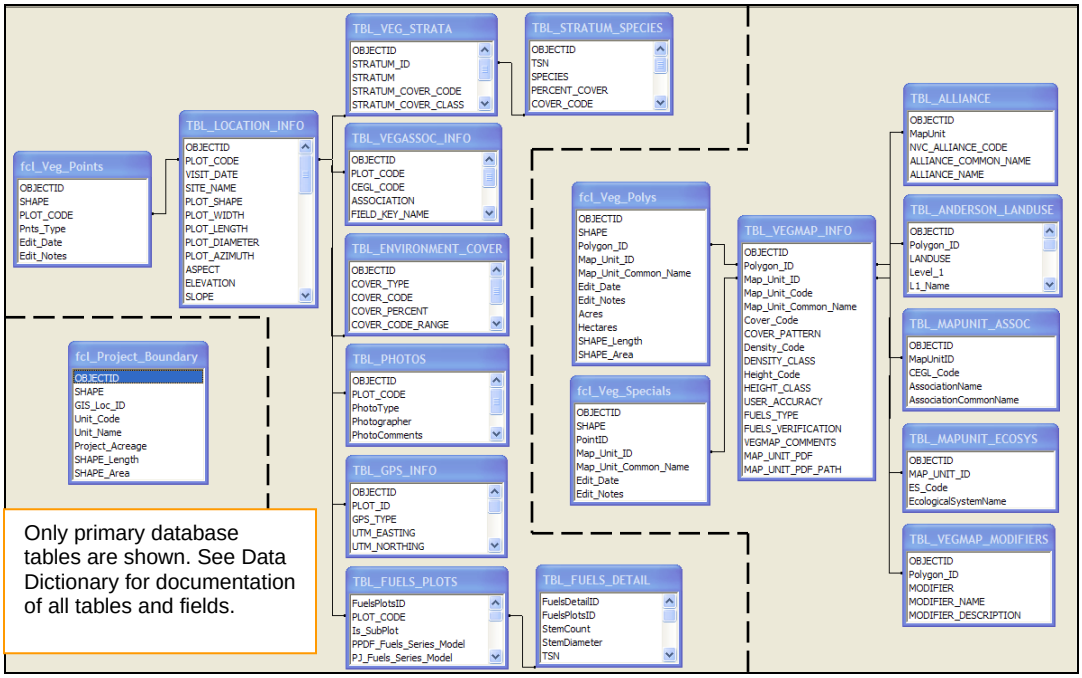


Figure 2. Entity Relationship Diagram for BLCA Geodatabase

Data Dictionary

The geodatabase consists of two types of tables: spatial (i.e., feature classes), and non-spatial tables. Tables appear in alphabetical order within these two categories.

Spatial tables

Table Name: fcl_Project_Boundary
Description: The feature class of the boundary of the vegetation mapping project area.

Field Name	Field Description	Field Type	Field Width
OBJECTID	ESRI generated autonumber	dbLong	4
SHAPE	ESRI generated	dbLongBinary	0
GIS_Loc_ID	unique ID	dbText	128
Unit_Code	Four-letter park code (BLCA)	dbText	10
Unit_Name	Full name of national park (Black Canyon of the Gunnison National Park)	dbText	255

Field Name	Field Description	Field Type	Field Width
Project_Acreage	Acreage of project area	dbLong	4
SHAPE_Length	ESRI generated	dbDouble	8
SHAPE_Area	ESRI generated	dbDouble	8

Table Name: fcl_Veg_Points
Description: The feature class containing all point data associated with the vegetation project (Plots, Observations, Fuels, AA).

Field Name	Field Description	Field Type	Field Width
OBJECTID	ESRI generated autonumber	dbLong	4
SHAPE	ESRI generated	dbLongBinary	0
PLOT_CODE	Unique Plot code, used for relating tables and feature class (TBL_LOCATION_INFO)	dbText	20
Pnts_Type	Type of point (fuels, plot, observation, aa, misc)	dbLong	4
Edit_Date	Date of any edits to the point or data	dbText	10
Edit_Notes	Notes regarding any edits	dbText	255

Table Name: fcl_Veg_Polys
Description: The feature class displaying the vegetation mapping units for the park.

Field Name	Field Description	Field Type	Field Width
OBJECTID	ESRI generated autonumber	dbLong	4
SHAPE	ESRI generated	dbLongBinary	0
Polygon_ID	Unique polygon code, used for relating tables (TBL_VEGMAP_INFO)	dbText	128
Map_Unit_ID	The map unit identifier, used by the mappers (aka: grid_code or map class code)	dbText	10
Map_Unit_Common_Name	The name of the map unit (or map class)	dbText	250
Edit_Date	Date of any edits to the polygon or its attributes	dbDate	8
Edit_Notes	Notes regarding any edits to the polygon or its attributes	dbText	250
Acres	Acres per polygon, generated using ArcMap	dbDouble	8
Hectares	Hectares per polygon, generated using ArcMap	dbDouble	8
SHAPE_Length	ESRI generated	dbDouble	8
SHAPE_Area	ESRI generated	dbDouble	8

Table Name: fcl_Veg_Specials
Description: The feature class containing point data for vegetation types of special interest to the park too small to delineate with a polygon.

Field Name	Field Description	Field Type	Field Width
OBJECTID	ESRI generated autonumber	dbLong	4
SHAPE	ESRI generated	dbLongBinary	0
PointID	Unique Plot code, used for relating tables (TBL_VEGMAP_INFO)	dbText	15
Map_Unit_ID	The map unit identifier, used by the mappers (aka: grid_code or map class code)	dbText	15
Map_Unit_Common_Name	The name of the map unit (or map class)	dbText	250
Edit_Date	Date of any edits to the point or its attributes	dbText	20
Edit_Notes	Notes regarding any edits to the point or its attributes	dbText	150

Non-spatial tables

Table Name: TBL_ALLIANCE
Description: Contains the alliances for the vegetation polygons by map unit ID.

Field Name	Field Description	Field Type	Field Width
OBJECTID	ESRI generated autonumber	dbLong	4
MapUnit	The map unit identifier, used by the mappers (aka: grid_code or map class code, usually a number)	dbText	12
NVC_ALLIANCE_CODE	The NVC alliance code	dbText	20
ALLIANCE_COMMON_NAME	NVC alliance common name	dbText	250
ALLIANCE_NAME	NVC alliance latin name	dbText	250

Table Name: TBL_ANDERSON_LANDUSE
Description: Contains the Anderson Landuse classes for the vegetation polygons.

Field Name	Field Description	Field Type	Field Width
OBJECTID	ESRI generated autonumber	dbLong	4
Polygon_ID	Unique polygon code, used for relating tables (TBL_VEGMAP_INFO)	dbText	20
LANDUSE	The Anderson landuse classes of the polygon (version 1.5, January 2002)	dbDouble	8
Level_1	Anderson landuse code for level one	dbText	255
L1_Name	Anderson landuse name for level one	dbText	255
Level_2	Anderson landuse code for level two	dbText	50
L2_Name	Anderson landuse name for level two	dbText	255
Level_3	Anderson landuse code for level three	dbText	255
L3_Name	Anderson landuse name for level three	dbText	255
Level_4	Anderson landuse code for level four	dbText	255
L4_Name	Anderson landuse name for level four	dbText	255
Level_5	Anderson landuse code for level five	dbText	255
L5_Name	Anderson landuse name for level five	dbText	255
Level_6	Anderson landuse code for level six	dbText	255
L6_Name	Anderson landuse name for level six	dbText	255

Table Name: TBL_ENVIRONMENT_COVER
Description: Contains ground cover data for the veg points feature class.

Field Name	Field Description	Field Type	Field Width
OBJECTID	ESRI generated autonumber	dbLong	4
COVER_TYPE	Ground cover type	dbText	30
COVER_CODE	Cover code from field sheet - AA & observation points only	dbText	5
COVER_PERCENT	Field estimate to the nearest percentage of ground cover type (plots only).	dbDouble	8
COVER_CODE_RANGE	Cover code range - for plots with non-integer percentages.	dbText	50
COVER_PERCENT_DESC	Description of cover, if "other"	dbText	255
PLOT_CODE	Unique Plot code, used for relating tables	dbText	20

Table Name: TBL_ENVIRONMENT_LANDFORM

Description: Contains landform data for the veg points feature class.

Field Name	Field Description	Field Type	Field Width
OBJECTID	ESRI generated autonumber	dbLong	4
LANDFORM	Landform on which plot is located, any landform could be entered by crew.	dbText	100
PLOT_CODE	Unique Plot code, used for relating tables (TBL_LOCATION_INFO)	dbText	20

Table Name: TBL_FORMATION
Description: Contains NVC formation level data for the vegetation polygons.

Field Name	Field Description	Field Type	Field Width
OBJECTID	ESRI generated autonumber	dbLong	4
MAP_UNIT_ID	The map unit identifier, used by the mappers (aka: grid_code or map class code)	dbText	10
Formation_Code	NVC formation level code	dbText	30
Formation_Name	NVC formation level name	dbText	255

Table Name: TBL_FUELS_DETAIL
Description: Details on stems, height, crown width, and other attributes of trees within plot for the veg points feature class.

Field Name	Field Description	Field Type	Field Width
FuelsDetailID	Unique identifier for record	dbLong	4
FuelsPlotsID	Foreign key to TBL_FUELS_PLOTS	dbLong	4
StemCount	Number of stems measured. Value will be 1 if forest species; >=1 if woodland species.	dbInteger	2
StemDiameter	Diameter in cm of stem(s). If stem count =1 for a forest species, diameter represents dbh. If stem count is >1 for a woodland species, diameter represents the average diameter of all stems measured at crown base.	dbDouble	8
TSN	Taxonomic Serial Number - unique taxon identifier assigned by ITIS	dbDouble	8
Species	Species name	dbText	250
WoodlandCrownWidth	In PJ woodlands, the width of the tree crown at its widest point, in meters to the nearest half-meter	dbDouble	8
WoodlandCrownHeight	In PJ woodlands, distance from the ground to the top of the living tree crown, in meters to the nearest half-meter	dbDouble	8
ForestCrownBaseHeight	In Douglas-fir, ponderosa pine, or other tall tree woodlands, the distance from the ground to the base of the living tree crown, exclusive of dead or single branches, in meters to the nearest half-meter	dbDouble	8
ForestCrownHeight	Same as for woodlands, but for real trees	dbDouble	8
CrownRatio	The ratio of crown height to total tree height.	dbText	12
StructureStage	Describes the place of the tree in the canopy - emergent above the canopy, main canopy, sub canopy, sapling, seedling	dbText	12
Comments	General comments regarding the fuels at a specific plot.	dbText	255
PLOT_CODE	Unique Plot code, used for relating tables (TBL_LOCATION_INFO)	dbText	20

Table Name: TBL_FUELS_PLOTS
Description: Details on stems, height, crown width, and other attributes of trees within plot for the veg points feature class.

Field Name	Field Description	Field Type	Field Width
FuelsPlotsID	Unique identifier for record	dbLong	4
PLOT_CODE	Unique Plot code, used for relating tables (TBL_LOCATION_INFO)	dbText	20
Is_SubPlot	Indicate if measurements are for subplot (if plot has >25 trees, one quadrant (subplot) of plot can be measured for fuels. “-1” = Yes, “0” = No	dbText	4
PPDF_Fuels_Series_Model	n/a for BLCA	dbText	6
PJ_Fuels_Series_Model	n/a for BLCA	dbText	6
SB_Fuels_Series_Model	n/a for BLCA	dbText	6
PJ_Age_Class	If plot contains pinyon and/or juniper, enter value that best describes the age class of the stand	dbText	50
LitterOrigin	Litter measured in cm at origin of plot	dbText	3
LitterNorth	Litter measured in cm at 10 m north of plot center	dbText	3
LitterSouth	Litter measured in cm at 10 m south of plot center	dbText	3
LitterEast	Litter measured in cm at 10 m east of plot center	dbText	3
LitterWest	Litter measured in cm at 10 m west of plot center	dbText	3
DuffOrigin	Duff measured in cm at origin of plot	dbText	3
DuffNorth	Duff measured in cm at 10 m north of plot center	dbText	3
DuffSouth	Duff measured in cm at 10 m south of plot center	dbText	3
DuffEast	Duff measured in cm at 10 m east of plot center	dbText	3
DuffWest	Duff measured in cm at 10 m west of plot center	dbText	3

Table Name: TBL_GPS_INFO
Description: Contains information about the GPS unit and accuracies of data collected for the veg points feature class.

Field Name	Field Description	Field Type	Field Width
OBJECTID	ESRI generated autonumber	dbLong	4
PLOT_ID	Unique Plot code, used for relating tables (TBL_LOCATION_INFO)	dbText	20
GPS_TYPE	Manufacturer / model of GPS unit (e.g., Garmin Etrex or Trimble XM)	dbText	30
UTM_EASTING	UTM easting of plot	dbDouble	8
UTM_NORTHING	UTM northing of plot	dbDouble	8
UTM_ZONE	UTM zone of coordinates	dbText	3
DATUM	Datum of UTM coordinates (NAD83)	dbText	10
GPS_ERROR	Error, in meters, of location data (based on reading from Garmin GPS unit)	dbText	5
DIFF_CORRECTED	Indicates if coordinates have been differentially corrected (from Garmin screen)	dbText	3
GPS_COMMENTS	Any brief comments on GPS data collection at plot.	dbText	255
GPS_QUALITY	Indicates the quality of the GPS unit used (recreational, mapping grade)	dbText	35
PDOP	Positional Dilution Of Precision reading (from Garmin screen)	dbText	30
ERROR_RANGE	General error range, in meters, of the type of GPS unit used.	dbText	20

Table Name: TBL_LOCATION_INFO
Description: Contains data about the location of the point and general observations about the area for the veg points feature class.

Field Name	Field Description	Field Type	Field Width
OBJECTID	ESRI generated autonumber	dbLong	4
PLOT_CODE	Unique Plot code, used for relating tables and feature class (fcl_Veg_Points)	dbText	20
VISIT_DATE	Date the location was visited	dbText	10
SITE_NAME	General Site name given by field crew	dbText	180
PLOT_SHAPE	The shape of the area observed as a point	dbText	20
PLOT_WIDTH	The width of the point (plot and obs only)	dbText	3
PLOT_LENGTH	The length of the point (plot and obs only)	dbText	3
PLOT_DIAMETER	The diameter of the point (plot and obs only)	dbText	5
PLOT_AZIMUTH	The azimuth of the point (plot and obs only)	dbText	5
ASPECT	Aspect of plot	dbText	10
ELEVATION	Elevation of plot in meters, generated by GPS unit	dbDouble	8
SLOPE	Slope of plot measured in degrees	dbText	15
TOPO_POSITION	Topographic position of plot	dbText	50
DIRECTIONS_PLOT	Directions to the location of the plot (plot and obs only)	dbText	255
REPRESENTATIVENESS	The representativeness of the vegetation (at plots and obs only)	dbText	255
OBSERVER	The names of the field crew member(s) observing the site.	dbText	50
IN_PARK	Indicates if the point was inside or outside the park boundary (only applicable to Plots and Observation points, all AA pts inside park. “1” = In Park, “0” = Not in park)	dbBoolean	1
UNIT_CODE	4 letter park code (BLCA)	dbText	10
AERIAL_PHOTO_NO	9X9 photo name on which the point most directly falls (2002 flight, plots & obs only)	dbText	30
STATE_CODE	State (CO)	dbText	2
USGS_NAME	USGS 1:24k Topo Name	dbText	75
COUNTY_NAME	County where plot is located (Montrose or Gunnison County)	dbText	80
PHENOLOGY	Leaf phenology of the dominant stratum. Field is blank for non-vascular plots	dbText	50
PHYSIOGNOMIC_NAME	Physiognomic class of plot	dbText	80
LEAF_TYPE	Leaf form of the dominant stratum.	dbText	80
LEAF_TYPE_COMMENTS	If Leaf Type is "mixed," this field describes the multiple leaf types found in the dominant stratum.	dbText	250
PROVISIONAL_COMM_NAME	Community name (provisional) assigned by field crews by following naming protocols as described in field manual and training (plot and obs only).	dbText	220
ALLIANCE	Alliance corresponding to provisional community name (plots and obs only)	dbText	150
PLANT_SPECIES_COMMENTS	Comments about the plant species observed.	dbText	200
COWARDIN_SYSTEM	If the plot is in a wetland system, select term that best describes its hydrology (Upland,	dbText	40

Field Name	Field Description	Field Type	Field Width
	Palustrine, Riverine, Lacustrine), plot and obs only		
HYDROLOGY	Describes hydrology of plot (plot and obs only)	dbText	40
GEOLOGY	Geologic substrate influencing the plant community (plot and obs only); Surficial geology (AA points)	dbText	60
ENV_COMMENTS	Comments on environmental setting and its effect on the vegetation; also comments on any disturbance or reproduction factors	dbText	255
LANDSCAPE_COMMENTS	Description of landscape context of plot, including any important landscape features influencing the community (plot and obs only)	dbText	255
ANIMAL_USE_COMMENTS	Comments on evidence of use by non-domestic animals in plot area (plot and obs only)	dbText	255
DISTURBANCE_COMMENTS	Comments on evidence of natural or anthropogenic disturbance in plot area, severity and effects on vegetation (plot and obs only)	dbText	255
OTHER_COMMENTS	Other general comments (plot and obs only)	dbText	255
SOIL_TEXTURE	Assessment of average soil texture from sample taken a few inches below the surface (plot and obs only)	dbText	50
SOIL_DRAINAGE	Soil drainage class based on actual moisture content and extent period (plot and obs only)	dbText	30
SOIL_TAXON_DESC	Field used for either identifying soils keyed, or to describe if large rocks or outcrops are present on the surface (plot and obs only)	dbText	255

Table Name: TBL_MAPUNIT_ASSOC
Description: Contains association data for the vegetation polygons by map unit ID.

Field Name	Field Description	Field Type	Field Width
OBJECTID	ESRI generated autonumber	dbLong	4
MapUnitID	The map unit identifier, used by the mappers (aka: grid_code or map class code)	dbText	20
CEGL_Code	NVC association code	dbText	18
AssociationName	The NVC Association name (scientific)	dbText	250
AssociationCommonName	The NVC Association Common name	dbText	250

Table Name: TBL_MAPUNIT_ECOSYS
Description: Contains ecological system data for the vegetation polygons by map unit ID.

Field Name	Field Description	Field Type	Field Width
OBJECTID	ESRI generated autonumber	dbLong	4
MAP_UNIT_ID	The map unit identifier, used by the mappers (aka: grid_code or map class code)	dbText	10
ES_Code	Ecological System code	dbText	30
EcologicalSystemName	Ecological system name (mid-scale classification, larger than associations or alliances, smaller than ecoregions).	dbText	255

Table Name: TBL_PHOTOS
Description: Details on individual photos taken of a point.

Field Name	Field Description	Field Type	Field Width
OBJECTID	ESRI generated autonumber	dbLong	4
PLOT_CODE	Unique Plot code, used for relating tables (TBL_LOCATION_INFO)	dbText	50
PhotoType	Type of photo being referenced.	dbText	16
Photographer	Name of photographer.	dbText	50
PhotoComments	Brief description of photo.	dbText	255
IMAGE_ID	NCPN Photo Database (unique) file name.	dbText	50
PHOTO_PATH	Hard-coded path name to photos (update this field)	dbText	200

Table Name: TBL_STRATUM_SPECIES
Description: Contains species level data by stratum.

Field Name	Field Description	Field Type	Field Width
OBJECTID	ESRI generated autonumber	dbLong	4
TSN	Taxonomic Serial Number - unique taxon identifier assigned by ITIS	dbDouble	8
SPECIES	Latin names of species	dbText	255
PERCENT_COVER	Applicable to AA data only, percent cover by species	dbText	4
COVER_CODE	Cover class code to describe species and strata	dbText	5
COVER_CLASS	Cover class to describe species and strata	dbText	50
DIAGNOSTIC	Check yes if the species is known to be diagnostic of the vegetation type.	dbInteger	2
SPECIMEN_COLLECTED	"yes" (-1) if a specimen of the species was collected.	dbInteger	2
SPECIMEN_NO	The collector's reference number for the specimen collected.	dbText	10
DEAD	Percent cover of dead species seen at plot. Not completed of every species, but always done if diagnostic species.	dbInteger	2
STRATUM_ID	Unique ID, relates to TBL_VEG_STRATA	dbLong	4

Table Name: TBL_VEG_STRATA
Description: Contains stratum data for the veg points feature class.

Field Name	Field Description	Field Type	Field Width
OBJECTID	ESRI generated autonumber	dbLong	4
STRATUM_ID	Links to strata	dbLong	4
STRATUM	Stratum name/type	dbText	20
STRATUM_COVER_CODE	stratum cover code	dbText	5
STRATUM_COVER_CLASS	stratum percentage cover class	dbText	50
STRATUM_HEIGHT_CODE	stratum height code	dbText	5
STRATUM_HEIGHT_CLASS	stratum height class in meters	dbText	50
PLOT_CODE	Unique Plot code, used for relating tables (TBL_STRATUM_SPECIES)	dbText	15

Table Name: TBL_VEGASSOC_INFO
Description: Contains association data for all points (plots, obs, and AA points) in the veg points feature class.

Field Name	Field Description	Field Type	Field Width
OBJECTID	ESRI generated autonumber	dbLong	4
PLOT_CODE	Unique Plot code, used for relating tables	dbText	35
CEGL_CODE	CEGL (association) code	dbText	10
ASSOCIATION	Association corresponding to provisional community name	dbText	180
FIELD_KEY_NAME	Yes if association name was chosen from field key	dbText	10
CREATED_NAME	Yes if no name really fits from the field key, the surveyor will create a new name.	dbText	10
POST_AA_FIELD_NAME	Yes if association name was assigned after AA field work, based on species lists and comments fields -- during AA meetings.	dbText	10
ASSOC_RANK	Rank of vegetation association (primary, secondary, tertiary)	dbText	50
OTHER_ASSOC_50M	Other associations noted in a 50meter area beyond plot	dbText	200

Table Name: TBL_VEGMAP_INFO
Description: Contains map unit level data for each vegetation map unit polygon.

Field Name	Field Description	Field Type	Field Width
OBJECTID	ESRI generated autonumber	dbLong	4
Polygon_ID	Unique polygon code, used for relating tables and feature classes (fcl_Veg_polys)	dbText	30
Map_Unit_ID	The map unit identifier, used by the mappers (aka: grid_code or map class code)	dbText	10
Map_Unit_Code	NCPN code (e.g., W-PJQU)	dbText	10
Map_Unit_Common_Name	The name of the map unit (or map class)	dbText	250
Cover_Code	n/a for BLCA	dbText	1
COVER_PATTERN	n/a for BLCA	dbText	100
Density_Code	Density value code	dbText	1
DENSITY_CLASS	Density of Forest/Woodland vegetation, and density for sagebrush communities per polygon.	dbText	100
Height_Code	n/a for BLCA	dbText	1
HEIGHT_CLASS	n/a for BLCA	dbText	100
USER_ACCURACY	User accuracy of the map unit (determined during AA meetings). N/A means the class was not accuracy assessed.	dbText	3
FUELS_TYPE	Fuels vegetation types (if applicable)	dbText	50
FUELS_VERIFICATION	Fuels verification (if applicable)	dbText	255
VEGMAP_COMMENTS	Any comments about the particular polygon or map class.	dbText	255
MAP_UNIT_PDF	File name of pdf describing map unit (class)	dbText	50
MAP_UNIT_PDF_PATH	Hard-coded link to Map Unit description PDF document - path name (e.g. C:/BLCA/Vegetation/Map classDescriptions/ W-PJQU_mu99.pdf)	dbText	250

Table Name: TBL_VEGMAP_MODIFIERS
Description: Contains modifiers for the vegetation map unit polygons.

Field Name	Field Description	Field Type	Field Width
OBJECTID	ESRI generated autonumber	dbLong	4
Polygon_ID	Unique polygon code, used for relating tables (TBL_VEGMAP_INFO)	dbText	20
MODIFIER	Modifier code (one lower case letter)	dbText	12
MODIFIER_NAME	Name/type of modifier	dbText	50
MODIFIER_DESCRIPTION	Description of modifier	dbText	255

Appendix D. Plant Species List and Crosswalk

Three hundred twenty-two vascular plant species representing 56 families were noted during plot, observation point and accuracy assessment point data collection at Black Canyon National Park (BLCA). The Northern Colorado Plateau Network uses three taxonomic authorities for vascular plants: Welsh et al. 2003 as the nomenclatural authority for Utah parks, Weber and Wittmann 2001 for Colorado parks, and Dorn and Lichvar 1984 for the single park in Wyoming; the BLCA vegetation mapping project database reflects scientific names as assigned by Welsh. These names are crosswalked to Kartesz 1999, which is the nomenclatural authority used by NatureServe for the National Vegetation Classification. Scientific and common names used by NatureServe are presented in this crosswalk; these names are used throughout the BLCA vegetation mapping report and in the individual association descriptions in Appendix F. The taxonomic serial number (TSN) assigned by the Integrated Taxonomic Information System (ITIS) is provided for each species

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VASCULAR PLANTS

Family	Scientific Name (Welsh et al. 2003)	Scientific Name (Kartesz 1999)	Common Name (NatureServe)	TSN
Aceraceae	*Acer glabrum* Torr.	*Acer glabrum*	Rocky Mountain maple	28742
	Acer negundo L.	*Acer negundo*	boxelder	28749
Agavaceae	*Yucca harrimaniae* Trel.	*Yucca harrimaniae*	Spanish bayonet	43144
Anacardiaceae	*Rhus aromatica* var. *trilobata* (Nutt.) Gray ex. S. Wats.	*Rhus trilobata* var. *trilobata*	skunkbush sumac	530014
	Toxicodendron rydbergii (Small ex Rydb.) Greene	*Toxicodendron rydbergii*	western poison ivy	28822
Apiaceae	*Cymopterus bulbosus* A. Nels.	*Cymopterus bulbosus*	bulbous springparsley	29631
	Cymopterus planosus (Osterhout) Mathias	*Cymopterus planosus*	Rocky Mountain springparsley	29652
	Cymopterus purpureus S. Wats.	*Cymopterus purpureus*	purple springparsley	29654
	Cymopterus Raf.	*Cymopterus* sp.	springparsley	29625
	Ligusticum L.	*Ligusticum* sp.	ligusticum	29523
	Ligusticum porteri Coult. & Rose	*Ligusticum porteri*	Porter's licoriceroot	29532
	Lomatium dissectum (Nutt.) Mathias & Constance	*Lomatium dissectum*	fernleaf biscuitroot	503534
	Lomatium Raf.	*Lomatium* sp.	biscuitroot	29677
	Lomatium simplex var. *simplex* (Nutt.) J.F. Macbr.	*Lomatium simplex* var. *simplex*	Great Basin desertparsley	528884
	Oryzopsis micrantha (Trin. & Rupr.) Thurb.	*Piptatherum micranthum*	littleseed ricegrass	41989
	Osmorhiza berteroi DC.	*Osmorhiza berteroi*	sweet cicely	507093
Asclepiadaceae	*Asclepias* L..	*Asclepias*	milkweed	30240
Asteraceae	*Achillea millefolium* L..	*Achillea millefolium*	common yarrow	35423
	Agoseris glauca var. *laciniata* (D.C. Eat.) Smiley	*Agoseris glauca* var. *laciniata*	false agoseris	182410
	Antennaria dimorpha (Nutt.) Torr. & Gray	*Antennaria dimorpha*	low pussytoes	36727
	Antennaria parvifolia Nutt.	*Antennaria parvifolia*	small-leaf pussytoes	36749
	Antennaria rosea Greene	*Antennaria rosea*	rosy pussytoes	36754
	Arctium minus Bernh.	*Arctium minus*	lesser burdock	36546
	Arnica cordifolia Hook.	*Arnica cordifolia*	heartleaf arnica	36561
	Artemisia dracunculus L.	*Artemisia dracunculus*	wild tarragon	35462
	Artemisia frigida Willd.	*Artemisia frigida*	fringed sagebrush	35465
	Artemisia L..	*Artemisia* sp.	sagebrush	35431
	Artemisia ludoviciana Nutt.	*Artemisia ludoviciana*	white sagebrush	35474
	Artemisia michauxiana Bess.	*Artemisia michauxiana*	Michaux's wormwood	35479
	Artemisia nova A. Nels.	*Artemisia nova A.*	black sagebrush	500971

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Asteraceae	*Artemisia tridentata* Nutt.	*Artemisia tridentata*	big sagebrush	35498
	Artemisia tridentata ssp. *vaseyana* (Rydb.) Beetle	*Artemisia tridentata* ssp. *vaseyana*	mountain big sagebrush	183740
	Artemisia tridentata ssp. *wyomingensis* Beetle & Young	*Artemisia tridentata ssp. wyomingensis*	Wyoming big sagebrush	183741
	Aster foliaceus DC.	*Symphyotrichum foliaceum*	alpine leafybract aster	522208
	Aster L..	*Aster* sp.	aster	35510
	Aster laeve L.	*Symphyotrichum laeve*	smooth blue aster	522218
	Balsamorhiza sagittata (Pursh) Nutt.	*Balsamorhiza sagittata*	arrowleaf balsamroot	36818
	Brickellia Ell.	*Brickellia* sp.	brickellbush	36859
	Brickellia grandiflora (Hook.) Nutt.	*Brickellia grandiflora*	tasselflower brickellbush	36878
	Carduus nutans L.	*Carduus nutans*	nodding plumeless thistle	35787
	Centaurea cyanus L.	*Centaurea cyanus*	garden cornflower	36954
	Chaenactis douglasii (Hook.) Hook. & Arn.	*Chaenactis douglasii*	Douglas' dustymaiden	36987
	Chaetopappa ericoides (Torr.) Nesom	*Chaetopappa ericoides*	rose heath	501376
	Chrysopsis villosa (Pursh) Nutt. ex DC	*Heterotheca villosa*	hairy false goldenaster	37689
	Chrysothamnus depressus Nutt.	*Chrysothamnus depressus*	longflower rabbitbrush	37051
	Chrysothamnus greenei (Gray) Greene	*Chrysothamnus greenei*	Greene’s rabbitbrush	37052
	Chrysothamnus nauseosus (Pallas ex Pursh) Britt.	*Ericameria nauseosa*	rubber rabbitbrush	507594
	Chrysothamnus Nutt.	*Chrysothamnus* sp.	rabbitbrush	37048
	Chrysothamnus parryi (Gray) Greene	*Chrysothamnus parryi*	Parry's rabbitbrush	37071
	Chrysothamnus viscidiflorus (Hook.) Nutt.	*Chrysothamnus viscidiflorus*	yellow rabbitbrush	37090
	Cirsium arvense (L.) Scop.	*Cirsium arvense*	Canada thistle	36335
	Cirsium P. Mill.	*Cirsium* sp.	thistle	36334
	Cirsium undulatum var. *tracyi* (Rydb.) Welsh	*Cirsium* var. *tracyi*	Tracy's thistle	36420
	Crepis acuminata Nutt.	*Crepis acuminata*	tapertip hawksbeard	37169
	Crepis L..	*Crepis* sp.	hawksbeard	37168
	Crepis modocensis Greene	*Crepis modocensis*	Modoc hawksbeard	37186
	Erigeron concinnus (Hook. & Arn.) Torr. & Gray	*Erigeron concinnus*	Navajo fleabane	502385
	Erigeron divergens Torr. & Gray	*Erigeron divergens*	spreading fleabane	35852
	Erigeron engelmannii A. Nels.	*Erigeron engelmannii*	Engelmann's fleabane	35859
	Erigeron flagellaris Gray	*Erigeron flagellaris*	trailing fleabane	35865
	Erigeron L.	*Erigeron* sp.	fleabane	35803
	Erigeron peregrinus (Banks ex Pursh) Greene	*Erigeron peregrinus*	subalpine fleabane	35921

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Asteraceae	*Erigeron pumilus* Nutt.	*Erigeron pumilus*	shaggy fleabane	35934
	Erigeron speciosus (Lindl.) DC.	*Erigeron speciosus*	aspen fleabane	35950
	Gutierrezia microcephala (DC.) Gray	*Gutierrezia microcephala*	threadleaf snakeweed	37482
	Gutierrezia sarothrae (Pursh) Britt. & Rusby	*Gutierrezia sarothrae*	broom snakeweed	37483
	Haplopappus acaulis (Nutt.) Gray	*Stenotus acaulis*	stemless mock goldenweed	505369
	Haplopappus armerioides (Nutt.) Gray	*Stenotus armerioides*	thrift mock goldenweed	505370
	Haplopappus Cass.	*Stenotus* sp.	haplopappus	37497
	Heliomeris multiflora Nutt.	*Heliomeris multiflora*	showy goldeneye	37603
	Hymenopappus filifolius Hook.	*Hymenopappus filifolius*	fineleaf hymenopappus	37766
	Hymenoxys acaulis (Pursh) Parker	*Tetraneuris acaulis*	stemless four-nerve daisy	38508
	Hymenoxys torreyana (Nutt.) Parker	*Tetraneuris torreyana*	Torrey's four-nerve daisy	515002
	Machaeranthera canescens (Pursh) Gray	*Machaeranthera canescens*	hoary tansyaster	37984
	*Machaeranthera gracilis (*Nutt.) Shinners	*Machaeranthera gracilis*	slender goldenweed	37991
	Machaeranthera grindelioides (Nutt.) Shinners	*Machaeranthera grindelioides*	rayless tansyaster	37992
	Petradoria pumila (Nutt.) Greene	*Petradoria pumila*	grassy rockgoldenrod	38233
	Senecio integerrimus Nutt.	*Senecio integerrimus*	lambstongue groundsel	36148
	Senecio L..	*Senecio* sp.	ragwort	36084
	Senecio multilobatus Torr. & Gray ex Gray	*Packera multilobata*	lobeleaf groundsel	36161
	Senecio tridenticulatus Rydb.	*Packera tridenticulata*	threetooth ragwort	-999002
	Solidago L.	*Solidago*	goldenrod	36223
	Solidago velutina DC.	*Solidago velutina*	threenerve goldenrod	505290
	Taraxacum officinale G.H. Weber ex Wiggers	*Taraxacum officinale*	dandelion	36213
	Tetradymia canescens DC.	*Tetradymia canescens*	spineless horsebrush	38494
	Tetradymia spinosa Hook. & Arn.	*Tetradymia spinosa*	shortspine horsebrush	38499
	Townsendia Hook.	*Townsendia*	Townsend daisy	38536
	Townsendia incana Nutt.	*Townsendia incana*	hoary Townsend daisy	38549
	Tragopogon dubius Scop.	*Tragopogon dubius*	yellow salsify	38564
	Wyethia amplexicaulis (Nutt.) Nutt.	*Wyethia amplexicaulis*	mulesear wyethia	38674
	Wyethia Nutt.	*Wyethia* sp.	wyethia	38673
	Xylorhiza venusta (M.E. Jones) Heller	*Xylorhiza venusta*	charming woodyaster	38701
Berberidaceae	*Mahonia fremontii* (Torr.) Fedde	*Mahonia fremontii*	Fremont's mahonia	195033

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	Mahonia repens (Lindl.) G. Don	*Mahonia repens*	creeping barberry	195045
Boraginaceae	*Cryptantha flavoculata* (A. Nels.) Payson	*Cryptantha flavoculata*	roughseed cryptantha	31809
	Cryptantha Lehm. ex G. Don	*Cryptantha*	cryptantha	31765
	Lappula occidentalis (S. Wats.) Greene	*Lappula occidentalis*	beggar's tick	528678
	Lappula squarrosa (Retz.) Dumort.	*Lappula squarrosa*	European stickseed	503330
	Lithospermum L.	*Lithospermum* sp.	stoneseed	31937
	Lithospermum ruderale Dougl. ex Lehm.	*Lithospermum ruderale*	western stoneseed	31953
	Mertensia brevistyla S. Wats.	*Mertensia brevistyla*	shortstyle bluebells	31676
	Mertensia Roth	*Mertensia* sp.	bluebells	31660
Brassicaceae	*Alyssum alyssoides* (L.) L.	*Alyssum alyssoides*	pale madwort	23030
	Alyssum minus (L.) Rothm.	*Alyssum simplex*	alyssum	508080
	Alyssum minus var. micranthum (C.A. Mey.) Dudley	*Alyssum simplex*	alyssum	531468
	Arabis crandallii B.L. Robins.	*Arabis crandallii*	Crandall's rockcress	22682
	Arabis drummondii Gray	*Arabis drummondii*	Drummond's rockcress	22689
	Arabis fendleri (S. Wats.) Greene	*Arabis fendleri*	Fendler's rockcress	22690
	Arabis glabra (L.) Bernh.	*Arabis glabra*	tower rockcress	22695
	Arabis gunnisoniana Rollins	*Arabis gunnisoniana*	Gunnison's rockcress	22698
	Arabis hirsuta (L.) Scop.	*Arabis hirsuta*	hairy rockcress	184344
	Arabis holboellii var. *retrofracta* (Graham) Rydb.	*Arabis holboellii* var. *retrofracta*	second rockcress	184362
	Arabis L.	*Arabis* sp.	rockcress	22671
	Arabis lignifera A. Nels.	*Arabis lignifera*	desert rockcress	22708
	Arabis oxylobula Greene	*Arabis oxylobula*	Glenwood Springs rockcress	22716
	Arabis pallidifolia Rollins	*Arabis pallidifolia*	Gunnison County rockcress	507688
	Arabis selbyi Rydb.	*Arabis selbyi*	Selby's rockcress	22731
	Capsella bursa-pastoris (L.) Medik.	*Capsella bursa-pastoris*	shepherd's purse	22766
	Descurainia pinnata (Walt.) Britt.	*Descurainia pinnata*	western tansymustard	22826
	Descurainia pinnata ssp. *filipes* (Gray) Detling	*Descurainia pinnata* ssp. *filipes*	western tansymustard	22829
	Descurainia pinnata ssp. *nelsonii (Rydb.) Detling*	*Descurainia pinnata* ssp. *nelsonii*	Nelson's tansymustard	22834
	Draba cuneifolia Nutt. ex Torr. & Gray	*Draba cuneifolia*	wedgeleaf draba	22874
	Erysimum asperum (Nutt.) DC.	*Erysimum asperum*	western wall flower	22931
	Erysimum capitatum (Dougl. ex Hook.) Greene	*Erysimum capitatum*	sanddune wallflower	22932
	Erysimum cheiranthoides L..	*Erysimum cheiranthoides*	wormseed mustard	22933

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	Erysimum inconspicuum (S. Wats.) MacM.	*Erysimum inconspicuum*	shy wallflower	502432
	Erysimum L.	*Erysimum* sp.	wallflower	22926
Brassicaceae	*Lepidium* L.	*Lepidium*	pepperweed	22953
	Lepidium montanum Nutt.	*Lepidium montanum*	mountain pepperweed	503381
	Malcolmia africana (L.) Ait. f.	*Malcolmia africana*	African mustard	23243
	Physaria (Nutt. ex Torr. & Gray) Gray	*Physaria*	twinpod	23269
	Physaria acutifolia Rydb.	*Physaria acutifolia*	sharpleaf twinpod	23270
	Physaria rectipes (Woot. & Stan.) O'Kane & Al-Shehbaz	*Lesquerella rectipes*	straight bladderpod	-14
	Physaria rollinsii Mulligan	*Physaria rollinsii*	Rollins' twinpod	23284
	Schoenocrambe linearifolia (Gray) Rollins	*Schoenocrambe linearifolia*	slimleaf plainsmustard	195791
	Schoenocrambe linifolia (Nutt.) Greene	*Schoenocrambe linifolia*	flaxleaf plainsmustard	23296
	Sisymbrium altissimum L.	*Sisymbrium altissimum*	tall tumblemustard	23312
	Stanleya albescens M.E. Jones	*Stanleya albescens*	white princesplume	23326
	Streptanthus cordatus Nutt.	*Streptanthus cordatus*	heartleaf twistflower	23348
Cactaceae	*Echinocereus coccineus* Engelm.	*Echinocereus coccineus*	scarlet hedgehog cactus	502202
	Echinocereus triglochidiatus Engelm.	*Echinocereus triglochidiatus*	kingcup cactus	19815
	Opuntia fragilis (Nutt.) Haw.	*Opuntia fragilis*	brittle pricklypear	19707
	Opuntia polyacantha Haw.	*Opuntia polyacantha*	plains pricklypear	19726
	Pediocactus simpsonii (Engelm.) Britt. & Rose	*Pediocactus simpsonii*	Simpson's hedgehog cactus	19776
Caprifoliaceae	*Symphoricarpos oreophilus* Gray	*Symphoricarpos oreophilus*	mountain snowberry	35338
	Symphoricarpos rotundifolius Gray	*Symphoricarpos oreophilus*	roundleaf snowberry	35341
Caryophyllaceae	*Arenaria congesta* Nutt.	*Arenaria congesta*	ballhead sandwort	20243
	Arenaria fendleri Gray	*Arenaria fendleri*	Fendler's sandwort	20245
	Arenaria hookeri Nutt.	*Arenaria hookeri*	Hooker's sandwort	20247
	Phlox longifolia Nutt.	*Phlox longifolia*	longleaf phlox	30956
	Pseudostellaria jamesiana (Torr.) W.A. Weber & R.L. Hartman	*Pseudostellaria jamesiana*	tuber starwort	20358
Celastraceae	*Paxistima myrsinites* (Pursh) Raf.	*Paxistima myrsinites*	mountain lover	504149
Chenopodiaceae	*Atriplex canescens* (Pursh) Nutt.	*Atriplex canescens*	fourwing saltbush	20518
	Atriplex confertifolia (Torr. & Frém.) S. Wats.	*Atriplex confertifolia*	shadscale saltbush	20519
	Atriplex corrugata S. Wats.	*Atriplex corrugata*	mat saltbush	20522
	Atriplex gardneri (Moq.) D. Dietr.	*Atriplex gardneri*	Gardner's saltbush	20531

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	Chenopodium album L.	*Chenopodium album*	lambsquarters	20592
	Chenopodium atrovirens Rydb.	*Chenopodium atrovirens*	pinyon goosefoot	20593
	Chenopodium foliosum (Moench) Aschers.	*Chenopodium foliosum*	leafy goosefoot	20606
Chenopodiaceae	*Chenopodium fremontii* S. Wats.	*Chenopodium fremontii*	Fremont's goosefoot	20607
	Chenopodium L.	*Chenopodium*	goosefoot	20589
	Krascheninnikovia lanata (Pursh) A.D.J. Meeuse & Smit	*Krascheninnikovia lanata*	winterfat	503290
	Sarcobatus vermiculatus (Hook.) Torr.	*Sarcobatus vermiculatus*	greasewood	20707
Convolvulaceae	*Convolvulus arvensis* L..	*Convolvulus arvensis*	field bindweed	30705
Crassulaceae	*Sedum lanceolatum* Torr.	*Sedum lanceolatum*	lanceleaf stonecrop	24126
Crossosomataceae	*Glossopetalon spinescens* var. *meionandrum* (Koehne) Trel.	*Glossopetalon spinescens* var. *meionandrum*	spiny greasebush	528523
Cupressaceae	*Juniperus osteosperma* (Torr.) Little	*Juniperus osteosperma*	Utah juniper	194859
	Juniperus scopulorum Sarg.	*Juniperus scopulorum*	Rocky Mountain juniper	194872
Cyperaceae	*Carex duriuscula* C.A. Mey.	*Carex duriuscula*	needleleaf sedge	501216
	Carex egglestonii Mackenzie	*Carex egglestonii*	Eggleston's sedge	39585
	Carex geyeri Boott	*Carex geyeri*	elk sedge	39613
	Carex L..	*Carex* sp.	sedge	39369
	Carex rossii Boott	*Carex rossii*	Ross' sedge	39786
	Carex vallicola **Dewey**	*Carex vallicola*	valley sedge	39860
Ephedraceae	*Ephedra viridis* Coville	*Ephedra viridis*	Mormon-tea	502319
Equisetaceae	*Equisetum hyemale* var. *affine* (Engelm.) A.A. Eat.	*Equisetum hyemale* var. *affine*	scouringrush horsetail	527892
Ericaceae	*Arctostaphylos uva-ursi* (L.) Spreng	*Arctostaphylos uva-ursi*	kinnikinnick	23530
Euphorbiaceae	*Euphorbia fendleri* Torr. & Gray	*Chamaesyce fendleri*	Fendler's sandmat	501419
	Tragia ramosa Torr.	*Tragia ramosa*	branched noseburn	28433
Fabaceae	*Astragalus* L..	*Astragalus* sp.	milkvetch	25392
	Astragalus convallarius Greene	*Astragalus convallarius*	timber milkvetch	25477
	Astragalus falcatus Lam.	*Astragalus falcatus*	Russian milkvetch	25513
	Astragalus nuttallianus DC.	*Astragalus nuttallianus*	smallflowered milkvetch	25607
	Astragalus oophorus S. Wats.	*Astragalus oophorus*	egg milkvetch	25616
	Astragalus tenellus Pursh	*Astragalus tenellus*	looseflower milkvetch	25696
	Lathyrus L..	*Lathyrus* sp.	Peavine	25834
	Lathyrus lanszwertii var. *leucanthus* (Rydb.) Dorn	*Lathyrus lanszwertii* var. *leucanthus*	aspen peavine	528691
	Lupinus argenteus Pursh	*Lupinus argenteus*	silvery lupine	503575

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	Lupinus bakeri Greene	*Lupinus bakeri*	Baker's lupine	25961
	Lupinus caudatus Kellogg	*Lupinus caudatus*	tailcup lupine	25981
	Lupinus L..	*Lupinus* sp.	lupine	25916
Fabaceae	*Medicago sativa* L.	*Medicago sativa*	alfalfa	183623
	Melilotus officinalis (L.) Lam.	*Melilotus officinalis*	yellow sweetclover	26204
	Trifoium L.	*Trifolium* sp.	clover	504645
	Trifolium pratense L.	*Trifolium pratense*	red clover	26313
	Vicia americana Muhl. ex Willd.	*Vicia americana*	American vetch	26331
Fagaceae	*Quercus gambelii* Nutt.	*Quercus gambelii*	Gambel oak	19337
Fumariaceae	*Corydalis aurea* Willd.	*Corydalis aurea*	scrambled eggs	18999
Geraniaceae	*Erodium cicutarium* (L.) L'Hér. ex Ait.	*Erodium cicutarium*	redstem stork's bill	29147
	Geranium L.	*Geranium* sp.	geranium	29104
Grossulariaceae	*Ribes cereum* Dougl.	*Ribes cereum*	wax currant	24457
	Ribes inerme Rydb.	*Ribes inerme*	whitestem gooseberry	24473
	Ribes L..	*Ribes* sp.	currant	24448
	Ribes leptanthum Gray	*Ribes leptanthum*	trumpet gooseberry	24479
	Ribes wolfii Rothrock	*Ribes wolfii*	Wolf's currant	24512
Hydrangeaceae	*Fendlera rupicola* Gray	*Fendlera rupicola*	cliff fendlerbush	24331
	Fendlerella utahensis (S. Wats.) Heller	*Fendlerella utahensis*	Utah fendlerbush	24334
	Philadelphus microphyllus Gray	*Philadelphus microphyllus*	littleleaf mock orange	24437
Hydrophyllaceae	*Hydrophyllum capitatum* Dougl. ex Benth.	*Hydrophyllum capitatum*	ballhead waterleaf	31391
	Phacelia constancei	*Phacelia constancei*	Constance's phacelia	31474
Juncaceae	*Juncus arcticus* Willd.	*Juncus arcticus*	arctic rush	39222
	Juncus L..	*Juncus* sp.	rush	39220
Liliaceae	*Allium* L.	*Allium* sp.	onion	42634
	Allium acuminatum Hook.	*Allium acuminatum*	tapertip onion	42707
	Allium textile A. Nels. & J.F. Macbr.	*Allium textile*	wild onion	42670
	Calochortus nuttallii Torr. & Gray	*Calochortus nuttallii*	sego lily	42863
	Calochortus Pursh	*Calochortus* sp.	mariposa lily	42823
	Smilacina racemosa (L.) Desf.	*Maianthemum racemosum*	feathery false lily of the valley	43036
	Smilacina stellata (L.) Desf.	*Maianthemum stellatum*	starry false lily of the valley	43038
	Zigadenus venenosus S. Wats.	*Zigadenus venenosus*	meadow deathcamas	43168

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Linaceae	*Linum lewisii* Pursh	*Linum lewisii*	Lewis flax	29214
	Linum perenne var. *lewisii* (Pursh) Eat. & J. Wright	*Linum lewisii* var. *lewisii*	prairie flax	528819
Malvaceae	*Sphaeralcea coccinea* (Nutt.) Rydb.	*Sphaeralcea coccinea*	scarlet globemallow	21920
Nyctaginaceae	*Mirabilis linearis* (Pursh) Heimerl	*Mirabilis linearis*	narrowleaf four o'clock	19651
Oleaceae	*Fraxinus anomala* Torr. ex S. Wats.	*Fraxinus anomala*	singleleaf ash	32937
Onagraceae	*Gayophytum* A. Juss.	*Gayophytum*	groundsmoke	27669
	Gayophytum diffusum Torr. & Gray	*Gayophytum diffusum*	spreading groundsmoke	27671
	Oenothera caespitosa Nutt.	*Oenothera caespitosa*	tufted evening-primrose	565328
Pinaceae	*Pinus edulis* Engelm.	*Pinus edulis*	twoneedle pinyon	183336
	Pseudotsuga menziesii (Mirbel) Franco	*Pseudotsuga menziesii*	Douglas-fir	183424
Plantaginaceae	*Plantago patagonica* Jacq.	*Plantago patagonica*	woolly plantain	32907
Poaceae	*Agropyron cristatum* (L.) Gaertn.	*Agropyron cristatum*	crested wheatgrass	182478
	Agrostis gigantea Roth	*Agrostis gigantea Roth*	redtop	40414
	Aristida purpurea Nutt.	*Aristida purpurea*	purple threeawn	41429
	Bouteloua gracilis (Willd. ex Kunth) Lag. ex Griffiths	*Bouteloua gracilis*	blue grama	41493
	Bromus inermis Leyss.	*Bromus inermis*	smooth brome	40502
	Bromus L.	*Bromus* sp.	brome	40478
	Bromus tectorum L.	*Bromus tectorum*	cheatgrass	40524
	Calamagrostis scopulorum M.E. Jones	*Calamagrostis scopulorum*	ditch reedgrass	40566
	Dichanthelium oligosanthes var. *scribnerianum* (Nash) Gould	*Dichanthelium oligosanthes* var. *scribnerianum*	Scribner's rosette grass	527696
	Elymus elymoides (Raf.) Swezey	*Elymus elymoides*	squirreltail	502264
	Elymus repens (L.) Gould	*Elymus repens*	quackgrass	512839
	Elymus salinus M.E. Jones	*Leymus salinus*	saline wildrye	512841
	Elymus smithii (Rydb.) Gould	*Pascopyrum smithii*	western wheatgrass	512844
	Elymus spicatus (Pursh) Gould	*Pseudoroegneria spicata*	bluebunch wheatgrass	512845
	Elymus trachycaulus (Link) Gould ex Shinners	*Elymus trachycaulus*	slender wheatgrass	502282
	Festuca arizonica Vasey	*Festuca arizonica*	Arizona fescue	40809
	Festuca saximontana Rydb.	*Festuca saximontana*	Rocky Mountain fescue	502611
	Hilaria jamesii (Torr.) Benth.	*Pleuraphis jamesii*	James' galleta	41768
	Koeleria macrantha (Ledeb.) J.A. Schultes	*Koeleria macrantha*	Junegrass	503284
	Phalaris arundinacea L..	*Phalaris arundinacea*	reed canarygrass	41335
	Poa arida Vasey	*Poa arida*	plains bluegrass	41109

Family	Scientific Name (Welsh et al. 2003)	Scientific Name (Kartesz 1999)	Common Name (NatureServe)	TSN
	Poa bigelovii Vasey & Scribn.	*Poa bigelovii*	Bigelow's bluegrass	41112
	Poa compressa L.	*Poa compressa*	Canada bluegrass	41082
	Poa cusickii Vasey	*Poa cusickii*	Cusick's bluegrass	41121
	Poa fendleriana (Steud.) Vasey	*Poa fendleriana*	muttongrass	504467
Poaceae	*Poa* L..	*Poa* sp.	bluegrass	41074
	Poa pratensis L.	*Poa pratensis*	Kentucky bluegrass	41088
	Poa secunda J. Presl	*Poa secunda*	Sandberg bluegrass	41103
	Sporobolus cryptandrus (Torr.) Gray	*Sporobolus cryptandrus*	sand dropseed	42132
	Stipa L.	obsolete	needlegrass	42158
	Stipa comata Trin. & Rupr.	*Hesperostipa comata*	needle and thread	42172
	Stipa hymenoides Roemer & J.A. Schultes	*Achnatherum hymenoides*	Indian ricegrass	522063
	Stipa lettermanii Vasey	*Achnatherum lettermanii*	Letterman needlegrass	522065
	Stipa nelsonii Scribn.	*Achnatherum nelsonii*	Nelson needlegrass	42182
	Stipa pinetorum M.E. Jones	*Achnatherum pinetorum*	Pine needlegrass	42188
Polemoniaceae	*Collomia linearis* Nutt.	*Collomia linearis*	tiny trumpet	31041
	Gilia inconspicua (Sm.) Sweet	*Gilia inconspicua*	shy gilia	31127
	Gilia pinnatifida Nutt. ex Gray	*Aliciella pinnatifida*	Sticky gilia	31168
	Ipomopsis aggregata (Pursh) V. Grant	*Ipomopsis aggregata*	scarlet gilia	31192
	Linanthus septentrionalis Mason	*Linanthus septentrionalis*	northern linanthus	31277
Polygonaceae	*Eriogonum* Michx.	*Eriogonum*	buckwheat	21054
	Eriogonum alatum Torr.	*Eriogonum alatum*	winged buckwheat	21057
	Eriogonum gordonii Benth.	*Eriogonum gordonii*	Gordon's buckwheat	21138
	Eriogonum leptocladon Torr. & Gray	*Eriogonum leptocladon*	sand buckwheat	21179
	Eriogonum lonchophyllum Torr. & Gray	*Eriogonum lonchophyllum*	spearleaf buckwheat	21185
	Eriogonum racemosum Nutt.	*Eriogonum racemosum*	redroot buckwheat	21230
	Eriogonum umbellatum ssp. *subaridum* (S. Stokes) Munz	*Eriogonum umbellatum* ssp. *subaridum*	sulphur-flower buckwheat	195621
	Eriogonum umbellatum Torr.	*Eriogonum umbellatum*	sulphur-flower buckwheat	21266
	Polygonum douglasii Greene	*Polygonum douglasii*	Douglas' knotweed	20891
	Rumex crispus L.	*Rumex crispus*	curly dock	20937
Primulaceae	*Androsace septentrionalis* L..	*Androsace septentrionalis*	pygmy rockjasmine	23935
Ranunculaceae	*Aquilegia micrantha* Eastw.	*Aquilegia micrantha*	Mancos columbine	18743
	Clematis hirsutissima Pursh	*Clematis hirsutissima*	sugarbowls	18699

Family	Scientific Name (Welsh et al. 2003)	Scientific Name (Kartesz 1999)	Common Name (NatureServe)	TSN
	Delphinium L.	*Delphinium*	larkspur	18457
	Delphinium nuttallianum Pritz. ex Walp.	*Delphinium nuttallianum*	twolobe larkspur	18483
	Delphinium ramosum Rydb.	*Delphinium ramosum*	mountain larkspur	18503
	Ranunculus testiculatus Crantz	*Ceratocephala testiculata*	curveseed butterwort	501365
Rosaceae	*Amelanchier alnifolia* (Nutt.) Nutt. ex M. Roemer	*Amelanchier alnifolia*	Saskatoon serviceberry	25109
Rosaceae	*Amelanchier utahensis* Koehne	*Amelanchier utahensis*	Utah serviceberry	25121
	Cercocarpus montanus Raf.	*Cercocarpus montanus*	alderleaf mountain mahogany	25136
	Holodiscus dumosus (Nutt. ex Hook.) Heller	*Holodiscus dumosus*	rockspirea	25178
	Peraphyllum ramosissimum Nutt.	*Peraphyllum ramosissimum*	squawapple	25270
	Prunus virginiana L..	*Prunus virginiana*	chokecherry	24806
	Purshia tridentata (Pursh) DC.	*Purshia tridentata*	antelope bitterbrush	25290
	Rosa woodsii Lindl.	*Rosa woodsii*	Woods' rose	24847
	Rubus idaeus ssp. *strigosus* (Michx.) Focke	*Rubus idaeus* ssp. *strigosus*	grayleaf raspberry	524636
Rubiaceae	*Galium aparine* L..	*Galium aparine*	catchweed bedstraw	34797
	Galium boreale L..	*Galium boreale*	northern bedstraw	565204
	Galium coloradoense W. Wight	*Galium coloradoens*	Colorado bedstraw	34847
Salicaceae	*Populus tremuloides* Michx.	*Populus tremuloides*	quaking aspen	195773
	Salix exigua Nutt.	*Salix exigua*	narrowleaf willow	22529
Santalaceae	*Comandra umbellata* (L.) Nutt.	*Comandra umbellata*	bastard toadflax	501614
Saxifragaceae	*Heuchera* L.	*Heuchera* sp.	alumroot	24337
	Saxifraga bronchialis ssp. *austromontana* (Wieg.) Piper	*Saxifraga bronchialis* ssp. *austromontana*	matted saxifrage	524663
	Sullivantia hapemanii var. *purpusii* (Brand) Soltis	*Sullivantia hapemanii var. purpusii*	Purpus' sullivantia	530603
Scrophulariaceae	*Castilleja* Mutis ex L. f.	*Castilleja*	Indian paintbrush	33049
	Castilleja chromosa A. Nels.	*Castilleja applegatei ssp. martinii*	wavyleaf Indian paintbrush	525154
	Castilleja integra Gray	*Castilleja integra*	wholeleaf Indian paintbrush	33131
	Castilleja linariifolia Benth.	*Castilleja linariifolia*	Wyoming Indian paintbrush	33138
	Collinsia parviflora Lindl.	*Collinsia parviflora*	maiden blue eyed Mary	33534
	Orthocarpus luteus Nutt.	*Orthocarpus luteus*	yellow owl's-clover	33577
	Penstemon Schmidel	*Penstemon*	beardtongue	33665
	Penstemon caespitosus Nutt. ex Gray	*Penstemon caespitosus*	mat penstemon	33839
	Penstemon strictus Benth.	*Penstemon strictus*	Rocky Mountain beardtongue	33772

Family	Scientific Name (Welsh et al. 2003)	Scientific Name (Kartesz 1999)	Common Name (NatureServe)	TSN
	Penstemon teucrioides Greene	*Penstemon teucrioides*	germander beardtongue	34000
	Verbascum thapsus L..	*Verbascum thapsus*	common mullein	33394
Tamaricaceae	*Tamarix chinensis* Lour.	*Tamarix chinensis*	tamarisk, salt-cedar	22308
Violaceae	*Viola* L..	*Viola* sp.	violet	22030

NON-VASCULAR PLANTS

Family	Scientific Name	Scientific Name	Common Name (NatureServe)	TSN
Selaginellaceae	*Selaginella* Beauv.	*Selaginella* sp.	spikemoss	17064
	Selaginella densa Rydb.	*Selaginella densa*	lesser spikemoss	17076
Viscaceae	*Phoradendron juniperinum* Engelm. ex Gray	*Phoradendron juniperinum*	juniper mistletoe	27866

Appendix E. Field Plot Crosswalk to NVC Associations

Plots, observation points, and accuracy assessment (AA) points are assigned to National Vegetation Classification associations based on their composition and structure as they were recorded in the field. A total of 76 NVC associations and one "Park Special" were described for Black Canyon. Twenty-eight associations in the table below were documented only during accuracy assessment (Plot codes in the rightmost column contain the letters "AA"). Accuracy assessment points assigned to associations already described from plots or observation points are not included in this table unless they comprise the majority of plots sampled in the type. Element codes are used by NatureServe and state Natural Heritage Programs to track nomenclature and status of rare plants, rare animals, and communities ("elements"). Nomenclature used by the NVC follows Kartesz (1999).

Plant Association Scientific Name	Element Code	No. of Samples	Supporting Plot, Observation Point, and AA Point Assignments
Acer negundo / Disturbed Understory Woodland	CEGL002693	1	BLCA.0119
Acer negundo / Quercus gambelii Woodland	CEGL002797	5	BLCA_AA.597, BLCA_AA.601, BLCA_AA.608, BLCA_AA.610, BLCA_AA.618
Achnatherum hymenoides Shale Barren Herbaceous Vegetation	CEGL001651	1	BLCA_AA.641
Amelanchier (utahensis, alnifolia) - Cercocarpus montanus Shrubland	CEGL001070	5	BLCA.0021, BLCA_AA.388, BLCA_AA.409, BLCA_AA.915, BLCA_AA.916
Amelanchier utahensis - Mixed Shrub / Carex geyeri Shrubland	CEGL001068	8	BLCA.0007, BLCA.0013, BLCA.0014, BLCA.0043, BLCA.0048, BLCA.0049, BLCA.0050, BLCA.0056
Aquilegia micrantha - Calamagrostis scopulorum Herbaceous Vegetation	CEGL002592	1	BLCA.0117
Artemisia nova / Poa fendleriana Shrubland	CEGL002698	1	BLCA_AA.731
Artemisia nova / Poa secunda Shrubland	CEGL001423	1	BLCA.0047
Artemisia tridentata (ssp. vaseyana, ssp. wyomingensis) - Amelanchier utahensis Shrubland	CEGL002820	1	BLCA.0020
Artemisia tridentata / Pleuraphis jamesii Shrubland	CEGL001005	1	BLCA.0028
Artemisia tridentata ssp. vaseyana / Achnatherum lettermanii Shrubland	CEGL002811	1	BLCA.0057
Artemisia tridentata ssp. vaseyana / Achnatherum pinetorum Shrubland	CEGL002806	1	BLCA.0010
Artemisia tridentata ssp. vaseyana / Balsamorhiza sagittata Shrubland	CEGL001020	1	BLCA.0030
Artemisia tridentata ssp. vaseyana / Hesperostipa comata Shrubland	CEGL002931	1	BLCA_AA.706
Artemisia tridentata ssp. vaseyana / Pascopyrum smithii Shrubland	CEGL001028	18	BLCA_AA.264, BLCA_AA.266, BLCA_AA.270, BLCA_AA.273, BLCA_AA.320, BLCA_AA.326, BLCA_AA.397, BLCA_AA.893, BLCA_AA.931, BLCA_AA.932, BLCA_AA.933, BLCA_AA.934, BLCA_AA.935, BLCA_AA.943, BLCA_AA.948, BLCA_AA.953, BLCA_AA.959, BLCA_AA.960

Plant Association Scientific Name	Element Code	No. of Samples	Supporting Plot, Observation Point, and AA Point Assignments
Artemisia tridentata ssp. vaseyana / Poa (pratensis, compressa) Semi-natural Shrub Herbaceous	CEGL002339	4	BLCA.0012, BLCA.0027, BLCA.0054, BLCA.0134
Artemisia tridentata ssp. vaseyana / Poa fendleriana Shrubland	CEGL002812	26	BLCA_AA.204, BLCA_AA.245, BLCA_AA.305, BLCA_AA.308, BLCA_AA.324, BLCA_AA.325, BLCA_AA.339, BLCA_AA.344, BLCA_AA.406, BLCA_AA.407, BLCA_AA.434, BLCA_AA.438, BLCA_AA.472, BLCA_AA.713, BLCA_AA.814, BLCA_AA.828, BLCA_AA.929, BLCA_AA.930, BLCA_AA.940, BLCA_AA.945, BLCA_AA.946, BLCA_AA.951, BLCA_AA.952, BLCA_AA.954, BLCA_AA.957, BLCA_AA.958
Artemisia tridentata ssp. wyomingensis / (Agropyron cristatum, Psathyrostachys juncea) Seeded Grasses Semi-natural Shrubland	CEGL002185	1	BLCA_AA.348
Artemisia tridentata ssp. wyomingensis / Disturbed Understory Semi-natural Shrubland	CEGL002083	9	BLCA_AA.290, BLCA_AA.384, BLCA_AA.385, BLCA_AA.423, BLCA_AA.612, BLCA_AA.667, BLCA_AA.738, BLCA_AA.758, BLCA_AA.928,
Artemisia tridentata ssp. wyomingensis / Hesperostipa comata Colorado Plateau Shrubland	CEGL002761	10	BLCA.0104, BLCA_AA.590, BLCA_AA.656, BLCA_AA.705, BLCA_AA.747, BLCA_AA.927, BLCA_AA.939, BLCA_AA.941, BLCA_AA.942, BLCA_AA.944
Atriplex canescens - Artemisia tridentata Shrubland	CEGL001282	1	BLCA.0062
Atriplex confertifolia Wyoming Basins Shrubland	CEGL001293	3	BLCA.0084, BLCA_0092, BLCA_0124
Atriplex corrugata Dwarf-shrubland	CEGL001437	3	BLCA.0085, BLCA_0091, BLCA_0126
Atriplex gardneri Dwarf-shrubland	CEGL001438	1	BLCA.0118
Bromus inermis - (Pascopyrum smithii) Semi-natural Herbaceous Vegetation	CEGL005264	1	BLCA_AA.936
Bromus tectorum Semi-natural Herbaceous Vegetation	CEGL003019	3	BLCA.0095, BLCA_0120, BLCA_0132
Cercocarpus montanus Shale Shrubland	CEGL002798	7	BLCA_AA.168, BLCA_AA.171, BLCA_AA.176, BLCA_AA.177, BLCA_AA.180, BLCA_AA.431, BLCA_AA.616
Ericameria nauseosa Shrubland	CEGL002713	3	BLCA_AA.169, BLCA_AA.234, BLCA_AA.375

Plant Association Scientific Name	Element Code	No. of Samples	Supporting Plot, Observation Point, and AA Point Assignments
Ericameria parryi / Achnatherum hymenoides Shrubland	CEGL003040	2	BLCA.0079, BLCA.0081
Erodium cicutarium Semi-natural Annual Herbaceous Vegetation	CEGL002085	1	BLCA.0094
Glossopetalon spinescens var. meionandrum - Atriplex confertifolia Shrubland [Park Special]	Park Special	1	BLCA.0128
Hesperostipa comata Great Basin Herbaceous Vegetation	CEGL001705	1	BLCA_AA.435
Holodiscus dumosus Rock Outcrop Sparse Vegetation	CEGL002801	3	BLCA_AA.537, BLCA_AA.538, BLCA_AA.607
Juncus balticus Herbaceous Vegetation	CEGL001838	1	BLCA.0003
Juniperus osteosperma / Artemisia nova Woodland	CEGL000728	1	BLCA.0100
Juniperus osteosperma / Artemisia tridentata ssp. wyomingensis Woodland	CEGL000730	8	BLCA.0026, BLCA_AA.444, BLCA_AA.448, BLCA_AA.467, BLCA_AA.502, BLCA_AA.511, BLCA_AA.594, BLCA_AA.621, BLCA_AA.673
Juniperus osteosperma / Bromus tectorum Semi-natural Woodland	CEGL002817	18	BLCA.0115, BLCA_AA.296, BLCA_AA.302, BLCA_AA.304, BLCA_AA.307, BLCA_AA.311, BLCA_AA.318, BLCA_AA.319, BLCA_AA.327, BLCA_AA.365 BLCA_AA.413, BLCA_AA.445, BLCA_AA.637, BLCA_AA.769, BLCA_AA.854, BLCA_AA.856, BLCA_AA.857, BLCA_AA.858
Juniperus osteosperma / Leymus salinus Woodland	CEGL003109	1	BLCA.0116
Krascheninnikovia lanata / Achnatherum hymenoides Dwarf-shrubland	CEGL001323	2	BLCA_AA.707, BLCA_AA.710
Leymus salinus Shale Sparse Vegetation	CEGL002745	2	BLCA.0086, BLCA.0114
Pascopyrum smithii Herbaceous Vegetation	CEGL001577	2	BLCA_AA.950, BLCA_AA.956
Phalaris arundinacea Western Herbaceous Vegetation	CEGL001474	2	BLCA.0063, BLCA.0111
Pinus edulis - (Juniperus monosperma, Juniperus osteosperma) / Hesperostipa comata Woodland	CEGL000797	2	BLCA_AA.466, BLCA_AA.703

Plant Association Scientific Name	Element Code	No. of Samples	Supporting Plot, Observation Point, and AA Point Assignments
Pinus edulis – (Juniperus spp). / Holodiscus dumosus Woodland	CEGL002802	2	BLCA_AA.316, BLCA_AA.614
Pinus edulis - Juniperus osteosperma / Amelanchier utahensis Woodland	CEGL002329	4	BLCA.0073, BLCA.0082, BLCA.0130, BLCA.0136
Pinus edulis - Juniperus osteosperma / Artemisia nova Woodland	CEGL002331	3	BLCA.0087, BLCA.0105, BLCA.0108
Pinus edulis - Juniperus osteosperma / Atriplex spp. Woodland [Provisional]	CEGL002366	3	BLCA_AA.617, BLCA_AA.785, BLCA_AA.803
Pinus edulis - Juniperus osteosperma / Bromus tectorum Semi-natural Woodland	CEGL002367	12	BLCA_AA.297, BLCA_AA.312, BLCA_AA.313, BLCA_AA.329, BLCA_AA.359, BLCA_AA.373, BLCA_AA.379, BLCA_AA.386, BLCA_AA.393, BLCA_AA.400, BLCA_AA.864, BLCA_AA.865
Pinus edulis - Juniperus osteosperma / Mixed Shrubs Talus Woodland	CEGL002328	3	BLCA.0066, BLCA.0069, BLCA.0110
Pinus edulis - Juniperus osteosperma / Sparse Understory Woodland	CEGL002148	58	BLCA.0146, BLCA_AA.227, BLCA_AA.291, BLCA_AA.328, BLCA_AA.330, BLCA_AA.343, BLCA_AA.366, BLCA_AA.377, BLCA_AA.378, BLCA_AA.381, BLCA_AA.412, BLCA_AA.424, BLCA_AA.475, BLCA_AA.478, BLCA_AA.481, BLCA_AA.482, BLCA_AA.486, BLCA_AA.487, BLCA_AA.493, BLCA_AA.498, BLCA_AA.499, BLCA_AA.514, BLCA_AA.515, BLCA_AA.528, BLCA_AA.530, BLCA_AA.531, BLCA_AA.575, BLCA_AA.598, BLCA_AA.599, BLCA_AA.602, BLCA_AA.604, BLCA_AA.626, BLCA_AA.653, BLCA_AA.658, BLCA_AA.691, BLCA_AA.722, BLCA_AA.744, BLCA_AA.754, BLCA_AA.760, BLCA_AA.761, BLCA_AA.763, BLCA_AA.770, BLCA_AA.772, BLCA_AA.800, BLCA_AA.810, BLCA_AA.829, BLCA_AA.839, BLCA_AA.840, BLCA_AA.841, BLCA_AA.844, BLCA_AA.850, BLCA_AA.852, BLCA_AA.859, BLCA_AA.860, BLCA_AA.862, BLCA_AA.866, BLCA_AA.907, BLCA_AA.909
Pinus edulis - Juniperus spp. / Artemisia tridentata (ssp. wyomingensis, ssp. vaseyana) Woodland	CEGL000776	6	BLCA.0033, BLCA.0034, BLCA.0059, BLCA.0065, BLCA.0067, BLCA.0068

Plant Association Scientific Name	Element Code	No. of Samples	Supporting Plot, Observation Point, and AA Point Assignments
Pinus edulis - Juniperus spp. / Cercocarpus montanus - Mixed Shrubs Woodland	CEGL000780	9	BLCA.0015, BLCA.0017, BLCA.0029, BLCA.0042, BLCA.0061, BLCA.0076, BLCA.0090, BLCA.0097, BLCA.0102
Pinus edulis - Juniperus spp. / Leymus salinus Woodland	CEGL002340	20	BLCA.0101, BLCA.0109, BLCA_AA.436, BLCA_AA.613, BLCA_AA.654, BLCA_AA.702, BLCA_AA.714, BLCA_AA.718, BLCA_AA.727, BLCA_AA.728, BLCA_AA.749, BLCA_AA.753, BLCA_AA.781, BLCA_AA.782, BLCA_AA.813, BLCA_AA.816, BLCA_AA.820, BLCA_AA.848, BLCA_AA.868, BLCA_AA.875
Pinus edulis - Juniperus spp. / Poa fendleriana Woodland	CEGL000787	9	BLCA.0011, BLCA.0018, BLCA.0036, BLCA.0077, BLCA.0096, BLCA.0140, BLCA.0142, BLCA.0144, BLCA.0148
Pinus edulis - Juniperus spp. / Pseudoroegneria spicata Woodland	CEGL000788	4	BLCA.0060, BLCA.0088, BLCA.0089, BLCA.0093
Pinus edulis - Juniperus spp. / Quercus gambelii Woodland	CEGL000791	8	BLCA.0004, BLCA.0019, BLCA.0032, BLCA.0035, BLCA.0037, BLCA.0038, BLCA.0053, BLCA.0078
Pleuraphis jamesii Herbaceous Vegetation	CEGL001777	4	BLCA.0098, BLCA.0106, BLCA.0112
Poa pratensis - (Pascopyrum smithii) Semi-natural Herbaceous Vegetation	CEGL005265	3	BLCA_AA.450, BLCA_AA.891, BLCA_AA.949
Poa fendleriana Herbaceous Vegetation	CEGL001925	4	BLCA.0099, BLCA_AA.289, BLCA_AA.640, BLCA_AA.789
Populus tremuloides / Amelanchier alnifolia - Symphoricarpos oreophilus / Calamagrostis rubescens Forest	CEGL000567	1	BLCA.0083
Populus tremuloides / Quercus gambelii / Symphoricarpos oreophilus Forest	CEGL000598	4	BLCA_AA.189, BLCA_AA.286, BLCA_AA.894, BLCA_AA.973

Plant Association Scientific Name	Element Code	No. of Samples	Supporting Plot, Observation Point, and AA Point Assignments
Populus tremuloides / Symphoricarpos oreophilus / Thalictrum fendleri Forest	CEGL000616	10	BLCA_AA.281, BLCA_AA.293, BLCA_AA.300, BLCA_AA.301, BLCA_AA.306, BLCA_AA.317, BLCA_AA.895, BLCA_AA.972, BLCA_AA.974, BLCA_AA.975
Pseudotsuga menziesii / Carex geyeri Forest	CEGL000430	6	BLCA_AA.202, BLCA_AA.207, BLCA_AA.278, BLCA_AA.394, BLCA_AA.480, BLCA_AA.903
Pseudotsuga menziesii / Holodiscus dumosus Scree Woodland	CEGL000902	4	BLCA.0005, BLCA_AA.267, BLCA.276, BLCA_AA.619
Pseudotsuga menziesii / Mahonia repens Forest	CEGL000442	1	BLCA_AA.274
Pseudotsuga menziesii / Quercus gambelii Forest	CEGL000452	2	BLCA.0022, BLCA.0023
Pseudotsuga menziesii / Symphoricarpos oreophilus Forest	CEGL000462	3	BLCA_AA.279, BLCA_AA.351, BLCA_AA.518
Pseudotsuga menziesii Scree Woodland	CEGL000911	2	BLCA_AA.642, BLCA_AA.646
Quercus gambelii - Cercocarpus montanus / (Carex geyeri) Shrubland	CEGL001113	3	BLCA.0009, BLCA.0031, BLCA.0041
Quercus gambelii – Holodiscus dumosus Shrubland	CEGL002341	2	BLCA.0008, BLCA.0113
Quercus gambelii / Amelanchier alnifolia Shrubland	CEGL001109	6	BLCA_AA.404, BLCA_AA.405, BLCA_AA.414, BLCA_AA.452, BLCA_AA.473, BLCA_AA.579
Quercus gambelii / Amelanchier utahensis Shrubland	CEGL001110	14	BLCA.0002, BLCA.0006, BLCA.0016, BLCA.0024, BLCA.0025, BLCA.0044, BLCA.0045, BLCA.0046, BLCA.0051, BLCA.0052, BLCA.0055, BLCA.0058, BLCA.0064, BLCA.0075

Plant Association Scientific Name	Element Code	No. of Samples	Supporting Plot, Observation Point, and AA Point Assignments
Quercus gambelii / Artemisia tridentata Shrubland	CEGL001111	34	BLCA.0040, BLCA_AA.170, BLCA_AA.244, BLCA_AA.246, BLCA_AA.256, BLCA_AA.275, BLCA_AA.456, BLCA_AA.542, BLCA_AA.549, BLCA_AA.563, BLCA_AA.564, BLCA_AA.585, BLCA_AA.609, BLCA_AA.625, BLCA_AA.660, BLCA_AA.666, BLCA_AA.671, BLCA_AA.678, BLCA_AA.679, BLCA_AA.692, BLCA_AA.694, BLCA_AA.700, BLCA_AA.709, BLCA_AA.730, BLCA_AA.737, BLCA_AA.740, BLCA_AA.788, BLCA_AA.825, BLCA_AA.877, BLCA_AA.884, BLCA_AA.885, BLCA_AA.889. BLCA_AA.947, BLCA_AA.967
Quercus gambelii / Carex geyeri Shrubland [Provisional]	CEGL005995	4	BLCA_AA.271, BLCA_AA.719, BLCA_AA.724, BLCA_AA.729
Quercus gambelii / Poa fendleriana Shrubland	CEGL002949	4	BLCA.0039, BLCA_AA.215, BLCA_AA.657, BLCA_AA.721
Quercus gambelii / Symphoricarpos oreophilus Shrubland	CEGL001117	33	BLCA.0138, BLCA_AA.211, BLCA_AA.219, BLCA_AA.233, BLCA_AA.235, BLCA_AA.237, BLCA_AA.250, BLCA_AA.253, BLCA_AA.258, BLCA_AA.347, BLCA_AA.353, BLCA_AA.371, BLCA_AA.421, BLCA_AA.422, BLCA_AA.426, BLCA_AA.432, BLCA_AA.433, BLCA_AA.457, BLCA_AA.484, BLCA_AA.520, BLCA_AA.566, BLCA_AA.582, BLCA_AA.586, BLCA_AA.695, BLCA_AA.701, BLCA_AA.883, BLCA_AA.888, BLCA_AA.968, BLCA_AA.969, BLCA_AA.970, BLCA_AA.971, BLCA_AA.980. BLCA_AA.981
Sarcobatus vermiculatus Disturbed Shrubland	CEGL001357	7	BLCA.0122, BLCA_AA.392, BLCA_AA.399, BLCA_AA.583, BLCA_AA.584, BLCA_AA.587, BLCA_AA.588

Appendix F. Plant Association Descriptions for Black Canyon of the Gunnison National Park

NATIONAL VEGETATION CLASSIFICATION

Vegetation Associations of
Black Canyon of the Gunnison National Park
24 June 2010

by

NatureServe

1101 Wilson Blvd., 15th floor
Arlington, VA 22209

4001 Discovery, Suite 270
Boulder, CO 80303

This subset of the International Ecological Classification Standard covers vegetation associations of Black Canyon of the Gunnison National Park. This classification has been developed in consultation with many individuals and agencies and incorporates information from a variety of publications and other classifications. Comments and suggestions regarding the contents of this subset should be directed to Mary J. Russo, Central Ecology Data Manager, Durham, NC mary_russo@natureserve.org, and/or Keith Schulz, Vegetation Ecologist, Boulder, CO keith_schulz@natureserve.org.

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Canada
Alberta Natural Heritage Information Centre, Edmonton, AB, Canada; Atlantic Canada Conservation Data Centre, Sackville, New Brunswick, Canada; British Columbia Conservation Data Centre, Victoria, BC, Canada; Manitoba Conservation Data Centre. Winnipeg, MB, Canada; Ontario Natural Heritage Information Centre, Peterborough, ON, Canada; Quebec Conservation Data Centre, Quebec, QC, Canada; Saskatchewan Conservation Data Centre, Regina, SK, Canada; Yukon Conservation Data Centre, Yukon, Canada

Latin American and Caribbean
Centro de Datos para la Conservacion de Bolivia, La Paz , Bolivia; Centro de Datos para la Conservacion de Colombia, Cali,Valle, Columbia; Centro de Datos para la Conservacion de Ecuador, Quito, Ecuador; Centro de Datos para la Conservacion de Guatemala, Ciudad de Guatemala , Guatemala; Centro de Datos para la Conservacion de Panama, Querry Heights , Panama; Centro de Datos para la Conservacion de Paraguay, San Lorenzo , Paraguay; Centro de Datos para la Conservacion de Peru, Lima, Peru; Centro de Datos para la Conservacion de Sonora, Hermosillo, Sonora , Mexico; Netherlands Antilles Natural Heritage Program, Curacao , Netherlands Antilles; Puerto Rico-Departmento De Recursos Naturales Y Ambientales, Puerto Rico; Virgin Islands Conservation Data Center, St. Thomas, Virgin Islands.

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Pseudotsuga menziesii / Carex geyeri Forest

Douglas-fir / Geyer's Sedge Forest

CODE	CEGL000430
PHYSIOGNOMIC CLASS	Forest (I)
PHYSIOGNOMIC SUBCLASS	Evergreen forest (I.A.)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen forest (I.A.8.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar needle-leaved evergreen forest (I.A.8.N.)
FORMATION	Conical-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.c.)
ALLIANCE	PSEUDOTSUGA MENZIESII FOREST ALLIANCE (A.157) Douglas-fir Forest Alliance

ECOLOGICAL SYSTEM(S): Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland (CES306.823)
Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest (CES306.805)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY

Globally

This association has been found in the montane zone of the Rocky Mountains of Colorado, Idaho, Montana, Oregon and Washington. Stands occur at lower montane elevations of these mountainous regions, on sites typically drier than most other *Pseudotsuga menziesii* associations. Site slope and aspect vary greatly. Slopes where this association is found in Colorado are reported to be steep to very steep (45-80%). Parent materials include granitics, conglomerates, sandstones, basalts, and shales. Exposed bare ground is low (less than 30%), and litter/duff is relatively thin, usually less than 5 cm deep. Vegetation is characterized by the dominance of *Pseudotsuga menziesii*, with a relatively closed canopy, as well as stands that are more open or have a mixed conifer tree canopy. *Pseudotsuga* is self-regenerating in this association. Several other conifers may be present to codominant, including *Pinus ponderosa* or *Juniperus scopulorum* in southern Rocky Mountain stands, and *Abies lasiocarpa, Pinus albicaulis, Pinus contorta*, or *Populus tremuloides* in stands farther north. These species are typically present only in early-seral stands of this association. There is no shrub layer, although several shrub species are typically present with low cover. These include the evergreen needle-leaved *Juniperus communis* and the broad-leaved cold-deciduous *Amelanchier alnifolia, Lonicera utahensis, Mahonia repens, Paxistima myrsinites, Purshia tridentata, Spiraea betulifolia, Vaccinium membranaceum, Vaccinium scoparium*, and *Symphoricarpos occidentalis* or *Symphoricarpos oreophilus*. The herbaceous layer is dominated by the perennial sedge *Carex geyeri* (averaging 35% cover). No other herbaceous species are well-represented, but many different forbs can occur in low amounts.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association is uncommon to common in the recreation area and was sampled near the Curecanti Creek Trail, near Crystal Trail, Crystal Trail at Bear Trap Gulch, and along the west side of Cimarron Point in the Curecanti National Recreation Area, and the Blue Creek area of Gunnison National Forest.

Globally

This association has been found in the montane zone throughout much of the Rocky Mountains from Colorado to Montana, and west into Oregon and Washington.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This forest association occurs on slopes in drainages, gulches, ridges, mesas and canyons. Sites are steep (53-68% slopes), occur between 2418 and 2649 m elevation, and are oriented to northern aspects. The unvegetated surface has moderate to high cover of litter and downed wood. Low to moderate cover of large and small rocks is common. Litter (0.7-8.0 cm deep) and duff (0-10.0 cm deep) depth were measured. Parent materials are Tertiary volcanic rocks and metamorphic/granitic rocks. Soils are rapidly drained sandy loams and silty clay loams.

Globally
This association has been found throughout much of the Rocky Mountains. Stands occur at lower montane elevations of these mountainous regions, on sites typically drier than most other *Pseudotsuga menziesii* associations. Elevations range from 1480-1500 m (4854-4920 feet) in Alberta, to 1860-2315 m (6100-7600 feet) in southern Montana, 2315-2800 m (7600-9200 feet) in central Colorado, and from 1125-2650 m (3700-8700 feet) in Idaho. Slope and aspect of sites vary greatly. Slopes vary from gentle to very steep (3-80%) but are generally moderate to steep (20-45%). Parent materials include granitics, conglomerates, sandstone, siltstone, rhyolite, basalt, and shale. Soils are rapidly drained loamy sand to silty clay loams. Exposed bare ground is low (less than 30%), and litter/duff is relatively thin, usually less than 5 cm deep.

VEGETATION DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This Douglas-fir / elk sedge forest association is uncommon to common within the recreation area. Total vegetation cover ranges from 100 to 130% in these densely vegetated stands. *Pseudotsuga menziesii* forms an open to moderately closed canopy 5-20 m high that contributes 5 to 100% cover, and the graminoid *Carex geyeri* provides 5 to 75% cover. The emergent stratum forms an open canopy 10-20 m high of *Pseudotsuga menziesii* and *Pinus ponderosa* trees that provide low to moderate cover. Other canopy trees providing low to moderate cover include *Picea pungens, Populus tremuloides*, and *Juniperus scopulorum*. The subcanopy stratum (2-15 m tall) provides sparse to low cover and includes *Populus tremuloides, Pseudotsuga menziesii*, and *Picea pungens*. The shrub layer is diverse in terms of species composition and provides moderate cover. The tall-shrub layer (1-5 m high) includes *Amelanchier alnifolia, Amelanchier utahensis, Populus tremuloides* saplings, *Pseudotsuga menziesii* saplings, and *Prunus virginiana*. Short and dwarf-shrubs commonly present include *Mahonia repens* and *Symphoricarpos rotundifolius*. The herbaceous layer is moderately diverse and provides moderate to high cover. Additional graminoids include *Bromus porteri* and *Poa fendleriana*. Common forbs include *Antennaria parvifolia, Arnica cordifolia, Galium boreale, Lupinus* sp., *Maianthemum racemosum ssp. amplexicaule*, and *Pseudostellaria jamesiana*. Mosses and lichens are often present and provide 1 to 25% and 0 to 25% cover, respectively.

Globally
This is an association dominated by the evergreen needle-leaved tree *Pseudotsuga menziesii*, with a relatively closed canopy. *Pseudotsuga* is self-regenerating in this association. Several other canopy trees may be present, including *Pinus ponderosa, Juniperus scopulorum*, and *Populus tremuloides*, with *Pinus albicaulis, Pinus contorta, Pinus flexilis*, or *Abies lasiocarpa* more typical in stands further north. These species are typically present only in early-seral stands of this association (Steele et al. 1981). It is reported that in some Idaho stands the canopy may be more open, with larger, more widely spaced trees in late-seral stands. There is no shrub layer, although several shrub or dwarf-shrub species are typically present with low cover. These include the evergreen needle-leaved *Juniperus communis* and the broad-leaved, cold-deciduous *Amelanchier* spp., *Dasiphora fruticosa ssp. floribunda, Lonicera utahensis, Mahonia repens, Paxistima myrsinites, Prunus virginiana, Purshia tridentata, Spiraea betulifolia, Symphoricarpos occidentalis*, or *Symphoricarpos oreophilus* depending on geographic region. The herbaceous layer is dominated by the perennial sedge *Carex geyeri*. Typically no other herbaceous species are well-represented, but many different forbs can occur in low amounts, including *Fragaria* spp., *Arnica cordifolia, Achillea millefolium , Antennaria parvifolia, Osmorhiza* spp., and *Astragalus* spp. Other graminoids can include *Poa* spp., *Bromus porteri, Carex siccata (= Carex foenea)*, and *Calamagrostis rubescens*.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tree canopy	*Picea pungens*, *Pinus ponderosa*, *Pseudotsuga menziesii*
Tree canopy	*Populus tremuloides*
Tree subcanopy	*Picea pungens*, *Pseudotsuga menziesii*
Tall shrub/sapling	*Amelanchier alnifolia*, *Populus tremuloides*, *Pseudotsuga menziesii*
Short shrub/sapling	*Juniperus communis*
Short shrub/sapling	*Amelanchier alnifolia*, *Populus tremuloides*, *Quercus gambelii*, *Rosa woodsii*, *Symphoricarpos rotundifolius*
Short shrub/sapling	*Purshia tridentata*
Herb (field)	*Arctostaphylos uva-ursi*, *Mahonia repens*, *Paxistima myrsinites*
Herb (field)	*Arenaria congesta*, *Galium boreale*

Herb (field)	*Bromus porteri, Carex geyeri*

Globally

Stratum	Species
Tree canopy	*Pseudotsuga menziesii*
Herb (field)	*Carex geyeri*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CONSERVATION STATUS RANK
Global Rank & Reasons: G4? (1-Feb-1996).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Some stands had an open tree canopy (40% cover) that could be classified as a woodland, but were included in this forest association until review of this association is completed rangewide. Stands included in this association from Colorado may be different from stands in the northwestern United States and northern Rocky Mountains and need to be re-analyzed.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: The fuel loading is moderate to high, particularly for downed limbs and trunks. There is some evidence of past burns. Big game use of the stands is common.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (5 plots, 10 observation points): (Plots: CURE.0077, CURE.0115, CURE.0150, CURE.0165, CURE.0361. Observation Points: BLCA_AA.202, BLCA_AA.207, BLCA_AA.278, BLCA_AA.394, BLCA_AA.480, BLCA_AA.903, CURE_AA.0436, CURE_AA.0842, CURE_AA.1005, CURE_AA.1097).
Local Description Authors: J. Von Loh
Global Description Authors: K.A. Schulz

REFERENCES: Bell et al. 2009, Bourgeron and Engelking 1994, Boyce 1977, CONHP unpubl. data 2003, Clausnitzer and Zamora 1987, Cooper et al. 1987, Driscoll et al. 1984, Giese 1975, Hess 1981, Hess and Alexander 1986, Johnson and Clausnitzer 1992, Johnston 1987, Jones and Ogle 2000, Kagan et al. 2000, Komarkova et al. 1988a, MTNHP 2002b, Pfister et al. 1977, Steele et al. 1981, Steele et al. 1983, Topik et al. 1988, Western Ecology Working Group n.d., Williams and Smith 1990

Pseudotsuga menziesii / Mahonia repens Forest

Douglas-fir / Creeping Oregon-grape Forest

CODE	CEGL000442
PHYSIOGNOMIC CLASS	Forest (I)
PHYSIOGNOMIC SUBCLASS	Evergreen forest (I.A.)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen forest (I.A.8.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar needle-leaved evergreen forest (I.A.8.N.)
FORMATION	Conical-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.c.)
ALLIANCE	*PSEUDOTSUGA MENZIESII* FOREST ALLIANCE (A.157) Douglas-fir Forest Alliance

ECOLOGICAL SYSTEM(S): Middle Rocky Mountain Montane Douglas-fir Forest and Woodland (CES306.959)
Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland (CES306.823)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY

Globally

This forest association occurs on dry, often nutrient-poor sites in the southern and central Rocky Mountains and high plateaus of the Colorado Plateau from northern Arizona and New Mexico north through Colorado and Utah into central Idaho, Wyoming and Montana, and extends to the eastern Cascades in Oregon. Stands occur on lower mountain slopes and upper canyon slopes. Elevations range from 1740 to 2930 m (5700-9600 feet) in northern New Mexico, Arizona and Colorado, and 1375 to 2595 m (4500-8500 feet) in Utah, Wyoming and southern Idaho. Soils are variable in texture and parent material but are usually deep and often rocky. The vegetation is representative of closed-canopy stands of *Pseudotsuga menziesii* where most species other than *Mahonia repens* have been shaded out. In some stands, a few individual *Pinus ponderosa, Pinus contorta, Pinus flexilis, Pinus strobiformis, Populus tremuloides*, or *Juniperus scopulorum* may persist in the canopy or subcanopy. The understory may be sparse, with 10% or less total cover, but sometimes will have up to 30% total herbaceous and shrub cover. *Mahonia repens* is the dominant species with at least 1% cover, but other species are usually present with at least trace cover, including *Juniperus communis, Symphoricarpos oreophilus, Paxistima myrsinites*, and *Prunus virginiana*. The herbaceous layer is generally sparse but may include small amounts of graminoids such as *Poa fendleriana, Festuca arizonica, Carex geyeri, Carex rossii*, and scattered forbs such as *Arnica cordifolia, Galium boreale*, and *Thalictrum fendleri*. The mature, older canopy trees in some stands are fire-scarred, indicating that ground-fire activity may be important in stands of this type. Some stands appear to be ponderosa pine woodlands that have filled in within the last 150 years with a closed canopy of Douglas-fir.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association was sampled along Crystal Trail in Curecanti National Recreation Area and in Long Gulch in the Gunnison National Forest.

Globally

This association occurs in dry mountain and canyon sites in northern Arizona and New Mexico, north through central Utah into Oregon and southern Idaho, and east into Wyoming and Colorado.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This forest association occurs on the slopes of ridges and in valleys. Sites are very steep (70-72% slopes), occur between 2665 and 2686 m elevation, and are oriented to north aspects. The unvegetated surface has high cover of litter and downed wood. Litter (0.3-1.0 cm deep) and duff (0-1.0 cm deep) depths were measured on one stand. Parent materials are metamorphic/granitic rocks. Soils are rapidly drained sandy loams and sandy clay loams.

Globally

This forest occurs on dry, often nutrient-poor sites in northern Arizona and New Mexico north through Colorado and Utah into Idaho, Wyoming and Montana, and extends to the eastern Cascades in Oregon (Cole 1982, Atzet and Wheeler 1984, Mauk and Henderson 1984, Stuever and Hayden 1997b). Stands occur on lower mountain slopes and upper canyon slopes. Elevations range from 2135 to 2595 m (7000-8500 feet) in northern Arizona and New Mexico, 1740 to 2930 m (5700-9600 feet) in Colorado, and 1375 to 2595 m (4500-8500 feet) in Utah, Wyoming and southern Idaho. Soils are variable in texture and parent material but are usually deep and often rocky. Litter and downed wood cover nearly all the unvegetated surface.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This Douglas-fir / creeping Oregon-grape forest association is rare to uncommon within the recreation area. Total vegetation cover ranges from 119% to approximately 150% in these densely vegetated stands. *Pseudotsuga menziesii* forms a moderately closed canopy 10-20 m high that contributes 40 to 75% cover, and the dwarf-shrub *Mahonia repens* provides 20 to 50% cover. An emergent layer of 20- to 35-m tall *Pseudotsuga menziesii* trees

provides up to 25% cover. *Populus tremuloides* trees provide low cover in the canopy layer. *Pseudotsuga menziesii* trees from 2-10 m tall provide up to 25% cover in the subcanopy layer. The shrub layer has low species diversity and provides moderate cover. Short shrubs and additional dwarf-shrubs include *Amelanchier alnifolia, Paxistima myrsinites, Rosa woodsii*, and *Symphoricarpos rotundifolius*. The herbaceous layer is low in terms of species diversity and provides moderate cover. Graminoid cover, up to 50%, is provided by *Carex geyeri*. Forbs provide sparse cover and include *Arnica cordifolia, Castilleja miniata*, and *Lathyrus lanszwertii*. The vine or liana *Clematis ligusticifolia* also provides sparse cover. Lichens and mosses provide up to 6% cover.

Globally
This association represents closed-canopy stands of *Pseudotsuga menziesii* where most species other than *Mahonia repens* have been shaded out. In some stands, a few individual *Pinus ponderosa, Pinus contorta, Pinus flexilis, Pinus strobiformis, Populus tremuloides*, or *Juniperus scopulorum* may persist in the canopy or subcanopy. The understory may be sparse, with 10% or less total cover, but sometimes will have up to 30% total herbaceous and shrub cover. *Mahonia repens* is the dominant species with at least 1% cover, but other species are usually present with at least trace cover, including *Juniperus communis, Symphoricarpos oreophilus, Paxistima myrsinites*, and *Prunus virginiana*. The herbaceous layer is generally sparse but may include small amounts of *Poa fendleriana, Festuca arizonica, Carex geyeri, Carex rossii, Arnica cordifolia, Maianthemum racemosum (= Smilacina racemosa), Galium boreale, Bromus ciliatus, Clematis columbiana*, and *Thalictrum fendleri*.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tree canopy	*Pseudotsuga menziesii*
Tree subcanopy	*Pseudotsuga menziesii*
Tree subcanopy	*Populus tremuloides*
Herb (field)	*Mahonia repens*
Herb (field)	*Arnica cordifolia*
Herb (field)	*Carex geyeri*

Globally

Stratum	Species
Tree canopy	*Pseudotsuga menziesii*
Herb (field)	*Mahonia repens*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CONSERVATION STATUS RANK
Global Rank & Reasons: G5 (1-Feb-1996).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
This association describes a dry, mature to old-growth, closed-canopy *Pseudotsuga menziesii* forest of the interior western U.S.; earlier seral stages have a more open, mixed canopy and more diversity and cover by shrubs and herbaceous species. *Mahonia repens* is a common understory species in all seral stages of these dry Douglas-fir forests, but usually is mixed with varying amounts of species that are also indicators in other associations. It is not necessarily clear what degree of dominance by *Mahonia repens* versus other diagnostic species (such as *Carex geyeri, Paxistima myrsinites, Symphoricarpos oreophilus*, or *Juniperus communis*) constitutes a stand of this association. This association is similar to *Pseudotsuga menziesii / Arnica cordifolia* Habitat Type of Pfister et al. (1977) in Montana.

CLASSIFICATION CONFIDENCE: 1 - Strong

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Historic fire created canopy openings resulting in high graminoid cover. Downed wood is common to these stands.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (6 plots, 6 observation points): (Plots: CURE.0098, CURE.0205, CURE.0265, CURE.0267, CURE.0297, CURE.0395. Observation Points: BLCA_AA.274, CURE_AA.0135, CURE_AA.0144, CURE_AA.0831, CURE_AA.1095, CURE_AA.1369).
Local Description Authors: J. Von Loh
Global Description Authors: J. Coles, mod. K.A. Schulz

REFERENCES: Alexander et al. 1984b, Atzet and Wheeler 1984, Bourgeron and Engelking 1994, CONHP unpubl. data 2003, Cole 1977b, Cole 1982, Driscoll et al. 1984, Hoffman and Alexander 1976, Johnston 1984, Johnston 1987, Jones and Ogle 2000, Kagan et al. 2004, Larson and Moir 1987, MTNHP 2002b, Mauk and Henderson 1984, Pfister et al. 1977, Roberts 1980, Roberts et al. 1992, Steele et al. 1981, Steele et al. 1983, Stuever and Hayden 1997b, Western Ecology Working Group n.d., Youngblood and Mauk 1985

Pseudotsuga menziesii / Quercus gambelii Forest

Douglas-fir / Gambel Oak Forest

CODE	CEGL000452
PHYSIOGNOMIC CLASS	Forest (I)
PHYSIOGNOMIC SUBCLASS	Evergreen forest (I.A.)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen forest (I.A.8.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar needle-leaved evergreen forest (I.A.8.N.)
FORMATION	Conical-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.c.)
ALLIANCE	*PSEUDOTSUGA MENZIESII* FOREST ALLIANCE (A.157) Douglas-fir Forest Alliance

ECOLOGICAL SYSTEM(S): Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland (CES306.823)
Southern Rocky Mountain Mesic Montane Mixed Conifer Forest and Woodland (CES306.825)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY
Globally
This forest association occurs on mountains and plateaus from Colorado to Trans-Pecos Texas, west into New Mexico, Arizona and Utah. Elevation ranges from 1229 to 2870 m (4030-9400 feet). Stands are found along drainages, lower and middle slopes, steep upper slopes and gentle to rolling tops of mesas and ridges. Aspects are variable. This forest occurs as both a non-obligate riparian community on the outer margins of riparian areas in desert canyons and steep draws, and as an upland forest forming extensive stands on typically north-facing hillslopes (southern aspects at higher elevations). Soils vary but are often shallow and rocky, ranging from sand to clay, often derived from sandstone. The vegetation is characterized by a relatively sparse to dense evergreen tree canopy dominated by *Pseudotsuga menziesii*, sometimes with *Quercus gambelii* well-represented in the understory. Scattered large *Pinus ponderosa, Pinus strobiformis, Pinus flexilis, Pinus edulis*, or *Juniperus* spp. (especially on drier sites) may be present in the tree canopy or subcanopy. *Abies concolor* is typically not present. *Quercus gambelii* dominates both the subcanopy (tree form, if present) and the moderately dense tall-shrub layer that consists of dense clumps of oak. *Quercus gambelii* must have at least 5% cover, but there is frequently well over 25%. At higher elevations, *Quercus gambelii* are more treelike and *Symphoricarpos oreophilus* will be present with significant cover in the short-shrub layer. At lower elevations, scattered *Pinus edulis, Juniperus osteosperma*, or *Juniperus deppeana* are often present. The presence of *Chrysothamnus depressus* in some stands reflects the presence of fairly well-developed soils. The herbaceous layer is generally sparse and composed of mostly graminoids with scattered forbs, but it can be moderately dense and diverse. Many other species are associated, such as *Amelanchier* spp., *Holodiscus dumosus, Fendlera rupicola, Fraxinus anomala, Mahonia repens, Paxistima*

myrsinites, Quercus X pauciloba, Robinia neomexicana, Rosa woodsii, Carex spp., *Festuca arizonica, Koeleria macrantha, Muhlenbergia virescens, Poa fendleriana, Lathyrus lanszwertii var. leucanthus, Thalictrum fendleri*, and *Vicia americana*. The shrub layer has equal or greater cover than graminoids.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This association is uncommon to common within the recreation area and was sampled near Corral Creek on Curecanti Ranch, near the Dillon Pinnacles, near the Cimarron Power Line Road, west of Pine Creek, on the east side of Dillon Mesa, Cebolla Creek, in Tenderfoot Gulch, and west of Hermit's Rest within the Curecanti National Recreation Area.

Globally
This *Pseudotsuga menziesii* forest association occurs in the southern Rocky Mountains and southwestern U.S. and is found on foothills, mountains and plateaus from Colorado to Trans-Pecos Texas, west to Arizona and Utah.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This forest association occurs on the slopes of ridges, shoulders, ravines, and gorges. Sites are moderately steep to steep (27-86% slopes), occur between 2361 and 2747 m elevation, and are oriented to all aspects. The unvegetated surface has moderate to high cover of litter and downed wood. Large and small rocks may be absent or provide moderate cover. Litter and duff depths for these stands ranged from 0-10 cm and 0-12 cm deep, respectively. Parent materials are Tertiary volcanic rocks, metamorphic/granitic rocks, and Quaternary landslide deposits. Soils are rapidly drained and variable, ranging from sands to clay loams.

Globally
This forest association occurs on mountains and plateaus at elevations ranging from 1229 to 2870 m (4030-9400 feet). Stands are found along drainages, gentle to moderate lower and middle slopes, steep upper slopes and gentle to rolling tops of mesas and ridges. Aspects are variable. This forest occurs as both a non-obligate riparian community on the outer margins of riparian areas in desert canyons and steep draws, and as an upland forest forming extensive stands on typically north-facing hillslopes, canyon sideslopes and mesa escarpments (southern aspects at higher elevations). Soils vary but are often shallow and rocky, ranging from sand to clay, often derived from sandstone. The surface is generally largely covered with a thin layer of litter. Parent materials are variable and include recent alluvium, fractured limestone, sandstone, metamorphic/granitic rocks, basalt, andesite, volcanic tuff, eroded Claron Formation (Pink Member), and even slickrock. Occasionally, talus to large blocks of rock and bedrock dominate the surface of sites on colluvial slopes / landslide deposits.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This Douglas-fir / Gambel oak forest association is uncommon to common in the recreation area. Total vegetation cover ranges from 52 to 77% in these moderately to densely vegetated stands. *Pseudotsuga menziesii* forms an open canopy 5-35 m high that contributes 1 to 75% cover, and *Quercus gambelii* tall shrubs (1-5 m tall) provided 6 to 75% cover. The emergent layer is rarely present and consists of 10- to 20-m tall *Pseudotsuga menziesii* trees that provide 7 to 15% cover. The subcanopy layer (2-15 m high) provides low to moderate cover and includes *Juniperus scopulorum, Populus tremuloides, Pseudotsuga menziesii*, and *Quercus gambelii*. The shrub layer is moderate in terms of species diversity and provides low to dense cover. The tall-shrub layer (1-5 m tall) provides sparse to low cover and includes *Pseudotsuga menziesii* and *Quercus gambelii*. Short and dwarf-shrubs provide moderate cover and include *Mahonia repens, Quercus gambelii, Ribes cereum, Ribes inerme*, and *Symphoricarpos rotundifolius*. The herbaceous layer is moderately diverse and provides sparse to moderate cover. Common graminoids include *Achnatherum hymenoides, Carex geyeri*, and *Poa fendleriana*. Forbs commonly present include only *Achillea millefolium var. occidentalis*. Mosses and lichens provide low cover, ranging from 0-10% and 0-20%, respectively.

Globally
This forest is characterized by a relatively sparse to moderately dense evergreen tree canopy dominated by *Pseudotsuga menziesii*, with *Quercus gambelii* well-represented in the understory. Scattered large *Pinus ponderosa, Pinus strobiformis, Pinus flexilis, Pinus edulis*, or *Juniperus* spp. (especially on drier sites) may be present in the tree canopy or subcanopy. *Abies concolor* is typically not present. *Quercus gambelii* typically dominates both the subcanopy (tree form, if present) and the open to moderately dense tall-shrub layer that often consists of dense

clumps of oak. *Quercus gambelii* must have at least 5% cover, but there is frequently well over 25%. At higher elevations, *Quercus gambelii* are more treelike, and *Symphoricarpos oreophilus* will be present with significant cover in the short-shrub layer. At lower elevations, scattered *Pinus edulis, Juniperus osteosperma*, or *Juniperus deppeana* are often present. The presence of *Chrysothamnus depressus* in some stands reflects the presence of fairly well-developed soils. Other common shrub species, depending on geographic location, may include *Acer glabrum, Arctostaphylos patula, Amelanchier* spp., *Brickellia longifolia, Cercocarpus montanus, Fendlera rupicola, Fraxinus anomala, Holodiscus dumosus, Mahonia repens, Paxistima myrsinites, Prunus virginiana, Purshia tridentata, Quercus X pauciloba, Rhus trilobata, Ribes cereum, Robinia neomexicana, Rosa woodsii, Shepherdia rotundifolia*, and *Yucca* spp. The generally sparse herbaceous layer is composed of mostly graminoids with scattered forbs but ranges to moderately dense and diverse. Species vary greatly by site characteristics and location. Associated graminoids may include *Achnatherum hymenoides, Bromus* spp., *Carex geyeri, Carex rossii, Elymus elymoides, Festuca arizonica, Koeleria macrantha, Muhlenbergia montana, Muhlenbergia virescens, Piptatherum micranthum*, and *Poa fendleriana*. Common forbs include *Achillea millefolium var. occidentalis, Cryptantha* sp., *Galium coloradoense, Gilia stenothyrsa, Lathyrus lanszwertii var. leucanthus, Lepidium montanum, Machaeranthera grindelioides, Maianthemum stellatum, Packera multilobata, Packera neomexicana, Physaria acutifolia, Thalictrum fendleri, Solidago* spp., and *Vicia americana*. The shrub layer generally has equal or greater cover than graminoids. Post-burn stands may have relatively low cover of *Quercus gambelii* temporarily, as these shrubs resprout and grow. This open conifer forest transitions to *Quercus gambelii* woodlands in drier sites and at lower elevations.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tree canopy	*Pseudotsuga menziesii*
Tree subcanopy	*Juniperus scopulorum*, *Pseudotsuga menziesii*
Tree subcanopy	*Populus tremuloides*, *Quercus gambelii*
Tall shrub/sapling	*Quercus gambelii*, *Ribes cereum*, *Ribes inerme*
Tall shrub/sapling	*Cercocarpus montanus*
Short shrub/sapling	*Amelanchier utahensis*, *Quercus gambelii*, *Symphoricarpos rotundifolius*
Short shrub/sapling	*Artemisia tridentata* ssp. *vaseyana*, *Artemisia tridentata* ssp. *wyomingensis*
Herb (field)	*Mahonia repens*
Herb (field)	*Apocynum cannabinum*, *Solidago nemoralis*, *Solidago velutina*
Herb (field)	*Achnatherum hymenoides*, *Carex geyeri*, *Leymus cinereus*, *Poa fendleriana*

Globally

Stratum	Species
Tree canopy	*Pinus ponderosa*, *Pseudotsuga menziesii*
Tall shrub/sapling	*Quercus gambelii*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Exotic/Invasive: *Poa pratensis* (exotic, Medium)

Globally
Vulnerable: *Gilia stenothyrsa* (globally imperiled, G3)

CONSERVATION STATUS RANK
Global Rank & Reasons: G5 (23-Feb-1994).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
This is a broadly defined association characterized by dominance or codominance of two widespread species, *Pseudotsuga menziesii* and *Quercus gambelii*. Within the literature on habitat type, there are four phases mentioned: *Festuca arizonica* phase, *Holodiscus dumosus* phase, *Muhlenbergia virescens* phase (all defined by having at least 5% cover of both *Quercus gambelii* and the nominal species), and *Quercus gambelii* (typic) phase by a undeveloped

herbaceous layer (Alexander et al. 1984b, DeVelice et al. 1986, Alexander et al. 1987, Fitzhugh et al. 1987, Johnston 1987, Larson and Moir 1987, Muldavin et al. 1996, Stuever and Hayden 1997b). There are three similar *Pseudotsuga menziesii* associations in the USNVC that use these phase species as nominal species. These phases represent "intermediate" vegetation. Review of these associations is needed to clarify relationships among associations and possibly subdivide this broadly defined association into types based on herbaceous layer and habitat.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Some stands of *Pseudotsuga menziesii* trees have moderate canopy openings. One stand is supported on a narrow bedrock ledge and another in a mesic alcove between pinnacles. An arid stand occupies a west-facing slope with very large boulders as the substrate. Downed wood is abundant in some stands. Big game use is common in all stands.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (14 plots, 58 observation points): (Plots: BLCA.0022, BLCA.0023, CURE.0021, CURE.0096, CURE.0104, CURE.0111, CURE.0203, CURE.0207, CURE.0212, CURE.0214, CURE.0222, CURE.0248, CURE.0309, CURE.0318. Observation Points: BLCA_AA.173, BLCA_AA.182, BLCA_AA.263, BLCA_AA.265, BLCA_AA.368, BLCA_AA.369, BLCA_AA.370, BLCA_AA.387, BLCA_AA.395, BLCA_AA.415, BLCA_AA.425, BLCA_AA.427, BLCA_AA.446, BLCA_AA.547, BLCA_AA.902, BLCA_AA.905, BLCA_AA.906, CURE_AA.0165, CURE_AA.0226, CURE_AA.0259, CURE_AA.0269, CURE_AA.0362, CURE_AA.0394, CURE_AA.0404, CURE_AA.0412, CURE_AA.0414, CURE_AA.0418, CURE_AA.0423, CURE_AA.0432, CURE_AA.0473, CURE_AA.0512, CURE_AA.0524, CURE_AA.0536, CURE_AA.0543, CURE_AA.0562, CURE_AA.0563, CURE_AA.0579, CURE_AA.0589, CURE_AA.0597, CURE_AA.0598, CURE_AA.0615, CURE_AA.0657, CURE_AA.0676, CURE_AA.0768, CURE_AA.0783, CURE_AA.0791, CURE_AA.0793, CURE_AA.0832, CURE_AA.0833, CURE_AA.0852, CURE_AA.0880, CURE_AA.0985, CURE_AA.1045, CURE_AA.1051, CURE_AA.1053, CURE_AA.1115, CURE_AA.1293, CURE_AA.1460).
Local Description Authors: J. Von Loh
Global Description Authors: K.A. Schulz, mod. J. Drake

REFERENCES: Alexander et al. 1984b, Alexander et al. 1987, Bader 1932, Blackhawk Coal Company 1981, Bourgeron and Engelking 1994, Bourgeron et al. 1993b, Bourgeron et al. 1995, CONHP unpubl. data 2003, Cogan et al. 2004, DeVelice et al. 1986, Diamond 1993, Fitzhugh et al. 1987, Freeman and Dick-Peddie 1970, Hansen et al. 2004d, Hess and Wasser 1982, Johnston 1987, Keammerer 1974b, Kittel et al. 1994, Kittel et al. 1999b, Komarkova et al. 1988a, Komarkova et al. 1988b, Larson and Moir 1987, Muldavin et al. 1996, Stuever and Hayden 1997b, Tiedemann and Terwilliger 1978, Western Ecology Working Group n.d., Youngblood and Mauk 1985

Pseudotsuga menziesii / Symphoricarpos oreophilus Forest

Douglas-fir / Mountain Snowberry Forest

CODE	CEGL000462
PHYSIOGNOMIC CLASS	Forest (I)
PHYSIOGNOMIC SUBCLASS	Evergreen forest (I.A.)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen forest (I.A.8.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar needle-leaved evergreen forest (I.A.8.N.)
FORMATION	Conical-crowned temperate or subpolar needle-leaved evergreen forest (I.A.8.N.c.)
ALLIANCE	*PSEUDOTSUGA MENZIESII* FOREST ALLIANCE (A.157) Douglas-fir Forest Alliance
ECOLOGICAL SYSTEM(S):	Middle Rocky Mountain Montane Douglas-fir Forest and Woodland (CES306.959) Northern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest (CES306.805) Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland (CES306.823)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY

Globally

This widespread forest association occurs in foothills, mountains and plateaus from southwestern Montana through Wyoming and Colorado to Trans-Pecos Texas, west to Arizona, Utah, and into eastern Oregon and Washington. Elevation ranges from 700-2900 m (2310-9500 feet). This broadly defined forest association occurs as both a non-obligate riparian community and as an upland community. In more arid regions stands occur along drainages along narrow riparian areas in ravines, canyons, and up steep draws. It continues upland on steep north-facing slopes in narrow canyons where dense shade and steepness preclude any significant shrub or herbaceous understory. Elsewhere at more northern latitudes, it occurs near lower treeline on warm, dry southern aspects with moderate to very steep mid- and upper slopes and ridges. Soils are variable and range from deep silt loam to shallow, rocky substrates. Most stands have abundant litter on the ground, and some have high rock cover. The vegetation is characterized by a relatively sparse to dense evergreen tree canopy dominated by *Pseudotsuga menziesii*, sometimes with scattered large *Pinus ponderosa, Pinus flexilis, Populus tremuloides, Juniperus scopulorum*, or *Juniperus occidentalis*, especially on drier sites. *Abies concolor* is typically not present. *Symphoricarpos oreophilus* dominates the sparse to moderately dense short-shrub layer. Shrub associates vary depending on range and habitat and may include *Acer glabrum, Amelanchier* spp., *Artemisia tridentata ssp. vaseyana, Cercocarpus montanus, Holodiscus dumosus, Juniperus communis, Mahonia repens, Paxistima myrsinites, Prunus virginiana, Quercus gambelii, Ribes cereum, Ribes inerme, Rosa woodsii*, or *Shepherdia canadensis*. The generally sparse herbaceous layer is composed of mostly graminoids with scattered forbs.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association is uncommon in the recreation area and was sampled on Tenderfoot Hill, northeast of the Ponderosa Campground, on Pine Creek Mesa, above the Pine Creek boat dock, and in Kezar Basin in the Curecanti National Recreation Area.

Globally

This widespread montane forest association occurs in foothills, mountains and plateaus from southwestern Montana through Wyoming and Colorado to Trans-Pecos Texas, west to Arizona, Utah, and into eastern Oregon and Washington.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This forest association occurs on the slopes of ridges, valleys, mesas and hills, as well as in gullies below a saddle and on ancient landslides. Slopes range from gentle to steep (10-80% slopes), occur between 2270 and 2658 m elevation, and are oriented to northern aspects. The unvegetated surface has moderate to high cover of litter and low to high cover of downed wood. Large and small rocks may provide low to moderate cover. Litter and duff depths range from 0-8 cm and 0-10 cm, respectively. Parent materials are Tertiary volcanic rocks, Quaternary landslide deposits, and Quaternary alluvium. Soils are rapidly drained loamy sands, silty clay loams, and peat.

Globally

This widespread Douglas-fir forest occurs in foothills, mountains and plateaus from southwestern Montana through Wyoming and Colorado to Trans-Pecos Texas, west to Arizona, Utah, and into eastern Oregon and Washington. Elevation ranges from 700-2900 m (2310-9500 feet). This broadly defined forest association occurs as both a non-obligate riparian community and as an upland community. In more arid regions stands occur along drainages along narrow riparian areas in ravines, canyons, and up steep draws. It continues upland on steep north-facing slopes in narrow canyons where dense shade and steepness preclude any significant shrub or herbaceous understory. Elsewhere at more northern latitudes, it occurs near lower treeline on warm, dry southern aspects on moderate to very steep mid- and upper slopes and ridges. Soils are variable and range from deep loamy sands, silt loams, silty clay loams, sandy clay loams and peat to shallow, rocky substrates. Parent materials are also variable and may include colluvium or residuum derived from calcareous shale, sandstone, granite, limestone, rhyolite and basalt. Most stands have abundant litter on the ground, and some have high rock cover.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This Douglas-fir / mountain snowberry forest association is uncommon within the recreation area. Total vegetation cover ranges from 12% to approximately 90% in these sparsely to densely vegetated stands. *Pseudotsuga menziesii* trees form an open canopy 5-35 m high that contributes 1 to 75 % cover, and *Symphoricarpos rotundifolius* short shrubs provide 1 to 50% cover. Emergent *Pseudotsuga menziesii* trees (15-20 m tall) provide sparse cover in a single stand. Other tree species forming portions of the canopy layer and providing sparse cover include *Juniperus scopulorum* and *Pinus ponderosa*. The subcanopy layer (5-10 m high) provides sparse cover and includes *Pseudotsuga menziesii* and *Juniperus scopulorum*. The shrub layer is low to moderate in terms of species diversity and provides low to moderate cover. Tall shrubs provide sparse to low cover and include *Amelanchier alnifolia, Holodiscus dumosus*, and *Pseudotsuga menziesii* saplings. Additional short and dwarf-shrubs provide low cover and include *Cercocarpus montanus, Juniperus communis, Mahonia repens, Ribes cereum*, and *Prunus virginiana*. The herbaceous layer is low in terms of species diversity and provides low to moderate cover. Common graminoids include *Carex geyeri, Poa fendleriana*, and *Poa secunda*. Forbs provide sparse cover with only *Packera tridenticulata (= Senecio tridenticulatus)* providing over 1% cover. Moss and lichen cover is moderate to high, up to 75% in one stand.

Globally
This forest is characterized by a relatively sparse to dense evergreen tree canopy dominated by *Pseudotsuga menziesii*, sometimes with scattered large *Pinus ponderosa, Pinus flexilis, Populus tremuloides, Juniperus scopulorum*, or *Juniperus occidentalis* in canopy or subcanopy, especially on drier sites. *Abies concolor* is typically not present. *Symphoricarpos oreophilus* is present and usually dominates the sparse to moderately dense short-shrub layer. Shrub associates vary depending on location and habitat and may include sparse cover of *Acer glabrum, Amelanchier* spp., *Artemisia tridentata ssp. vaseyana, Cercocarpus montanus, Holodiscus dumosus, Juniperus communis, Mahonia repens, Paxistima myrsinites, Prunus virginiana, Quercus gambelii, Ribes cereum, Ribes inerme, Rosa woodsii*, or *Shepherdia canadensis*. The generally sparse herbaceous layer is composed of mostly graminoids with scattered forbs. Associated graminoids may include *Bromus* spp., *Carex geyeri, Carex rossii, Elymus lanceolatus, Festuca idahoensis, Leucopoa kingii, Leymus cinereus, Koeleria macrantha*, and *Poa fendleriana, Poa secunda*. Common forbs include *Achillea millefolium, Arnica cordifolia, Artemisia frigida, Balsamorhiza sagittata, Thalictrum fendleri*, and *Vicia americana*.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tree canopy	*Pseudotsuga menziesii*
Tree subcanopy	*Pseudotsuga menziesii*
Tall shrub/sapling	*Pseudotsuga menziesii*
Tall shrub/sapling	*Amelanchier alnifolia*
Short shrub/sapling	*Symphoricarpos rotundifolius*
Herb (field)	*Carex geyeri*, *Poa fendleriana*

Globally

Stratum	Species
Tree canopy	*Pseudotsuga menziesii*
Short shrub/sapling	*Symphoricarpos oreophilus*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Exotic/Invasive: *Poa pratensis* (exotic, Medium); **Other**: *Descurainia pinnata* (G5)

Globally
Data are not available.

CONSERVATION STATUS RANK
Global Rank & Reasons: G5 (1-Feb-1996).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
This is a broadly defined *Pseudotsuga menziesii* association which includes a variety of stands from different environments that are tied together by a common widespread species, *Symphoricarpos oreophilus*.

CLASSIFICATION CONFIDENCE: 1 - Strong

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Evidence of fire is strong on one site. *Pseudotsuga menziesii* trees are growing from shelving slumps on one ridge. One small stand is succumbing to drought and disease. Big game use is high in all stands.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (5 plots, 12 observation points): (Plots: CURE.0032, CURE.0035, CURE.0147, CURE.0200, CURE.0343. Observation Points: BLCA_AA.279, BLCA_AA.351, BLCA_AA.518, CURE_AA.0004, CURE_AA.0005, CURE_AA.0132, CURE_AA.0375, CURE_AA.0751, CURE_AA.0773, CURE_AA.1004, CURE_AA.1024, CURE_AA.1093).
Local Description Authors: J. Von Loh
Global Description Authors: K.A. Schulz, mod. J. Drake, J. Coles, K.A. Schulz

REFERENCES: Arno 1980, Bell et al. 2009, Bourgeron and Engelking 1994, CONHP unpubl. data 2003, Cogan et al. 2004, Day and Wright 1985, Diamond 1993, Fischer and Bradley 1987, Hess and Wasser 1982, Johnson and Clausnitzer 1992, Johnson and Simon 1987, Johnston 1987, Jones and Ogle 2000, Kagan et al. 2000, Kittel et al. 1994, Kittel et al. 1999b, Komarkova et al. 1988b, Lillybridge et al. 1995, MTNHP 2002b, Mauk and Henderson 1984, Muldavin et al. 1996, Pfister et al. 1977, Reed 1976, Steele et al. 1981, Steele et al. 1983, Western Ecology Working Group n.d., Williams and Lillybridge 1983, Williams and Lillybridge 1985, Williams et al. 1990b, Wright et al. 1979, Youngblood and Mauk 1985

Populus tremuloides / Amelanchier alnifolia - Symphoricarpos oreophilus / Calamagrostis rubescens Forest

Quaking Aspen / Saskatoon Serviceberry - Mountain Snowberry / Pinegrass Forest

CODE	CEGL000567
PHYSIOGNOMIC CLASS	Forest (I)
PHYSIOGNOMIC SUBCLASS	Deciduous forest (I.B.)
PHYSIOGNOMIC GROUP	Cold-deciduous forest (I.B.2.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
FORMATION	Montane or boreal cold-deciduous forest (I.B.2.N.b.)
ALLIANCE	*POPULUS TREMULOIDES* FOREST ALLIANCE (A.274) Quaking Aspen Forest Alliance

ECOLOGICAL SYSTEM(S): Rocky Mountain Aspen Forest and Woodland (CES306.813)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY
Globally
This is a multi-layered deciduous forest that occurs at relatively low elevations in the Rocky Mountains. Most of the stands occur at less than 2135 m (7000 feet) elevation. Elevation range is 1680 to 2517 m (5500-8257 feet). It occurs on any aspect but can favor southerly and westerly aspects, on moderate to very steep slopes. The tree layer consists almost exclusively of *Populus tremuloides*. Conifers can be present in small amounts. The undergrowth is multi-structured. A tall-shrub stratum exists that is usually dominated by *Amelanchier alnifolia* or *Prunus virginiana*. Occasionally *Acer grandidentatum* is abundant. This layer may be broken or ill-defined but generally exceeds 10% cover. The low-shrub stratum is dominated by *Symphoricarpos oreophilus* or *Symphoricarpos albus*. Occasionally *Paxistima myrsinites* or *Spiraea betulifolia* can be abundant. The herbaceous layer is dominated by *Calamagrostis rubescens* and sometimes *Carex geyeri*. Other herbs present include *Elymus glaucus, Lupinus* spp., *Galium boreale*, and *Geranium viscosissimum*.

DISTRIBUTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association is rare and was observed and sampled near East Portal Road in the park and in Pool Gulch in the recreation area.

Globally
This association is known from eastern Idaho, western Wyoming, northern Utah, western Colorado, and southwestern Montana.

ENVIRONMENTAL DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This forest association was observed on the toeslope and midslope of gulches. Sites are moderately steep (32-35% slopes), occur from 2412 to 2517 m elevation, and are oriented to northern aspects. The unvegetated surface has high cover of litter and low to moderate cover of downed wood. Soils are moderately well-drained loams to sandy loams derived from local alluvium.

Globally
This is a major aspen association, making up 22% of the aspen communities on the Targhee National Forest and 15% of those on the Caribou National Forest. It is known from Grand Teton National Park, northern Utah, Idaho, and western Colorado. It is a lush and relatively low-elevation type; most of the stands occur at less than 2100 m (7000 feet) elevation. Elevation range is 1675 to 2517 m (5500-8257 feet). It occurs on any aspect but can favor southerly and westerly aspects, on moderate to very steep slopes (3-27 degrees). It can occur in isolated clumps in moist depressions surrounded by *Artemisia - Symphoricarpos* meadows, or surrounded by aspen, conifer or mixed aspen-conifer forests. The soils are moderately well- to well-drained loams or moderately well-drained silty clay loams, mostly derived from sandstone.

VEGETATION DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This quaking aspen / Saskatoon serviceberry - mountain snowberry / reedgrass forest association is rare in the park and recreation area. The total vegetation cover ranges from 148 to 224% in these densely vegetated stands with multiple canopy and understory layers. This forest association is characterized by a closed tree canopy that is typically 20 to 35 m tall of *Populus tremuloides* trees that range in cover from 60 to 65%. The subcanopy layer is present in one stand, with *Populus tremuloides* and *Amelanchier alnifolia* trees from 5 to 10 m tall providing 15% and 8% cover, respectively. The shrub layer is highly variable in composition and provides moderate cover. Tall shrubs from 2 to 5 m tall provide moderate cover and include *Amelanchier alnifolia* and *Prunus virginiana*. Short and dwarf-shrubs are diverse and provide moderate cover, including *Amelanchier alnifolia, Mahonia repens, Populus tremuloides, Prunus virginiana, Ribes inerme, Rosa woodsii*, and *Symphoricarpos rotundifolius*. The herbaceous layer is typically dense and diverse. Graminoids have low diversity but provide moderate cover by *Carex geyeri* and *Poa pratensis*. Forbs have moderately high diversity, provide low to moderate cover, and include *Achillea millefolium var. occidentalis, Lathyrus lanszwertii var. leucanthus*, and *Maianthemum racemosum ssp. amplexicaule*. Cryptogam cover is typically sparse.

Globally
This is a very lush, multi-layered deciduous forest. The tree layer consists almost exclusively of *Populus tremuloides*. Conifers, such as *Pseudotsuga menziesii, Abies lasiocarpa*, or *Picea engelmannii*, can be present in small amounts. The undergrowth is multi-structured. A tall-shrub stratum exists that is usually dominated by *Amelanchier alnifolia* or *Prunus virginiana*. Occasionally *Acer grandidentatum* is abundant. This layer may be broken or ill-defined but generally exceeds 10% cover. The low-shrub stratum is dominated by *Symphoricarpos oreophilus* or *Symphoricarpos albus*. Frequently *Paxistima myrsinites* and occasionally *Spiraea betulifolia* are abundant. The herbaceous layer is dominated by *Calamagrostis rubescens* and sometimes *Carex geyeri*. Other herbs present include *Elymus glaucus, Lupinus* spp., *Galium boreale*, and *Geranium viscosissimum*.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tree canopy	*Populus tremuloides*
Tall shrub/sapling	*Amelanchier alnifolia*, *Prunus virginiana*
Short shrub/sapling	*Ribes inerme*, *Rosa woodsii*, *Symphoricarpos rotundifolius*
Herb (field)	*Mahonia repens*, *Quercus gambelii*

Herb (field)	*Achillea millefolium* var. *occidentalis*, *Galium boreale*, *Lathyrus lanszwertii* var. *leucanthus*, *Ligusticum porteri*, *Maianthemum racemosum* ssp. *amplexicaule*, *Vicia americana*
Herb (field)	*Carex geyeri*

Globally

Stratum	Species
Tree canopy	*Populus tremuloides*
Tall shrub/sapling	*Amelanchier alnifolia*, *Prunus virginiana*
Short shrub/sapling	*Symphoricarpos oreophilus*
Herb (field)	*Calamagrostis rubescens*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CONSERVATION STATUS RANK
Global Rank & Reasons: G4 (1-Feb-1996).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Compare this association to *Populus tremuloides / Prunus virginiana* Forest (CEGL000596).

CLASSIFICATION CONFIDENCE: 1 - Strong

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: There is much downed wood collected in associated drainage of one stand. One stand is heavily grazed by sheep.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on 2002 and 2003 field data (2 plots): (Plots: BLCA.0083, CURE.0360).
Local Description Authors: J. Von Loh, mod. J. Coles
Global Description Authors: G. Kittel, mod. J. Drake

REFERENCES: Bourgeron and Engelking 1994, Driscoll et al. 1984, Hoffman and Alexander 1983, Mueggler 1988, Mueggler and Campbell 1982, Mueggler and Campbell 1986, Western Ecology Working Group n.d., Youngblood and Mueggler 1981

Populus tremuloides / Symphoricarpos oreophilus / Thalictrum fendleri Forest

Quaking Aspen / Mountain Snowberry / Fendler's Meadowrue Forest

CODE	CEGL000616
PHYSIOGNOMIC CLASS	Forest (I)
PHYSIOGNOMIC SUBCLASS	Deciduous forest (I.B.)
PHYSIOGNOMIC GROUP	Cold-deciduous forest (I.B.2.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
FORMATION	Montane or boreal cold-deciduous forest (I.B.2.N.b.)
ALLIANCE	*POPULUS TREMULOIDES* FOREST ALLIANCE (A.274) Quaking Aspen Forest Alliance

ECOLOGICAL SYSTEM(S): Rocky Mountain Aspen Forest and Woodland (CES306.813)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY

Globally

This is a major aspen forest association common in the mountains of the Colorado Plateau, the eastern Great Basin, and the central and southern Rocky Mountains. Stands can occur from 1585-2848 m (5200-9340 feet) elevation but generally occur at moderate elevations. Stands grow on gentle slopes of less the 25% or mountains and mesas, rather than on benches or flats. The vegetation is characterized by a *Populus tremuloides*-dominated overstory canopy (40-100% cover), with an open, yet distinct low-shrub stratum comprised of *Symphoricarpos oreophilus* or *Symphoricarpos rotundifolius*. Other tree species present include *Abies lasiocarpa* and *Pseudotsuga menziesii* with low cover (generally <5% cover) and several other conifers in trace amounts. Other low shrubs present include *Artemisia tridentata ssp. vaseyana, Mahonia repens (= Berberis repens), Paxistima myrsinites*, and *Rosa woodsii*. Tall shrubs may be present but are never abundant enough to form a distinct stratum. The herbaceous layer is rich with many forbs. The most abundant forbs are *Thalictrum fendleri, Geranium viscosissimum, Helianthella uniflora, Osmorhiza berteroi (= Osmorhiza chilensis), Lathyrus lanszwertii, Galium boreale, Achillea millefolium*, and the introduced species *Taraxacum officinale*. Common graminoids include *Bromus carinatus, Poa secunda, Elymus trachycaulus*, and the introduced *Poa pratensis*.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association is rare in the recreation area and was sampled on Poverty Mesa in the Curecanti National Recreation Area.

Globally

This is a major aspen forest association common in the mountains of the Colorado Plateau, the eastern Great Basin, and the central and southern Rocky Mountains from the Abajo Mountains in southern Utah, northern and eastern Nevada, eastern Idaho, and into western Wyoming and western Colorado.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This forest association occurs on the slopes of mesas. The site is gently sloped (9%), occurs at 2848 m elevation, and is oriented to the northeast. The unvegetated surface has high cover of litter and moderate exposure of bare soil. Downed wood is common. Parent materials are Tertiary volcanic rocks. Soils are rapidly drained loams.

Globally

This is a major aspen forest association common in the mountains of the Colorado Plateau, the eastern Great Basin, and the central and southern Rocky Mountains. Stands can occur between 1585 and 2848 m (5200-9340 feet) elevation but generally occur at moderate elevations between 1828 and 2651 m (6000-8700 feet) (Mueggler 1988). Stands grow on gentle slopes of less the 25% or mountains and mesas, rather than on benches or flats. They are found on all aspects and on soil derived from igneous and sedimentary parent materials.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This quaking aspen forest association is rare within the recreation area. The total vegetation cover is 165% in this densely vegetated stand. *Populus tremuloides* trees 15-20 m tall form closed canopies that provide 65% cover, the short shrub *Symphoricarpos rotundifolius* contributes 40% cover, and the tall forb *Thalictrum fendleri* contributes 15% cover. The subcanopy provides sparse cover by 5- to 10-m tall *Populus tremuloides* trees. The shrub layer is limited to a single species, the short shrub *Symphoricarpos rotundifolius*, which provides moderate cover. The herbaceous layer is moderate in species diversity and provides moderate to dense cover. Graminoids provide low to moderate cover by the non-native *Poa pratensis*. Forbs are moderately diverse, provide moderate cover and include *Achillea millefolium var. occidentalis, Galium boreale, Geranium* sp., and *Lathyrus lanszwertii var. leucanthus*.

Globally

This montane forest association has a relatively simple vegetation structure. The dominant overstory canopy is *Populus tremuloides* (40-100% cover with 70% average), with an open, yet distinct low-shrub stratum comprised of *Symphoricarpos oreophilus* or *Symphoricarpos rotundifolius* (Mueggler 1988). Other tree species present include *Abies lasiocarpa* and *Pseudotsuga menziesii* with low cover (generally <5% cover). Several other conifers may be present in trace amounts, such as *Abies concolor, Picea pungens, Pinus contorta*, and *Pinus flexilis*. Other low shrubs present include *Artemisia tridentata ssp. vaseyana, Mahonia repens (= Berberis repens), Paxistima*

myrsinites, and *Rosa woodsii*. Tall shrubs, such as *Acer glabrum, Amelanchier alnifolia*, and *Prunus virginiana*, may be present but are never abundant enough to form a distinct stratum. The herbaceous layer is rich with many forbs. The most abundant forbs are *Thalictrum fendleri, Geranium viscosissimum, Helianthella uniflora, Osmorhiza berteroi (= Osmorhiza chilensis), Lathyrus lanszwertii, Galium boreale, Achillea millefolium*, and the introduced species *Taraxacum officinale* (Mueggler 1988). Common graminoids include *Bromus carinatus, Poa secunda, Elymus trachycaulus*, and the introduced *Poa pratensis*.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tree canopy	*Populus tremuloides*
Short shrub/sapling	*Symphoricarpos rotundifolius*
Herb (field)	*Thalictrum fendleri*
Herb (field)	*Poa pratensis*

Globally

Stratum	Species
Tree canopy	*Populus tremuloides*
Short shrub/sapling	*Symphoricarpos oreophilus*
Herb (field)	*Geranium viscosissimum*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Exotic/Invasive: *Poa pratensis* (exotic, Medium), *Taraxacum officinale* (exotic)

CONSERVATION STATUS RANK
Global Rank & Reasons: G5 (1-Feb-1996).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
This association is differentiated from the similar *Populus tremuloides / Symphoricarpos oreophilus / Calamagrostis rubescens* Community Type (Mueggler 1988) by the lack of the principal indicator species *Calamagrostis rubescens* or *Carex geyeri*, reduced prominence of *Lupinus argenteus*, and a greater abundance of *Bromus carinatus, Pseudostellaria jamesiana (= Stellaria jamesiana)*, and annuals.

CLASSIFICATION CONFIDENCE: 1 - Strong

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: The sampled site is a *Populus tremuloides* stand surrounded by *Symphoricarpos oreophilus* shrubland and occupying a gentle, mesic slope. Grazing by domestic livestock is evident, including the presence of non-native plant species.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (1 plot, 10 observation points): (Plot: CURE.0362. Observation Points: BLCA_AA.281, BLCA_AA.293, BLCA_AA.300, BLCA_AA.301, BLCA_AA.306, BLCA_AA.317, BLCA_AA.895, BLCA_AA.972, BLCA_AA.974, BLCA_AA.975).
Local Description Authors: J. Von Loh
Global Description Authors: G. Kittel, mod. K.A. Schulz

REFERENCES: Bourgeron and Engelking 1994, Driscoll et al. 1984, Hoffman and Alexander 1980, Mueggler 1988, Mueggler and Campbell 1982, Mueggler and Campbell 1986, Western Ecology Working Group n.d., Youngblood and Mueggler 1981

Populus tremuloides / Quercus gambelii / Symphoricarpos oreophilus Forest

Quaking Aspen / Gambel Oak / Mountain Snowberry Forest

CODE	CEGL000598
PHYSIOGNOMIC CLASS	Forest (I)
PHYSIOGNOMIC SUBCLASS	Deciduous forest (I.B.)
PHYSIOGNOMIC GROUP	Cold-deciduous forest (I.B.2.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural cold-deciduous forest (I.B.2.N.)
FORMATION	Temporarily flooded cold-deciduous forest (I.B.2.N.d.)
ALLIANCE	*POPULUS TREMULOIDES* TEMPORARILY FLOODED FOREST ALLIANCE (A.300) Quaking Aspen Temporarily Flooded Forest Alliance

ECOLOGICAL SYSTEM(S): Rocky Mountain Aspen Forest and Woodland (CES306.813)
Rocky Mountain Subalpine-Montane Riparian Woodland (CES306.833)

USFWS WETLAND SYSTEM: Palustrine

CONCEPT SUMMARY

Globally

This deciduous forest is known from central New Mexico, the southwestern Colorado Plateau and southern Rocky Mountains where it occurs along drainages on plateaus and in draws on mountain slopes. Elevations range from 2240-2538 m. Stands occur along intermittent streams on moderately steep to steep slopes with southwestern to northwestern aspects. Soils tend to be relatively shallow, finer-textured loams derived from alluvium and residuum from volcanic or sedimentary rocks. Litter covers much of the ground surface. The vegetation is characterized by a moderately dense to dense tree canopy dominated by *Populus tremuloides*. *Quercus gambelii* dominates the tall-shrub layer (>10% cover) and may be present in the tree canopy. *Symphoricarpos oreophilus* or *Symphoricarpos rotundifolius* form the short-shrub layer (>10% cover) with several other shrub species. The herbaceous layer is generally sparse, but may be moderately dense, and is usually a diverse mixture of grasses and forbs.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association is rare in the recreation area and was sampled near the Crystal Overlook pullout south of Crystal Trail in Curecanti National Recreation Area.

Globally

This deciduous forest association is known from the Sacramento Mountains of central New Mexico, the southwestern Colorado Plateau and southern Rocky Mountains in western Colorado.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This forest association occurs on the slopes of drainages between ridges. The site is moderately steep (50% slope), occurs at 2538 m elevation, and is oriented to the northwest. The unvegetated surface has high cover of litter. Downed wood is common. Measurements of litter (1.5-4.2 cm deep) and duff (2.8-4.8 cm deep) were recorded. Parent materials are Tertiary volcanic rocks. Soils are rapidly drained silty loams.

Globally

This deciduous forest is known from the Sacramento Mountains of central New Mexico, the southwestern Colorado Plateau and southern Rocky Mountains where it occurs along drainages on plateaus and in draws on mountain slopes. Elevations range from 2240-2538 m. Stands occur along intermittent streams on moderately steep to steep slopes with southwestern to northwestern aspects. Soils tend to be relatively shallow, finer-textured loams derived from alluvium and residuum from volcanic or sedimentary rocks. Litter covers much of the ground surface.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This quaking aspen forest is rare within the recreation area. The total vegetation cover is 149% in this densely vegetated stand. *Populus tremuloides* trees 20-35 m tall form a moderately closed canopy that provides 55% cover, and 1- to 2-m tall *Quercus gambelii* and *Symphoricarpos rotundifolius* shrubs provide 40% and 15% cover, respectively. The subcanopy layer of 2- to 5-m tall *Quercus gambelii* and *Populus tremuloides* trees provide low cover. The shrub layer is moderately diverse and provides moderate cover. Additional tall, short, and dwarf-shrubs

provide low to moderate cover and include *Amelanchier alnifolia, Prunus virginiana, Pseudotsuga menziesii, Mahonia repens, Paxistima myrsinites*, and *Rosa woodsii*. The herbaceous layer is diverse and provides low to moderate cover. Graminoids are low in diversity, provide moderate cover, and include *Bromus porteri, Carex geyeri, Festuca thurberi*, and the non-native *Poa pratensis*. Forbs are diverse but provide only sparse cover, including *Achillea millefolium var. occidentalis, Galium boreale, Geranium* sp., *Heracleum maximum, Lathyrus lanszwertii, Ligusticum porteri, Maianthemum stellatum, Pedicularis procera, Thalictrum fendleri*, and *Vicia americana*. Seedling *Quercus gambelii* provide up to 2% cover in this stand.

Globally
The association is characterized by a moderately dense to dense tree canopy dominated by *Populus tremuloides*. *Quercus gambelii* dominates the tall-shrub layer (>10% cover) and may be present in the tree canopy. *Symphoricarpos oreophilus* or *Symphoricarpos rotundifolius* form the short-shrub layer (>10% cover) with several other shrub species. Additional tall, short, and dwarf-shrubs provide low to moderate cover and include *Amelanchier alnifolia, Mahonia repens, Paxistima myrsinites, Prunus virginiana, Pseudotsuga menziesii* seedlings, and *Rosa woodsii*. The herbaceous layer is generally sparse, but may be moderately dense, and is usually a diverse mixture of grasses and forbs. Forb species may include *Achillea millefolium, Galium boreale, Geranium* sp., *Heracleum maximum, Lathyrus lanszwertii, Ligusticum porteri, Maianthemum stellatum, Pedicularis procera, Senecio eremophilus, Solidago velutina, Thalictrum fendleri*, and *Vicia americana*. Common graminoids include *Bromus anomalus, Bromus porteri, Carex geyeri, Festuca thurberi*, and the introduced perennial *Poa pratensis*.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tree canopy	*Populus tremuloides*
Tree subcanopy	*Populus tremuloides*, *Quercus gambelii*
Tall shrub/sapling	*Amelanchier alnifolia*, *Prunus virginiana*, *Quercus gambelii*
Short shrub/sapling	*Quercus gambelii*, *Symphoricarpos rotundifolius*
Herb (field)	*Bromus porteri*

Globally

Stratum	Species
Tree canopy	*Populus tremuloides*, *Quercus gambelii*
Short shrub/sapling	*Symphoricarpos oreophilus*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Exotic/Invasive: *Poa pratensis* (exotic, Medium)

Globally
Exotic/Invasive: *Poa pratensis* (invasive, Medium)

CONSERVATION STATUS RANK
Global Rank & Reasons: GNR (1-Feb-1996).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
This poorly known association is reported from only 2 locations and needs additional classification work to further define the type and its range.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: This is an unusual association of *Populus tremuloides* and *Quercus gambelii* on a mesic slope; in the drainage below, *Populus tremuloides* is associated with *Amelanchier alnifolia* and *Prunus virginiana* in one area and with *Acer glabrum* in

another portion. The stand is bordered by *Pseudotsuga menziesii* on the upper border, and the south-facing slope is dominated by *Quercus gambelii* and *Amelanchier utahensis*.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (2 plots, 5 observation points): (Plots: CURE.0262, CURE.0263. Observation Points: BLCA_AA.189, BLCA_AA.286, BLCA_AA.894, BLCA_AA.973, CURE_AA.0125).
Local Description Authors: J. Von Loh
Global Description Authors: K.A. Schulz

REFERENCES: Bourgeron and Engelking 1994, Cogan et al. 2004, Driscoll et al. 1984, Freeman and Dick-Peddie 1970, Western Ecology Working Group n.d.

Juniperus osteosperma / Artemisia nova Woodland

Utah Juniper / Black Sagebrush Woodland

CODE	CEGL000728
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Evergreen woodland (II.A.)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen woodland (II.A.4.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.)
FORMATION	Rounded-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.a.)
ALLIANCE	*JUNIPERUS OSTEOSPERMA* WOODLAND ALLIANCE (A.536) Utah Juniper Woodland Alliance

ECOLOGICAL SYSTEM(S): Great Basin Pinyon-Juniper Woodland (CES304.773)
Colorado Plateau Pinyon-Juniper Woodland (CES304.767)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY
Globally
This association occurs on the slopes of ridges, saddles and benches below 2200 m elevation in the Colorado Plateau and Great Basin. Substrates and soils are variable but tend to be coarse and contain a calcareous element. *Juniperus osteosperma* forms an open canopy, with a sparse to moderate understory of *Artemisia nova*. The herbaceous layer tends to be sparse and dominated by graminoids, including *Poa secunda*.

DISTRIBUTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This association was observed and sampled in the Red Rocks area near the boundary between the park and adjacent land managed by the U.S. Bureau of Land Management.

Globally
This association is known to occur in Idaho, western Colorado, northeastern Utah, and northern and central Nevada. It is suspected to occur in eastern California but has not yet been documented from there.

ENVIRONMENTAL DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This woodland association was observed on the high slopes of saddles. The site is gentle (5% slope), occurs at 2180 m elevation, and is oriented to the southeast. The unvegetated surface has high exposure of bare soil and low to moderate cover of litter. The soil is rapidly drained sandy loam derived from Morrison Formation.

Globally
This association occurs in small to moderate patches (<1 to approximately 10 ha) on saddles, benches and ridges within the Colorado Plateau and Great Basin. Stands occur on gentle to moderate slopes oriented to any aspect between 1500 and 2200 m (4920-7220 feet) elevation. The substrate is often a calcareous shale, sandstone, or volcanic tuff. Soils are generally shallow sandy loams with a high percentage of bare ground or desert pavement accounting for most of the non-vegetated surface.

VEGETATION DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This Utah juniper / black sagebrush woodland association is rare, occurring on the western edge of the park. The total vegetation cover ranges from 10 to 40% in this sparely to moderately vegetated stand. This woodland association is characterized by an open canopy, typically 2-5 m tall, of *Juniperus osteosperma* and *Pinus edulis* trees that provide 10% and less than 1% cover, respectively. The understory is characterized by the short shrub *Artemisia nova* that provides 2% cover. The associated shrub layer is moderate in diversity but provides sparse cover. Short and dwarf-shrubs present include *Amelanchier utahensis, Cercocarpus montanus, Chrysothamnus depressus, Ephedra viridis, Gutierrezia sarothrae, Juniperus osteosperma*, and the succulent *Opuntia fragilis*. The parasitic species *Phoradendron juniperinum* is present in *Juniperus osteosperma* tree canopies with less than 1% cover. The herbaceous layer is diverse but provides sparse cover. Graminoids are sparse, providing up to 1% cover for any individual species, and include *Bromus tectorum, Leymus salinus, Pleuraphis jamesii, Poa fendleriana*, and *Poa secunda*. Forbs are varied without any single species contributing 1% or more cover; characteristic species include *Arenaria hookeri, Descurainia pinnata, Phlox longifolia*, and *Tetraneuris acaulis*. Seedlings of *Juniperus osteosperma* and *Pinus edulis* contribute less than 1% cover in the herbaceous layer.

Globally
This woodland association is characterized by an open canopy (10-40% cover) of *Juniperus osteosperma*. *Pinus edulis* is occasionally present with less than 1% cover. *Artemisia nova* dominates the sparse to moderate shrub layer (2-25% cover); other shrubs that may contribute to the shrub layer include *Ephedra viridis, Gutierrezia sarothrae, Amelanchier utahensis*, and *Purshia tridentata*. The herbaceous layer is variable and generally sparse, with few species exceeding 1% cover. The most common herbaceous species include *Poa secunda, Leymus salinus, Pleuraphis jamesii*, and *Phlox* spp.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tree canopy	*Juniperus osteosperma*, *Pinus edulis*
Herb (field)	*Artemisia nova*

Globally

Stratum	Species
Tree canopy	*Juniperus osteosperma*
Short shrub/sapling	*Artemisia nova*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Exotic/Invasive: *Bromus tectorum* (exotic, High)

Globally
Exotic/Invasive: *Bromus tectorum* (exotic, High)

CONSERVATION STATUS RANK
Global Rank & Reasons: G5? (1-Feb-1996).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: This type is very similar to *Pinus edulis - Juniperus osteosperma / Artemisia nova* Woodland. More quantitative data are needed to define this association and differentiate it from similar associations. Field researchers noted the presence of eolian sand and rain crust that resembles cryptogams.

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on 2003 field data (1 plot, 1 observation point): (Plot: BLCA.0100. Observation Point: CURE_AA.0467).
Local Description Authors: J. Von Loh, mod. G. Bradshaw and J. Coles
Global Description Authors: J. Coles

REFERENCES: Blackburn et al. 1968c, Blackburn et al. 1971, Bourgeron and Engelking 1994, Caicco and Wellner 1983c, Driscoll et al. 1984, Western Ecology Working Group n.d.

Juniperus osteosperma / Artemisia tridentata ssp. wyomingensis Woodland

Utah Juniper / Wyoming Big Sagebrush Woodland

CODE	CEGL000730
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Evergreen woodland (II.A.)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen woodland (II.A.4.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.)
FORMATION	Rounded-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.a.)
ALLIANCE	*JUNIPERUS OSTEOSPERMA* WOODLAND ALLIANCE (A.536) Utah Juniper Woodland Alliance

ECOLOGICAL SYSTEM(S): Colorado Plateau Pinyon-Juniper Woodland (CES304.767)
Rocky Mountain Foothill Limber Pine-Juniper Woodland (CES306.955)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY
Globally
This sparse woodland association has been reported from semi-arid foothills, plateaus and mountains throughout much of the western Rocky Mountains, Colorado Plateau, and Great Basin. Elevation ranges from 1220 to 2260 m (4000-7400 feet). This community generally occurs on a variety of slopes and aspects, often at the break between foothill and basin. Soils are generally coarse-textured, calcareous alluvial or eolian deposits derived from sandstone and shale. Evidence of erosion such as gullies and rills is not uncommon. There are generally significant amounts of bare ground, litter, and desert pavement at the soil surface. Rock cover is variable. The vegetation is characterized by an open tree canopy dominated by *Juniperus osteosperma* with *Artemisia tridentata ssp. wyomingensis* dominating the sparse to moderately dense short-shrub layer. Tree canopy cover values are over 5%, but typically less than 20%, and canopy height is usually 2-10 m. Other shrubs, such as *Atriplex canescens, Atriplex confertifolia, Artemisia nova, Chrysothamnus viscidiflorus, Ephedra nevadensis, Ericameria nauseosa, Gutierrezia sarothrae, Opuntia* spp., or *Purshia* spp., may be present but generally with low cover. The sparse to moderately dense herbaceous layer is dominated by graminoids such as *Achnatherum hymenoides, Aristida* spp., *Bouteloua* spp., *Carex filifolia, Elymus elymoides, Hesperostipa comata, Pleuraphis jamesii (= Hilaria jamesii), Pascopyrum smithii, Poa secunda, Pseudoroegneria spicata, Sporobolus* spp., and introduced annual *Bromus* spp. Associated forbs may include *Artemisia frigida, Eriogonum* spp., *Gayophytum racemosum, Leptodactylon pungens, Phlox hoodii*, and *Plantago patagonica*.

DISTRIBUTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This association was observed and sampled along the Chukar Trailhead Road west of the park on land managed by the U.S. Bureau of Land Management and in the East Portal area of the park. It is likely to be present on similar sites within the canyon, but these sites are difficult to access.

Globally
This sparse woodland association occurs throughout much of the western Rocky Mountains, Colorado Plateau, and Great Basin region and extends east to the Bighorn Mountains and hills of central Wyoming.

ENVIRONMENTAL DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This woodland association was sampled in two very different environments. One plot is located on ridges in Mancos shale badlands. The other was sampled on very steep, rocky slopes that are subject to rockslides. Slopes range from moderately steep (26% slope) to steep (70% slope), and elevation ranges between 1882 and 2067 m; both plots are oriented to the northwest. The unvegetated surface has moderate to high cover of litter and sparse cover of cryptogams. Large rocks, small rocks, and bare soil comprise much of the unvegetated surface. Downed wood is uncommon. Soils are rapidly drained clay loams on the Manco shale site and coarse in texture where derived from Black Canyon schist and gneiss.

Globally
This sparse woodland association has been reported from semi-arid foothills, plateaus and mountains throughout much of the western Rocky Mountains, Colorado Plateau, and Great Basin. Elevation ranges from 1220 to 2260 m (4000-7400 feet). This community occurs on a variety of slopes and aspects, often at the break between foothill and basin. Soils are generally coarse-textured, calcareous alluvial or eolian deposits derived from sandstone and shale. Evidence of erosion such as gullies and rills is not uncommon. There are generally significant amounts of bare ground, litter, and desert pavement at the soil surface. Rock cover is variable.

VEGETATION DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This rare woodland association is sparsely vegetated where it occurs on shale badlands west of the park (5-20% total cover) and densely vegetated on coarser substrates (45-90% total cover). This woodland association is characterized by an open tree canopy, typically 2-10 m tall, of *Juniperus osteosperma* trees that range in cover up to 20%. The shrub layer may be sparse but is dominated by one of the upland subspecies of *Artemisia tridentata* (either ssp. *wyomingensis* or ssp. *vaseyana*), ranging in cover from 1% in the sparse stands to nearly 50% in dense stands. A sparse subcanopy of *Juniperus osteosperma* and *Pinus edulis* trees from 1-2 m tall may be present. The shrub layer is relatively diverse but sparse in cover. The tall shrub *Amelanchier utahensis* provides sparse cover in mesic situations. Short and dwarf-shrubs provide sparse cover and include *Atriplex confertifolia, Glossopetalon spinescens var. meionandrum, Gutierrezia sarothrae*, and the succulents *Opuntia fragilis, Opuntia polyacantha*, and *Yucca harrimaniae*. The herbaceous layer is sparse to moderate in cover and low in diversity. Graminoids provide less than 1% cover per species and include *Achnatherum hymenoides, Bromus tectorum, Leymus salinus ssp. salinus, Pleuraphis jamesii*, and *Poa fendleriana*. Forbs include *Artemisia michauxiana, Ceratocephala testiculata* and *Cymopterus planosus*. Seedling *Juniperus osteosperma* and *Pinus edulis* trees are present. Cryptogram cover is sparse, provided by crustose lichens and mosses.

Globally
The vegetation is characterized by an open tree canopy dominated by *Juniperus osteosperma* with *Artemisia tridentata ssp. wyomingensis* dominating the sparse to moderately dense short-shrub layer. Tree canopy cover values are over 5%, but typically less than 20%, and the height of the tree canopy is 2-10 m. Other shrubs, such as *Atriplex canescens, Atriplex confertifolia, Artemisia nova, Chrysothamnus viscidiflorus, Ephedra nevadensis, Ericameria nauseosa, Gutierrezia sarothrae, Opuntia* spp., or *Purshia* spp., may be present but generally with low cover. The herbaceous layer tends to have sparse to low cover but can range to moderately dense cover in some stands. It is dominated by graminoids such as *Achnatherum hymenoides, Aristida* spp., *Bouteloua* spp., *Carex filifolia, Elymus elymoides, Hesperostipa comata, Pleuraphis jamesii (= Hilaria jamesii), Pascopyrum smithii, Poa secunda, Pseudoroegneria spicata, Sporobolus* spp., and introduced annual *Bromus* spp. Associated forbs may include *Artemisia frigida, Eriogonum* spp., *Gayophytum racemosum, Leptodactylon pungens, Phlox hoodii*, and *Plantago patagonica*.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tree canopy	*Juniperus osteosperma*
Tree subcanopy	*Juniperus osteosperma*
Tall shrub/sapling	*Amelanchier utahensis*
Short shrub/sapling	*Philadelphus microphyllus*
Short shrub/sapling	*Artemisia tridentata* ssp. *wyomingensis*
Herb (field)	*Artemisia frigida*
Herb (field)	*Artemisia michauxiana*

Herb (field)	*Achnatherum hymenoides*, *Bromus tectorum*, *Hesperostipa comata*

Globally

Stratum	Species
Tree canopy	*Juniperus osteosperma*
Short shrub/sapling	*Artemisia tridentata* ssp. *wyomingensis*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Exotic/Invasive: *Bromus tectorum* (exotic, High)

Globally
Data are not available.

CONSERVATION STATUS RANK
Global Rank & Reasons: G5? (1-Feb-1996).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
On dry, rocky or slickrock sites on the Colorado Plateau, this pinyon-juniper woodland association may include stands with very open tree canopies (5-10% cover) in cases where the total vegetation cover is less than 15%. These stands may be similar to open *Artemisia tridentata ssp. wyomingensis* shrublands with scattered pinyon and juniper trees, but they are considered a variation of the woodland type because of the ecological values of the trees.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: The sites are heavily grazed. This association is definitely slope- and aspect-related.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (8 observation points): (Observation Points: BLCA_AA.444, BLCA_AA.448, BLCA_AA.467, BLCA_AA.502, BLCA_AA.511, BLCA_AA.594, BLCA_AA.621, BLCA_AA.673).
Local Description Authors: J. Von Loh, mod. J. Coles
Global Description Authors: K.A. Schulz, mod. J. Drake and J. Coles

REFERENCES: Barney and Frischknecht 1974, Blackburn 1967, Blackburn et al. 1968a, Blackburn et al. 1968c, Blackburn et al. 1969a, Blackburn et al. 1969e, Blackburn et al. 1971, Bourgeron and Engelking 1994, Bradley 1964, Brotherson and Evenson 1983, Bunting 1987, CONHP unpubl. data 2003, Cogan et al. 2004, Dastrup 1963, DeVelice and Lesica 1993, Donart et al. 1978b, Driscoll et al. 1984, Everett 1987, Francis 1986, Isaacson 1967, Jameson et al. 1962, Johnson and Payne 1968, Johnston 1987, Jones 1992b, Larson and Moir 1987, MTNHP 2002b, Milton and Purdy 1983, Moir and Carleton 1987, Stuever and Hayden 1997a, USFS 1983a, West et al. 1998, Western Ecology Working Group n.d., Wright et al. 1979

Juniperus osteosperma / Bromus tectorum Semi-natural Woodland

Utah Juniper / Cheatgrass Semi-natural Woodland

CODE	CEGL002817
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Evergreen woodland (II.A.)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen woodland (II.A.4.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.)
FORMATION	Rounded-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.a.)
ALLIANCE	*JUNIPERUS OSTEOSPERMA* WOODLAND ALLIANCE (A.536) Utah Juniper Woodland Alliance

ECOLOGICAL SYSTEM(S): Great Basin Pinyon-Juniper Woodland (CES304.773)
Colorado Plateau Pinyon-Juniper Woodland (CES304.767)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY

Globally

This semi-natural woodland association is usually a degraded form of other *Juniperus osteosperma* associations with native grass understories. It occurs on ridges and benches in western Colorado and eastern Utah. In these stands, significant ground disturbance, such as ground fire or sheep grazing, allows *Bromus tectorum* to establish and out-compete native grasses. Elevations range from below 1600 to 1745 m (5250-5725 feet), and slopes vary from gentle to moderately steep. Soils are sandy and well-drained. The substrate is often rocky, and rocks, downed wood and cryptobiotic crusts may cover most of the unvegetated surface. The canopy of *Juniperus osteosperma* is usually open, with between 20 and 55% cover. Shrubs are sparse and low in diversity but may include scattered individuals of *Artemisia tridentata, Gutierrezia sarothrae*, and *Opuntia polyacantha*. The exotic annual grass *Bromus tectorum* dominates the understory, although cover will vary from year to year depending on soil moisture levels in the early spring. Sometimes traces of the original native grasses will persist, including *Achnatherum hymenoides, Poa fendleriana, Pleuraphis jamesii*, and *Hesperostipa comata*. If forbs are present, they also tend to indicate disturbance.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association is rare and was observed and sampled in the Black Canyon near the Warner Route within the park.

Globally

This association has been described from western Colorado and eastern Utah. It is likely to occur throughout the Intermountain West.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This woodland association was observed on toeslopes in the main canyon. The site is moderately steep (32% slope), occurs at 1744 m elevation, and is oriented to a northeastern aspect. The unvegetated surface has sparse cover of litter and cryptogams. Bedrock, large rocks, and small rocks comprise much of the unvegetated surface. Downed wood is common, up to 20% cover. Soils are rapidly drained sandy loams derived from Precambrian granitic and metamorphic rocks.

Globally

This woodland association occurs on ridges and benches in western Colorado and eastern Utah. Elevations range from below 1600 to 1745 m (5250-5725 feet), and slopes vary from gentle to moderately steep. Soils are sandy and well-drained. The substrate is often rocky, and rocks, downed wood and cryptobiotic crusts may cover most of the unvegetated surface.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This Utah juniper / cheatgrass woodland association is rare, occurring within the Black Canyon. The total vegetation cover ranges between 55 to 125% for this moderately to densely vegetated stand. This woodland association is characterized by an open tree canopy and subcanopy, typically 1-10 m tall, of *Juniperus osteosperma* trees that range in cover from 26 to 55%, and the exotic grass *Bromus tectorum* that ranges in cover from 25 to 50%. The shrub layer is sparse and low in diversity, including *Fraxinus anomala, Ribes* sp., and the succulent *Opuntia polyacantha*. The herbaceous layer is also low in diversity but provides moderate cover mostly by *Bromus tectorum*. Another grass species present and providing sparse cover is *Poa bigelovii*. Forbs provide sparse cover, less than 5% cover, and include *Androsace septentrionalis* and *Chenopodium fremontii*. Cryptogam cover is sparse, less than 5%, and is provided by lichens and mosses.

Globally

This semi-natural woodland association is usually a degraded form of other *Juniperus osteosperma* associations with native grass understories. The canopy of *Juniperus osteosperma* is usually open, with between 20 and 55% cover. Shrubs are sparse and low in diversity but may include scattered individuals of *Artemisia tridentata, Gutierrezia*

sarothrae, and *Opuntia polyacantha*. The exotic annual grass *Bromus tectorum* dominates the understory, although cover will vary from year to year depending on soil moisture levels in the early spring. Sometimes traces of the original native grasses will persist, including *Achnatherum hymenoides, Poa fendleriana, Pleuraphis jamesii*, and *Hesperostipa comata*. If forbs are present, they also tend to indicate disturbance.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tree canopy	*Juniperus osteosperma*
Herb (field)	*Bromus tectorum*

Globally

Stratum	Species
Tree canopy	*Juniperus osteosperma*
Herb (field)	*Bromus tectorum*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CONSERVATION STATUS RANK
Global Rank & Reasons: GNA (ruderal) (12-Jul-2005).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: This association is common where it was observed but is not well-sampled.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (1 plot, 17 observation points): (Plot: BLCA.0115. Observation Points: BLCA_AA.296, BLCA_AA.302, BLCA_AA.304, BLCA_AA.307, BLCA_AA.311, BLCA_AA.318, BLCA_AA.319, BLCA_AA.327, BLCA_AA.365, BLCA_AA.413, BLCA_AA.445, BLCA_AA.637, BLCA_AA.769, BLCA_AA.854, BLCA_AA.856, BLCA_AA.857, BLCA_AA.858).
Local Description Authors: J. Von Loh, mod. J. Coles
Global Description Authors: J. Coles

REFERENCES: Western Ecology Working Group n.d.

Juniperus osteosperma / Leymus salinus Woodland

Utah Juniper / Saline Wildrye Woodland

CODE	CEGL003109
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Evergreen woodland (II.A.)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen woodland (II.A.4.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.)
FORMATION	Rounded-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.a.)
ALLIANCE	*JUNIPERUS OSTEOSPERMA* WOODLAND ALLIANCE (A.536) Utah Juniper Woodland Alliance

ECOLOGICAL SYSTEM(S): Colorado Plateau Pinyon-Juniper Woodland (CES304.767)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY

Globally

This sparse woodland association occurs on low- to mid-elevation hogbacks, colluvial slopes and badlands in the Colorado Plateau of western Colorado and eastern Utah. Elevations range from 1488 to 1997 m (4880-6550 feet), and most sites are on cooler north and east aspects. Slopes may be gentle to moderately steep (3-46% slope) and are generally underlain by Mesozoic marine shales of the Morrison Formation or Mancos shale. Colluvium from sandstone cliffs or outcrops upslope from the stand may cover the ground surface. Soils are rapidly drained and may be sandy loams or silty clays. The vegetation is characterized by a sparse to open canopy of *Juniperus osteosperma* with between 1 and 25% cover. *Pinus edulis* is either absent or present in very low amounts in the canopy, although *Juniperus osteosperma* and *Pinus edulis* seedlings may be present. There is no shrub layer, but scattered short and dwarf-shrubs may total up to 10% cover in more heavily vegetated stands. Common species include *Atriplex confertifolia, Artemisia bigelovii, Artemisia nova, Artemisia tridentata ssp. wyomingensis, Chrysothamnus viscidiflorus, Gutierrezia sarothrae, Glossopetalon spinescens var. meionandrum, Ephedra viridis, Gutierrezia sarothrae, Krascheninnikovia lanata, Opuntia erinacea, Opuntia polyacantha, Shepherdia rotundifolia*, and *Yucca harrimaniae*. The herbaceous layer is dominated by *Leymus salinus* with between 1 and 25% cover. The remainder of the herbaceous cover is sparse but diverse. Additional graminoids present include *Achnatherum hymenoides, Pleuraphis jamesii, Poa fendleriana*, and *Poa secunda*. Forbs include *Arenaria hookeri, Arenaria fendleri, Calochortus gunnisonii, Cymopterus bulbosus, Cymopterus purpureus, Eriogonum umbellatum, Leptodactylon pungens, Lepidium montanum, Oenothera pallida, Phlox austromontana, Petradoria pumila, Phlox hoodii, Sphaeralcea coccinea, Streptanthella longirostris, Stenotus acaulis*, and *Xylorhiza venusta*.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association is absent from or rare in the park and was observed and sampled west of Red Rocks on BLM-managed land.

Globally

The plant association occurs on low-elevation marine shales in western Colorado and eastern Utah.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This wooded herbaceous association was observed midslope in badlands topography. The site is moderately steep (25% slope), occurs at 1882 m elevation, and is oriented to the northwest. The unvegetated surface has high exposure of bare soil and moderate cover of litter and gravel. Soils are rapidly drained clay loams derived from Mancos and Morrison shales.

Globally

This sparse woodland association occurs on canyon rims, ledges, low- to mid-elevation hogbacks, colluvial slopes, toeslopes and badlands in the Colorado Plateau of western Colorado and eastern Utah. Elevations range from 1488 to 1997 m (4880-6550 feet), and most sites are on cooler north and east aspects, although they are reported from west aspects in the Piceance Basin of northwestern Colorado (Baker 1982b). Slopes may be gentle to moderately steep (3-46% slope) and are generally underlain by Mesozoic marine shales of the Morrison Formation, Chinle Formation or Mancos shale. Other parent materials include Kayenta Formation and Cedar Mesa sandstone. Colluvium from sandstone cliffs or outcrops upslope is common on the ground surface. Soils are rapidly drained and may be sandy loams or silty clays.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This Utah juniper / Salina wildrye wooded herbaceous association is absent from or rare in the park. The total vegetation cover is 21% in this moderately vegetated stand. This wooded herbaceous association is characterized by an open tree canopy, from 2-5 m tall, of *Juniperus osteosperma* trees that provide 6% cover, and the tall bunchgrass *Leymus salinus ssp. salinus* that provides up to 4% cover. *Juniperus osteosperma* trees also occurred in the stand as saplings and seedlings but with sparse cover of 1% or less. The shrub layer is relatively diverse and is comprised of sparse short and dwarf-shrubs that provide up to 10% total cover. Most shrub cover is provided by *Atriplex*

confertifolia and *Glossopetalon spinescens var. meionandrum*, with sparse cover provided by *Artemisia tridentata ssp. wyomingensis, Chrysothamnus greenei, Gutierrezia sarothrae, Krascheninnikovia lanata, Opuntia polyacantha*, and *Yucca harrimaniae*. Herbaceous cover is sparse, less than 5%, but the layer is diverse. Additional graminoids present providing sparse cover include *Achnatherum hymenoides, Elymus elymoides, Pleuraphis jamesii, Poa fendleriana*, and *Poa secunda*. Forbs also provide sparse cover and include *Alyssum minus, Arenaria hookeri, Astragalus* sp., *Cymopterus purpureus, Erigeron* spp., *Eriogonum umbellatum var. subaridum*, and *Xylorhiza venusta*.

Globally
This association has a sparse to open canopy of *Juniperus osteosperma* with between 1 and 25% cover. *Pinus edulis* is either absent or present in very low amounts in the canopy, although *Juniperus osteosperma* and *Pinus edulis* seedlings may be present. There is no shrub layer, but scattered short and dwarf-shrubs may total up to 10% cover in more heavily vegetated stands. Common species include *Atriplex confertifolia, Artemisia bigelovii, Artemisia nova, Artemisia tridentata ssp. wyomingensis, Chrysothamnus viscidiflorus, Ephedra viridis, Gutierrezia sarothrae, Glossopetalon spinescens var. meionandrum, Ephedra viridis, Eriogonum microthecum, Gutierrezia sarothrae, Krascheninnikovia lanata, Opuntia erinacea, Opuntia polyacantha, Shepherdia rotundifolia*, and *Yucca harrimaniae*. The herbaceous layer is dominated by *Leymus salinus* with between 1 and 25% cover. Herbaceous cover is sparse but diverse. Additional graminoids present include *Achnatherum hymenoides, Pleuraphis jamesii, Poa fendleriana*, and *Poa secunda*. Forbs also provide sparse cover and include *Arenaria hookeri, Arenaria fendleri, Calochortus gunnisonii, Cymopterus bulbosus, Cymopterus purpureus, Eriogonum umbellatum, Leptodactylon pungens, Lepidium montanum, Oenothera pallida, Phlox austromontana, Petradoria pumila, Phlox hoodii, Sphaeralcea coccinea, Streptanthella longirostris, Stenotus acaulis*, and *Xylorhiza venusta*.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tree canopy	*Juniperus osteosperma*
Herb (field)	*Atriplex confertifolia*, *Glossopetalon spinescens* var. *meionandrum*

Globally

Stratum	Species
Tree canopy	*Juniperus osteosperma*
Herb (field)	*Leymus salinus*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Exotic/Invasive: *Ovis canadensis* (reintroduced bighorn sheep may utilize this type.)

CONSERVATION STATUS RANK
Global Rank & Reasons: G3 (26-Jan-2006). The Colorado Natural Heritage Program tracks this association and has given it a rank of S3. It may be somewhat more common in Utah, as there is more potential habitat, but it is unlikely that there are more than 100 viable occurrences worldwide. All stands tend to be small, generally less than five hectares.

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
The classification and description of this type are based on data from a single vegetation plot.

Globally
There may be some difficulty in clearly distinguishing *Pinus edulis - Juniperus* spp. / *Leymus salinus* Woodland (CEGL002340) from this association, in which case they may need to be combined. In particularly sparse stands, it may also be difficult to distinguish *Leymus salinus* Shale Sparse Vegetation (CEGL002745) from this association.

CLASSIFICATION CONFIDENCE: 1 - Strong

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Sampled stand covers several acres in the vicinity.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (1 plot, 1 observation point): (Plot: BLCA.0116. Observation Point: BLCA_AA.696).
Local Description Authors: J. Von Loh, mod. J. Coles
Global Description Authors: J. Coles, mod. K.A. Schulz

REFERENCES: Baker 1982b, Bourgeron and Engelking 1994, CONHP unpubl. data 2003, Driscoll et al. 1984, Western Ecology Working Group n.d.

Pinus edulis - (Juniperus monosperma, Juniperus osteosperma) / Hesperostipa comata Woodland

Two-needle Pinyon - (One-seed Juniper, Utah Juniper) / Needle-and-Thread Woodland

CODE	CEGL000797
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Evergreen woodland (II.A.)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen woodland (II.A.4.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.)
FORMATION	Rounded-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.a.)
ALLIANCE	*PINUS EDULIS - (JUNIPERUS* SPP.) WOODLAND ALLIANCE (A.516) Two-needle Pinyon - (Juniper species) Woodland Alliance

ECOLOGICAL SYSTEM(S): Colorado Plateau Pinyon-Juniper Woodland (CES304.767)
Southern Rocky Mountain Pinyon-Juniper Woodland (CES306.835)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY
Globally
This woodland association is known from western and south-central Colorado and eastern Utah. Stands occur on a variety of sites from flat or gentle lower slopes, benches, mesatops to steep colluvial slopes to montane alluvial fans. Parent materials are frequently sandstone or shale. This woodland is characterized by the dominance or codominance of *Pinus edulis* in an open evergreen tree canopy. *Juniperus osteosperma* or *Juniperus monosperma* may codominate some stands, and *Juniperus scopulorum* may also be present. The sparse to moderately dense herbaceous layer is dominated by the perennial bunchgrass *Hesperostipa comata (= Stipa comata)*, with *Achnatherum hymenoides (= Oryzopsis hymenoides), Koeleria macrantha, Bouteloua gracilis, Pleuraphis jamesii (= Hilaria jamesii)*, and *Pascopyrum smithii* often present to common. Forb cover is generally sparse but may include *Heterotheca villosa, Hymenoxys* spp., *Artemisia dracunculus (= Artemisia dracunculoides), Oxytropis lambertii, Castilleja* sp., *Eriogonum jamesii*, and *Sphaeralcea coccinea*. Scattered shrubs and dwarf-shrubs may also be present, such as *Cercocarpus montanus, Quercus gambelii, Atriplex canescens, Artemisia frigida, Ephedra viridis*, or *Gutierrezia sarothrae*. *Opuntia polyacantha* and *Yucca glauca* are often present. Diagnostic of this woodland association is the dominance or codominance of *Pinus edulis* in the tree canopy and a *Hesperostipa comata*-dominated herbaceous layer.

DISTRIBUTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This association is uncommon in the park and was sampled in the canyons on the North Rim and near Bostwick Park in the Black Canyon of the Gunnison National Park.

Globally
This association is known from four counties (Montrose, San Miguel, Mesa, and Saguache) in western portion of Colorado (Isaacson 1967, P. Lyon pers. comm.). It also occurs in southeastern Utah.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This pinyon-juniper woodland association is found on midslopes of canyon sides with a mixture of talus and cliffs. Sites are steep (29- to 48-degree slopes), occur at 2123 and 2156 m elevation, and are oriented to southerly aspects. The unvegetated ground surface has high cover of bedrock and large and small rocks. Vegetation is rooted in rock fractures.

Globally

This woodland association occurs on slopes, benches and ridges with coarse-sandy, sometimes rocky soils. Elevations range between 1490 and 2156 m (4900-7070 feet); slopes are level to steep and may be oriented to any aspect. The unvegetated soil surface may be rocky, gravelly, or mostly bare ground, or biological soil crusts can have high cover in areas that have been protected from grazing. The sandy or silty soils are generally derived from sandstone, less often from shale, alluvial or eolian deposits.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This pinyon-juniper woodland has an open to moderately dense (10-25% cover) tree canopy dominated by 10- to 15-m tall *Pinus edulis* and *Juniperus osteosperma* with an herbaceous understory typically dominated by *Hesperostipa comata*. Scattered shrubs of variable species may form an open shrub layer. Common shrubs include *Brickellia grandiflora, Ephedra viridis, Fendlera rupicola, Holodiscus dumosus, Rhus trilobata*, and cacti *Echinocereus engelmannii* and *Opuntia fragilis*. The open (10-12% cover) herbaceous layer is primarily composed of graminoids and is dominated or codominated by *Hesperostipa comata* with other species present such as *Aristida purpurea, Artemisia ludoviciana, Poa fendleriana*, and the introduced annual grass *Bromus tectorum*.

Globally

This woodland association occurs on sandy, sometimes rocky soils in the northern Colorado Plateau. Total vegetation cover ranges between 10% to at least 70%. This woodland association is characterized by an open to somewhat closed canopy, typically 2-5 m tall, of *Pinus edulis* and *Juniperus osteosperma* trees, and an understory dominated by the bunchgrass *Hesperostipa comata*. Scattered shrubs such as *Ephedra viridis* and *Chrysothamnus viscidiflorus* are present but do not form a layer. The herbaceous layer is diverse and provides up to 15% cover. *Achnatherum hymenoides* may be codominant with *Hesperostipa comata*, and *Pleuraphis jamesii* or *Bouteloua gracilis* may be present with low cover. Forbs are more diverse but contribute little cover and may include *Hymenoxys richardsonii, Sphaeralcea coccinea*, and *Mirabilis multiflora*. Cryptobiotic crusts are present in some stands.

MOST ABUNDANT SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tree canopy	*Juniperus osteosperma*, *Pinus edulis*
Short shrub/sapling	*Ephedra viridis*
Herb (field)	*Hesperostipa comata*

Globally

Stratum	Species
Tree canopy	*Juniperus osteosperma*, *Pinus edulis*
Herb (field)	*Hesperostipa comata*

OTHER NOTEWORTHY SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Exotic/Invasive: *Bromus tectorum* (exotic, High)

Globally

Data are not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: G2? (14-Nov-1997). This is a rare, regionally endemic association. It is poorly known, with only five documented locations from four counties (Montrose, San Miguel, Mesa, and Saguache) in the western

portion of Colorado (CONHP 1997). None of these stands are protected. There is some uncertainty about the accuracy of this rank (the actual rank may be lower) because both Isaacson (1967) and Colorado Natural Heritage Program field investigators (P. Lyons pers. comm.) suggest it may be more widespread on the western slope of Colorado and may extend into Utah. This association occurs in a relatively common environmental setting, being found on flat or gently inclining slopes or benches of sandstone origin (CONHP 1997). Existing stands have been degraded by overgrazing, non-native species invasion, and possibly fire suppression. As of 2006, this association has been found regularly in national park units in southern and eastern Utah, as well as western Colorado. However, stands tend to be small, isolated, and affected by grazing.

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Juniperus monosperma-codominated stands are restricted to south-central Colorado.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Data are not available.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on data collected in 2004 during accuracy assessment (2 observation points): (Observation Points: BLCA_AA.466, BLCA_AA.703).
Local Description Authors: K.A. Schulz
Global Description Authors: D. Clark, mod. J. Coles and K.A. Schulz

REFERENCES: Bourgeron and Engelking 1994, CONHP unpubl. data, CONHP unpubl. data 2003, Driscoll et al. 1984, Isaacson 1967, Western Ecology Working Group n.d.

Pinus edulis - Juniperus osteosperma / Amelanchier utahensis Woodland

Two-needle Pinyon - Utah Juniper / Utah Serviceberry Woodland

CODE	CEGL002329
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Evergreen woodland (II.A.)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen woodland (II.A.4.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.)
FORMATION	Rounded-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.a.)
ALLIANCE	*PINUS EDULIS - (JUNIPERUS* SPP.) WOODLAND ALLIANCE (A.516) Two-needle Pinyon - (Juniper species) Woodland Alliance

ECOLOGICAL SYSTEM(S): Rocky Mountain Foothill Limber Pine-Juniper Woodland (CES306.955)
Colorado Plateau Pinyon-Juniper Woodland (CES304.767)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY
Globally
This association is characteristic of rocky slopes in the Colorado Plateau and extends into the southern Rocky Mountains in western Colorado and northeastern Arizona. Elevations and aspects are variable. Stands occurring at lower elevations (1406-2006 m) on the Colorado Plateau and northwestern Colorado tend to occur on northerly aspects, whereas stands occurring in west-central and southwestern Colorado occur at higher elevations (2481-2510 m) and have southerly aspects. Stands throughout the range may be on gentle to steep slopes (7-160%). Soils are rapidly drained, but texture and parent materials vary from clay to sandy loam and from marine shale to sandstone and granite. The unvegetated ground surface is composed primarily of exposed bedrock, rocks, gravel and bare ground. This woodland association has an open to relatively closed tree canopy and sparse to dense total vegetation cover. *Juniperus osteosperma* and *Pinus edulis* comprise the tree canopy, but individually do not exceed 25% cover.

There is a tall-shrub stratum with up to 25% cover dominated by *Amelanchier utahensis*. Other shrubs that may be present with low cover include *Artemisia tridentata, Cercocarpus montanus, Fraxinus anomala, Ephedra viridis, Fendlera rupicola, Quercus gambelii, Rhus trilobata*, and *Symphoricarpos oreophilus*. Dwarf-shrubs may include *Yucca harrimaniae, Gutierrezia sarothrae*, and *Chrysothamnus viscidiflorus*. The herbaceous layer has sparse to low cover and contains graminoids, such as *Achnatherum hymenoides, Carex geyeri, Leymus salinus*, and *Poa fendleriana*, and forbs, such as *Antennaria parvifolia, Erigeron peregrinus, Eriogonum ovalifolium, Heterotheca villosa, Lathyrus lanszwertii, Lepidium montanum, Phlox austromontana*, and *Streptanthella longirostris*. Disturbed stands may contain *Bromus tectorum*.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association is uncommon and was observed and sampled in Jones Draw near the Sandberg Ranches, in Dead Horse Gulch south of Poison Springhill, and on the South Rim southeast of Warner Point and Sunset Point on the park and adjacent BLM and private land.

Globally

This association is found in the Colorado Plateau in northeastern Arizona and southeastern Utah and extends east into the southern Rocky Mountains of western Colorado.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This woodland association was observed on the lower toeslopes to the upper slopes of ridges at middle elevations. Sites are moderate to steep (15-58% slopes), occur between 2481 and 2510 m elevation, and are oriented to southeastern to southwestern aspects. The unvegetated surface has low to high cover of litter and low to moderate cover of bedrock, large and small rocks, and exposure of bare soil. Soils are rapidly drained sandy loams derived from metamorphic and granitic rocks.

Globally

This association is characteristic of rocky slopes in the Colorado Plateau and extends into the southern Rocky Mountains in western Colorado and northeastern Arizona. Elevations and aspects are variable. Stands occurring at lower elevations (1406-2006 m) on the Colorado Plateau and northwestern Colorado tend to occur on northerly aspects, whereas stands occurring in west-central and southwestern Colorado occur at higher elevations (2481-2510 m) and have southerly aspects. Stands throughout the range may be on gentle to steep slopes (7-160%). Soils are rapidly drained, but texture and parent materials vary from clay to sandy loam and from marine shale to sandstone and granite. The unvegetated ground is composed primarily of exposed bedrock, rocks, gravel and bare ground.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This pinyon - Utah juniper / Utah serviceberry woodland is uncommon within the park and adjacent environs. The total vegetation cover ranges from 13 to 100% in these sparsely to densely vegetated stands. This woodland association is characterized by an open to relatively closed tree canopy, typically 1-10 m tall, of *Pinus edulis* and *Juniperus osteosperma* trees that range in cover from 5 to 25% and 0 to 5%, respectively. The tall shrub *Amelanchier utahensis* characterizes the stand understory and ranges in cover from 0 to 25%. The shrub layer is variable in cover and composition. Other tall shrubs commonly present include *Pinus edulis* and *Juniperus osteosperma* saplings that each provide up to 5% cover. Short and dwarf-shrubs provide sparse to low cover and include *Amelanchier utahensis, Artemisia tridentata ssp. vaseyana, Quercus gambelii*, and *Symphoricarpos oreophilus*. The herbaceous layer is diverse but provides sparse to low cover. Common graminoids include *Bromus tectorum, Carex geyeri*, and *Poa fendleriana*. Forbs commonly present and providing sparse to low cover include *Antennaria parvifolia, Artemisia ludoviciana, Collinsia parviflora, Erigeron peregrinus, Heterotheca villosa*, and *Lathyrus lanszwertii*. Scattered seedlings of *Pinus edulis* and *Quercus gambelii* provide less than 1% foliar cover for each species. Cryptogams are rarely present providing up to 5% cover.

Globally

This woodland association has an open to relatively closed tree canopy and sparse to dense total vegetation cover. The dominant tree species, *Juniperus osteosperma* and *Pinus edulis*, are typically between 2 and 10 m tall and individually do not exceed 25% cover. There is a tall-shrub stratum with up to 25% cover dominated by *Amelanchier utahensis*. Other shrubs that may be present with low cover (<5% cover) include *Artemisia tridentata,*

Coleogyne ramosissima, Cercocarpus montanus, Eriogonum microthecum, Fraxinus anomala, Ephedra viridis, Fendlera rupicola, Quercus gambelii, Purshia mexicana, Rhus trilobata, and *Symphoricarpos oreophilus*. Dwarf-shrubs may include *Yucca harrimaniae, Gutierrezia sarothrae*, and *Chrysothamnus viscidiflorus*. The herbaceous layer has sparse to low cover and contains graminoids, such as *Aristida purpurea, Achnatherum hymenoides, Carex geyeri, Leymus salinus, Pleuraphis jamesii*, and *Poa fendleriana*, and forbs, such as *Antennaria parvifolia, Artemisia ludoviciana, Astragalus moencoppensis, Collinsia parviflora, Cryptantha flava, Erigeron peregrinus, Erigeron utahensis, Eriogonum ovalifolium, Heterotheca villosa, Hymenopappus filifolius, Lathyrus lanszwertii, Lepidium montanum, Phlox austromontana*, and *Streptanthella longirostris*. Disturbed stands may contain *Bromus tectorum*.

MOST ABUNDANT SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tree canopy	*Juniperus osteosperma*, *Pinus edulis*
Tall shrub/sapling	*Amelanchier utahensis*
Short shrub/sapling	*Quercus gambelii*
Short shrub/sapling	*Artemisia tridentata* ssp. *vaseyana*
Herb (field)	*Symphoricarpos oreophilus*
Herb (field)	*Bromus tectorum*, *Poa fendleriana*

Globally

Stratum	Species
Tree canopy	*Juniperus osteosperma*, *Pinus edulis*
Tall shrub/sapling	*Amelanchier utahensis*

OTHER NOTEWORTHY SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Exotic/Invasive: *Bromus tectorum* (exotic, High)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (11-Jan-2005).

CLASSIFICATION COMMENTS

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Amelanchier utahensis is a common constituent of plant communities on rocky slopes in the Colorado Plateau. There is some overlap with *Pinus edulis - Juniperus osteosperma / (Shepherdia rotundifolia, Amelanchier utahensis)* Wooded Shrubland (CEGL002334), and as more information becomes available, woodlands with *Amelanchier utahensis* as a significant component should be re-analyzed.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Often occurs on scree slopes.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (4 plots, 12 observation points): (Plots: BLCA.0073, BLCA.0082, BLCA.0130, BLCA.0136. Observation Points: BLCA_AA.243, BLCA_AA.314, BLCA_AA.335, BLCA_AA.336, BLCA_AA.350, BLCA_AA.360, BLCA_AA.402, BLCA_AA.526, BLCA_AA.768, BLCA_AA.851, BLCA_AA.869, BLCA_AA.917).
Local Description Authors: J. Von Loh, mod. J. Coles
Global Description Authors: J. Drake and J. Coles, mod. K.A. Schulz

REFERENCES: Western Ecology Working Group n.d.

Pinus edulis - Juniperus osteosperma / Artemisia nova Woodland

Two-needle Pinyon - Utah Juniper / Black Sagebrush Woodland

CODE	CEGL002331
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Evergreen woodland (II.A.)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen woodland (II.A.4.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.)
FORMATION	Rounded-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.a.)
ALLIANCE	*PINUS EDULIS - (JUNIPERUS* SPP.) WOODLAND ALLIANCE (A.516) Two-needle Pinyon - (Juniper species) Woodland Alliance

ECOLOGICAL SYSTEM(S): Colorado Plateau Pinyon-Juniper Woodland (CES304.767)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY

Globally

This Colorado Plateau association occurs in western and northern Colorado, eastern Utah and northeastern Arizona on the higher areas of local topographical features such as canyon rims, mesas, hills, ridgetops, and upper slopes. Sites are nearly level to moderately steep and tend toward northern aspects, although other directions are possible. Elevation ranges from 1772 to 2518 m (5800-8260 feet). The soils are variable and range from sandy loam to silt clay loam and sandy clay soil textures. Soils are typically shallow and rapidly drained. Parent materials are often sandstones or limestones but can also be eolian deposits or shale. The unvegetated surface is composed of litter, bare soil, bedrock, and large and small rocks. Cryptogams often have moderate to high cover. This woodland association ranges from a moderately dense to a more typically open tree canopy (10-60% cover) dominated by short evergreen trees 2-10 m tall. *Pinus edulis* and *Juniperus osteosperma* dominate the tree canopy and may form a sparse subcanopy 2-5 m tall where the upper canopy is taller. In most stands, *Pinus edulis* and *Juniperus osteosperma* each have between 3 and 35% canopy cover, although in some sparsely vegetated stands, they may have less. Scattered *Pseudotsuga menziesii* may be present at higher elevations. Shrubs provide low to moderate cover. The dwarf-shrub *Artemisia nova* is the most abundant shrub, usually with less than 20% cover (rarely up to 50%). Other shrubs include *Amelanchier utahensis, Artemisia tridentata, Cercocarpus montanus, Ephedra viridis, Gutierrezia microcephala, Purshia stansburiana, Purshia tridentata*, and *Opuntia* spp. A number of herbaceous species can be found across the range of this association, but any one stand usually has low to moderate diversity and less than 10% cover in aggregate. Common herbaceous species include the graminoids *Achnatherum hymenoides, Bouteloua gracilis, Carex* spp., *Elymus elymoides, Koeleria macrantha,* and *Poa fendleriana* and forbs *Antennaria parvifolia, Arabis* spp., *Hymenoxys richardsonii, Petradoria pumila, Phlox* spp., and many others.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association was observed and sampled on Green Mountain at the boundary of the park and lands administered by the BLM.

Globally

This association is found on the Colorado Plateau and western slope of the southern Rocky Mountains in western and northern Colorado, southern and eastern Utah and northeastern Arizona.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This woodland association was observed along canyon rims and on mesatops. Sites are nearly level to gently sloping (2-9% slopes), occur between 2421 and 2518 m elevation, and are oriented to northern aspects. The unvegetated surface has low to moderate cover of litter and cryptogams. Large and small rocks and exposures of bare soil provide moderate to high cover of the unvegetated surface. Downed wood is present and may be common, up to 20% cover. Soils are well-drained sandy clays and sandy clay loams derived from Mesozoic sandstones.

Globally

This Colorado Plateau association occurs on the higher areas of local topographical features such as canyon rims, mesas, hills, ridgetops, and upper slopes. Sites are nearly level to moderately steep and tend toward northern aspects,

although other directions are possible. Elevation ranges from 1772 to 2518 m (5800-8260 feet). The soils are variable and include sandy loam, sandy clay loam, silt loam, and silt clay loam soil textures. They tend to be shallow and rapidly drained. Parent materials are often sandstones but can also be eolian deposits, limestone, or shale. The unvegetated surface is composed of litter, bare soil, bedrock, and large and small rocks. Cryptogams often have moderate to high cover.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This pinyon pine - Utah juniper / black sagebrush association is rare on the west side of the park. The total vegetation cover ranges from 70 to 82% in these densely vegetated stands. This woodland association is characterized by an open canopy, typically 2-10 m tall, of *Pinus edulis* and *Juniperus osteosperma* trees that range in cover from 15 to 35% and 0 to 11%, respectively. The understory dwarf-shrub layer is characterized by *Artemisia nova* that provides 12 to 50% cover. A subcanopy layer of *Pinus edulis* and *Juniperus osteosperma* trees provides sparse cover in one stand. *Pinus edulis* and *Juniperus osteosperma* also occur in the stands as shorter seedlings or saplings but with sparse cover. The shrub layer is moderately diverse and provides low cover. Shrubs present include *Amelanchier utahensis, Cercocarpus montanus, Chrysothamnus depressus, Quercus gambelii, Symphoricarpos rotundifolius*, and *Tetradymia canescens*, and the succulent *Opuntia fragilis*. The herbaceous layer is relatively diverse and provides sparse to low cover. Common graminoids include *Carex* sp., *Elymus elymoides, Koeleria macrantha*, and *Poa fendleriana*. Forbs include *Arabis* spp., *Comandra umbellata, Erigeron* sp., *Eriogonum racemosum, Lathyrus lanszwertii, Penstemon* sp., *Petradoria pumila*, and *Phlox longifolia*. Cryptogam cover ranges from 5 to 25%.

Globally

This woodland association ranges from a moderately dense to a more typically open tree canopy (10-60% cover) dominated by short evergreen trees 2-10 m tall. *Pinus edulis* and *Juniperus osteosperma* dominate the tree canopy and may form a sparse subcanopy 2-5 m tall where the upper canopy is taller. In most stands, *Pinus edulis* and *Juniperus osteosperma* each have between 3 and 35% canopy cover, although in some sparsely vegetated stands, they may have less. Shrubs are present but provide low to moderate cover. The dwarf-shrub *Artemisia nova* is the most abundant shrub, usually with less than 20% cover, but stands with up to 50% cover have been observed. Other shrubs that are typically found include *Amelanchier utahensis, Artemisia tridentata, Cercocarpus montanus, Ephedra viridis, Gutierrezia microcephala, Purshia stansburiana, Purshia tridentata*, and *Opuntia* spp. Herbaceous species can be relatively diverse between stands, but any one stand usually has low to moderate diversity and less than 10% cover in aggregate. Common species include *Achnatherum hymenoides, Bouteloua gracilis, Carex* spp., *Elymus elymoides, Koeleria macrantha*, and *Poa fendleriana*. Forbs can include *Antennaria parvifolia, Arabis* spp., *Hymenoxys richardsonii, Petradoria pumila, Phlox* spp., and many others.

MOST ABUNDANT SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tree canopy	*Juniperus osteosperma*, *Pinus edulis*
Herb (field)	*Artemisia nova*
Herb (field)	*Poa fendleriana*

Globally

Stratum	Species
Tree canopy	*Juniperus osteosperma*, *Pinus edulis*
Herb (field)	*Artemisia nova*

OTHER NOTEWORTHY SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Other: *Erethizon dorsatum* (G5)

Globally

Data are not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (11-Jan-2005).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: It is likely that more examples of this association can be found in the western parts of Black Canyon of the Gunnison National Park. Many *Pinus edulis* trees have scars from porcupine foraging activities.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (3 plots, 2 observation points): (Plots: BLCA.0087, BLCA.0105, BLCA.0108. Observation Points: BLCA_AA.536, BLCA_AA.581).
Local Description Authors: J. Von Loh and G. Bradshaw, mod. J. Coles
Global Description Authors: J. Drake, mod. J. Coles and K.A. Schulz

REFERENCES: Western Ecology Working Group n.d.

Pinus edulis - Juniperus osteosperma / Atriplex spp. Woodland

Two-needle Pinyon - Utah Juniper / Saltbush species Woodland

CODE	CEGL002366
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Evergreen woodland (II.A.)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen woodland (II.A.4.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.)
FORMATION	Rounded-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.a.)
ALLIANCE	*PINUS EDULIS - (JUNIPERUS* SPP.) WOODLAND ALLIANCE (A.516) Two-needle Pinyon - (Juniper species) Woodland Alliance

ECOLOGICAL SYSTEM(S): Colorado Plateau Pinyon-Juniper Woodland (CES304.767)
Great Basin Pinyon-Juniper Woodland (CES304.773)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY
Globally
This woodland association is described from Capitol Reef National Park in southern Utah and Black Canyon of the Gunnison National Park in western Colorado; it likely occurs elsewhere in the Colorado Plateau. These higher elevation pinyon-juniper stands occur on shale-derived soils at 1583-2083 m. Sites are gentle to steep (4- to 88-degree slopes) and occur on plateau slopes, valley sides, midslopes of hills, and on ridgetops and hogbacks. Substrates are variable and include silty or sandy soils derived from sandstones and shale, rapidly drained gravelly/rocky soils, and soils derived from eroded, highly dissected gypsum parent material with poor infiltration/rapid runoff. The unvegetated ground surface has high cover of biotic crust, bare ground, or sometimes a layer of surface rock and gravel. The vegetation is characterized by an open to moderate (15-25% cover) tree canopy 2-5 m tall that is dominated by *Pinus edulis* and *Juniperus osteosperma* trees, with an open to moderately dense short-shrub layer dominated by *Atriplex confertifolia* or *Atriplex canescens*. Other short and dwarf-shrubs present may include *Artemisia tridentata ssp. wyomingensis, Atriplex cuneata, Chrysothamnus viscidiflorus, Ephedra torreyana, Ephedra viridis, Gutierrezia sarothrae, Krascheninnikovia lanata, Mahonia fremontii*, and the cactus *Opuntia polyacantha*. The open to sparse (<15% cover) herbaceous layer is primarily composed of graminoids such as *Achnatherum hymenoides, Leymus salinus (= Elymus salinus), Pleuraphis jamesii, Poa secunda*, and *Sporobolus flexuosus*. Forbs such as *Eriogonum inflatum* typically provide less than 1% total cover. The introduced annual species *Bromus tectorum* and *Erodium cicutarium* are often abundant. *Atriplex canescens* and *Artemisia tridentata*

ssp. wyomingensis are restricted to the stand with non-gypsum parent material. Cryptogams provide up to 27% cover.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This pinyon-juniper woodland association was sampled near Chukar Trailhead in Black Canyon and in Red Rock Canyon.

Globally

This association is described from southern Utah and western Colorado. It has been reported from the Wasatch Formation at the foot of Grand Mesa in western Colorado and is likely to occur in relatively small stands throughout the Colorado Plateau.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This pinyon-juniper woodland association is found on the midslope of hills and on ridgetops. Sites are gentle to steep (4- to 88-degree slopes), occur between 1979 and 2082 m elevation, and are oriented from east to south and southwest aspects. Substrate is derived from highly dissected gypsum parent material with rapid runoff or rapidly drained gravelly/rocky substrate. The unvegetated ground surface has high cover biotic crust, bare ground, or a layer of surface rock and gravel in one non-gypsum stand.

Globally

This woodland association has been described from the Colorado Plateau in southeastern Utah and western Colorado. These higher elevation pinyon-juniper stands occur on shale-derived soils at 1583-2083 m. Sites are gentle to steep (4- to 88-degree slopes) and occur on plateau slopes, valley sides, midslopes of hills, and on ridgetops and hogbacks. Substrates are variable and include silty or sandy soils derived from Dakota Formation sandstones and Morrison Formation (Brushy Basin Member) shale, rapidly drained gravelly/rocky soils, and soils derived from eroded, highly dissected gypsum parent material with poor infiltration/rapid runoff. The unvegetated ground surface has high cover of biotic crust, bare ground, or sometimes a layer of surface rock and gravel.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This woodland has an open to moderate (15-25% cover) tree canopy dominated by 2- to 5-m tall *Pinus edulis* and *Juniperus osteosperma* trees with an open to moderately dense short-shrub layer dominated by *Atriplex confertifolia* or *Atriplex canescens*. Other short and dwarf-shrubs present may include *Artemisia tridentata ssp. wyomingensis, Ephedra torreyana, Ephedra viridis, Gutierrezia sarothrae, Krascheninnikovia lanata, Mahonia fremontii*, and cacti *Opuntia polyacantha*. The open to sparse (<15% cover) herbaceous layer is primarily composed of graminoids, including *Achnatherum hymenoides, Leymus salinus (= Elymus salinus), Pleuraphis jamesii, Poa secunda, Sporobolus flexuosus*, and the introduced annual species *Bromus tectorum* and *Erodium cicutarium*. *Atriplex canescens* and *Artemisia tridentata ssp. wyomingensis* are restricted to the stand with non-gypsum parent material.

Globally

This woodland has an open to moderate (15-25% cover) tree canopy 2-5 m tall that is dominated by *Pinus edulis* and *Juniperus osteosperma* trees, with an open to moderately dense short-shrub layer dominated by *Atriplex confertifolia* or *Atriplex canescens*. Other short and dwarf-shrubs present may include *Artemisia tridentata ssp. wyomingensis, Atriplex cuneata, Chrysothamnus viscidiflorus, Ephedra torreyana, Ephedra viridis, Gutierrezia sarothrae, Krascheninnikovia lanata, Mahonia fremontii*, and the cactus *Opuntia polyacantha*. The open to sparse (<15% cover) herbaceous layer is primarily composed of graminoids such as *Achnatherum hymenoides, Leymus salinus (= Elymus salinus), Pleuraphis jamesii, Poa secunda*, and *Sporobolus flexuosus*. Forbs such as *Eriogonum inflatum* typically provide less than 1% total cover. The introduced annual species *Bromus tectorum* and *Erodium cicutarium* are often abundant. *Atriplex canescens* and *Artemisia tridentata ssp. wyomingensis* are restricted to the stand with non-gypsum parent material. Cryptogams provide up to 27% cover.

MOST ABUNDANT SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tree canopy	*Juniperus osteosperma*, *Pinus edulis*

Tall shrub/sapling	*Mahonia fremontii*
Short shrub/sapling	*Atriplex confertifolia*
Short shrub/sapling	*Atriplex canescens*, *Ephedra viridis*

Globally

Stratum	Species
Tree canopy	*Juniperus osteosperma*, *Pinus edulis*
Tall shrub/sapling	*Mahonia fremontii*
Short shrub/sapling	*Atriplex confertifolia*, *Atriplex cuneata*
Short shrub/sapling	*Atriplex canescens*, *Ephedra viridis*
Herb (field)	*Gutierrezia sarothrae*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Exotic/Invasive: *Bromus tectorum* (exotic, High)

Globally
Data are not available.

CONSERVATION STATUS RANK
Global Rank & Reasons: GNR (23-Mar-2005).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CLASSIFICATION CONFIDENCE: 3 - Weak

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Data are not available.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on data collected in 2004 during accuracy assessment (3 observation points): (Observation Points: BLCA_AA.617; BLCA_AA.785, BLCA_AA.803).
Local Description Authors: K.A. Schulz
Global Description Authors: J. Coles, mod. K.A. Schulz

REFERENCES: Western Ecology Working Group n.d.

Pinus edulis - Juniperus osteosperma / Bromus tectorum Semi-natural Woodland

Two-needle Pinyon - Utah Juniper / Cheatgrass Semi-natural Woodland

CODE	CEGL002367
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Evergreen woodland (II.A.)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen woodland (II.A.4.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.)
FORMATION	Rounded-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.a.)
ALLIANCE	*PINUS EDULIS - (JUNIPERUS* SPP.) WOODLAND ALLIANCE (A.516) Two-needle Pinyon - (Juniper species) Woodland Alliance
ECOLOGICAL SYSTEM(S):	Colorado Plateau Pinyon-Juniper Woodland (CES304.767) Southern Rocky Mountain Pinyon-Juniper Woodland (CES306.835) Great Basin Pinyon-Juniper Woodland (CES304.773)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY

Globally

This woodland association has only been described from Capitol Reef National Park in southern Utah and Black Canyon of the Gunnison National Park in western Colorado. Stands are found on mesas, canyon sides, ridges, hillslopes, often on steep colluvial midslopes, valley bottoms and high stream terraces. Sites are typically moderate to steep, but range from 4- to 38-degree slopes, occur between 1555 and 2274 m elevation, and are often oriented to warmer southerly aspects. The unvegetated ground surface is generally bedrock, rock and gravel with moderate cover of bare ground and relatively low cover of litter. Soils in bottomland and stream terrace sites are typically well-drained fine sand derived from alluvium. It occurs in areas that experienced more than a century of concentrated domestic livestock grazing. The vegetation is characterized by an open to relatively closed canopy, typically 5-10 m tall, of *Pinus edulis* and *Juniperus osteosperma* trees that range in cover from 15 to 50%. *Juniperus osteosperma* cover tends to be more abundant than *Pinus edulis*, but either can dominate. The shrub layer is diverse but sparse to low in cover, providing less than 15% cover per stratum. Common shrubs include *Amelanchier alnifolia, Amelanchier utahensis, Artemisia tridentata ssp. wyomingensis, Brickellia californica, Cercocarpus montanus, Ericameria nauseosa, Opuntia fragilis, Opuntia polyacantha, Quercus gambelii, Ribes inerme, Symphoricarpos oreophilus*, and *Symphoricarpos rotundifolius*. The herbaceous layer has sparse to low cover (typically <15%) and has low diversity, being characteristically dominated by *Bromus tectorum*. Common graminoids with low cover include *Achnatherum hymenoides, Carex geyeri, Poa fendleriana, Sporobolus cryptandrus*, and *Sporobolus airoides*. Forbs are of moderate diversity and include *Agoseris glauca var. laciniata, Allium* sp., *Antennaria rosea, Arabis* spp., *Arenaria fendleri, Astragalus* sp., *Balsamorhiza sagittata, Chaenactis douglasii, Collinsia parviflora, Descurainia pinnata, Eriogonum lonchophyllum, Heterotheca villosa, Lomatium simplex, Machaeranthera canescens, Phlox longifolia*, and *Senecio* spp.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This woodland association was sampled at Red Rock Canyon, near Bostwick Park Access, south slope of Warner Trail, near Warner Point and other sites on North and South Rim in Black Canyon of the Gunnison National Park.

Globally

This association has only been described from Capitol Reef National Park in southern Utah and Black Canyon of the Gunnison National Park in western Colorado. It is likely to occur in disturbed pinyon-juniper woodlands throughout the Colorado Plateau, southern Rocky Mountain foothills, and Great Basin.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This woodland association is found on mesas, canyon sides, ridges, hillslopes, often on steep colluvial midslopes and one valley bottom site. Sites are typically moderate to steep, but range from 4- to 38-degree slopes, occur between 1916-2274 m elevation, and are often oriented to warmer southerly aspects. The unvegetated ground surface is generally bedrock, rock and gravel with moderate cover of bare ground and relatively low cover of litter.

Globally

This woodland association has only been described from Capitol Reef National Park in southern Utah and Black Canyon of the Gunnison National Park in western Colorado. Stands are found on mesas, canyon sides, ridges, hillslopes, often on steep colluvial midslopes, valley bottoms and high stream terraces. Sites are typically moderate to steep, but range from 4- to 38-degree slopes and occur between 1555 and 2274 m elevation, and are often oriented to warmer southerly aspects. The unvegetated ground surface is generally bedrock, rock and gravel with moderate cover of bare ground and relatively low cover of litter. Soils in bottomland and stream terrace sites are typically well-drained fine sand derived from alluvium. It occurs in areas that experienced more than a century of concentrated domestic livestock grazing.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This pinyon pine woodland association is characterized by an open to relatively closed canopy, typically 5-10 m tall, of *Pinus edulis* and *Juniperus osteosperma* trees that range in cover from 15 to 45%. *Juniperus osteosperma* with 3-35% cover tends to be more abundant than *Pinus edulis* with 3-25% cover, but either can dominate. The shrub

layer is diverse but sparse to low in cover, providing less than 15% cover per stratum. Common shrubs include *Amelanchier utahensis, Artemisia tridentata ssp. wyomingensis, Cercocarpus montanus, Opuntia fragilis, Quercus gambelii, Ribes inerme, Symphoricarpos oreophilus*, and *Symphoricarpos rotundifolius*. The herbaceous layer has sparse to low cover (typically <15%) and has low diversity, being characteristically dominated by *Bromus tectorum*. Common graminoids with low cover include *Achnatherum hymenoides, Carex geyeri*, and *Poa fendleriana*. Forbs are of moderate diversity and include *Agoseris glauca var. laciniata, Allium* sp., *Antennaria rosea, Arabis* spp., *Arenaria fendleri, Astragalus* sp., *Balsamorhiza sagittata, Chaenactis douglasii, Collinsia parviflora, Descurainia pinnata, Eriogonum lonchophyllum, Heterotheca villosa, Lomatium simplex, Phlox longifolia*, and *Senecio* spp.

Globally
The vegetation is characterized by an open to relatively closed canopy, typically 5-10 m tall, of *Pinus edulis* and *Juniperus osteosperma* trees that range in cover from 15 to 50%. *Juniperus osteosperma* cover tends to be more abundant than *Pinus edulis*, but either can dominate. The shrub layer is diverse but sparse to low in cover, providing less than 15% cover per stratum. Common shrubs include *Amelanchier alnifolia, Amelanchier utahensis, Artemisia tridentata ssp. wyomingensis, Brickellia californica, Cercocarpus montanus, Ericameria nauseosa, Opuntia fragilis, Opuntia polyacantha, Quercus gambelii, Ribes inerme, Symphoricarpos oreophilus*, and *Symphoricarpos rotundifolius*. The herbaceous layer has sparse to low cover (typically <15%) and has low diversity, being characteristically dominated by *Bromus tectorum*. Common graminoids with low cover include *Achnatherum hymenoides, Carex geyeri, Poa fendleriana, Sporobolus cryptandrus*, and *Sporobolus airoides*. Forbs are of moderate diversity and include *Agoseris glauca var. laciniata, Allium* sp., *Antennaria rosea, Arabis* spp., *Arenaria fendleri, Astragalus* sp., *Balsamorhiza sagittata, Chaenactis douglasii, Collinsia parviflora, Descurainia pinnata, Eriogonum lonchophyllum, Heterotheca villosa, Lomatium simplex, Machaeranthera canescens, Phlox longifolia*, and *Senecio* spp.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tree canopy	*Juniperus osteosperma*, *Pinus edulis*

Globally

Stratum	Species
Tree canopy	*Juniperus osteosperma*, *Pinus edulis*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CONSERVATION STATUS RANK
Global Rank & Reasons: GNA (ruderal) (23-Mar-2005).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
This association has only been described from Capitol Reef National Park and Black Canyon of the Gunnison National Park. It has likely been undersampled throughout its range because if its highly disturbed nature.

CLASSIFICATION CONFIDENCE: 3 - Weak

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Data are not available.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on data collected in 2004 during accuracy assessment (12 observation points): (Observation

Points: BLCA_AA.297, BLCA_AA.312, BLCA_AA.313, BLCA_AA.329, BLCA_AA.359, BLCA_AA.373, BLCA_AA.379, BLCA_AA.386, BLCA_AA.393, BLCA_AA.400, BLCA_AA.864, BLCA_AA.865).
Local Description Authors: K.A. Schulz
Global Description Authors: J. Coles, mod. K.A. Schulz

REFERENCES: Western Ecology Working Group n.d.

Pinus edulis - Juniperus osteosperma / Mixed Shrubs Talus Woodland

Two-needle Pinyon - Utah Juniper / Mixed Shrubs Talus Woodland

CODE	CEGL002328
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Evergreen woodland (II.A.)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen woodland (II.A.4.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.)
FORMATION	Rounded-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.a.)
ALLIANCE	*PINUS EDULIS - (JUNIPERUS* SPP.) WOODLAND ALLIANCE (A.516) Two-needle Pinyon - (Juniper species) Woodland Alliance

ECOLOGICAL SYSTEM(S): Colorado Plateau Pinyon-Juniper Woodland (CES304.767)
Colorado Plateau Pinyon-Juniper Shrubland (CES304.766)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY
Globally
This Colorado Plateau open woodland association is found in western Colorado and eastern Utah generally on lower slopes where talus and rockfalls accumulate. Sites can be between 1330 and 2290 m (4365-7500 feet) elevation. Slopes can be gentle to steep and of any aspect. The unvegetated ground surface is mostly bedrock and large and small rocks. Soils are rapidly drained. The parent material is talus rockfall. This woodland association can have sparse to moderate vegetation cover (4-61%) but is most often relatively sparse (<15% cover). The sparse to open tree canopy is 2-10 m tall. *Pinus edulis* and *Juniperus osteosperma* are the dominant canopy trees; either species can range from extremely low to moderate cover. The composition of the shrub stratum can be diverse, but cover is sparse to low. Common species are *Amelanchier utahensis, Artemisia bigelovii, Artemisia tridentata ssp. vaseyana, Cercocarpus montanus, Chrysothamnus viscidiflorus, Echinocereus triglochidiatus, Ephedra viridis, Eriogonum corymbosum, Fendlera rupicola, Gutierrezia sarothrae, Opuntia* spp., and *Rhus trilobata*. The herbaceous layer also provides sparse to low cover. Common graminoid species are *Achnatherum hymenoides, Aristida purpurea, Bromus tectorum, Elymus elymoides, Pleuraphis jamesii*, and *Poa fendleriana*. Common forbs are *Chamaesyce fendleri, Descurainia pinnata, Heterotheca villosa, Lepidium montanum*, and *Streptanthus cordatus*. Cryptogams are rare or absent on these active slopes.

DISTRIBUTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This association was observed and sampled near the Chukar Trailhead Road, in Red Rock Canyon, and on the South Rim in the Warner Point area of the park.

Globally
This association is found on the eastern edge of the Colorado Plateau and western slope of the southern Rocky Mountains in western Colorado.

ENVIRONMENTAL DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This woodland association was observed on midslopes of ridges and sideslopes of ravines. Sites are moderately steep (33-42% slopes), occur between 1955 and 2291 m elevation, and are oriented to western aspects. The unvegetated surface has low cover of litter and high cover of bedrock, large and small rocks, and exposure of bare soil. Downed wood is uncommon. Soils are rapidly drained clay loams, sandy loams, and loamy sands derived from mixed materials contained in Quaternary landslides.

Globally
This association is found on midslopes of ridges on dry colluvial slopes and in ravines and canyons on talus and rockfalls in the Colorado Plateau. Sites are found between 1330 and 2290 m elevation. Slopes can be gentle to steep (up to 78%) and of any aspect. The unvegetated ground surface is mostly bedrock and large and small rocks. Bare soil and litter are also found. Soils are variable and are generally rapidly drained clay loam, loam, sandy loam, loamy sand and, less commonly, silty clay soils. The parent material is talus rockfall and older landslide deposits from the Tidwell Member of the Morrison Formation, Chinle Formation, Kayenta and Wingate sandstones, Moenkopi Formation and Cutler Group (including Cedar Mesa sandstone).

VEGETATION DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This pinyon pine - Utah juniper / mixed shrub association is relatively uncommon on talus slopes of the park. The total vegetation cover ranges from 10 to 57% in these sparsely to moderately vegetated stands. This woodland association is characterized by an open tree canopy, typically 2-10 m tall, of *Juniperus osteosperma* and *Pinus edulis* trees that range in cover from 5 to 40% and 0 to 5%, respectively. A subcanopy tree layer of *Pinus edulis* provides low cover in one stand. *Pinus edulis* and *Juniperus osteosperma* trees also occur in the stands as saplings and seedlings. The shrub layer is diverse but sparse in terms of cover. The short shrub *Artemisia tridentata ssp. vaseyana* and the dwarf-shrub *Opuntia fragilis* range in cover from 2 to 3%. Other short and dwarf-shrubs providing sparse cover include *Amelanchier utahensis, Cercocarpus montanus, Ephedra viridis, Glossopetalon spinescens var. meionandrum, Gutierrezia sarothrae*, and the succulent *Echinocereus triglochidiatus*. The herbaceous layer is moderately diverse but sparse, providing less than 5% cover. Common graminoids include *Achnatherum hymenoides, Aristida purpurea, Bromus tectorum, Elymus elymoides, Pleuraphis jamesii*, and *Poa fendleriana*. Forbs are sparse in terms of diversity and cover; they include *Arabis* sp., *Chaetopappa ericoides, Chamaesyce fendleri, Heterotheca villosa, Physaria acutifolia, Stenotus armerioides, Streptanthus cordatus*, and *Tragia ramosa*. Cryptogam cover is sparse, up to 5% cover.

Globally
This woodland association can have very sparse to moderate total vegetation cover (4-61%) but is most often relatively sparse (<15%). The sparse to open tree canopy is 2-10 m tall. *Pinus edulis* and *Juniperus osteosperma* are the dominant canopy trees. Either species can have extremely low cover. *Juniperus osteosperma* has been observed with up to 45% cover, and *Pinus edulis* with up to 15% cover. A few *Fraxinus anomala* may be found in some stands. The composition of the shrub stratum can be diverse, but cover is sparse to low. Common species are *Amelanchier utahensis, Artemisia bigelovii, Artemisia tridentata ssp. vaseyana, Brickellia microphylla, Cercocarpus montanus, Chrysothamnus viscidiflorus, Echinocereus triglochidiatus, Ephedra viridis, Ephedra torreyana, Eriogonum corymbosum, Fendlera rupicola, Gutierrezia sarothrae, Opuntia* spp., and *Rhus trilobata*. The herbaceous layer also provides sparse to low cover, usually less than 5%. Common graminoid species are *Achnatherum hymenoides, Aristida purpurea, Bromus tectorum, Elymus elymoides, Pleuraphis jamesii*, and *Poa fendleriana*. Common forbs are *Chamaesyce fendleri, Descurainia pinnata, Heterotheca villosa, Lepidium montanum*, and *Streptanthus cordatus*. Cryptogams are rare or absent on these active slopes.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tree canopy	*Juniperus osteosperma*, *Pinus edulis*
Short shrub/sapling	*Artemisia tridentata* ssp. *vaseyana*, *Cercocarpus montanus*

Globally

Stratum	Species
Tree canopy	*Juniperus osteosperma*, *Pinus edulis*
Tall shrub/sapling	*Amelanchier utahensis*
Short shrub/sapling	*Artemisia bigelovii*, *Ephedra viridis*
Herb (field)	*Opuntia fragilis*
Herb (field)	*Achnatherum hymenoides*, *Elymus elymoides*, *Poa fendleriana*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Exotic/Invasive: *Bromus tectorum* (exotic, High)

CONSERVATION STATUS RANK
Global Rank & Reasons: GNR (11-Jan-2005).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Slopes supporting stands range from talus to boulder-strewn and are active.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (3 plots, 10 observation points): (Plots: BLCA.0066, BLCA.0069, BLCA.0110. Observation Points: BLCA_AA.299, BLCA_AA.333, BLCA_AA.334, BLCA_AA.506, BLCA_AA.551, BLCA_AA.690, BLCA_AA.698, BLCA_AA.699, BLCA_AA.711, BLCA_AA.802).
Local Description Authors: J. Von Loh, mod. J. Coles
Global Description Authors: J. Drake, mod. K.A. Schulz

REFERENCES: Western Ecology Working Group n.d.

Pinus edulis - Juniperus osteosperma / Sparse Understory Woodland

Two-needle Pinyon - Utah Juniper / Sparse Understory Woodland

CODE	CEGL002148
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Evergreen woodland (II.A.)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen woodland (II.A.4.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.)
FORMATION	Rounded-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.a.)
ALLIANCE	*PINUS EDULIS - (JUNIPERUS* SPP.) WOODLAND ALLIANCE (A.516) Two-needle Pinyon - (Juniper species) Woodland Alliance

ECOLOGICAL SYSTEM(S): Colorado Plateau Pinyon-Juniper Woodland (CES304.767)
Great Basin Pinyon-Juniper Woodland (CES304.773)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY
Globally
This variable woodland association is widespread in parts of western Colorado and eastern Utah. It is found most commonly on mid- to upper slopes, though other topographic positions are possible. It has been sampled at elevations between 1354 and 2389 m and on all aspects. At higher elevations, it tends toward southwestern aspects. Sites range from flat to moderately steep. The ground has variable amounts of litter and often has moderate to high amounts of gravel, rocks, and exposed bedrock. Cryptogamic cover is usually low to moderate, but some sites have up to 55-65% cover. Soils are always rapidly drained to moderately well-drained. Parent materials are also highly variable and can be sandstones, shales, or limestones. The lack of an understory may be due to high rock cover, low soil moisture, or a closed evergreen canopy of pinyon and juniper. This widespread association occurs as relatively sparse to moderately vegetated stands with total vegetation cover ranging from 10-75%. Sparsely vegetated stands (<10% total vegetation cover) composed of only trees are included as a best fit in this woodland association in extremely dry, rocky portions of the Colorado Plateau. The tree canopy is dominated by *Pinus edulis* and *Juniperus osteosperma*. Both typically range from 1-35% cover with some stands having canopy cover by one species up to 50%. The tree canopy is short, usually 2-10 m tall, and open to moderately closed. *Fraxinus anomala* has been

observed in the canopy of some stands but always at no more than 5% cover. Several shrub species are commonly found in this association, but they occur as widely scattered individuals or an open shrub stratum. Scattered small *Pinus edulis* and *Juniperus osteosperma* are found along with shrubs such as *Amelanchier utahensis, Artemisia tridentata ssp. wyomingensis, Cercocarpus montanus, Ephedra viridis, Eriogonum microthecum, Shepherdia rotundifolia*, and *Opuntia* spp. The herbaceous layer is low in cover (<5%) and usually low in diversity. *Achnatherum hymenoides, Bouteloua gracilis, Bromus tectorum, Poa fendleriana*, and *Pleuraphis jamesii* are common graminoids. Forbs are not abundant, but typical species include *Descurainia pinnata, Cryptantha* spp., and *Tetraneuris acaulis*.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This association was observed and sampled near Spring Draw on BLM-administered land and at Cimarron in the recreation area.

Globally
This association is known to occur in western Colorado and eastern Utah.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This woodland association was observed on midslopes of ridges and on high slopes of hills. Sites are moderately steep (17-30% slope), occur between 2317 and 2389 m elevation, and are oriented to southwestern aspects. The unvegetated surface has high cover of litter and low cover of cryptogams. Bedrock, large and small rocks, and exposures of bare soil comprise a moderate amount of the unvegetated surface. Soils are rapidly drained sandy loams and loamy sands derived from Mesozoic sandstones and Tertiary volcanic rocks.

Globally
This woodland association is found most commonly on mid- to upper slopes, though other topographic positions are possible, such as valley floors, plateaus, colluvial slopes, hills, canyon rims, canyon sides, mesas, plains, and benches.. It has been sampled at elevations between 1354 and 2389 m and on all aspects. At higher elevations, such as in Black Canyon of the Gunnison National Park it tends toward southwestern aspects. Sites range from flat to moderately steep (0-25 degrees). The ground has variable amounts of litter and often has moderate to high amounts of gravel, rocks, and exposed bedrock. Cryptogamic cover is usually low to moderate, but some sites have up to 55-65% cover. Soils vary in texture and can be loamy sand, silts, loams or silty clay but are always rapidly drained to moderately well-drained. Parent materials are also highly variable and can be sandstones, shales, limestones, among others.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This pinyon pine - Utah juniper / sparse understory association is rare within the project environs and the recreation area. The total vegetation cover ranges from 40 to 75% in these moderately to densely vegetated stands. This woodland association is characterized by an open to relatively closed canopy, typically 5-10 m tall, of *Pinus edulis* and *Juniperus osteosperma* trees that each range in cover from 35 to 50% and 0 to <1%, respectively. A subcanopy layer of *Pinus edulis, Juniperus osteosperma*, and *Juniperus scopulorum* trees is present and each provides <5% cover. *Pinus edulis* and *Juniperus scopulorum* also occur as shorter saplings and seedlings but with sparse cover. The shrub layer is diverse but sparse to low in cover, providing less than 5% cover per stratum. Common shrubs include *Amelanchier utahensis, Artemisia tridentata ssp. wyomingensis, Cercocarpus montanus, Opuntia fragilis, Quercus gambelii, Ribes inerme, Symphoricarpos oreophilus*, and *Symphoricarpos rotundifolius*. The herbaceous layer is low in diversity and sparse, providing less than 5% cover for both graminoids and forbs. Common graminoids include *Achnatherum hymenoides, Bromus tectorum, Carex geyeri*, and *Poa fendleriana*. Forbs are of moderate diversity and include *Agoseris glauca var. laciniata, Allium* sp., *Antennaria rosea, Arabis* spp., *Arenaria fendleri, Astragalus* sp., *Balsamorhiza sagittata, Chaenactis douglasii, Collinsia parviflora, Descurainia pinnata, Eriogonum lonchophyllum, Heterotheca villosa, Lomatium simplex, Phlox longifolia*, and *Senecio* spp.

Globally
This widespread pinyon-juniper woodland association occurs as relatively sparse to moderately vegetated stands with total vegetation cover ranging from 10-75%. Sparsely vegetated stands (<10% total vegetation cover) composed of only trees are included as a best fit in this woodland association in extremely dry, rocky portions of the

Colorado Plateau. The tree canopy is dominated by *Pinus edulis* and *Juniperus osteosperma*. Both typically range from 1-35% cover with some stands having canopy cover by one species up to 50%. The tree canopy is short, usually 2-10 m tall, and open to moderately closed. *Fraxinus anomala* has been observed in the canopy of some stands at Colorado National Monument but always at no more than 5% cover. Several shrub species are commonly found in this association, but they occur as widely scattered individuals or an open shrub stratum. Scattered small *Pinus edulis* and *Juniperus osteosperma* are found along with shrubs such as *Amelanchier utahensis, Artemisia bigelovii, Artemisia tridentata ssp. wyomingensis, Cercocarpus montanus, Chrysothamnus viscidiflorus, Coleogyne ramosissima, Ephedra viridis, Eriogonum microthecum, Gutierrezia sarothrae, Shepherdia rotundifolia, Symphoricarpos longiflorus*, and *Opuntia* spp., usually *Opuntia fragilis* or *Opuntia polyacantha*. The herbaceous layer is low in cover (<5%) and usually low in diversity. *Achnatherum hymenoides, Bouteloua gracilis, Bromus tectorum, Poa fendleriana*, and *Pleuraphis jamesii* are common graminoids. Forbs are not abundant, but typical species include *Descurainia pinnata, Cryptantha* spp., and *Tetraneuris acaulis*.

MOST ABUNDANT SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tree canopy	*Juniperus osteosperma*, *Pinus edulis*
Tree subcanopy	*Pinus edulis*

Globally

Stratum	Species
Tree canopy	*Juniperus osteosperma*, *Pinus edulis*

OTHER NOTEWORTHY SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Exotic/Invasive: *Bromus tectorum* (exotic, High), *Marrubium vulgare* (exotic, Medium/Low), *Phleum pratense* (exotic, Medium), *Poa pratensis* (exotic, Medium), *Verbena bracteata* (weedy native)

Globally

Exotic/Invasive: *Bromus tectorum* (invasive, High)

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (15-Dec-2004).

CLASSIFICATION COMMENTS

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Data are not available.

Globally

Environmental and physiognomic variability within this association is high. There are few consistent understory species across all parks, but that is part of the concept of this type. The general sparseness of the understory is one of the main diagnostic features. Because of the wide range of circumstances that result in a sparse understory, a lot of variability in the floristic components of the understory is allowed. It is possible that this type will be split into several associations based on environmental factors, since floristic factors are not diagnostic. On dry, rocky or slickrock sites on the Colorado Plateau, this pinyon-juniper woodland association may include stands with very open tree canopies (5-10% cover) in cases where the total vegetation cover is less than 15%, and they are considered a variation of the woodland type because of the ecological values of the trees.

CLASSIFICATION CONFIDENCE: 1 - Strong

ELEMENT SOURCES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Trees are of medium age, and boulders occupy one slope.

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (2 plots, 67 observation points): (Plots: BLCA.0146, CURE.0164. Observation Points: BLCA_AA.227, BLCA_AA.291, BLCA_AA.328, BLCA_AA.330, BLCA_AA.343, BLCA_AA.366, BLCA_AA.377, BLCA_AA.378, BLCA_AA.381, BLCA_AA.412, BLCA_AA.424, BLCA_AA.475, BLCA_AA.478, BLCA_AA.481, BLCA_AA.482, BLCA_AA.486, BLCA_AA.487, BLCA_AA.493,

BLCA_AA.498, BLCA_AA.499, BLCA_AA.514, BLCA_AA.515, BLCA_AA.528, BLCA_AA.530, BLCA_AA.531, BLCA_AA.575, BLCA_AA.598, BLCA_AA.599, BLCA_AA.602, BLCA_AA.604, BLCA_AA.626, BLCA_AA.653, BLCA_AA.658, BLCA_AA.691, BLCA_AA.722, BLCA_AA.744, BLCA_AA.754, BLCA_AA.760, BLCA_AA.761, BLCA_AA.763, BLCA_AA.770, BLCA_AA.772, BLCA_AA.800, BLCA_AA.810, BLCA_AA.829, BLCA_AA.839, BLCA_AA.840, BLCA_AA.841, BLCA_AA.844, BLCA_AA.850, BLCA_AA.852, BLCA_AA.859, BLCA_AA.860, BLCA_AA.862, BLCA_AA.866, BLCA_AA.907, BLCA_AA.909, CURE_AA.0498, CURE_AA.0747, CURE_AA.0769, CURE_AA.0782, CURE_AA.0808, CURE_AA.0818, CURE_AA.0828, CURE_AA.0841, CURE_AA.0851, CURE_AA.0873).
Local Description Authors: J. Von Loh, mod. J. Coles
Global Description Authors: J. Drake, mod. J. Coles and K.A. Schulz

REFERENCES: Western Ecology Working Group n.d.

Pinus edulis - Juniperus scopulorum / Holodiscus dumosus Woodland

Two-needle Pinyon - Rocky Mountain Juniper / Rockspirea Woodland

CODE	CEGL002802
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Evergreen woodland (II.A.)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen woodland (II.A.4.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.)
FORMATION	Rounded-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.a.)
ALLIANCE	*PINUS EDULIS - (JUNIPERUS* SPP.) WOODLAND ALLIANCE (A.516) Two-needle Pinyon - (Juniper species) Woodland Alliance

ECOLOGICAL SYSTEM(S): Colorado Plateau Pinyon-Juniper Woodland (CES304.767)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY
Globally
This woodland association is currently known from Black Canyon of the Gunnison, Curecanti National Recreation Area and Great Sand Dunes in Colorado and El Malpais National Monument in New Mexico. More survey and classification work are needed to fully characterize this type. The sampled Colorado stand occurs on a steep (100%), southwest-facing midslope on a ridge at 2303 m elevation. The unvegetated surface has moderate cover of litter and bedrock, large rocks, and small rocks. Downed wood is common. Substrate is a rapidly drained loamy sand soil derived from Black Canyon schist (mica schist). At El Malpais, this association occurs between about 2240 and 2390 m (7340-7850 feet) elevation on very gently rolling lava plateaus and collapse features, to steep slopes of cinder cones. Substrates are derived from basalt lava rock and cinders from cinder cone flows. Ground surface is made up of lava rock with abundant litter and occasional soil and coarse woody debris present. The vegetation is characterized by an open to moderately closed (30-60% cover) tree canopy 2-5 m tall codominated by *Pinus edulis* and *Juniperus scopulorum* with a short-shrub layer dominated by *Holodiscus dumosus*. The shrub layer is diverse in terms of species composition and provides low to moderate cover. Associated shrub species include *Cercocarpus montanus, Quercus gambelii, Artemisia tridentata, Philadelphus microphyllus, Pinus edulis* saplings, and *Artemisia frigida*. In New Mexico, *Ribes cereum* is common, and the cacti *Echinocereus coccineus* and *Opuntia polyacantha* are frequent associates, though cover is low. The herbaceous layer is low in species diversity and provides sparse to low cover. Species include *Achnatherum hymenoides, Arabis crandallii, Artemisia carruthii, Bouteloua gracilis, Descurainia incana, Poa fendleriana*, and *Senecio integerrimus*. Lichens and mosses can each provide low cover, up to 5%.

DISTRIBUTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This association is rare in the recreation area and was sampled near Hermit's Rest in the vicinity of Morrow Point Reservoir on Curecanti National Recreation Area.

Globally

This woodland association is currently known from Black Canyon of the Gunnison, Curecanti National Recreation Area and Great Sand Dunes in Colorado and El Malpais National Monument in New Mexico. More survey work is needed to fully document its global range.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This woodland association occurs midslope on ridges. The site is steep (100% slope), occurs at 2303 m elevation, and is oriented to the southwest. The unvegetated surface has moderate cover of litter and bedrock, large rocks, and small rocks. Downed wood is common. Litter depth ranges from 0.5-3 cm, with no measurable duff. Parent materials are Black Canyon schist (mica schist). Soils are rapidly drained loamy sands.

Globally

This woodland association occurs midslope on an extremely steep site with 100% slope at Black Canyon and on gently rolling lava plateaus, collapse features and steep slopes of cinder cones at El Malpais from 2240-2390 m elevation. Parent materials include mica schist, basalt and cinders. Unvegetated surfaces include bedrock, large rocks, small rocks with moderate to abundant litter and downed wood.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This two-needle pinyon pine - juniper species / glandular oceanspray woodland association is rare within the recreation area. The total vegetation cover is 65% in this moderately to densely vegetated stand. *Pinus edulis* and *Juniperus scopulorum* trees 2-5 m tall form a sparse to open canopy and contribute 25% and 5% cover, respectively, and *Holodiscus dumosus* short shrubs contribute up to 15% cover. The shrub layer is diverse in terms of species composition and provides low to moderate cover. Associated tall, short, and dwarf-shrubs include *Cercocarpus montanus, Quercus gambelii, Artemisia tridentata, Philadelphus microphyllus, Pinus edulis* saplings, and *Artemisia frigida*. The herbaceous layer is low in species diversity and provides sparse to low cover. The medium-tall bunchgrass *Achnatherum hymenoides* is the only grass present and provides sparse cover. Forbs provide sparse cover and include *Arabis crandallii, Descurainia incana ssp. incisa*, and *Senecio integerrimus*. A few *Pinus edulis* seedlings were present. Lichen and moss each provide low cover, up to 5%.

Globally

Vegetation of this association is characterized by a open to moderately closed (30-60%) canopy codominated by *Pinus edulis* and *Juniperus scopulorum* with a short-shrub layer of *Holodiscus dumosus*. Other coniferous species such as *Pinus ponderosa* or *Pseudotsuga menziesii* may be present but incidental. Shrub cover varies from low to abundant (up to 30%). Associated shrubs include *Cercocarpus montanus, Quercus gambelii, Artemisia tridentata, Philadelphus microphyllus, Artemisia frigida, Ribes cereum*, and cacti including *Echinocereus coccineus* and *Opuntia polyacantha*. Herbaceous diversity is low. At Black Canyon, the only documented graminoid is *Achnatherum hymenoides*, whereas at El Malpais, *Poa fendleriana* and *Bouteloua gracilis* are the most abundant, but do not exceed 5% cover. Forbs are sparse and sporadic and may include, but are not limited to, *Arabis crandallii, Artemisia carruthii, Descurainia incana ssp. incisa*, and *Senecio integerrimus*.

MOST ABUNDANT SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tree canopy	*Juniperus scopulorum*, *Pinus edulis*
Tall shrub/sapling	*Holodiscus dumosus*
Tall shrub/sapling	*Cercocarpus montanus*
Short shrub/sapling	*Philadelphus microphyllus*
Short shrub/sapling	*Artemisia tridentata*

Globally

Stratum	Species
Tree canopy	*Juniperus scopulorum*, *Pinus edulis*
Tall shrub/sapling	*Holodiscus dumosus*

OTHER NOTEWORTHY SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Data are not available.

Globally
Vulnerable: *Arabis crandallii* (globally imperiled, G2)

CONSERVATION STATUS RANK
Global Rank & Reasons: GNR (23-Jun-2005).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
This association has only been sampled from one location in Curecanti National Recreation Area in western Colorado. More surveys and classification work are needed to change the provisional status of this association.

CLASSIFICATION CONFIDENCE: 3 - Weak

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Type occurs on steep slopes. More quantitative data are needed to define this association.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (1 plot, 3 observation points): (Plot: CURE.0143. Observation Points: BLCA_AA.316, BLCA_AA.614, CURE_AA.0383).
Local Description Authors: J. Von Loh, mod. G. Bradshaw
Global Description Authors: K.A. Schulz, mod. M.E. Hall

REFERENCES: Western Ecology Working Group n.d.

Pinus edulis - Juniperus spp. / *Artemisia tridentata (ssp. wyomingensis, ssp. vaseyana)* Woodland

Two-needle Pinyon - Juniper species / (Wyoming Big Sagebrush, Mountain Big Sagebrush) Woodland

CODE	CEGL000776
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Evergreen woodland (II.A.)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen woodland (II.A.4.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.)
FORMATION	Rounded-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.a.)
ALLIANCE	*PINUS EDULIS - (JUNIPERUS* SPP.) WOODLAND ALLIANCE (A.516) Two-needle Pinyon - (Juniper species) Woodland Alliance

ECOLOGICAL SYSTEM(S): Colorado Plateau Pinyon-Juniper Woodland (CES304.767)
Southern Rocky Mountain Pinyon-Juniper Woodland (CES306.835)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY
Globally
This broadly defined woodland association is common in the Colorado Plateau but also occurs on dry foothills and mesas from north-central New Mexico and southern Colorado west to the eastern Mojave Desert, in extreme northwestern Colorado and adjacent Utah. Elevations range from 1465 to 2500 m (4800-8200 feet). Stands occur most often on flat to gentle slopes on all aspects. The soils are generally poorly developed, moderately deep to deep, well-drained to rapidly drained loams and sands. Ground cover is variable; bare soil is common, but bedrock, litter, and large or small rocks can also be abundant on some sites. Parent material includes sandstone and shale. The vegetation is characterized by a typically open tree canopy (10-30% cover but ranges up to 50% cover) that is codominated by *Pinus edulis* and *Juniperus* spp. The species of *Juniperus* varies with geography and elevation.

Juniperus monosperma is common in north-central New Mexico and southern Colorado. *Juniperus osteosperma* is common from northwestern New Mexico west and north into Arizona and Utah. *Juniperus scopulorum* is more common in higher elevation stands. *Artemisia tridentata* (either *ssp. vaseyana* or *ssp. wyomingensis* depending on location) strongly dominates the sparse to moderately dense short-shrub layer (10-35% cover). *Purshia stansburiana* is typically absent or scarce. Other shrubs present may include *Amelanchier utahensis, Arctostaphylos patula, Cercocarpus montanus, Ephedra viridis, Gutierrezia sarothrae, Quercus gambelii* (typically <5% cover), or species of *Yucca* and *Opuntia*. Herbaceous cover is variable but generally sparse and dominated by graminoids (<5% cover) with scattered forbs.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This type is uncommon and was observed and sampled along the Cimarron Utility Road of the recreation area and in Red Rock Canyon and the Green Mountain Basin of the park.

Globally
This woodland association is common on the Colorado Plateau, occurring from north-central New Mexico and southern Colorado west to the Mogollon Rim of Arizona and the eastern Mojave Desert, and in extreme northwestern Colorado and adjacent Utah.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This woodland association was observed on all slope positions of ridges. Sites are gentle to steep (8-74% slopes), occur between 2046 and 2502 m elevation, and are oriented to the southeast and southwest. The unvegetated surface has low to high cover of litter, gravel, cobbles, boulders, and bedrock. Exposure of bare soil is highest on the sites of the Green Mountain area. Litter and duff depths measured 0-4 cm and 0-6 cm, respectively. Soils are well-drained to rapidly drained sandy loams, loamy sands, and silt loams derived from Precambrian schist and gneiss, Quaternary alluvium and colluvium, or Morrison Formation.

Globally
This broadly defined woodland association occurs on dry foothills and mesas across much of the Colorado Plateau and adjacent areas. Elevations range from 1459 to 2502 m. Stands occur most often on flat to gentle slopes but can be found on moderate to moderately steep slopes on all aspects. The soils are often deep, generally poorly developed, moderately well-drained to rapidly drained loams and sands, and skeletal. Ground cover is variable; bare soil is common, but bedrock, litter, and large or small rocks can also be abundant on some sites. Parent material includes sandstone and shale.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This pinyon pine - juniper species / big sagebrush association is locally common in the park and recreation area. The total vegetation cover ranges from 39 to 89% in these moderately to densely vegetated stands. This woodland association is characterized by an open canopy, typically 2-10 m tall, of *Pinus edulis* and *Juniperus osteosperma* trees that range in cover from 5 to 25% and 5 to 50%, respectively. Subcanopy trees provide low to moderate cover, up to 20% cover, and include *Pinus edulis, Juniperus osteosperma*, and *Juniperus scopulorum*. The understory is characterized by the short shrub *Artemisia tridentata ssp. vaseyana* that ranges in cover from 5 to 20%. The shrub layer is diverse and provides low to moderate cover. The tall-shrub layer consists of sapling trees that provide sparse cover and include *Juniperus osteosperma, Juniperus scopulorum*, and *Pinus edulis*. Short and dwarf-shrubs provide low to moderate cover, including *Amelanchier utahensis, Ephedra viridis, Gutierrezia sarothrae*, and *Opuntia fragilis*. The herbaceous layer has high diversity and provides sparse to low cover. Common graminoids include *Achnatherum hymenoides, Bromus tectorum, Elymus elymoides*, and *Poa fendleriana*. Forbs commonly present include *Eriogonum racemosum* and *Sphaeralcea coccinea*. A few seedling *Pinus edulis, Juniperus osteosperma, Juniperus scopulorum*, and *Quercus gambelii* are occasionally present. Cryptogams are commonly present and provide cover from 5 to 25%.

Globally
This woodland is characterized by a typically open tree canopy (usually 10-30% cover but ranges up to 50% cover) that ranges from 2 to 10 m tall in most stands. The tree canopy is codominated by *Pinus edulis* and *Juniperus* spp. The species of *Juniperus* varies with geography and elevation. *Juniperus monosperma* is common in north-central

New Mexico and southern Colorado. *Juniperus osteosperma* is common in stands reported from northwestern New Mexico, western Colorado, Arizona and Utah. *Juniperus scopulorum* is more common in higher elevation stands. *Artemisia tridentata* strongly dominates the relatively sparse to moderately dense short-shrub layer (10-35% cover); either *ssp. vaseyana* or *ssp. wyomingensis* may be present, with *ssp. vaseyana* being more characteristic of higher elevations or more mesic conditions. *Purshia stansburiana* is typically absent or scarce. Other shrubs present may include *Amelanchier utahensis, Arctostaphylos patula, Cercocarpus montanus, Ephedra viridis, Gutierrezia sarothrae, Quercus gambelii* (typically <5% cover), or species of *Yucca* and *Opuntia*. Herbaceous cover is variable but is generally sparse and dominated by graminoids (<5% cover) with scattered forbs. Associated graminoids include *Achnatherum hymenoides (= Oryzopsis hymenoides), Bouteloua gracilis, Carex filifolia, Hesperostipa comata, Koeleria macrantha, Muhlenbergia torreyi, Pascopyrum smithii, Pleuraphis jamesii*, and *Poa fendleriana*. Forbs include species of *Cryptantha, Eriogonum, Penstemon*, and *Phlox*. Cryptogram cover tends to be low, but some stands may have moderate cover.

MOST ABUNDANT SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tree canopy	*Juniperus osteosperma*, *Juniperus scopulorum*, *Pinus edulis*
Tree subcanopy	*Juniperus osteosperma*, *Pinus edulis*
Short shrub/sapling	*Artemisia tridentata* ssp. *vaseyana*
Herb (field)	*Opuntia fragilis*
Herb (field)	*Bromus tectorum*, *Poa fendleriana*

Globally

Stratum	Species
Tree canopy	*Juniperus monosperma*, *Juniperus osteosperma*, *Pinus edulis*
Short shrub/sapling	*Artemisia tridentata* ssp. *vaseyana*

OTHER NOTEWORTHY SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (1-Feb-1996).

CLASSIFICATION COMMENTS

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
On dry, rocky or slickrock sites on the Colorado Plateau, this pinyon-juniper woodland association may include stands with very open tree canopies (5-10% cover) in cases where the total vegetation cover is less than 15%. These stands may be similar to open *Artemisia tridentata* shrublands with scattered pinyon and juniper trees but is considered to be a variation of the woodland type because of the ecological values of the trees.

CLASSIFICATION CONFIDENCE: 1 - Strong

ELEMENT SOURCES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Sites are located on scree and ledgy cliff faces.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (8 plots, 36 observation points): (Plots: BLCA.0033, BLCA.0034, BLCA.0059, BLCA.0065, BLCA.0067, BLCA.0068, CURE.0208, CURE.0209. Observation Points: BLCA_AA.294, BLCA_AA.315, BLCA_AA.341, BLCA_AA.342, BLCA_AA.349, BLCA_AA.364, BLCA_AA.376, BLCA_AA.403, BLCA_AA.454, BLCA_AA.455, BLCA_AA.458, BLCA_AA.468, BLCA_AA.488, BLCA_AA.494, BLCA_AA.500, BLCA_AA.501, BLCA_AA.516, BLCA_AA.553,

BLCA_AA.554, BLCA_AA.577, BLCA_AA.578, CURE_AA.0437, CURE_AA.0500, CURE_AA.0508, CURE_AA.0517, CURE_AA.0665, CURE_AA.0687, CURE_AA.0737, CURE_AA.0738, CURE_AA.0748, CURE_AA.0749, CURE_AA.0755, CURE_AA.0770, CURE_AA.0771, CURE_AA.0772, CURE_AA.0789, CURE_AA.0891).
Local Description Authors: J. Von Loh, mod. G. Bradshaw and J. Coles
Global Description Authors: K.A. Schulz, mod. J. Drake and J. Coles

REFERENCES: Bourgeron and Engelking 1994, Bunting 1987, CONHP unpubl. data 2003, Cogan et al. 2004, Dick-Peddie 1993, Driscoll et al. 1984, Erdman 1970, Everett 1987, Heinze et al. 1962, Isaacson 1967, Jameson et al. 1962, Johnston 1987, Larson and Moir 1987, Mason et al. 1967, Moir and Carleton 1987, Salas et al. 2009, Stuever and Hayden 1997a, Tiedemann 1978, USFS 1983a, USFS 1985a, USFS 1985e, Warren et al. 1982, Western Ecology Working Group n.d., Wright et al. 1979

Pinus edulis - *Juniperus* spp. / *Cercocarpus montanus* - Mixed Shrubs Woodland

Two-needle Pinyon - Juniper species / Alderleaf Mountain-mahogany - Mixed Shrubs Woodland

CODE	CEGL000780
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Evergreen woodland (II.A.)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen woodland (II.A.4.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.)
FORMATION	Rounded-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.a.)
ALLIANCE	*PINUS EDULIS - (JUNIPERUS* SPP.) WOODLAND ALLIANCE (A.516)

Two-needle Pinyon - (Juniper species) Woodland Alliance

ECOLOGICAL SYSTEM(S): Colorado Plateau Pinyon-Juniper Shrubland (CES304.766)
Colorado Plateau Pinyon-Juniper Woodland (CES304.767)
Southern Rocky Mountain Pinyon-Juniper Woodland (CES306.835)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY
Globally
This broadly defined woodland association is common on the Colorado Plateau, occurring on sheltered colluvial slopes, sandstone hogbacks, dry foothills and mesas from north-central New Mexico and southern Colorado west to the Mogollon Rim of Arizona, and in western Colorado and adjacent Utah. It can be found on any slope position, though lower slopes are less common. Elevations range from 1472 to 2480 m (4830-8135 feet). Stands occur on gentle to steep slopes on all aspects. The soils are variable but generally shallow, poorly developed and skeletal, ranging from clayey marl to loamy sands. The unvegetated surface is characterized by bedrock, large and small rocks, and/or bare soil with little litter. Sandstone or shale are the most common parent materials. This association is characterized by an open to moderately dense tree canopy (10-60% cover) dominated by a combination of *Pinus edulis* and *Juniperus* spp. with a shrub layer dominated by *Cercocarpus montanus*. The tree canopy averages 2-5 m tall, but some stands may be as tall as 10 m. *Pinus edulis* and *Juniperus* spp. codominate in most stands, but sometimes one may be more prevalent than the other. The species of *Juniperus* varies with geography and elevation and includes *Juniperus deppeana, Juniperus monosperma, Juniperus osteosperma*, and *Juniperus scopulorum*. The total shrub cover may range from sparse to moderate. *Cercocarpus montanus* is the dominant shrub with up to 35% cover. It typically occurs as a short shrub but can be a tall shrub on some sites. Other shrubs may be present, including *Amelanchier* spp., *Artemisia bigelovii, Artemisia tridentata, Ephedra viridis, Chrysothamnus viscidiflorus, Gutierrezia sarothrae, Fendlera rupicola, Garrya ovata, Mahonia* spp., *Nolina microcarpa, Quercus gambelii, Quercus grisea, Rhus trilobata*, or species of *Yucca* and *Opuntia*. Herbaceous cover is variable, ranging from sparse to moderately dense, and generally dominated by graminoids (>5% cover) with scattered forbs. Extremely open stands of this association, usually occurring on fractured slickrock exposures, may have as little as 5% total vegetation cover and an upper canopy only 2 m tall.

DISTRIBUTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association common in the park and recreation area and was observed and sampled in Green Mountain Basin, on the South Rim in the vicinity of Warner Point and the High Point Trail, near North Vista Trail, on the North Rim across from the South Rim Visitor Center, Pleasant Park, Red Rocks, and northwest of the Big Island Overlook on the park and on land managed by the BLM at June's Draw and at Red Rocks.

Globally
This widespread woodland association is found from southern Colorado and north-central New Mexico to the Mogollon Rim of Arizona, north across the Colorado Plateau into western Colorado and adjacent Utah.

ENVIRONMENTAL DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This woodland association occurs on all slope positions on ridges. Sites are moderately steep to steep (18-62% slopes), occur between 2045 and 2480 m elevation, and are oriented to southeast through northwest aspects. The unvegetated surface has low to high cover of rocks in the form of gravel, cobbles, boulders, and bedrock. Low to moderate cover by litter and exposure of bare soil also characterize the unvegetated surface. Litter and duff depths were measured on some plots; the range of depths for litter is 0-4 cm and for duff is 0-1 cm. Soils are well-drained to rapidly drained sandy loams, loamy sands, sandy clay loams, and clays derived from diverse sources, including colluvium or Wanakah, Entrada, Dakota and Morrison formations.

Globally
This broadly defined woodland association is common on the Colorado Plateau, occurring on sheltered colluvial slopes, sandstone hogbacks, dry foothills and mesas. It can be found on any slope position (upper, middle, or lower), though lower slopes are the least common. Elevations range from 1472 to 2480 m (4830-8135 feet). Stands occur on gentle to steep (3- to 36-degree) slopes on all aspects. The soils are variable but generally shallow, poorly developed and skeletal, ranging from clayey marl to loamy sands. The unvegetated surface is characterized by bedrock, large and small rocks, and/or bare soil. Litter has low cover. Parent materials are often sandstone or shale, but others are possible.

VEGETATION DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
The pinyon pine - Utah juniper / mountain-mahogany woodland association is common in the park, less so in the recreation area. The total vegetation cover ranges from 50 to 108% in these moderately to densely vegetated stands. This woodland association is characterized by an open to somewhat closed canopy, typically 2-10 m tall, of *Pinus edulis* and *Juniperus osteosperma* trees that each range in cover from 1 to 50%. The understory is characterized by the tall- and short-shrub *Cercocarpus montanus* that ranges in cover from 1 to 25%. A subcanopy tree layer is also present on three of the nine plots and is characterized by *Pinus edulis* with up to 30% cover, and *Juniperus osteosperma* with up to 5% cover. *Pinus edulis* and *Juniperus osteosperma* also occur with sparse to low cover as saplings and seedlings in shrub and herbaceous layers. The shrub layer is diverse and provides low to moderate cover. The common shrubs present include *Amelanchier utahensis* and *Ephedra viridis* and the succulent *Opuntia fragilis*. The herbaceous layer is diverse but typically provides sparse to low cover in a given stand. The common graminoids include *Achnatherum hymenoides, Carex geyeri, Elymus elymoides*, and *Poa fendleriana*. Forbs common to the association include *Cryptantha flavoculata, Balsamorhiza sagittata, Draba cuneifolia, Lesquerella rectipes*, and *Stenotus armerioides*. A few seedling *Pinus edulis, Juniperus osteosperma, Quercus gambelii*, and *Cercocarpus montanus* are occasionally present. Cryptogams provide low cover, up to 8%. One stand (BLCA.0097) has excellent crusts on about half the plot area.

Globally
This association is characterized by an open to moderately dense tree canopy (10-60% cover) dominated by a combination of *Pinus edulis* and *Juniperus* spp. The canopy averages 2-5 m tall, but some stands may be as tall as 10 m. *Pinus edulis* and *Juniperus* spp. codominate in most stands, but sometimes one may be more prevalent than the other. *Pinus edulis* and *Juniperus* spp. are also present as smaller individuals in the shrub and field strata. The species of *Juniperus* varies with geography and elevation. *Juniperus monosperma* is common in north-central New Mexico and southern Colorado. *Juniperus deppeana* is common in southern New Mexico, and *Juniperus osteosperma* is common from northwestern New Mexico west into Arizona and north into western Colorado and Utah. *Juniperus scopulorum* is more common in higher elevation stands. The total shrub cover may range from sparse to moderate. *Cercocarpus montanus* is the dominant shrub with 1-35% cover. It typically occurs as a short

shrub <2 m tall but can be a tall shrub (2-5 m) on some sites. Other shrubs may be present, including *Amelanchier* spp., *Artemisia bigelovii, Artemisia tridentata, Ephedra viridis, Chrysothamnus viscidiflorus, Gutierrezia sarothrae, Fendlera rupicola, Fraxinus anomala, Garrya ovata, Mahonia* spp., *Nolina microcarpa, Purshia stansburiana, Quercus gambelii* (<5% cover), *Quercus grisea, Rhus trilobata, Symphoricarpos oreophilus*, or species of *Yucca* and *Opuntia*. Herbaceous cover is variable, ranging from sparse to moderately dense, and generally dominated by graminoids (>5% cover) with scattered forbs. Associated graminoids include *Achnatherum hymenoides (= Oryzopsis hymenoides), Andropogon gerardii, Aristida purpurea, Bouteloua curtipendula, Bouteloua gracilis, Bouteloua hirsuta, Carex rossii, Hesperostipa comata, Koeleria macrantha, Leymus salinus (= Elymus salinus), Muhlenbergia pauciflora, Pascopyrum smithii, Pleuraphis jamesii, Poa fendleriana, Pseudoroegneria spicata*, and *Schizachyrium scoparium*. Common forbs include species of *Chamaesyce, Cryptantha, Eriogonum, Machaeranthera, Packera, Penstemon, Petradoria, Phlox*, and *Tetraneuris*. Extremely open stands of this association occurring on exposed and fractured slickrock may have as little as 5% total vegetation cover and an upper canopy only 2 m tall. Biological soil crusts are patchy but may contribute up to 27% cover and are generally well-developed.

MOST ABUNDANT SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tree canopy	*Juniperus osteosperma*, *Pinus edulis*
Short shrub/sapling	*Amelanchier utahensis*
Short shrub/sapling	*Cercocarpus montanus*
Herb (field)	*Opuntia fragilis*
Herb (field)	*Achnatherum hymenoides*, *Poa fendleriana*

Globally

Stratum	Species
Tree canopy	*Juniperus monosperma*, *Juniperus osteosperma*, *Pinus edulis*
Short shrub/sapling	*Cercocarpus montanus*

OTHER NOTEWORTHY SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Exotic/Invasive: *Bromus tectorum* (exotic, High)

Globally
Data are not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (23-Feb-1994).

CLASSIFICATION COMMENTS

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
This is a widely distributed and variable association, found throughout much of the Colorado Plateau, edges of the Colorado Rockies and south into New Mexico. On dry, rocky or slickrock sites on the Colorado Plateau, this pinyon-juniper woodland association may include stands with very open tree canopies (5-10% cover) in cases where the total vegetation cover is less than 15%. These stands may be similar to open *Cercocarpus montanus* shrublands with scattered pinyon and juniper trees but is considered to be a variation of the woodland type because of the ecological values of the trees.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Mature stands that are regularly and heavily grazed and browsed.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (10 plots, 80 observation points): (Plots: BLCA.0015, BLCA. 0017,

BLCA.0029, BLCA.0042, BLCA.0061, BLCA.0076, BLCA.0090, BLCA.0097, BLCA.0102 CURE.0142.
Observation Points: BLCA_AA.164, BLCA_AA.179, BLCA_AA.183, BLCA_AA.184, BLCA_AA.185, BLCA_AA.186, BLCA_AA.190, BLCA_AA.196, BLCA_AA.200, BLCA_AA.205, BLCA_AA.474, BLCA_AA.485, BLCA_AA.495, BLCA_AA.505, BLCA_AA.512, BLCA_AA.513, BLCA_AA.521, BLCA_AA.535, BLCA_AA.545, BLCA_AA.552, BLCA_AA.567, BLCA_AA.568, BLCA_AA.574, BLCA_AA.592, BLCA_AA.593, BLCA_AA.600, BLCA_AA.603, BLCA_AA.605, BLCA_AA.611, BLCA_AA.622, BLCA_AA.630, BLCA_AA.631, BLCA_AA.651, BLCA_AA.668, BLCA_AA.733, BLCA_AA.739, BLCA_AA.748, BLCA_AA.750, BLCA_AA.757, BLCA_AA.764, BLCA_AA.766, BLCA_AA.767, BLCA_AA.771, BLCA_AA.780, BLCA_AA.790, BLCA_AA.818, BLCA_AA.826, BLCA_AA.855, BLCA_AA.861, BLCA_AA.863, BLCA_AA.867, BLCA_AA.870, BLCA_AA.871, BLCA_AA.872, BLCA_AA.873, BLCA_AA.918, CURE_AA.0100, CURE_AA.0101, CURE_AA.0317, CURE_AA.0319, CURE_AA.0351, CURE_AA.0378, CURE_AA.0385, CURE_AA.0413, CURE_AA.0448, CURE_AA.0471, CURE_AA.0472, CURE_AA.0485, CURE_AA.0499, CURE_AA.0509, CURE_AA.0510, CURE_AA.0556, CURE_AA.0616, CURE_AA.0656, CURE_AA.0664, CURE_AA.0666, CURE_AA.0677, CURE_AA.0678, CURE_AA.0710, CURE_AA.0754).
Local Description Authors: J. Von Loh, mod. G. Bradshaw and J. Coles
Global Description Authors: K.A. Schulz, mod. J. Drake and J. Coles

REFERENCES: Baker 1983b, Baker 1984a, Baker and Kennedy 1985, Bourgeron and Engelking 1994, Bradley et al. 1992, CONHP unpubl. data 2003, Cogan et al. 2004, Driscoll et al. 1984, Erdman 1962, Erdman 1969, Hansen et al. 2004d, Hess and Wasser 1982, Isaacson 1967, Johnston 1987, Kennedy 1983a, Larson and Moir 1987, Marr et al. 1979, Medina 1986, Moir 1963, Moir and Carleton 1987, Moir and Ludwig 1979, Pase and Lindenmuth 1971, Stuever and Hayden 1997a, USFS 1981a, USFS 1981b, USFS 1983a, USFS 1985d, USFS 1985e, USFS 1985g, Vories 1974, Western Ecology Working Group n.d., Wright et al. 1979

Pinus edulis - Juniperus spp. / *Leymus salinus* Woodland

Two-needle Pinyon - Juniper species / Saline Wildrye Woodland

CODE	CEGL002340
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Evergreen woodland (II.A.)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen woodland (II.A.4.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.)
FORMATION	Rounded-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.a.)
ALLIANCE	*PINUS EDULIS - (JUNIPERUS* SPP.) WOODLAND ALLIANCE (A.516) Two-needle Pinyon - (Juniper species) Woodland Alliance

ECOLOGICAL SYSTEM(S): Colorado Plateau Pinyon-Juniper Woodland (CES304.767)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY
Globally
This woodland association is widespread throughout the Colorado Plateau, but limited to small stands on specific substrates. Stands tend to occupy the tops, shoulders, upper and middle slopes of ridges, as well as canyon sides. These sites range from moderately to steeply sloping (47% to more than 100% slopes), although a minority of stands occur on gentle slopes with gradients not exceeding 10%. Elevations range between 1483 and 2301 m (4865-7550 feet). Stands at higher elevations and latitudes (e.g., Black Canyon of the Gunnison National Park and Dinosaur National Monument) tend to be oriented to the south or west, but stands at lower elevations occur primarily on north or east aspects. Parent materials are variable but generally include a significant element of marine shale, sometimes redeposited with other rocks as alluvium or colluvium. Soils are rapidly drained and include sandy clay loams, clay loams and sandy loams. Total vegetation cover ranges from sparse (7%) to moderate (50%) in this variable community, with drier, more exposed sites supporting less overall plant cover. The canopy may be very open to moderate (5 to 30%), and consists of both *Pinus edulis* and *Juniperus osteosperma*. Either tree species may dominate the canopy. Shrubs are generally present but do not provide enough cover to constitute a stratum. Common species include *Ephedra viridis, Shepherdia rotundifolia, Opuntia* spp., and *Chrysothamnus viscidiflorus*. The herbaceous layer is more conspicuous than the shrub layer in this community, consisting of a variety of grasses,

among which *Leymus salinus* is clearly dominant. Total herbaceous cover can range from 5% in sparse stands to more than 30% in more sheltered sites. Common associated herbaceous species include *Achnatherum hymenoides* and *Pleuraphis jamesii*.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This association is uncommon or locally common and was observed and sampled in Pleasant Park within the park.

Globally
This association has been documented from southeastern Utah and western Colorado. It is likely to be found in small stands in similar environments throughout the Colorado Plateau.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This woodland association was observed on the shoulders of ridges and on ridgetops. Sites are moderately steep to steep (25-48% slope), occur from 2177 to 2301 m elevation, and are oriented to western aspects. The unvegetated surface has low to moderate cover of litter and high cover of bedrock, large and small rocks, and exposure of bare soil. Cryptobiotic soil crust has low cover, as does downed wood, which may be as much as 15%. Soils are rapidly drained sandy loams and sandy clay loams derived from Mesozoic shales and sandstones.

Globally
This woodland association is widespread throughout the Colorado Plateau, but limited to small stands on specific substrates. Stands tend to occupy well-drained, exposed sites on the tops, shoulders, upper and middle slopes of ridges, as well as canyon sides, gullies, ledges, and colluvial slopes. These sites range from moderately to steeply sloping (47% to more than 100% slopes), although a minority of stands occur on gentle slopes with gradients not exceeding 10%. Elevations range between 1483 and 2301 m (4865-7550 feet), with most stands occurring above 1700 m. Stands at higher elevations and latitudes (e.g., Black Canyon of the Gunnison National Park and Dinosaur National Monument) tend to be oriented to the south or west, but stands at lower elevations occur primarily on north or east aspects. Parent materials are variable but generally include a significant element of Paleozoic or Mesozoic marine shale, sometimes redeposited with other rocks as alluvium or colluvium. Soils are rapidly drained and include sandy clay loams, clay loams and sandy loams.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This pinyon pine - Utah juniper / Salina wildrye woodland association is limited to the westernmost portion of the park, adjoining land managed by the BLM. The total vegetation cover ranges from 38 to 45% in these moderately vegetated stands. This woodland association is characterized by an open tree canopy, typically 2-5 m tall, of *Juniperus osteosperma* and *Pinus edulis* trees that range in cover from 15 to 20% and 6 to 10%, respectively, and by the tall bunchgrass *Leymus salinus* that ranges in cover from 10 to 12%. The shrub layer is sparse with low species diversity. Short and dwarf-shrubs provided sparse cover and include *Amelanchier utahensis* and *Ephedra viridis*, and the succulents *Opuntia fragilis* and *Opuntia polyacantha*. The herbaceous layer is low in diversity and provides sparse to moderate cover. Common graminoids include *Achnatherum hymenoides* and *Bromus tectorum*. Forbs commonly present include *Descurainia pinnata* and *Stenotus acaulis*. *Pinus edulis* and *Juniperus osteosperma* also occur in stands as saplings or seedlings, providing sparse cover. Cryptogams are sparse to moderately dense, providing up to 50% cover.

Globally
Total vegetation cover ranges from sparse (7%) to moderate (50%) in this variable community, with drier, more exposed sites supporting less overall plant cover. The canopy may be very open to moderate (5 to 30%) and consists of both *Pinus edulis* and *Juniperus osteosperma*. Either tree species may dominate the canopy, but both should have at least 2% cover. Shrubs are generally present but do not provide enough cover to constitute a stratum. Common species include scattered *Ephedra viridis, Shepherdia rotundifolia, Opuntia* spp., and *Chrysothamnus viscidiflorus*. The herbaceous layer is more conspicuous than the shrub layer in this community, consisting of a variety of grasses, among which *Leymus salinus* is clearly dominant. Total herbaceous cover can range from 5% in sparse stands to more than 30% in more sheltered sites. Common associated herbaceous species include *Achnatherum hymenoides* and *Pleuraphis jamesii*. Other common graminoids may include *Poa fendleriana, Koeleria macrantha*, and *Vulpia octoflora*; additional forbs include *Arenaria fendleri, Calochortus gunnisonii, Cymopterus bulbosus, Erigeron*

utahensis, Machaeranthera grindelioides, Phlox hoodii, Sphaeralcea parvifolia, Stanleya pinnata, Stenotus armerioides (= Haplopappus armerioides), Streptanthella longirostris, and *Tetraneuris acaulis (= Hymenoxys acaulis)*. *Bromus tectorum* is common in stands that have experienced disturbance from roads or grazing.

MOST ABUNDANT SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tree canopy	*Juniperus osteosperma*, *Pinus edulis*
Short shrub/sapling	*Ephedra viridis*
Herb (field)	*Opuntia fragilis*, *Opuntia polyacantha*
Herb (field)	*Stenotus acaulis*
Herb (field)	*Leymus salinus*

Globally

Stratum	Species
Tree canopy	*Juniperus osteosperma*, *Pinus edulis*
Herb (field)	*Leymus salinus*

OTHER NOTEWORTHY SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Exotic/Invasive: *Bromus tectorum* (exotic, High)

Globally
Data are not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G4 (26-Jan-2006). This association is likely to be somewhat more common than *Juniperus osteosperma / Leymus salinus* Woodland (CEGL003109), because the combination of *Pinus edulis* and *Juniperus osteosperma* has a greater ecological amplitude than does *Juniperus osteosperma* alone. However, this is an unusual and probably rare type, as *Pinus edulis* usually does not grow in the same habitats or elevations favored by *Leymus salinus*.

CLASSIFICATION COMMENTS

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Baker (1982b) cites Shute and West (1978) as reporting a *Pinus edulis - Juniperus osteosperma / Leymus salinus* community in the vicinity of Price, Utah. There is no other information given for this community, other than that it occurs on Mancos shale. All other data used to support this association are derived from vegetation plots gathered by the National Park Vegetation Mapping Program.

CLASSIFICATION CONFIDENCE: 1 - Strong

ELEMENT SOURCES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Widespread in Pleasant Park on gently sloping ridges.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (2 plots, 18 observation points): (Plots: BLCA.0101, BLCA.0109. Observation Points: BLCA_AA.436, BLCA_AA.613, BLCA_AA.654, BLCA_AA.702, BLCA_AA.714, BLCA_AA.718, BLCA_AA.727, BLCA_AA.728, BLCA_AA.749, BLCA_AA.753, BLCA_AA.781, BLCA_AA.782, BLCA_AA.813, BLCA_AA.816, BLCA_AA.820, BLCA_AA.848, BLCA_AA.868, BLCA_AA.875).
Local Description Authors: J. Von Loh, mod. J. Coles
Global Description Authors: J. Coles, mod. K.A. Schulz

REFERENCES: Baker 1982b, Shute and West 1978, Western Ecology Working Group n.d.

Pinus edulis - Juniperus spp. / *Poa fendleriana* Woodland

Two-needle Pinyon - Juniper species / Muttongrass Woodland

CODE	CEGL000787
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Evergreen woodland (II.A.)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen woodland (II.A.4.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.)
FORMATION	Rounded-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.a.)
ALLIANCE	*PINUS EDULIS - (JUNIPERUS* SPP.) WOODLAND ALLIANCE (A.516) Two-needle Pinyon - (Juniper species) Woodland Alliance

ECOLOGICAL SYSTEM(S): Colorado Plateau Pinyon-Juniper Woodland (CES304.767)
Southern Rocky Mountain Pinyon-Juniper Woodland (CES306.835)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY

Globally

This association is widespread and common throughout the Colorado Plateau of Utah, Arizona, New Mexico and Colorado. It occurs on the slopes of canyons, ridges, toeslopes, alluvial fans, benches and plateaus at elevations ranging from 1525 to 2560 m (5000-8400 feet). Stands may occur on slopes ranging from 7 to 48% that are oriented to any aspect. Most stands are on sandy soils, with a few on silt loam or clay loam soils derived from sedimentary, granitic or metamorphic rocks. Total vegetation cover ranges from 40% to more than 75%. This woodland association is characterized by an open to moderately closed, mixed canopy of *Pinus edulis* and *Juniperus osteosperma* 2-10 m tall. In the southern part of the range, *Juniperus monosperma* and *Juniperus scopulorum* may be present in the canopy. The understory is dominated by the bunchgrass *Poa fendleriana* with between 1 and 25% cover. Scattered shrubs fail to form a stratum but may include *Amelanchier utahensis, Artemisia nova, Cercocarpus montanus, Ephedra viridis, Quercus gambelii, Purshia tridentata, Yucca baccata, Opuntia* spp., *Symphoricarpos oreophilus, Fallugia paradoxa*, and *Fendlera rupicola*. Other common herbaceous species (always with less cover than *Poa fendleriana*) include *Achnatherum hymenoides, Koeleria macrantha, Muhlenbergia montana, Blepharoneuron tricholepis, Pascopyrum smithii, Bouteloua gracilis, Balsamorhiza sagittata, Mirabilis multiflora, Penstemon linarioides*, and *Petradoria pumila*.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association was observed and sampled on Jones Summit, in Jones Draw, along North Vista Trail, at High Point, near the campground at Chasm View Trail, and in Green Mountain Basin in the park and east of the Hermit's Rest Trail in the recreation area.

Globally

This association occurs at moderate elevations in the Colorado Plateau region of western Colorado, northern Arizona and New Mexico and eastern Utah.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This woodland association was observed on all slope positions of ridges and on toeslopes of canyons. Sites are moderately steep to steep (13-48% slope), occur between 2311 and 2516 m elevation, and are oriented to aspects ranging from southeast to southwest. The unvegetated surface has moderate to high cover of litter and low to moderate cover of large and small rocks and exposure of bare soil. Downed wood is uncommon to common, up to 25% cover. Litter and duff depth ranges from 0-4 cm and 0-2 cm, respectively. Soils are well-drained sandy loams, loamy sands, and silt loams derived from a variety of sources, including Jurassic and Cretaceous sedimentary rocks and Precambrian metamorphic and granitic rocks.

Globally

This association is widespread and common throughout the Colorado Plateau of Utah, Arizona, New Mexico and Colorado. It occurs on the gentle to moderate slopes of canyons, ridges, toeslopes, benches and plateaus at elevations ranging from 1525 to 2560 m (5000-8400 feet). Stands may occur on slopes ranging from 7 to 48% and

oriented to any aspect. Most stands are on sandy soils, with a few on silt loam or clay loam soils derived from sedimentary, granitic or metamorphic rocks. A third to half the unvegetated ground surface is bare ground, and in some plots large rocks and gravel cover up to a third of the surface. In some cases, cryptogamic crusts and moss or litter cover up to 25% of the soil surface.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This pinyon pine / muttongrass woodland association is common to the park and recreation area. Total vegetation cover ranges from 65 to 100% in these moderately to densely vegetated stands. This woodland association is characterized by an open to moderately closed canopy, typically 2-10 m tall, of *Pinus edulis* and *Juniperus osteosperma* trees that range in cover from 25 to 50% and 1 to 50%, respectively. The understory is characterized by the bunchgrass *Poa fendleriana* that provides from 1 to 25%. A subcanopy layer of *Pinus edulis* and *Juniperus osteosperma* trees provides up to 15% cover for each species. *Juniperus osteosperma* and *Pinus edulis* saplings or mature, stunted trees occasionally occur in the shrub layers. The shrub layer is highly variable in cover and composition. The tall- and short-shrub layers provide low cover by *Quercus gambelii*. Dwarf-shrubs also provide sparse cover, most commonly by the succulent *Opuntia fragilis*. The herbaceous layer is diverse and provides sparse to low cover, usually less than 10% cover per stand. The common associated graminoids include *Bromus tectorum* and *Elymus elymoides*. Forbs are diverse but provide cover, the most common include *Balsamorhiza sagittata, Collinsia parviflora*, and *Descurainia pinnata*. Seedlings of *Juniperus osteosperma* and *Pinus edulis* trees and *Ribes inerme* and *Quercus gambelii* shrubs are sometimes present providing sparse cover. Cryptogams provide sparse cover, up to 10%.

Globally

This woodland association is widespread and relatively common at moderate elevations throughout the Colorado Plateau. Total vegetation cover ranges from 40% to more than 75%. This woodland association is characterized by an open to moderately closed, mixed canopy of *Pinus edulis* and *Juniperus osteosperma* 2-10 m tall. In the southern part of the range, *Juniperus monosperma* and *Juniperus scopulorum* may be present in the canopy. The understory is dominated by the bunchgrass *Poa fendleriana* with between 1 and 25% cover. Scattered shrubs present include *Amelanchier utahensis, Artemisia nova, Cercocarpus montanus, Quercus gambelii, Purshia tridentata, Yucca baccata, Opuntia* spp., *Symphoricarpos oreophilus, Fallugia paradoxa*, and *Fendlera rupicola*. Other common herbaceous species (always with less cover than *Poa fendleriana*) include *Achnatherum hymenoides, Koeleria macrantha, Muhlenbergia montana, Blepharoneuron tricholepis, Pascopyrum smithii, Bouteloua gracilis, Balsamorhiza sagittata, Mirabilis multiflora, Penstemon linarioides*, and *Petradoria pumila*.

MOST ABUNDANT SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tree canopy	*Juniperus osteosperma*, *Pinus edulis*
Tree subcanopy	*Juniperus osteosperma*, *Pinus edulis*
Herb (field)	*Opuntia fragilis*
Herb (field)	*Bromus tectorum*, *Poa fendleriana*

Globally

Stratum	Species
Tree canopy	*Juniperus osteosperma*, *Pinus edulis*
Herb (field)	*Poa fendleriana*

OTHER NOTEWORTHY SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Exotic/Invasive: *Bromus tectorum* (exotic, High)

Globally

Vulnerable: *Arabis fernaldiana* var. *fernaldiana* (rare, endemic (known only from Dinosaur NM), G4T3T4);
Exotic/Invasive: *Bromus tectorum* (exotic, High)

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (23-Feb-1994).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Even if stands have relatively sparse cover of *Poa fendleriana* (<5%), if no other species are present with more than trace cover, they have been placed in this association rather than *Pinus edulis - Juniperus osteosperma* / Sparse Understory Woodland (CEGL002148).

CLASSIFICATION CONFIDENCE: 1 - Strong

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Slopes are moderate to steep; soils range from deep to rocky talus.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (10 plots, 4 observation points): (Plots: BLCA.0011, BLCA.0018, BLCA.0036, BLCA.0077, BLCA.0096, BLCA.0140, BLCA.0142, BLCA.0144, BLCA.0148, CURE.0141. Observation Points: BLCA_AA.523, BLCA_AA.674, BLCA_AA.716, BLCA_AA.795).
Local Description Authors: J. Von Loh, mod. G. Bradshaw and J. Coles
Global Description Authors: J. Coles

REFERENCES: Baker 1982b, Barnes 1987, Bourgeron and Engelking 1994, CONHP unpubl. data 2003, Driscoll et al. 1984, Erdman 1962, Erdman 1969, Erdman et al. 1969, Floyd 2003, Floyd et al. 2001, Isaacson 1967, Johnston 1987, Larson and Moir 1987, Moir and Carleton 1987, USFS 1985a, Western Ecology Working Group n.d.

Pinus edulis - Juniperus spp. / *Pseudoroegneria spicata* Woodland

Two-needle Pinyon - Juniper species / Bluebunch Wheatgrass Woodland

CODE	CEGL000788
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Evergreen woodland (II.A.)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen woodland (II.A.4.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.)
FORMATION	Rounded-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.a.)
ALLIANCE	*PINUS EDULIS - (JUNIPERUS* SPP.) WOODLAND ALLIANCE (A.516) Two-needle Pinyon - (Juniper species) Woodland Alliance

ECOLOGICAL SYSTEM(S): Colorado Plateau Pinyon-Juniper Woodland (CES304.767)
Southern Rocky Mountain Pinyon-Juniper Woodland (CES306.835)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY
Globally
This association occurs in dry, rocky habitats on the slopes or summits of ridges, hills, canyons and ravines in western Colorado and northwestern New Mexico. Sites are gentle to steep (3-58% slopes), occur between 1700 and 2465 m elevation, and are oriented to all aspects. Rocks and bare ground occupy most of the unvegetated surface, up to 90% in some stands and averaging 60%. Soils are shallow to moderately deep, well-drained and variable in texture, depending on the underlying geology, which varies from shale, limestone and sandstone to metamorphic and granitic rocks. Total vegetation cover ranges from 25 to 55%. The tree canopy is generally dominated by *Juniperus osteosperma*, with between 10 and 30% cover. *Pinus edulis* contributes an additional 5-15% cover. Scattered shrubs may be present (with less than 5% total cover), including *Ephedra viridis, Cercocarpus montanus*, and *Artemisia tridentata*. The herbaceous layer ranges from moderately sparse to moderately dense (5-35% cover) and is dominated by *Pseudoroegneria spicata* (3-15% cover), sometimes with *Achnatherum hymenoides* as a codominant. Other grasses present may include *Poa fendleriana* and *Hesperostipa comata*; *Bromus tectorum* is common in disturbed stands. Common forbs include *Phlox hoodii, Stenotus armerioides*, and *Arenaria kingii*. Cryptobiotic soil crust development is minor.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association is uncommon and was observed and sampled near Exclamation Point off North Vista Trail (North Rim), near Chukar Trail Road, and northeast of Pleasant Park in the park.

Globally

This association occurs in dry, rocky habitats in western Colorado and northwestern New Mexico.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This woodland association was observed and sampled on the shoulders of ridges in ravines, midslopes of canyons, and shoulders of ridges. Sites are steep (46-58% slopes), occur between 2003 and 2465 m elevation, and are oriented to all aspects. The unvegetated surface has low cover of litter and low to moderate cover of mosses and lichens. Bedrock, large and small rocks, and bare soil comprise most of the unvegetated surface. Downed wood is uncommon to common from 2 to 25% cover. Litter and duff depth ranges from 0-0.8 cm and 0.0-1.0 cm, respectively. Soils are rapidly drained loamy sands, silty clays, and silty clay loams derived from Mesozoic sandstones, metamorphic and granitic rocks.

Globally

This association occurs in dry, rocky habitats on the slopes or summits of ridges, hills, canyons and ravines in western Colorado. Sites are gentle to steep (3-58% slopes), occur between 1700 and 2465 m elevation, and are oriented to all aspects. Rocks and bare ground occupy most of the unvegetated surface, up to 90% in some stands and averaging 60%, as litter is restricted to underneath the tree canopy. Soils are shallow to moderately deep, well-drained and variable in texture, depending on the underlying geology, which varies from shale, limestone and sandstone to metamorphic and granitic rocks.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This pinyon pine / bluebunch wheatgrass association is narrowly distributed in the western portion of the park. The total vegetation cover ranges from 45 to 52% in these moderately vegetated stands. This woodland association is characterized by an open tree canopy, typically 2-10 m tall, of *Juniperus osteosperma* and *Pinus edulis* trees that range in cover from 20 to 30% and 1 to 5%, respectively. The bunchgrass *Pseudoroegneria spicata* characterizes the understory and provides 5 to 15% cover. The shrub layer is low in cover and diverse in composition. Short and dwarf-shrubs provide sparse cover, and the most common include *Pinus edulis* and *Ephedra viridis*, and the succulent *Opuntia fragilis*. The herbaceous layer is relatively diverse and provides low cover, typically less than 15%, that is nearly evenly distributed between graminoids and forbs. The common graminoids include *Achnatherum hymenoides, Poa fendleriana*, and *Pseudoroegneria spicata*. Forbs commonly present include only *Stenotus armerioides*; the remaining forbs do not consistently occur from site to site. *Pinus edulis* and *Juniperus osteosperma* also occur in the stands as saplings or shorter seedlings but with cover of less than 3%. Seedling *Quercus gambelii* shrubs are present in one stand and provide sparse cover. Cryptogam cover is variable but typically less than 10%.

Globally

Total vegetation cover ranges from 25 to 55% in this woodland association. The tree canopy is generally dominated by *Juniperus osteosperma*, with between 10 and 30% cover. *Pinus edulis* contributes an additional 5-15% cover. Scattered shrubs may be present (with less than 5% total cover), including *Ephedra viridis, Cercocarpus montanus*, and *Artemisia tridentata*. The herbaceous layer ranges from moderately sparse to moderately dense (5-35% cover) and is dominated by *Pseudoroegneria spicata* (3-15% cover), sometimes with *Achnatherum hymenoides* as a codominant. Other grasses present may include *Poa fendleriana* and *Hesperostipa comata*; *Bromus tectorum* is common in disturbed stands. Common forbs include *Phlox hoodii, Stenotus armerioides*, and *Arenaria kingii*. Cryptobiotic soil crust development is minor.

MOST ABUNDANT SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tree canopy	*Juniperus osteosperma*, *Pinus edulis*
Herb (field)	*Pseudoroegneria spicata*

Globally

Stratum	Species
Tree canopy	*Juniperus osteosperma*, *Pinus edulis*
Herb (field)	*Pseudoroegneria spicata*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CONSERVATION STATUS RANK
Global Rank & Reasons: G4 (23-Feb-1994).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
This association is similar in habitat, range and species composition to *Pinus edulis - Juniperus osteosperma / Pseudoroegneria spicata* - Cushion Plant Woodland (CEGL002819) described for Dinosaur National Monument. These two associations should be carefully re-analyzed to determine if they are distinct enough to maintain them as separate associations.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: The slopes supporting this type are variable in terms of exposure. Some old-growth Utah juniper trees are present. Evidence of fire is present in one stand.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (4 plots, 1 observation point): (Plots: BLCA.0060, BLCA.0088, BLCA.0089, BLCA.0093. Observation Point: BLCA_AA.401).
Local Description Authors: J. Von Loh, mod. J. Coles
Global Description Authors: J. Coles

REFERENCES: Baker 1982b, Baker 1983b, Baker 1984a, Bourgeron and Engelking 1994, CONHP unpubl. data 2003, DeLeuw, Cather & Company 1977, Driscoll et al. 1984, Isaacson 1967, Tiedemann 1978, Vories 1974, Western Ecology Working Group n.d.

Pinus edulis - Juniperus spp. / *Quercus gambelii* Woodland

Two-needle Pinyon - Juniper species / Gambel Oak Woodland

CODE	CEGL000791
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Evergreen woodland (II.A.)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen woodland (II.A.4.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.)
FORMATION	Rounded-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.a.)
ALLIANCE	*PINUS EDULIS - (JUNIPERUS* SPP.) WOODLAND ALLIANCE (A.516) Two-needle Pinyon - (Juniper species) Woodland Alliance

ECOLOGICAL SYSTEM(S): Colorado Plateau Pinyon-Juniper Woodland (CES304.767)
Southern Rocky Mountain Pinyon-Juniper Woodland (CES306.835)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY

Globally
This widespread woodland association is known from the Colorado Plateau and southern Rocky Mountains, occurring from south-central Colorado to south-central New Mexico, west along the Mogollon Rim of Arizona, and north into Utah and western Colorado. Elevations normally range from 1509-2665 m but may be higher in stands in southern New Mexico. Sites are variable but generally are relatively mesic. Stands occur on flat to moderate slopes along drainages and on mesatops, and on moderate to steep, rocky slopes of foothills, mountains and canyons, especially in draws where soil moisture is concentrated, or on northern aspects or where shaded by upper canyon walls. The soils are variable and range from deep to shallow, silty clay to sandy loam, and often gravelly. Litter from *Quercus gambelii* and other shrubs is often extensive (over 50% cover). The vegetation is characterized by an open to moderately dense tree canopy (10-60% cover) codominated by *Pinus edulis* and *Juniperus* spp. The species of *Juniperus* varies with geography and elevation. *Juniperus monosperma* is common in north-central New Mexico and southern Colorado. *Juniperus deppeana* is common in southern New Mexico, and *Juniperus osteosperma* is common in northwestern New Mexico, northern Arizona and in Utah. *Juniperus scopulorum* is more common in higher elevation stands. An occasional *Pinus ponderosa* tree may be present in some stands. *Quercus gambelii* dominates the often patchy, moderately dense tall-shrub layer with at least 5% cover, but often over 25% cover. *Amelanchier utahensis, Cercocarpus montanus, Symphoricarpos oreophilus*, or species of *Yucca* and *Opuntia* are common shrub associates. Herbaceous cover is variable, ranging from sparse to moderately dense, but generally dominated by graminoids (>5% cover) with scattered forbs. Associated graminoids include *Achnatherum hymenoides (= Oryzopsis hymenoides), Bouteloua gracilis, Carex geyeri, Carex rossii, Elymus elymoides, Festuca arizonica, Koeleria macrantha, Muhlenbergia montana, Poa fendleriana*, and *Schizachyrium scoparium*.

DISTRIBUTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This association is common and was observed and sampled near Cimarron Point, west of Hermit's Rest on the recreation area and in the Green Mountain Basin, on Green Mountain, near Deadhorse Trail near Grizzly Gulch, and along North Vista Trail on the park.

Globally
This woodland association occurs in foothills and mesas from southern Colorado to south-central New Mexico, west along the Mogollon Rim of Arizona, and north into Utah and western Colorado.

ENVIRONMENTAL DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This woodland association was observed on the midslopes to shoulder position of ridges. Sites are gentle to moderately steep (2-48% slope), occur between 2342 and 2664 m elevation, and are oriented to southeastern to western aspects. The unvegetated surface has moderate to high cover by litter and moderate cover of large and small rocks. Exposures of bare soil may also be moderate in terms of the unvegetated surface area. Dead and downed wood is present, providing up to 35% cover. The range of depths for litter is 0-6 cm and for duff is 0-9 cm. Soils are well-drained to rapidly drained sandy loams, sandy clay loams, loamy sands, and silty loams derived from sedimentary rocks of the Wanakah and Morrison formations.

Globally
This widespread woodland association is known from the Colorado Plateau and southern Rocky Mountains, occurring from south-central Colorado to south-central New Mexico, west along the Mogollon Rim of Arizona, and north into Utah and western Colorado. Elevations normally range from 1509-2665 m but may be higher in stands in southern New Mexico. Sites are variable but generally are relatively mesic. Stands occur on flat to moderate slopes along drainages and on mesatops, and on moderate to steep, sometimes rocky slopes of foothills, mountains and canyons, especially in draws where soil moisture is concentrated, or on northern aspects or where shaded by upper canyon walls. Stands are less common on hot south-facing slopes, unless they are located in a moisture-concentrating gully. Soils are variable and range from deep to shallow, silty clay to sandy loam, and are often gravelly or rocky. Litter from *Quercus gambelii* and other shrubs is often extensive (over 50% cover). Parent materials include alluvial, colluvial or eolian deposits derived from sandstone, shale, limestone and rhyolite.

VEGETATION DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This pinyon - juniper / Gambel oak woodland association is common in the park and recreation area. The total vegetation cover ranges from 66 to 143% in these moderately to densely vegetated stands. This woodland

association is characterized by an open canopy, typically 2-10 m tall, of *Pinus edulis* and *Juniperus osteosperma* trees range in cover from 5 to 75% and 1 to 25%, respectively, and the tall shrub *Quercus gambelii* that ranges in cover from 5 to 50%. A subcanopy layer of *Pinus edulis* trees is occasionally present and provides from 1 to 20% cover. The shrub layer is moderately diverse and provides moderate cover. Additional tall shrubs that provide low to moderate cover include *Amelanchier utahensis* and *Cercocarpus montanus*. Short and dwarf-shrubs commonly present include *Artemisia tridentata ssp. vaseyana, Cercocarpus montanus, Quercus gambelii*, and *Symphoricarpos rotundifolius*. The herbaceous layer is diverse across stands but typically sparse to low in terms of cover. The most common graminoids include *Carex geyeri* and *Poa fendleriana*. Forbs are diverse and variable, contribute sparse cover, and include *Balsamorhiza sagittata, Ipomopsis aggregata*, and *Petradoria pumila*. Seedlings of *Quercus gambelii* shrubs are very common, and *Amelanchier utahensis, Juniperus osteosperma*, and *Pinus edulis* seedlings are also sometimes present. Cryptogam cover is sparse and occurs sporadically among sites.

Globally
This widespread association is characterized by an open to moderately dense tree canopy (10-70% cover) codominated by *Pinus edulis* and *Juniperus* spp. The species of *Juniperus* varies with geography and elevation. *Juniperus monosperma* is common in north-central New Mexico and southern Colorado. *Juniperus deppeana* is common in southern New Mexico, and *Juniperus osteosperma* is common in northwestern New Mexico, northern Arizona and in Utah. *Juniperus scopulorum* is more common in higher elevation stands. An occasional *Pinus ponderosa* tree may be present is some stands. *Quercus gambelii* dominates the often patchy, moderately dense tall-shrub layer with at least 5% cover, but often with more than 25% cover. *Amelanchier utahensis, Cercocarpus montanus, Symphoricarpos oreophilus*, or species of *Yucca* and *Opuntia* are common shrub associates. Other shrubs, depending on geography, may include *Artemisia tridentata, Artemisia nova, Arctostaphylos patula, Cercocarpus ledifolius, Ephedra viridis, Fendlera rupicola, Gutierrezia sarothrae, Garrya* spp., *Mahonia fremontii, Ptelea trifoliata, Prunus* spp., *Quercus X pauciloba, Robinia neomexicana*, or *Rosa* spp. Herbaceous cover is variable, ranging from sparse to moderately dense, but generally dominated by graminoids (>5% cover) with scattered forbs. Associated graminoids include *Achnatherum hymenoides (= Oryzopsis hymenoides), Bouteloua gracilis, Carex geyeri, Carex rossii, Elymus elymoides, Festuca arizonica, Koeleria macrantha, Muhlenbergia montana, Poa fendleriana*, and *Schizachyrium scoparium*. Common forbs may include *Artemisia frigida, Balsamorhiza sagittata, Geranium caespitosum, Lepidium montanum, Machaeranthera grindelioides, Packera neomexicana, Thalictrum fendleri, Tetraneuris acaulis*, or *Vicia americana*.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tree canopy	*Juniperus osteosperma*, *Pinus edulis*
Tall shrub/sapling	*Quercus gambelii*
Short shrub/sapling	*Symphoricarpos rotundifolius*
Short shrub/sapling	*Cercocarpus montanus*
Herb (field)	*Balsamorhiza sagittata*, *Ipomopsis aggregata*, *Petradoria pumila*
Herb (field)	*Carex geyeri*, *Poa fendleriana*

Globally

Stratum	Species
Tree canopy	*Juniperus monosperma*, *Juniperus osteosperma*, *Juniperus scopulorum*, *Pinus edulis*
Tall shrub/sapling	*Amelanchier utahensis*, *Quercus gambelii*
Tall shrub/sapling	*Cercocarpus montanus*
Short shrub/sapling	*Symphoricarpos oreophilus*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CONSERVATION STATUS RANK
Global Rank & Reasons: G5 (23-Feb-1994).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CLASSIFICATION CONFIDENCE: 1 - Strong

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Some plots are not diverse. There is a lot of downed wood on some plots.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (10 plots, 111 observation points): (Plots: BLCA.0004, BLCA.0019, BLCA.0032, BLCA.0035, BLCA.0037, BLCA.0038, BLCA.0053, BLCA.0078, CURE.0116, CURE.0243. Observation Points: BLCA_AA.162, BLCA_AA.174, BLCA_AA.216, BLCA_AA.220, BLCA_AA.287, BLCA_AA.298, BLCA_AA.322, BLCA_AA.338, BLCA_AA.382, BLCA_AA.469, BLCA_AA.476, BLCA_AA.496, BLCA_AA.504, BLCA_AA.517, BLCA_AA.524, BLCA_AA.525, BLCA_AA.527, BLCA_AA.529, BLCA_AA.532, BLCA_AA.541, BLCA_AA.546, BLCA_AA.555, BLCA_AA.559, BLCA_AA.569, BLCA_AA.570, BLCA_AA.571, BLCA_AA.606, BLCA_AA.615, BLCA_AA.620, BLCA_AA.623, BLCA_AA.624, BLCA_AA.632, BLCA_AA.643, BLCA_AA.644, BLCA_AA.647, BLCA_AA.675, BLCA_AA.708, BLCA_AA.712, BLCA_AA.715, BLCA_AA.717, BLCA_AA.723, BLCA_AA.734, BLCA_AA.741, BLCA_AA.742, BLCA_AA.751, BLCA_AA.755, BLCA_AA.756, BLCA_AA.759, BLCA_AA.773, BLCA_AA.776, BLCA_AA.779, BLCA_AA.783, BLCA_AA.786, BLCA_AA.791, BLCA_AA.793, BLCA_AA.794, BLCA_AA.796, BLCA_AA.797, BLCA_AA.799, BLCA_AA.805, BLCA_AA.807, BLCA_AA.811, BLCA_AA.822, BLCA_AA.823, BLCA_AA.827, BLCA_AA.831, BLCA_AA.832, BLCA_AA.835, BLCA_AA.836, BLCA_AA.837, BLCA_AA.838, BLCA_AA.842, BLCA_AA.843, BLCA_AA.846, BLCA_AA.847, BLCA_AA.853, BLCA_AA.874, BLCA_AA.886, BLCA_AA.901, BLCA_AA.908, CURE_AA.0090, CURE_AA.0138, CURE_AA.0164, CURE_AA.0318, CURE_AA.0352, CURE_AA.0368, CURE_AA.0369, CURE_AA.0372, CURE_AA.0373, CURE_AA.0384, CURE_AA.0405, CURE_AA.0406, CURE_AA.0411, CURE_AA.0433, CURE_AA.0458, CURE_AA.0511, CURE_AA.0544, CURE_AA.0557, CURE_AA.0581, CURE_AA.0599, CURE_AA.0625, CURE_AA.0631, CURE_AA.0639, CURE_AA.0647, CURE_AA.0655, CURE_AA.0756, CURE_AA.0806, CURE_AA.0807, CURE_AA.0829, CURE_AA.0861, CURE_AA.1180).
Local Description Authors: J. Von Loh, mod. G. Bradshaw and J. Coles
Global Description Authors: K.A. Schulz, mod. J. Coles

REFERENCES: Bassett 1987, Bourgeron and Engelking 1994, CONHP unpubl. data 2003, Cogan et al. 2004, Driscoll et al. 1984, Harmon 1980, Hess and Wasser 1982, Holm 1927, Isaacson 1967, Johnston 1987, Kallender 1959, Larson and Moir 1987, Marr et al. 1973b, Muldavin et al. 1994a, Muldavin et al. 2000b, Steinhoff 1978, Stuever and Hayden 1997a, Vories 1974, Warren et al. 1982, Western Ecology Working Group n.d., Wright 1972, Wright et al. 1979

Pseudotsuga menziesii / Holodiscus dumosus Scree Woodland

Douglas-fir / Rockspirea Scree Woodland

CODE	CEGL000902
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Evergreen woodland (II.A.)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen woodland (II.A.4.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.)
FORMATION	Conical-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.b.)
ALLIANCE	*PSEUDOTSUGA MENZIESII* WOODLAND ALLIANCE (A.552) Douglas-fir Woodland Alliance

ECOLOGICAL SYSTEM(S): Rocky Mountain Cliff, Canyon and Massive Bedrock (CES306.815)
Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland (CES306.823)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY

Globally

This plant association is documented from the mountains of Arizona and New Mexico and the Gunnison Basin of Colorado. It has also been reported from Arizona and likely occurs in the Sangre de Cristo Mountains of southern Colorado. Stands grow on steep slopes with rocky colluvial soils derived from sandstone or volcanic talus. *Pseudotsuga menziesii* dominates the open canopy. The understory is distinctly shrubby and characterized by *Holodiscus dumosus* and *Symphoricarpos oreophilus*, among the many species that may be present. The herbaceous layer is poorly represented.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association is uncommon within the park and recreation area and was observed and sampled at Gateview, near the Lake Fork of the Gunnison River, at West Elk Creek, and also near the Tomichi Point turnoff.

Globally

This limited-range endemic is reported from the Mogollon Mountains (Fitzhugh et al. 1987) and Sangre de Cristo Mountains (DeVelice et al. 1986) in New Mexico and the Gunnison Basin in Colorado, but it is expected to occur elsewhere at high elevations in New Mexico and Arizona.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This woodland association was observed on the upper slopes of mesas and on midslopes of active slopes. Sites are steep (38-75% slopes), occur between 2435 and 2474 m elevation, and occupy southwestern to northwestern aspects. The unvegetated surface has low cover of litter and moderate to high cover of bedrock, large and small rocks, and bare soil. Litter and duff depths were recorded and are 0-7 cm deep and 0-8 cm deep, respectively. Downed wood is common, providing up to 15% cover. Soils are rapidly drained loams and sandy loams derived from volcanic colluvium.

Globally

This association is restricted to steep to very steep talus slopes in the mountains of New Mexico, Arizona and Colorado. Up to 80% of the ground surface and 90% of the soil volume are cobbles, rocks or boulders. Stands in Colorado and northern New Mexico occur at around 2450 m (8040 feet) elevation, while in the mountains of southern New Mexico stands occur at elevations as high as 3020 m (9900 feet).

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This Douglas-fir / rock spiraea woodland association is uncommon on steep colluvial slopes. The total vegetation cover ranges from 28 to 55% in these sparsely to moderately vegetated stands. This woodland association is characterized by an open tree canopy that is typically 5-20 m tall of *Pseudotsuga menziesii* that ranges in cover from 10 to 50%. The subcanopy layer is occasionally present, provides low to moderate cover, and is characterized by 2- to 5-m tall *Pseudotsuga menziesii, Juniperus scopulorum*, and *Acer glabrum* trees that each provide from 2 to 25% cover. The shrub layer is variable in cover and composition, particularly between stands. *Holodiscus dumosus* is present in all stands, ranging in cover from 2 to 25%, and with heights varying from 0.5-5 m tall. Short and dwarf-shrubs are diverse, provide low to moderate cover, and include *Amelanchier utahensis, Artemisia tridentata ssp. wyomingensis, Cornus sericea, Mahonia repens, Paxistima myrsinites, Ribes cereum, Ribes inerme*, and *Symphoricarpos rotundifolius*. The herbaceous layer is typically sparse, usually less than 10% total cover and often less. A diverse group of species occurs across stands, but any one stand usually has low to moderate diversity. Common graminoids include *Carex geyeri, Elymus elymoides*, and *Poa fendleriana*. Forbs commonly present include *Heterotheca villosa* and *Saxifraga bronchialis*. The liana *Clematis* sp. is rarely present. Cryptogam cover is variable, with some stands having little, but cover can be as high as 25%.

Globally
This is an open woodland association with a sparse canopy of sometimes very large *Pseudotsuga menziesii* trees up to 20 m tall. Occasionally the canopy and subcanopy will contain other species, such as *Juniperus scopulorum* or *Pinus strobiformis*. Total vegetation cover is limited by the high percentage of rock in the soil and averages around 50%. The shrub understory is dominated by *Holodiscus dumosus* but is well-developed and diverse. Typical shrub associates include *Acer glabrum, Mahonia repens, Symphoricarpos oreophilus, Ribes* spp., *Jamesia americana, Cornus sericea*, and *Salix scouleriana*. The herbaceous layer is sparse, inconsistent, and generally poorly developed in most stands.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tree canopy	*Pseudotsuga menziesii*
Tree subcanopy	*Juniperus scopulorum*, *Pseudotsuga menziesii*
Short shrub/sapling	*Ribes cereum*
Herb (field)	*Paxistima myrsinites*, *Symphoricarpos rotundifolius*

Globally

Stratum	Species
Tree canopy	*Pseudotsuga menziesii*
Short shrub/sapling	*Holodiscus dumosus*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CONSERVATION STATUS RANK
Global Rank & Reasons: G3G4 (1-Dec-2000). This woodland community is a regional endemic to the higher elevations of southwestern U.S. mountains where it is associated with talus/scree slopes. Stands tend to be small, and many have been impacted by logging removals leading to increased fragmentation and loss. High-quality occurrences are not likely to exceed 100 in number. Most of the remaining high-quality occurrences are found in remote areas of national forest lands where logging has not occurred.

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
This type is similar to other scree/talus types such as *Abies concolor / Leymus triticoides* Woodland (CEGL000886), *Abies lasiocarpa / Holodiscus dumosus* Scree Woodland (CEGL000918), and *Abies lasiocarpa / Jamesia americana* Forest (CEGL000312).

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Occurs predominantly on colluvium or talus slopes that are very steep. Bedrock exposures may also be present.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (5 plots, 6 observation points): (Plots: BLCA.0005, CURE.0003, CURE.0227, CURE.0308, CURE.0373. Observation Points: BLCA_AA.267, BLCA_AA.276, BLCA_AA.619, CURE_AA.0699, CURE_AA.0814, CURE_AA.1296).
Local Description Authors: J. Von Loh, mod. J. Coles
Global Description Authors: E. Muldavin, mod. J. Coles

REFERENCES: Bourgeron and Engelking 1994, DeVelice et al. 1986, Driscoll et al. 1984, Fitzhugh et al. 1987, Larson and Moir 1986, Larson and Moir 1987, Western Ecology Working Group n.d.

Pseudotsuga menziesii Scree Woodland

Douglas-fir Scree Woodland

Douglas-fir Scree Slope

CODE	CEGL000911
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Evergreen woodland (II.A.)
PHYSIOGNOMIC GROUP	Temperate or subpolar needle-leaved evergreen woodland (II.A.4.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.)
FORMATION	Conical-crowned temperate or subpolar needle-leaved evergreen woodland (II.A.4.N.b.)
ALLIANCE	*PSEUDOTSUGA MENZIESII* WOODLAND ALLIANCE (A.552) Douglas-fir Woodland Alliance

ECOLOGICAL SYSTEM(S): Rocky Mountain Cliff, Canyon and Massive Bedrock (CES306.815)
Southern Rocky Mountain Dry-Mesic Montane Mixed Conifer Forest and Woodland (CES306.823)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY

Globally

This association occurs throughout the interior western U.S. but is restricted to steep slopes covered by loose rock and colluvium on mountain or canyon slopes. It has the appearance of a stand of scattered trees with a sparse understory; the vegetation is limited by the lack of soil development. Slopes generally exceed 60% and are generally unstable, with constantly shifting rocks on the slopes as well as additional rockfall from outcrops upslope. Elevations at the northern end of the range (Montana) are from 915 to 2180 m (3100-7150 feet), and sites are usually limited to warm, south- to west-facing slopes in canyons. In northern Arizona, stands occur on various aspects around 2930 m (9600 feet) elevation, and in southern Colorado stands have been documented at around 2560 m (8400 feet). Most of the unvegetated ground surface is covered by rocks and boulders, with small amounts of litter and dead wood. Soils are poorly developed and often too rocky to sample. The rocky slope is the dominant visual element of the community. The sparse to open canopy of this association is generally mixed and rarely exceeds 35% cover. *Pseudotsuga menziesii* is always present and dominant or codominant; other tree species may include *Juniperus osteosperma, Juniperus scopulorum, Picea engelmannii, Pinus edulis, Pinus flexilis, Pinus strobiformis, Pinus ponderosa, Populus tremuloides, Abies concolor*, and *Abies lasiocarpa*. Shrubs are variable depending on the site, but cover is too sparse and the mix either lacks a diagnostic species in the understory or the shrub layer is too poorly developed to be diagnostic. Shrub species present may include *Arctostaphylos uva-ursi, Acer glabrum, Amelanchier utahensis, Juniperus communis, Dasiphora fruticosa ssp. floribunda, Holodiscus dumosus, Prunus virginiana, Ribes inerme, Ribes montigenum, Salix scouleriana, Shepherdia canadensis, Shepherdia rotundifolia*, and *Symphoricarpos oreophilus*. Herbaceous species are sparse and inconsistent among sites.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This montane woodland association is restricted to colluvial slopes in canyons and on mountainsides south of Blue Mesa Dam, near Dillon Pinnacles, and south, east and west of Lake Fork of the Gunnison River, and north of Ute Mountain Indian Reservation in the Curecanti National Recreation Area.

Globally

This association has been documented from sites scattered throughout the interior western U.S., including Montana, Utah, New Mexico, Arizona and Colorado.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This woodland association is found on colluvial slopes of canyons and mountain slopes. Sites are typically moderately steep to steep (17- to 35-degree slopes) with one stand occurring on a gentle slope. Stands were sampled between 2309 and 2528 m elevation on typically northerly aspects, but also one westerly and one southerly. Substrates include exposed bedrock and a large coverage of boulders and loose, unstable soil or talus with variable stability. Lichen growth is consistent with stability, so these rocks must not experience much disturbance. There is

evidence of landslide, mudflows and debris flows on some sites. The ground is typically rocky with moderate to high (30-90%) cover of bedrock, rock and gravel, with a couple sites having relatively high litter, duff and deadwood cover (50-70%) and one site with 50% bare ground. Lichens and mosses are important on a couple stands.

Globally
This association occurs throughout the interior western U.S. but is restricted to steep slopes covered by loose rock and colluvium on mountain or canyon slopes. Slopes generally exceed 60% and are generally unstable, with constantly shifting rocks on the slopes as well as additional rockfall from outcrops upslope. Elevations at the northern end of the range (Montana) are from 915 to 2180 m (3100-7150 feet), and sites are usually limited to warm, south- to west-facing slopes in canyons. In northern Arizona, stands occur on various aspects around 2930 m (9600 feet) elevation, and in southern Colorado stands have been documented at around 2560 m (8400 feet). Most of the unvegetated ground surface is covered by rocks and boulders, with small amounts of litter and dead wood. Soils are poorly developed and often too rocky to sample.

VEGETATION DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This Douglas-fir scree/sparse understory woodland is characterized by an open to dense (20-90% cover) tree layer dominated by *Pseudotsuga menziesii*. Other tree species present, especially in the subcanopy, include *Acer negundo, Juniperus scopulorum, Populus angustifolia*, or *Populus tremuloides*. The shrub layers are sparse to open and typically without dominant/characteristic species. Shrubs may include *Amelanchier alnifolia, Artemisia tridentata ssp. vaseyana, Holodiscus dumosus, Mahonia repens, Prunus virginiana, Ribes cereum, Ribes inerme*, and *Symphoricarpos oreophilus*. If *Quercus gambelii* is present, then cove is low (<5%). The herbaceous layer is sparse and depauperate, only *Deschampsia caespitosa* and *Poa fendleriana* were recorded.

Globally
This association has the appearance of a stand of scattered trees with a sparse understory; the vegetation is limited by the lack of soil development. The rocky slope is the dominant visual element of the community. The sparse to open canopy of this association is generally mixed and rarely exceeds 35% cover. *Pseudotsuga menziesii* is always present and dominant or codominant; other tree species may include *Juniperus osteosperma, Juniperus scopulorum, Picea engelmannii, Pinus edulis, Pinus flexilis, Pinus strobiformis, Pinus ponderosa, Populus tremuloides, Abies concolor*, and *Abies lasiocarpa*. Shrubs are variable depending on the site, but cover is too sparse and the mix either lacks a diagnostic species in the understory or the shrub layer is too poorly developed to be diagnostic. Shrub species present may include *Arctostaphylos uva-ursi, Acer glabrum, Amelanchier utahensis, Juniperus communis, Dasiphora fruticosa ssp. floribunda, Holodiscus dumosus, Prunus virginiana, Ribes inerme, Ribes montigenum, Salix scouleriana, Shepherdia canadensis, Shepherdia rotundifolia*, and *Symphoricarpos oreophilus*. Herbaceous species are sparse and inconsistent among sites.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tree canopy	*Pseudotsuga menziesii*

Globally

Stratum	Species
Tree canopy	*Pseudotsuga menziesii*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Exotic/Invasive: *Bromus tectorum* (exotic, High)

CONSERVATION STATUS RANK
Global Rank & Reasons: G5 (23-Feb-1994).

CLASSIFICATION COMMENTS

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
This association is distinguished from other scree woodland associations by the clear dominance of *Pseudotsuga menziesii* in the canopy and a shrub layer that is too sparse and scattered to be diagnostic.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Data are not available.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (2 plots, 9 observation points): (Plots: CURE.0301, CURE.0310. Observation Points: BLCA_AA.642, BLCA_AA.646, CURE_AA.0794, CURE_AA.0796, CURE_AA.0869, CURE_AA.1052, CURE_AA.1056, CURE_AA.1209, CURE_AA.1368).
Local Description Authors: K.A. Schulz
Global Description Authors: J. Coles

REFERENCES: Bourgeron and Engelking 1994, DeVelice et al. 1986, Driscoll et al. 1984, Fitzhugh et al. 1987, MTNHP 2002b, Pfister et al. 1977, Western Ecology Working Group n.d.

Acer negundo / Disturbed Understory Woodland

Box-elder / Disturbed Understory Woodland

CODE	CEGL002693
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Deciduous woodland (II.B.)
PHYSIOGNOMIC GROUP	Cold-deciduous woodland (II.B.2.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural cold-deciduous woodland (II.B.2.N.)
FORMATION	Temporarily flooded cold-deciduous woodland (II.B.2.N.b.)
ALLIANCE	*ACER NEGUNDO* TEMPORARILY FLOODED WOODLAND ALLIANCE (A.642) Box-elder Temporarily Flooded Woodland Alliance

ECOLOGICAL SYSTEM(S): Rocky Mountain Lower Montane-Foothill Riparian Woodland and Shrubland (CES306.821)

USFWS WETLAND SYSTEM: Palustrine

CONCEPT SUMMARY
Globally
This riparian association is found in the Colorado Plateau and other areas of the southwestern U.S. on upper alluvial terraces below 2015 m (6600 feet) elevation. Sites are on gentle slopes or flat areas near permanent or temporary streams but are rarely flooded because of their location on high, abandoned stream terraces. Soils are usually sandy. The tree canopy of this association is open to moderately closed and 5-15 m tall. The dominant tree species is *Acer negundo* with scattered *Acer glabrum, Juniperus osteosperma*, or *Juniperus scopulorum*. There is a sparse shrub layer up to 2 m tall with *Artemisia tridentata, Ericameria nauseosa, Fraxinus anomala, Rhus trilobata, Ribes cereum, Tamarix ramosissima*, and (in the south) *Quercus gambelii*. Herbaceous cover and species composition are variable. The herbaceous stratum may be sparse or dominated by native and introduced species typically found in disturbed areas. *Bromus tectorum* is common. Other typical species are *Heterotheca villosa, Poa pratensis, Sisymbrium altissimum, Lepidium latifolium, Taraxacum officinale*, and *Verbascum thapsus*.

DISTRIBUTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This association is distributed along the Gunnison River and was observed and sampled on the alluvium of a river terrace adjacent to East Portal Road in the park and on roadway fill (riprap) that created an artificial embankment above the Gunnison River within the recreation area.

Globally
This association has been sampled in the Colorado Plateau from northwestern Colorado to southwestern Utah and northeastern Arizona; it is likely widespread elsewhere in the southwestern U.S.

ENVIRONMENTAL DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This woodland association was observed on alluvial flats and riprap slopes adjacent to the Gunnison River. Sites are nearly flat to gentle (2-10% slopes), occur between 1712 to 2015 m elevation, and are oriented to various aspects. The unvegetated surface has low cover of litter and high cover by bedrock, large and small rocks, and exposure of bare soil. Soils are well-drained to poorly drained sands at one site, with no soil occurring on the riprap.

Globally
This association is found on flat to gently sloping riparian sites near permanent or temporary streams below 2015 m (6600 feet) elevation. Sites are usually found on terraces several meters above the active floodplain and below the steeper upland slopes on any aspect. They rarely flood. Soils are usually sandy alluvium and can range from well-drained to poorly drained. The ground surface is largely covered by large rocks, litter, downed wood, or bare soil.

VEGETATION DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This box-elder woodland association is uncommon and distributed along the Gunnison River. The total vegetation cover ranges from 45 to 100% in these moderately to densely vegetated stands. This woodland association is characterized by an open to closed canopy, from 1-10 m tall, of *Acer negundo* trees that range in cover from 5 to 35%. *Acer negundo* is present in nearly all cover classes from short shrub through canopy tree providing a majority of the cover in these stands. The shrub layer is low in diversity and typically sparse to low in cover, an exception being a dense stand of *Salix exigua* short shrubs that are 1-2 m tall and contribute 50-75% cover in one stand. Other short and dwarf-shrubs present and providing sparse cover include *Ericameria parryi, Rhus trilobata, Ribes cereum, Solidago velutina*, and *Tamarix ramosissima*. The herbaceous layer provides sparse to moderate cover and is somewhat diverse, with several exotic species present. Common graminoids include *Agrostis gigantea, Bromus tectorum, Dichanthelium oligosanthes var. scribnerianum, Elymus repens, Phalaris arundinacea, Poa fendleriana*, and *Thinopyrum intermedium*. Forbs commonly observed include *Artemisia dracunculus, Artemisia ludoviciana, Asclepias* sp., *Brickellia grandiflora, Cirsium* sp., *Equisetum hyemale var. affine, Heterotheca villosa, Melilotus officinalis (= Melilotus albus), Taraxacum officinale, Toxicodendron rydbergii*, and *Verbascum thapsus*. Seedling *Amelanchier utahensis* and *Rhus trilobata* shrubs are present in one stand.

Globally
This woodland association has an open to moderately closed (10-80%) tree canopy and moderate to dense total vegetation cover. The tree canopy is between 5 and 15 m tall and dominated by *Acer negundo*. *Acer negundo* is also present as seedlings and saplings. Other trees that can be present are *Acer glabrum, Juniperus osteosperma*, and *Juniperus scopulorum*. Shrub cover is sparse, though it can be more prominent when the tree canopy is open. The shrub stratum is usually less than 2 m tall and contains species such as *Artemisia tridentata ssp. tridentata, Ericameria nauseosa, Fraxinus anomala, Rhus trilobata, Ribes cereum, Tamarix ramosissima*, and (in the south) *Quercus gambelii*. Herbaceous cover and species composition are variable. The herbaceous stratum is dominated by native and introduced species typically found in disturbed areas. *Bromus tectorum* is common. Other typical components of the herbaceous stratum are *Heterotheca villosa, Poa pratensis, Lepidium latifolium, Sisymbrium altissimum, Taraxacum officinale*, and *Verbascum thapsus*.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tree canopy	*Acer negundo*
Tree subcanopy	*Acer negundo*
Short shrub/sapling	*Salix exigua*
Herb (field)	*Phalaris arundinacea*
Herb (field)	*Equisetum hyemale* var. *affine*

Globally

Stratum	Species
Tree canopy	*Acer negundo*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Exotic/Invasive: *Bromus tectorum* (exotic, High), *Elymus repens* (exotic, High/Medium), *Melilotus officinalis* (exotic, Medium/Low), *Phalaris arundinacea* (exotic, High), *Tamarix ramosissima* (exotic, High), *Taraxacum officinale* (exotic), *Thinopyrum intermedium* (exotic, Medium/Insignificant), *Verbascum thapsus* (exotic, Medium)

Globally
Exotic/Invasive: *Bromus tectorum* (exotic, High), *Poa pratensis* (exotic, Medium)

CONSERVATION STATUS RANK
Global Rank & Reasons: GNR (14-Aug-2001).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CLASSIFICATION CONFIDENCE:

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: While this is a common semi-natural association along the Gunnison River in the canyon areas, it was not extensively sampled due to inaccessibility of inner-canyon sites, and a lack of emphasis placed upon sampling semi-natural communities. Park hydrologists have monitored *Acer negundo* stands in Black Canyon for the past several years to help quantify the effects of the altered hydrological regime on canyon ecosystems.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on 2002 and 2003 field data (2 plots): (Plots: BLCA.0119, CURE.0242).
Local Description Authors: J. Von Loh and G. Bradshaw, mod. J. Coles
Global Description Authors: J. Drake, mod. J. Coles and K.A. Schulz

REFERENCES: Cogan et al. 2004, Western Ecology Working Group n.d.

Acer negundo / Quercus gambelii Woodland

Box-elder / Gambel Oak Woodland

CODE	CEGL002797
PHYSIOGNOMIC CLASS	Woodland (II)
PHYSIOGNOMIC SUBCLASS	Deciduous woodland (II.B.)
PHYSIOGNOMIC GROUP	Cold-deciduous woodland (II.B.2.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural cold-deciduous woodland (II.B.2.N.)
FORMATION	Temporarily flooded cold-deciduous woodland (II.B.2.N.b.)
ALLIANCE	*ACER NEGUNDO* TEMPORARILY FLOODED WOODLAND ALLIANCE (A.642) Box-elder Temporarily Flooded Woodland Alliance

ECOLOGICAL SYSTEM(S): Rocky Mountain Lower Montane-Foothill Riparian Woodland and Shrubland (CES306.821)

USFWS WETLAND SYSTEM: Palustrine

CONCEPT SUMMARY
Globally
This woodland association is only known from along the Gunnison River in Curecanti National Recreation Area. Stands occur in riparian sites with natural or human disturbance, including constructed roadway fill slopes and rockfall or talus from adjacent cliffs. Sites are steep (75% slopes), occur between 2032 and 2073 m elevation, and

are oriented to northeastern and southern aspects. The unvegetated surface has high cover of bedrock, large and small rocks, and low to moderate cover of litter. Soil was not present in the rockfill and rockfall substrate in the sampled stands. The vegetation is characterized by an open to moderately dense tree canopy of *Acer negundo* and *Quercus gambelii*. Occasional emergent *Pseudotsuga menziesii* trees or subcanopy *Juniperus scopulorum* may be present. The understory is typically sparse and variable in species composition. Tall, short, and dwarf-shrubs contribute low cover and include *Cornus sericea, Fendlerella utahensis, Holodiscus dumosus, Mahonia repens, Rhus trilobata, Ribes cereum, Ribes inerme*, and *Prunus virginiana*. The herbaceous layer is sparse and has low in species diversity. Species include *Piptatherum micranthum, Arabis* sp., *Brickellia grandiflora*, and *Artemisia michauxiana*.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This association is uncommon in the recreation area and was sampled along the Gunnison River below Crystal Dam and the Gunnison River below Morrow Point Dam in Curecanti National Recreation Area.

Globally
This association has only been sampled from one location in Curecanti National Recreation Area in western Colorado.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This woodland association occurs in riparian sites with natural or human disturbance, including constructed roadway fill slopes and rockfall or talus from adjacent cliffs. Sites are steep (75% slopes), occur between 2032 and 2073 m elevation, and are oriented to northeastern and southern aspects. The unvegetated surface has high cover of bedrock, large rocks, and small rocks and low to moderate cover of litter. Downed wood is uncommon. Parent materials include Tertiary volcanic rockfall and introduced volcanic rubble. Soil was not present in the rockfill and rockfall substrate in the sampled stands.

Globally
Data are not available.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This box-elder / Gambel oak association is distributed in narrow belts along the Gunnison River in Curecanti National Recreation Area. The total vegetation cover ranges from 36 to 79% in these moderately to densely vegetated stands. *Acer negundo* and *Quercus gambelii* trees 2-12 m high range in cover from 10 to 60% and 8 to 25%, respectively. One stand has an emergent *Pseudotsuga menziesii* tree 10-15 m tall that contributed sparse cover. *Acer negundo* trees to 6 m tall also form a subcanopy layer, contributing 5% cover in one stand. Sapling *Juniperus scopulorum* and seedling *Pseudotsuga menziesii* trees contributing sparse cover are present in one stand. The shrub layer is diverse in cover and species composition. Tall, short, and dwarf-shrubs contribute low cover and include *Cornus sericea, Fendlerella utahensis, Holodiscus dumosus, Mahonia repens, Rhus trilobata, Ribes cereum, Ribes inerme*, and *Prunus virginiana*. The herbaceous layer is low in diversity and provides sparse cover. The only graminoid present in one stand is *Piptatherum micranthum*. Forbs are uncommon, contribute sparse cover, and include *Arabis* sp., *Brickellia grandiflora*, and *Artemisia michauxiana*.

Globally
Data are not available.

MOST ABUNDANT SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tree canopy	*Acer negundo*, *Quercus gambelii*
Tall shrub/sapling	*Prunus virginiana*, *Rhus trilobata*
Short shrub/sapling	*Fendlerella utahensis*
Herb (field)	*Mahonia repens*

Globally

Stratum	Species
Tree canopy	*Acer negundo*, *Quercus gambelii*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CONSERVATION STATUS RANK
Global Rank & Reasons: GNR (21-Jun-2005).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
This association has only been sampled from one location in Curecanti National Recreation Area in western Colorado. More survey and classification work are needed to change the provisional status of this association.

CLASSIFICATION CONFIDENCE: 3 - Weak

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Narrow bands of vegetation on rocky substrates along the Gunnison River.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (2 plots, 5 observation points): (Plots: CURE.0189, CURE.0244. Observation Points: BLCA_AA.597, BLCA_AA.601, BLCA_AA.608, BLCA_AA.610, BLCA_AA.618).
Local Description Authors: J. Von Loh
Global Description Authors: K.A. Schulz

REFERENCES: Western Ecology Working Group n.d.

Artemisia nova / Poa fendleriana Shrubland

Black Sagebrush / Muttongrass Shrubland

CODE	CEGL002698
PHYSIOGNOMIC CLASS	Shrubland (III)
PHYSIOGNOMIC SUBCLASS	Evergreen shrubland (III.A.)
PHYSIOGNOMIC GROUP	Microphyllous evergreen shrubland (III.A.4.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural microphyllous evergreen shrubland (III.A.4.N.)
FORMATION	Lowland microphyllous evergreen shrubland (III.A.4.N.a.)
ALLIANCE	*ARTEMISIA NOVA* SHRUBLAND ALLIANCE (A.1105) Black Sagebrush Shrubland Alliance

ECOLOGICAL SYSTEM(S):
Great Basin Xeric Mixed Sagebrush Shrubland (CES304.774)
Colorado Plateau Mixed Low Sagebrush Shrubland (CES304.762)
Inter-Mountain Basins Montane Sagebrush Steppe (CES304.785)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY
Globally
This short-shrub association occurs locally in southern Utah and western Colorado on the slopes and tops of ridges and plateaus, as well as the sides of drainages. Stands are usually small to medium-sized patches in a mosaic of other types of shrubland. Elevations range from 1830 to 3000 m (6000-9840 feet). Stands occur on gentle to moderately steep slopes with a tendency toward north and east aspects. Soils and substrates are variable but

generally are rocky and shallow. The vegetation is characterized by a shrub layer dominated by *Artemisia nova* with between 5 and 25% cover; associated species such as *Amelanchier utahensis, Artemisia tridentata, Tetradymia canescens, Symphoricarpos oreophilus*, and *Purshia tridentata* contribute another 10-25%. The herbaceous layer is diverse, but *Poa fendleriana* is among the dominants with between 5 and 20% cover. Other common grasses include *Koeleria macrantha, Bouteloua gracilis, Elymus elymoides*, and *Poa secunda*. Forbs contribute relative little cover and are inconsistent among sites.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association is common in the park and recreation area and was sampled between the "Bay of Chickens" and Elk Creek Campground, near South Willow Creek along Powerline Road, above Steuben Creek, on mesas west of South Willow Creek, in side drainages of Willow Creek near State Highway 149, on the south shore of Iola Landing across from Sometimes Isle, north of the Recreation Ranch, opposite Cooper's Ranch, on Haystack Mesa, on Dry Creek Mesa, on Dillon Mesa, in Cebolla Campground, in Kezar Basin, along Dry Creek East, opposite Rainbow Lake Road, east of Dry Creek, and at a site called the "Inlet" in Curecanti National Recreation Area.

Globally

This association has been documented from Zion and Capitol Reef national parks in southern Utah and from Curecanti National Recreation Area in western Colorado.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This short-shrub association occurs on active slopes and the sides of drainages, gullies, shoulders, and mesas, as well as on ridgetops and mesatops. Sites are gently sloped to moderately steep (3-35% slopes), occur between 2305 and 2998 m elevation, and are oriented to nearly all aspects, although there is a slight tendency toward a northwestern aspect. The unvegetated surface has low cover of litter. Large and small rocks and exposure of bare soil comprise most of the unvegetated surface. Parent materials are Tertiary volcanic rocks, metamorphic/granitic rocks, Mesozoic sandstone and shale, and Quaternary alluvial deposits. Soils are rapidly drained silty clay loams, silty loams, sandy clays, sandy clay loams, sandy loams and sands.

Globally

This short-shrub association occurs locally in southern Utah and western Colorado on the slopes and tops of ridges, mesas and plateaus, as well as the sides of drainages. Elevations range from 1830 to 3000 m (6000-9840 feet). Stands occur on gentle to moderately steep slopes (3-35%) with a tendency toward north and east aspects. Soils and substrates are variable but generally are rocky and shallow, with bare ground, gravel and rock providing a high percentage of the unvegetated ground cover. There is a slight tendency for *Artemisia nova* shrublands to occur on calcareous substrates such as limestone, marlstone and some types of volcanic rock.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This black sagebrush / muttongrass association is common within the recreation area. The total vegetation cover ranges from 30 to 90% in these moderately to densely vegetated stands. *Artemisia nova* forms open to closed-canopy stands and provides 5 to 85% cover. Other short- and dwarf-shrub species that contribute low to moderate cover include *Amelanchier utahensis, Artemisia tridentata ssp. wyomingensis, Chrysothamnus depressus, Gutierrezia sarothrae, Purshia tridentata*, and *Symphoricarpos oreophilus*, as well as the succulents *Opuntia polyacantha, Pediocactus simpsonii*, and *Yucca harrimaniae*. The herbaceous layer is diverse in terms of species composition and provides low to moderate cover. Common perennial grasses provide low to moderate cover and include *Achnatherum pinetorum, Poa fendleriana, Elymus elymoides*, and *Poa secunda*. Forbs are diverse but typically provide sparse cover and include *Erigeron concinnus, Penstemon teucrioides, Phlox hoodii*, and *Stenotus armerioides*. Moss and lichens (crustose and foliose) are present on rocks, on soil crusts, and are loose on the soil and provide up to 25% cover.

Globally

This short-shrub association occurs in small patches, usually surrounded by other types of shrublands. Total vegetation cover ranges from 10 to 60%. The shrub layer is dominated by *Artemisia nova* with between 5 and 25% cover; associated species such as *Amelanchier utahensis, Artemisia tridentata, Tetradymia canescens, Symphoricarpos oreophilus*, and *Purshia tridentata* contribute another 10-25%. The herbaceous layer is diverse, but

Poa fendleriana is among the dominants with between 5 and 20% cover. Other common grasses include *Koeleria macrantha, Bouteloua gracilis, Elymus elymoides*, and *Poa secunda*. Forbs contribute relative little cover and are inconsistent among sites.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Short shrub/sapling	*Artemisia nova*, *Artemisia tridentata* ssp. *wyomingensis*
Herb (field)	*Koeleria macrantha*, *Poa fendleriana*

Globally

Stratum	Species
Short shrub/sapling	*Artemisia nova*
Herb (field)	*Poa fendleriana*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Exotic/Invasive: *Bromus tectorum* (exotic, High)

Globally
Data are not available.

CONSERVATION STATUS RANK
Global Rank & Reasons: GNR (14-Aug-2001).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
This association may be a southern analogue of *Artemisia nova / Pseudoroegneria spicata* Shrubland (CEGL001424), which is common from northwestern Colorado north through Wyoming and the Columbia Basin.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Occurs as small, homogenous stands on rocky sites.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (22 plots, 14 observation points): (Plots: CURE.0010, CURE.0015, CURE.0016, CURE.0052, CURE.0056, CURE.0061, CURE.0064, CURE.0065, CURE.0089, CURE.0097, CURE.0121, CURE.0123, CURE.0149, CURE.0161, CURE.0239, CURE.0272, CURE.0284, CURE.0326, CURE.0330, CURE.0345, CURE.0367, CURE.0368. Observation Points: BLCA_AA.731, CURE_AA.0198, CURE_AA.0219, CURE_AA.0245, CURE_AA.0365, CURE_AA.0379, CURE_AA.0568, CURE_AA.0628, CURE_AA.0635, CURE_AA.0717, CURE_AA.0960, CURE_AA.0995, CURE_AA.0998, CURE_AA.1036).
Local Description Authors: J. Von Loh
Global Description Authors: J. Coles

REFERENCES: Cogan et al. 2004, Western Ecology Working Group n.d.

Artemisia nova / Poa secunda Shrubland

Black Sagebrush / Sandberg Bluegrass Shrubland

CODE	CEGL001423
PHYSIOGNOMIC CLASS	Shrubland (III)
PHYSIOGNOMIC SUBCLASS	Evergreen shrubland (III.A.)
PHYSIOGNOMIC GROUP	Microphyllous evergreen shrubland (III.A.4.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural microphyllous evergreen shrubland (III.A.4.N.)
FORMATION	Lowland microphyllous evergreen shrubland (III.A.4.N.a.)
ALLIANCE	*ARTEMISIA NOVA* SHRUBLAND ALLIANCE (A.1105) Black Sagebrush Shrubland Alliance

ECOLOGICAL SYSTEM(S): Great Basin Xeric Mixed Sagebrush Shrubland (CES304.774)
Colorado Plateau Mixed Low Sagebrush Shrubland (CES304.762)
Inter-Mountain Basins Montane Sagebrush Steppe (CES304.785)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY

Globally

This plant association is discontinuously distributed from southeastern Oregon to southeastern and central Idaho, with a disjunct occurrence in western Colorado. It is purported to occur in California and expected to occur in northern Nevada and Utah. The association has been reported from a wide variety of habitats at elevations ranging from about 1525 to 2745 m (5000-9000 feet). Stands are on shallow, rocky and gravelly calcareous soils that may be of volcanic origin or derived from limestone. Although it is often in mosaic with *Artemisia tridentata* or *Juniperus* spp. stands, this association does not support significant cover or reproduction of these species, nor perennial grasses other than *Poa secunda*. Some (but not all) stands may represent overgrazed stands of *Artemisia nova / Pseudoroegneria spicata* Shrubland (CEGL001424). *Artemisia nova / Poa secunda* stands are expected to have low amounts of other shrubs, such as *Artemisia arbuscula, Artemisia tridentata ssp. vaseyana, Chrysothamnus viscidiflorus, Eriogonum microthecum*, and *Tetradymia canescens*. Other herbs to be expected in these stands include perennial grasses, such as *Achnatherum* spp., *Koeleria macrantha*, and *Elymus elymoides*, and forbs common on shallow soils, such as *Balsamorhiza hookeri, Castilleja* spp., *Eriogonum* spp., *Petradoria pumila, Phlox* spp., and *Penstemon* spp. Its presence in Colorado may represent another *Artemisia nova* association that has been degraded by grazing until only *Poa secunda* and *Koeleria macrantha* remain.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association is rare and was observed and sampled on U.S. Bureau of Land Management-administered land northwest of the park and west of Black Canyon Road.

Globally

Artemisia nova associations are widely distributed throughout the western United States. This plant association, however, is apparently an uncommon *Artemisia nova* type. It is found in southeastern Oregon and again in central, south-central, and southeastern Idaho (IDCDC unpubl. data 2001, ORNHP unpubl. data 2001). Its presence in Colorado may represent another *Artemisia nova* association that has been degraded by grazing until only *Poa secunda* and *Koeleria macrantha* remain. In Idaho, the association is known from the Boulder Mountains in Custer County, Cassia County (near the Utah border), Bannock County (in the Portneuf Range), and at Menan Buttes on the Snake River Plain. It is purported to occur in California and is expected to occur in (but not documented in) northern Nevada and Utah.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This dwarf-shrub association was observed on upper midslopes of the shoulders of large hills. The site is gentle (10% slope), occurs at 2384 m elevation, and is oriented to a western aspect. The unvegetated surface has low cover of litter and moss and moderate cover of wildlife scat, possibly from domestic livestock. Large and small rocks and exposures of bare soil comprise much of the unvegetated surface. Soils are rapidly drained silty clay loams derived from alluvium.

Globally
This plant association is distributed discontinuously from southeastern Oregon to southeastern and central Idaho. An isolated occurrence has been reported from western Colorado. It is purported to occur in California and expected to occur in northern Nevada and Utah. The association has been reported from a wide variety of habitats and slope angles, including ridges, alluvial fans and hill slopes at elevations ranging from about 1525 m (5000 feet) on the Snake River Plain of eastern Idaho to 2745 m (9000 feet) in the Boulder Mountains of central Idaho. The Colorado stand is intermediate in elevation at 2384 m (7820 feet). Stands are on shallow, rocky and gravelly calcareous soils that may be of volcanic or sedimentary origin.

VEGETATION DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This black sagebrush shrubland association is extremely rare within the park. The total vegetation cover is 34% in this moderately vegetated stand. This dwarf-shrub association is characterized by an open stand of 0.5-m tall *Artemisia nova* shrubs that provide 20% cover. Other dwarf-shrub species present in the stand provide sparse cover and include *Amelanchier utahensis, Artemisia tridentata ssp. vaseyana*, and *Tetradymia canescens*. The herbaceous layer is also sparse, providing up to 10% cover that is evenly split between graminoids and forbs. The graminoids include *Koeleria macrantha* and *Poa secunda*. Forbs include *Astragalus* sp., *Erigeron pumilus, Eriogonum lonchophyllum, Lupinus* sp., *Petradoria pumila*, and *Phlox longifolia*. Moss is present but is very sparse.

Globally
This association is characterized by a sparse to moderate shrub layer dominated by *Artemisia nova* (average 20% cover); other shrubs present may include *Artemisia arbuscula, Artemisia tridentata ssp. vaseyana, Chrysothamnus viscidiflorus, Eriogonum microthecum*, and *Tetradymia canescens*. The herbaceous layer also tends to have 10% or less cover and is dominated by *Poa secunda*. Other herbs to be expected in these stands include perennial grasses, such as *Achnatherum* spp., *Koeleria macrantha*, and *Elymus elymoides*, and forbs common on shallow soils, such as *Balsamorhiza hookeri, Castilleja* spp., *Eriogonum* spp., *Petradoria pumila, Phlox* spp., and *Penstemon* spp.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Short shrub/sapling	*Artemisia nova*
Herb (field)	*Poa secunda*

Globally

Stratum	Species
Short shrub/sapling	*Artemisia nova*
Herb (field)	*Poa secunda*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CONSERVATION STATUS RANK
Global Rank & Reasons: G3 (19-Jan-2001). Within the range of *Artemisia nova*, this plant association is infrequently observed and has a discontinuous distribution. The association is likely restricted to shallow, rocky soil sites unable to support *Festuca idahoensis* and *Pseudoroegneria spicata*. It is the most common *Artemisia nova* association mapped in southeastern Oregon but is not common in Idaho. In addition, it has not been documented in Nevada or Utah where *Artemisia nova* stands are relatively common, nor is it known from the Owyhee Plateau of southwestern Idaho. The Colorado stand has been subjects to a long history of heavy grazing and may represent another *Artemisia nova* association that has become degraded. Numerous stands are currently protected, though some low-elevation sites with *Artemisia nova / Poa secunda* are at risk to *Bromus tectorum* invasion and subsequent wildfire. There are currently only 15-30 estimated occurrences of this association, and documentation of threats or condition trends are lacking. Further sampling and field assessment of the plant association are needed.

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
It is probably distinct from other *Artemisia nova* associations in lacking significant cover of perennial grasses other than *Poa secunda* (e.g., *Festuca idahoensis, Hesperostipa comata*, and *Pseudoroegneria spicata*). In south-central and southeastern Idaho, the plant association is often observed in a mosaic with *Juniperus osteosperma* associations (IDCDC 2001). In such mosaic areas of Idaho and Nevada, researchers have recognized a *Juniperus osteosperma / Artemisia nova / Poa secunda* plant association (Rust 1999). This association may have as little as 1% cover of *Juniperus osteosperma*, though its presence is used to indicate the site's potential. *Artemisia nova / Poa secunda* Shrubland (CEGL001423) lacks reproducing *Juniperus osteosperma* or other *Juniperus* spp. Hironaka et al. (1983) note the replacement of *Pseudoroegneria spicata* by *Poa secunda* in overgrazed stands of *Artemisia nova / Pseudoroegneria spicata* Shrubland (CEGL001424). It is possible that some, but probably not all, stands of *Artemisia nova / Poa secunda* are early seral.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Other examples of this association may occur in the vicinity. This occurrence is located near the edge of the sampled area.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (1 plot, 2 observation points): (Plot: BLCA.0047. Observation Points: CURE_AA.0344, CURE_AA.0611).
Local Description Authors: J. Von Loh and G. Bradshaw, mod. J. Coles
Global Description Authors: C. Murphy, mod. J. Coles

REFERENCES: Bourgeron and Engelking 1994, Caicco and Wellner 1983f, Driscoll et al. 1984, Hironaka et al. 1983, IDCDC unpubl. data, Kagan et al. 2000, ORNHP unpubl. data, Rust 1999, Western Ecology Working Group n.d.

Artemisia tridentata (ssp. vaseyana, ssp. wyomingensis) - Amelanchier utahensis Shrubland

(Mountain Big Sagebrush, Wyoming Big Sagebrush) - Utah Serviceberry Shrubland

CODE	CEGL002820
PHYSIOGNOMIC CLASS	Shrubland (III)
PHYSIOGNOMIC SUBCLASS	Evergreen shrubland (III.A.)
PHYSIOGNOMIC GROUP	Microphyllous evergreen shrubland (III.A.4.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural microphyllous evergreen shrubland (III.A.4.N.)
FORMATION	Lowland microphyllous evergreen shrubland (III.A.4.N.a.)
ALLIANCE	*ARTEMISIA TRIDENTATA* SHRUBLAND ALLIANCE (A.829) Basin Big Sagebrush Shrubland Alliance

ECOLOGICAL SYSTEM(S): Inter-Mountain Basins Montane Sagebrush Steppe (CES304.785)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY
Globally
This association has been described from Dinosaur National Monument, the Roan Plateau and the Piceance Basin in northwestern Colorado and adjacent Utah. It also occurs in southwestern Wyoming. Sites are on level to moderately sloping hills, valleys and benches. Elevation ranges from 2165 to 2600 m, and stands may be oriented to any aspect. The deep, well-drained soils are derived from sandstone, shale, loess or limestone and range in texture from clay loam and silt loam to loamy sand. Organic litter is typically a significant component of the ground surface cover. The vegetation is characterized by the codominance in the canopy of *Artemisia tridentata* (ssp. *vaseyana* or ssp. *wyomingensis*, or sometimes a hybrid of the two) and *Amelanchier utahensis* with 15 to 55% total cover. It often takes the appearance of a tall shrubland type in which clumps of serviceberry grow in a matrix of sagebrush.

Although serviceberry and sagebrush are visually dominant, in some stands *Symphoricarpos oreophilus* may have the highest cover of the three shrub species. *Chrysothamnus viscidiflorus, Mahonia repens*, and *Purshia tridentata* may be minor components of the shrub canopy. *Quercus gambelii*, if present, has less than 1% cover. Graminoids tend to dominate the well-developed herbaceous layer; typical species are *Pascopyrum smithii (= Agropyron smithii), Melica spectabilis (= Bromelica spectabilis), Carex geyeri, Koeleria macrantha, Poa fendleriana, Achnatherum nelsonii ssp. dorei (= Stipa columbiana), Hesperostipa comata (= Stipa comata)*, and *Achnatherum lettermanii (= Stipa lettermanii)*. The forb component of the understory is usually diverse and may contribute significant cover, especially in stands that have been grazed. *Achillea millefolium, Balsamorhiza sagittata, Comandra umbellata, Crepis acuminata, Eriogonum umbellatum, Lathyrus lanszwertii var. leucanthus (= Lathyrus leucanthus), Lupinus argenteus, Penstemon caespitosus, Sphaeralcea coccinea*, and *Viola nuttallii* are common species. *Poa pratensis* may be the dominant grass in areas that have a history of grazing.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association is uncommon in the recreation area and was sampled on ridges near the Entrance Road, North Rim Access Road, and North Vista Trail in the Curecanti National Recreation Area.

Globally

This association is currently known from the highlands of Dinosaur National Monument and Black Canyon of the Gunnison National Park, as well as the Roan Plateau and Piceance Basin in northwestern Colorado and northeastern Utah. It also occurs at Fossil Butte National Monument in southwestern Wyoming and is likely more widespread.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This montane shrubland association is found on midslopes of ridges. Sites are gently sloping (2- to 3-degree slopes) and occur at 2387 and 2445 m elevation on a variety of aspects. The unvegetated ground surface has moderate to high cover of bare ground (30-60%) with low to moderate cover (<30%) of gravel and typically lower cover of litter (20%) with one stand having 60% cover.

Globally

This association occurs on level to moderately sloping hills, plateaus, valleys, ridgetops and benches in northwestern Colorado. Sites are gentle to steep (2- to 20-degree slopes), occur at elevation ranges from 2165 to 2600 m (7100-8530 feet), and may be oriented to any aspect. The deep, well-drained soils are derived from sandstone, shale, loess or limestone and range in texture from clay loam and silt loam to loamy sand. Organic litter is typically a significant component of the ground surface cover.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This mixed mountain shrubland association is characterized by the codominance of *Artemisia tridentata ssp. vaseyana* (sagebrush) and *Amelanchier utahensis* (Utah serviceberry). Sagebrush generally has equal or higher cover than serviceberry and forms a moderately dense short-shrub layer with tall-shrub serviceberry forming an open canopy or denser clumps. Cover ranges between 15 and 45% for sagebrush and 15-35% for serviceberry. Other shrubs present include *Symphoricarpos oreophilus*. Herbaceous species are highly diverse but contribute minimal total cover. Species most likely to occur include *Poa fendleriana, Koeleria macrantha, Pascopyrum smithii*, and *Balsamorhiza sagittata*.

Globally

This mountain shrubland association is characterized by the codominance in the canopy of *Artemisia tridentata ssp. vaseyana* or *Artemisia tridentata ssp. wyomingensis* and *Amelanchier utahensis* with 15 to 75% total cover. It often takes the appearance of a tall shrubland type in which clumps of serviceberry grow in a matrix of sagebrush. Although serviceberry and sagebrush are visually dominant, in some stands *Symphoricarpos oreophilus* may have the highest cover of the three shrub species. *Chrysothamnus viscidiflorus, Mahonia repens*, and *Purshia tridentata* may be minor components of the shrub canopy. *Quercus gambelii*, if present, has less than 1% cover. Graminoids tend to dominate the well-developed herbaceous layer; typical species are *Pascopyrum smithii (= Agropyron smithii), Melica spectabilis (= Bromelica spectabilis), Carex geyeri, Koeleria macrantha, Poa fendleriana, Achnatherum nelsonii ssp. dorei (= Stipa columbiana), Hesperostipa comata (= Stipa comata)*, and *Achnatherum lettermanii (= Stipa lettermanii)*. The forb component of the understory is usually diverse and may contribute

significant cover, especially in stands that have been grazed. *Achillea millefolium, Balsamorhiza sagittata, Comandra umbellata, Crepis acuminata, Eriogonum umbellatum, Lathyrus lanszwertii var. leucanthus (= Lathyrus leucanthus), Lupinus argenteus, Penstemon caespitosus, Sphaeralcea coccinea*, and *Viola nuttallii* are common species. *Poa pratensis* may be the dominant grass in areas that have a history of grazing.

MOST ABUNDANT SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tall shrub/sapling	*Amelanchier utahensis*
Short shrub/sapling	*Artemisia tridentata* ssp. *vaseyana*

Globally

Stratum	Species
Tall shrub/sapling	*Amelanchier utahensis*
Short shrub/sapling	*Symphoricarpos oreophilus*
Short shrub/sapling	*Artemisia tridentata* ssp. *vaseyana*, *Artemisia tridentata* ssp. *wyomingensis*

OTHER NOTEWORTHY SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (12-Jul-2005).

CLASSIFICATION COMMENTS

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
There is some overlap between this community and the various sagebrush - snowberry associations in the IVC, but the codominance of *Artemisia tridentata* and *Amelanchier utahensis* distinguishes it from them. This association is not ecotonal between sagebrush shrublands and mixed mountain shrublands; instead, it appears to occupy its own habitat and can cover extensive areas.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Data are not available.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data collected in 2004 during accuracy assessment (6 observation points): (Observation Points: BLCA_AA.704, BLCA_AA.798, BLCA_AA.801, BLCA_AA.806, BLCA_AA.833, BLCA_AA.834).
Local Description Authors: K.A. Schulz
Global Description Authors: J. Coles, mod. K.A. Schulz

REFERENCES: Keammerer and Peterson 1981, Keammerer and Stoecker 1975, Western Ecology Working Group n.d.

Artemisia tridentata / Pleuraphis jamesii Shrubland

Basin Big Sagebrush / James' Galleta Shrubland

CODE	CEGL001005
PHYSIOGNOMIC CLASS	Shrubland (III)
PHYSIOGNOMIC SUBCLASS	Evergreen shrubland (III.A.)
PHYSIOGNOMIC GROUP	Microphyllous evergreen shrubland (III.A.4.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural microphyllous evergreen shrubland (III.A.4.N.)
FORMATION	Lowland microphyllous evergreen shrubland (III.A.4.N.a.)
ALLIANCE	*ARTEMISIA TRIDENTATA* SHRUBLAND ALLIANCE (A.829) Basin Big Sagebrush Shrubland Alliance

ECOLOGICAL SYSTEM(S): Inter-Mountain Basins Big Sagebrush Shrubland (CES304.777)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY

Globally

This shrubland association occurs on warm sites with relatively deep soils at around 2000 m (6560 feet) elevation in the Colorado Plateau and Great Basin. Slopes are gentle to moderate, aspects tend to be southerly, and the sandy soils may have a high percentage of bare soil, rock and gravel. This shrubland association is characterized by low to moderate cover of *Artemisia tridentata* and an understory dominated by grasses, chief among them *Pleuraphis jamesii*. *Chrysothamnus depressus* and various species of cactus are common in the shrub layer but with very low cover. Many other grasses may grow with the *Pleuraphis*, including *Achnatherum hymenoides, Elymus elymoides, Hesperostipa comata*, and *Pascopyrum smithii*. Forbs are sparse and include no diagnostic species. Most stands have been impacted by domestic livestock grazing.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association is rare and was observed and sampled in Red Rock Canyon on private land adjacent to the park and on the Lake Fork Arm.

Globally

This species has been reported from Nevada (Tueller et al. 1966) and western Colorado. Nothing is known about the habitat characteristics or species composition of stands in Nevada. Examples from both states may actually belong in *Artemisia tridentata ssp. wyomingensis / Pleuraphis jamesii* Shrubland (CEGL002084).

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This shrubland association was observed on the slopes of hills. Sites range from moderate to steep (16-47% slopes), occur between 2085 and 2295 m elevation, and are oriented to southerly aspects. The unvegetated surface has high cover of bedrock, large and small rocks, and exposure of bare soil. Soils are rapidly drained and coarse in texture, derived from Quaternary alluvial deposits.

Globally

This shrubland association occurs on warm sites with relatively deep soils at around 2000 m (6560 feet) elevation in Colorado. Slopes are gentle to moderate, aspects tend to be southerly, and the sandy soils may have a high percentage of bare soil, rock and gravel.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This mountain big sagebrush / James' galleta shrubland association is rare and occurs outside park boundaries. The total vegetation cover is between 45 and 65% in these moderately vegetated stands. The shrub layer is characterized by *Artemisia tridentata ssp. vaseyana* or *Artemisia tridentata ssp. wyomingensis* that are from 0.5-1 m tall and provide 5 to 50% cover and the short bunchgrass *Pleuraphis jamesii* that provides from 1 to 25% cover. The associated shrub layer is moderately diverse in composition and provides sparse to low cover. The succulents *Echinocereus triglochidiatus, Opuntia polyacantha*, and *Pediocactus simpsonii* provide minimal cover. The herbaceous layer is diverse and provides moderate cover by graminoids and forbs. Additional graminoids are present with much less cover than *Pleuraphis jamesii* and include *Achnatherum hymenoides, Elymus elymoides*, and

Hesperostipa comata. Common forbs include *Chaenactis douglasii* and *Sphaeralcea coccinea*. Seedling *Juniperus osteosperma* are present and provide sparse cover in stands.

Globally
This shrubland association is characterized by low to moderate cover of *Artemisia tridentata* and an understory dominated by grasses, chief among them *Pleuraphis jamesii*. *Chrysothamnus depressus* and various species of cactus are common in the shrub layer but with very low cover. Many other grasses may grow with the *Pleuraphis*, including *Achnatherum hymenoides, Elymus elymoides, Hesperostipa comata*, and *Pascopyrum smithii*. Forbs are sparse and include no diagnostic species.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Short shrub/sapling	*Artemisia tridentata* ssp. *vaseyana*, *Artemisia tridentata* ssp. *wyomingensis*
Herb (field)	*Pleuraphis jamesii*

Globally

Stratum	Species
Short shrub/sapling	*Artemisia tridentata*
Herb (field)	*Pleuraphis jamesii*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Exotic/Invasive: *Agropyron cristatum* (exotic, Medium/Low), *Elymus trachycaulus* (exotic)

Globally
Data are not available.

CONSERVATION STATUS RANK
Global Rank & Reasons: G5 (23-Feb-1994).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
The plot at Black Canyon of the Gunnison National Park was placed in this association because the dominant shrub was identified as *Artemisia tridentata ssp. vaseyana*. It is possible that this plot contains a hybrid of *Artemisia tridentata ssp. wyomingensis* and *Artemisia tridentata ssp. vaseyana*. Most examples of this association are probably dominated by *Artemisia tridentata ssp. wyomingensis* and should be placed in a different association [see CEGL002084].

CLASSIFICATION CONFIDENCE: 3 - Weak

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: The dominant species in one of the plots, *Artemisia tridentata ssp. vaseyana*, is not typically found at this low elevation, nor associated with these species. There is no indication in the database whether a UV-light test was done on a sample from the plot. Therefore, it is possible that the subspecies would more correctly be *Artemisia tridentata ssp. wyomingensis*. It could also be a hybrid of the two subspecies.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (3 plots, 1 observation point): (Plots: BLCA.0028, CURE.0082, CURE.0393. Observation Point: CURE_AA.1028).
Local Description Authors: J. Von Loh, mod. J. Coles
Global Description Authors: J. Coles

REFERENCES: Bourgeron and Engelking 1994, Driscoll et al. 1984, Salas et al. 2009, Tueller et al. 1966, Western Ecology Working Group n.d.

Artemisia tridentata ssp. vaseyana / Achnatherum lettermanii Shrubland

Mountain Big Sagebrush / Letterman's Needlegrass Shrubland

CODE	CEGL002811
PHYSIOGNOMIC CLASS	Shrubland (III)
PHYSIOGNOMIC SUBCLASS	Evergreen shrubland (III.A.)
PHYSIOGNOMIC GROUP	Microphyllous evergreen shrubland (III.A.4.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural microphyllous evergreen shrubland (III.A.4.N.)
FORMATION	Lowland microphyllous evergreen shrubland (III.A.4.N.a.)
ALLIANCE	*ARTEMISIA TRIDENTATA SSP. VASEYANA* SHRUBLAND ALLIANCE (A.831) Mountain Big Sagebrush Shrubland Alliance

ECOLOGICAL SYSTEM(S): Inter-Mountain Basins Montane Sagebrush Steppe (CES304.785)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY

Globally

This shrubland occurs in the upper elevations of the sagebrush zone in plateau areas of western Colorado. Stands are located on gently to moderately sloping hills, ridgetops and benches. Elevations range from 2268 to 2609 m, and aspect is not a factor. Soils are deep, well-developed and often derived from eolian loess, although the underlying substrate may be sandstone, limestone or shale. Soil texture is silt loam or fine sandy loam. Litter covers most of the unvegetated ground surface. The vegetation of this association is characterized by a moderately closed shrub canopy dominated by *Artemisia tridentata ssp. vaseyana* with a well-developed and diverse herbaceous understory dominated by *Achnatherum lettermanii*. Total shrub cover generally ranges between 20 and 50%, and the shrub layer often also includes *Symphoricarpos oreophilus* and *Chrysothamnus viscidiflorus*. The herbaceous layer is dominated by graminoids and usually contains a number of species, including *Poa fendleriana, Poa secunda, Achnatherum pinetorum, Elymus lanceolatus*, and *Carex rossii* or *Carex geyeri*. Forbs vary among sites, but *Eriogonum umbellatum* is often present.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association is uncommon in the recreation area and was sampled on Deadhorse Mesa Trail in Curecanti National Recreation Area.

Globally

This association has been documented from western Colorado and southwestern Wyoming. It is likely to occur elsewhere in the western U.S. at higher elevations of the sagebrush zone.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This shrubland association occurs on a ridgetop. The site is gently sloping (2%), occurs at 2508 m elevation, and is oriented to a southwest aspect. The unvegetated surface consists of litter and bare soil. Parent materials include Mesozoic shale, and the soils are rapidly drained silt loams.

Globally

This shrubland occurs in the upper elevations of the sagebrush zone in plateau areas of western Colorado. Stands are located on gently to moderately sloping hills, ridgetops and benches. Elevations range from 2268 to 2609 m, and aspect is not a factor. Soils are generally deep, well-developed and often derived from eolian loess, although the underlying substrate may be sandstone, limestone or shale. Soil texture is silt loam or fine sandy loam. Litter covers most of the unvegetated ground surface.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This Wyoming big sagebrush / Letterman's needlegrass association is rare within the recreation area. Total vegetation cover is 65% in this moderately densely vegetated stand. *Artemisia tridentata ssp. vaseyana* shrubs up to 1 m tall provide 50% cover. The bunchgrass *Achnatherum lettermanii* is dominant in the herbaceous layer with 5% cover. Other shrub species present, in addition to the sagebrush, include *Chrysothamnus viscidiflorus* and

Symphoricarpos oreophilus. The herbaceous layer is diverse and provides low cover. Associated graminoids include *Poa pratensis* and *Poa fendleriana*. Forbs are also diverse and provide sparse cover, including *Phlox longifolia*.

Globally
The vegetation of this association is characterized by a moderately closed shrub canopy dominated by *Artemisia tridentata ssp. vaseyana* with a well-developed and diverse herbaceous understory dominated by *Achnatherum lettermanii*. Total shrub cover generally ranges between 20 and 50%, and the shrub layer often also includes *Symphoricarpos oreophilus* and *Chrysothamnus viscidiflorus*. The herbaceous layer is dominated by graminoids and usually contains a number of species, including *Poa fendleriana, Poa secunda, Achnatherum pinetorum*, and *Carex rossii* or *Carex geyeri*. Forbs vary among sites, but *Eriogonum umbellatum* is often present.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Short shrub/sapling	*Chrysothamnus viscidiflorus*, *Symphoricarpos oreophilus*
Short shrub/sapling	*Artemisia tridentata* ssp. *vaseyana*
Herb (field)	*Achnatherum lettermanii*, *Poa fendleriana*

Globally

Stratum	Species
Short shrub/sapling	*Symphoricarpos oreophilus*
Short shrub/sapling	*Artemisia tridentata* ssp. *vaseyana*
Herb (field)	*Achnatherum lettermanii*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Vulnerable: *Astragalus anisus* (globally imperiled endemic, G2G3); **Exotic/Invasive**: *Poa pratensis* (exotic, Medium)

Globally
Vulnerable: *Astragalus anisus* (endemic, G2G3); **Exotic/Invasive**: *Poa pratensis* (exotic, Medium)

CONSERVATION STATUS RANK
Global Rank & Reasons: GNR (28-Jun-2005).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: *Achnatherum lettermanii* is considered an increaser under heavy grazing regimes; this plot may have been another mountain sagebrush association prior to grazing.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points:
The description is based on 2002 field data (1 plot): (Plot: BLCA.0057).
Local Description Authors: J. Coles
Global Description Authors: J. Coles, mod. K.A. Schulz

REFERENCES: Western Ecology Working Group n.d.

Artemisia tridentata ssp. vaseyana / Achnatherum pinetorum Shrubland

Mountain Big Sagebrush / Pine Needlegrass Shrubland

CODE	CEGL002806
PHYSIOGNOMIC CLASS	Shrubland (III)
PHYSIOGNOMIC SUBCLASS	Evergreen shrubland (III.A.)
PHYSIOGNOMIC GROUP	Microphyllous evergreen shrubland (III.A.4.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural microphyllous evergreen shrubland (III.A.4.N.)
FORMATION	Lowland microphyllous evergreen shrubland (III.A.4.N.a.)
ALLIANCE	*ARTEMISIA TRIDENTATA SSP. VASEYANA* SHRUBLAND ALLIANCE (A.831) Mountain Big Sagebrush Shrubland Alliance

ECOLOGICAL SYSTEM(S): Inter-Mountain Basins Montane Sagebrush Steppe (CES304.785)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY

Globally

This shrubland association is known from Black Canyon National Park and Curecanti National Recreation Area in the Gunnison River Valley and below Monarch Pass in western Colorado. Sites are gentle to moderately steep slopes (6-24% slopes) and valley bottoms. Stands occur between 2310 and 2706 m elevation, and most are oriented to east and southeast aspects. Soils are rapidly drained loams and sandy clay loams derived from Mesozoic sandstone. The vegetation is characterized by an open to closed (25-75% cover) short-shrub layer (to 1 m tall) that is dominated by *Artemisia tridentata ssp. vaseyana*, with a typically patchy graminoid layer dominated by the bunch grasses *Poa fendleriana* and *Achnatherum pinetorum* with 1-25% cover each. The shrub layer is variable in cover and composition. Other short and dwarf-shrubs present and providing sparse to low cover include *Artemisia frigida, Amelanchier utahensis, Ericameria nauseosa, Gutierrezia sarothrae*, and *Symphoricarpos oreophilus*, and the succulents *Opuntia polyacantha* and *Pediocactus simpsonii*. *Chrysothamnus viscidiflorus* and *Purshia tridentata* contribute high cover in a few stands. The herbaceous layer is diverse and provides low to moderate cover. Associated graminoids provide low to moderate cover and include *Achnatherum hymenoides, Koeleria macrantha, Poa secunda*, and *Elymus elymoides*. Forbs are also diverse and provide sparse cover, including *Castilleja linariifolia, Chaenactis douglasii, Comandra umbellata, Phlox multiflora*, and *Polygonum douglasii*. Species of moss and crustose lichen provide sparse cover.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association is uncommon in the recreation area and was sampled on Dillon Mesa, near Dillon Pinnacles, on the North Rim Drive, and near Cooper's Ranch in Curecanti National Recreation Area.

Globally

This shrubland association is known from Black Canyon National Park and Curecanti National Recreation Area in the Gunnison River Valley and below Monarch Pass (Komarkova 1986) in western Colorado. More survey is needed to determine its full extent.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This shrubland association occurs on toeslopes. Sites are gentle to moderately steep (6-24% slopes), occur between 2310 and 2706 m elevation, and mostly are oriented to east and southeast aspects. The unvegetated surface has no cover to moderate cover of litter, high exposure of bare soil, and moderate cover by large and small rocks. Downed wood is uncommon. Parent materials are Mesozoic sandstone. Soils are rapidly drained loams and sandy clay loams.

Globally

This shrubland association is known from Black Canyon National Park and Curecanti National Recreation Area in the Gunnison River Valley and below Monarch Pass in western Colorado. Sites are gentle to moderately steep slopes (6-24% slopes) and valley bottoms. Stands occur between 2310 and 2706 m elevation, and most are oriented to east and southeast aspects. Soils are rapidly drained loams and sandy clay loams derived from Mesozoic sandstone.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This mountain big sagebrush / pine needlegrass shrubland association is rare within the recreation area. The total vegetation cover ranges from 80 to over 100% in these densely vegetated stands. *Artemisia tridentata ssp. vaseyana* shrubs up to 1 m tall form open to closed canopies and provide from 25 to 75% cover. The bunch grasses *Poa fendleriana* and *Achnatherum pinetorum* form patchy open canopies, each species provides between 1% and 25% cover. The shrub layer is variable in cover and composition. Other short and dwarf-shrubs present and providing sparse to low cover include *Amelanchier utahensis, Gutierrezia sarothrae*, and *Symphoricarpos oreophilus*, and the succulents *Opuntia polyacantha* and *Pediocactus simpsonii*. *Chrysothamnus viscidiflorus* and *Purshia tridentata* contribute high cover in a few stands. The herbaceous layer is diverse and provides low to moderate cover. Associated graminoids provide low to moderate cover and include *Achnatherum hymenoides, Poa secunda*, and *Elymus elymoides*. Forbs are also diverse and provide sparse cover, including *Artemisia frigida, Chaenactis douglasii, Comandra umbellata*, and *Polygonum douglasii*. Species of moss and crustose lichen provide sparse cover.

Globally

The vegetation is characterized by an open to closed (25-75% cover) short-shrub layer (to 1 m tall) that is dominated by *Artemisia tridentata ssp. vaseyana*, with a typically patchy graminoid layer dominated by the bunch grasses *Poa fendleriana* and *Achnatherum pinetorum* with 1-25% cover each. The shrub layer is variable in cover and composition. Other short and dwarf-shrubs present and providing sparse to low cover include *Artemisia frigida, Amelanchier utahensis, Ericameria nauseosa, Gutierrezia sarothrae*, and *Symphoricarpos oreophilus*, and the succulents *Opuntia polyacantha* and *Pediocactus simpsonii*. *Chrysothamnus viscidiflorus* and *Purshia tridentata* contribute high cover in a few stands. The herbaceous layer is diverse and provides low to moderate cover. Associated graminoids provide low to moderate cover and include *Achnatherum hymenoides, Koeleria macrantha, Poa secunda*, and *Elymus elymoides*. Forbs are also diverse and provide sparse cover, including *Castilleja linariifolia, Chaenactis douglasii, Comandra umbellata, Phlox multiflora*, and *Polygonum douglasii* (Komarkova 1986). Species of moss and crustose lichen provide sparse cover.

MOST ABUNDANT SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Short shrub/sapling	*Chrysothamnus viscidiflorus*
Short shrub/sapling	*Artemisia tridentata* ssp. *vaseyana*, *Purshia tridentata*
Herb (field)	*Achnatherum pinetorum*

Globally

Stratum	Species
Short shrub/sapling	*Artemisia tridentata* ssp. *vaseyana*
Herb (field)	*Achnatherum pinetorum*

OTHER NOTEWORTHY SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Data are not available.

Globally

Data are not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (22-Jun-2005).

CLASSIFICATION COMMENTS

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Data are not available.

Globally

Data are not available.

CLASSIFICATION CONFIDENCE:

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Classification of these stands is complicated by extended drought conditions, which persisted throughout the sampling period and reduced the cover of perennial herbaceous species. Some stands may classify as a shrub herbaceous association during normal and above-average water years.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (7 plots, 18 observation points): (Plots: BLCA.0010, CURE.0001, CURE.0078, CURE.0163, CURE.0315, CURE.0317, CURE.0331. Observation Points: CURE_AA.0008, CURE_AA.0010, CURE_AA.0014, CURE_AA.0021, CURE_AA.0023, CURE_AA.0024, CURE_AA.0102, CURE_AA.0160, CURE_AA.0167, CURE_AA.0292, CURE_AA.0409, CURE_AA.0493, CURE_AA.0584, CURE_AA.0651, CURE_AA.0845, CURE_AA.0983, CURE_AA.1429, CURE_AA.1430).
Local Description Authors: J. Von Loh, mod. G. Bradshaw
Global Description Authors: K.A. Schulz

REFERENCES: Johnston 2001, Komarkova 1986, Western Ecology Working Group n.d.

Artemisia tridentata ssp. vaseyana / Balsamorhiza sagittata Shrubland

Mountain Big Sagebrush / Arrowleaf Balsamroot Shrubland

CODE	CEGL001020
PHYSIOGNOMIC CLASS	Shrubland (III)
PHYSIOGNOMIC SUBCLASS	Evergreen shrubland (III.A.)
PHYSIOGNOMIC GROUP	Microphyllous evergreen shrubland (III.A.4.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural microphyllous evergreen shrubland (III.A.4.N.)
FORMATION	Lowland microphyllous evergreen shrubland (III.A.4.N.a.)
ALLIANCE	*ARTEMISIA TRIDENTATA SSP. VASEYANA* SHRUBLAND ALLIANCE (A.831) Mountain Big Sagebrush Shrubland Alliance

ECOLOGICAL SYSTEM(S): Inter-Mountain Basins Montane Sagebrush Steppe (CES304.785)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY
Globally
This shrubland occurs on ridges, benches and mesas in the northern Colorado Plateau and western slope of the southern Rocky Mountains. Stands occur in somewhat isolated upland patches in western Colorado and in southwestern Wyoming. Slopes range from level to moderate and occur between 2300 and 2675 m (7545-8776 feet) elevation. Soils are derived from a wide variety of substrates; textures vary accordingly from clays to sandy loams. Biological soil crusts may be present but rarely have significant cover. Total vegetation cover ranges from 25 to nearly 100%. The vegetation is characterized by a shrub canopy of *Artemisia tridentata ssp. vaseyana* (15-75%), often associated with *Amelanchier utahensis, Symphoricarpos oreophilus*, and *Purshia tridentata*. The herbaceous understory is dominated by *Balsamorhiza sagittata* and other forbs, including *Phlox* spp., *Eriogonum umbellatum, Castilleja linariifolia, Senecio integerrimus, Arenaria congesta*, and *Crepis acuminata*. Total herbaceous cover ranges from 10 to 30%. Grasses vary among sites and may include *Poa fendleriana, Poa secunda, Hesperostipa comata, Pseudoroegneria spicata, Achnatherum pinetorum, Achnatherum lettermanii*, and *Pascopyrum smithii*. Scattered *Juniperus osteosperma* may be present, but pinyon or juniper trees appear not to threaten stands on high slopes and ridgetops because of their relatively thin soils. Fire tends to convert these sites to grasslands dominated by the herbaceous species present before the burn.

DISTRIBUTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This association is uncommon and was observed and sampled on Dillon Mesa in the recreation area and on the North Rim, northwest of Island Peaks Overlook in the park. It is also found on both rims of the Black Canyon, commonly occurring in a mosaic with *Quercus gambelii* shrublands (Observation points: BLCA.0024, BLCA.0025).

Globally
This association is known from the northern Colorado Plateau and western slope of the southern Rocky Mountains. Stands occur in somewhat isolated upland patches in western Colorado and in southwestern Wyoming.

ENVIRONMENTAL DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This shrubland association was observed on midslopes of mesas and toeslopes of swales. Sites are nearly level to gentle (3-12% slopes), occur between 2438 and 2675 m elevation, and include all aspects. The unvegetated surface has high exposure of bare soil and low to moderate cover of small rocks and litter. Soils are rapidly drained clay loams and silty loams derived from Morrison Formation shale and Sapinero Mesa tuff.

Globally
This shrubland occurs on ridges, benches and mesas in the northern Colorado Plateau. Slopes range from level to moderate, and known sites occur between 2300 and 2675 m (7545-8776 feet) elevation. Soils are derived from a wide variety of substrates, including shales, volcanic tuff and limestone; textures vary accordingly from clays to clay loams and silty loams to sandy loams. The unvegetated surface has high exposure of bare soil and low to moderate cover of small rocks and litter. Biological soil crusts may be present but rarely have significant cover.

VEGETATION DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This mountain big sagebrush / arrowleaf balsamroot shrubland association is rare within the park and recreation area. The total vegetation cover ranges from 59 to 120% in these densely vegetated stands. This shrubland association is characterized by a closed canopy, typically <0.5-1 m tall, of *Artemisia tridentata ssp. vaseyana* shrubs that range in cover from 30 to 75%, and the forb *Balsamorhiza sagittata* that ranges in cover from 6 to 25%. The remaining shrub layer is sparse in terms of diversity and provides low cover. Additional short and dwarf-shrubs and succulents include *Amelanchier utahensis, Chrysothamnus depressus*, and *Opuntia fragilis*. The herbaceous layer is diverse and provides sparse cover of graminoids and moderate cover of forbs. Graminoids include *Achnatherum lettermanii, Achnatherum pinetorum, Carex geyeri, Elymus elymoides, Hesperostipa comata, Pascopyrum smithii, Poa fendleriana*, and *Poa secunda*. Additional common forbs include *Arabis* spp., *Arenaria congesta, Castilleja integra, Castilleja linariifolia, Crepis acuminata, Erigeron divergens, Eriogonum umbellatum, Phlox multiflora*, and *Senecio integerrimus*. Seedling *Amelanchier utahensis* and *Symphoricarpos rotundifolius* shrubs are present and provide sparse cover. Species of lichen and/or moss provide sparse to low cover.

Globally
This shrubland is characterized by a sparse to dense cover of *Artemisia tridentata ssp. vaseyana* (15-75%), with an herbaceous understory in which *Balsamorhiza sagittata* is the most conspicuous species. Total vegetation cover ranges from 25 to nearly 100%. Other shrubs are usually present as minor canopy elements, including *Purshia tridentata, Symphoricarpos oreophilus, Amelanchier utahensis, Chrysothamnus viscidiflorus*, and the dwarf-shrub *Mahonia repens*. Total herbaceous cover ranges from 10 to 30%. Grasses often have 5 to 10% cover in the forb-dominated understory, but amounts vary among sites, and include *Poa fendleriana, Poa secunda, Hesperostipa comata, Pseudoroegneria spicata, Achnatherum pinetorum, Achnatherum lettermanii, Leymus cinereus*, and *Pascopyrum smithii*. Common forbs in addition to *Balsamorhiza* include *Phlox* spp., *Eriogonum umbellatum, Arenaria congesta, Castilleja linariifolia, Crepis acuminata, Mertensia oblongifolia, Pteryxia terebinthina (= Cymopterus terebinthinus), Senecio integerrimus*, and *Wyethia amplexicaulis*. Scattered individuals of *Juniperus osteosperma* may be present with less than 10% cover.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tall shrub/sapling	*Amelanchier utahensis*
Short shrub/sapling	*Artemisia tridentata* ssp. *vaseyana*
Herb (field)	*Chrysothamnus depressus*
Herb (field)	*Balsamorhiza sagittata*, *Phlox multiflora*
Herb (field)	*Poa fendleriana*, *Poa secunda*

Globally

Stratum	Species
Short shrub/sapling	*Artemisia tridentata* ssp. *vaseyana*
Herb (field)	*Balsamorhiza sagittata*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CONSERVATION STATUS RANK
Global Rank & Reasons: GNR (23-Feb-1994).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Two observation points (BLCA.0024 and BLCA.0025) were sampled in 2000 as part of a mosaic with *Quercus gambelii / Amelanchier utahensis* Shrubland (CEGL001110). One quantitative plot in that area would be of use to round out the description of the community.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on 2002 and 2003 field data (2 plots): (Plots: BLCA.0030, CURE.0333).
Local Description Authors: J. Von Loh, mod. G. Bradshaw and J. Coles
Global Description Authors: J. Coles, mod. K.A. Schulz

REFERENCES: Bourgeron and Engelking 1994, CONHP unpubl. data 2003, Driscoll et al. 1984, Hess and Wasser 1982, Johnston 2001, Komarkova 1986, Terwilliger and Tiedemann 1978, Western Ecology Working Group n.d.

Artemisia tridentata ssp. vaseyana / Hesperostipa comata Shrubland

Mountain Big Sagebrush / Needle-and-Thread Shrubland

CODE	CEGL002931
PHYSIOGNOMIC CLASS	Shrubland (III)
PHYSIOGNOMIC SUBCLASS	Evergreen shrubland (III.A.)
PHYSIOGNOMIC GROUP	Microphyllous evergreen shrubland (III.A.4.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural microphyllous evergreen shrubland (III.A.4.N.)
FORMATION	Lowland microphyllous evergreen shrubland (III.A.4.N.a.)
ALLIANCE	*ARTEMISIA TRIDENTATA SSP. VASEYANA* SHRUBLAND ALLIANCE (A.831) Mountain Big Sagebrush Shrubland Alliance

ECOLOGICAL SYSTEM(S): Inter-Mountain Basins Montane Sagebrush Steppe (CES304.785)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY
Globally
This association is known from southern Utah to southern Idaho and western Wyoming and is likely to occur in northern Nevada. It occurs on moderate slopes between 1372 to 2850 m (4500-9350 feet) elevation. Soils are deep and range from clay loam to sandy loams. *Artemisia tridentata ssp. vaseyana* is the dominant shrub. *Purshia tridentata, Symphoricarpos oreophilus, Ericameria* sp., *Artemisia tripartita*, and *Amelanchier alnifolia* may be

present at upper elevations, and at lower altitudes *Chrysothamnus viscidiflorus* and *Tetradymia canescens* can be common. *Hesperostipa comata (= Stipa comata)* is the principal understory species. *Festuca idahoensis, Pseudoroegneria spicata (= Agropyron spicatum)*, and *Koeleria macrantha* may be present in small amounts. Other herbaceous species that may be present include *Carex rossii, Achnatherum lettermanii, Achnatherum nelsonii, Pseudoroegneria spicata, Poa pratensis, Antennaria microphylla*, and *Eriogonum umbellatum*.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This association is uncommon in the park and recreation area and was observed and sampled in the Upper Pine Creek area, on Sheep Knob, and near West Elk Creek in the recreation area.

Globally
This association is known from southern Utah to southern Idaho and western Wyoming. It is likely to occur in northern Nevada.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This shrubland association was observed in shallow drainages or linear depressions on valley slopes, on shoulder slopes and ridge tops, and on dry benches on basin floors. Sites are gentle to moderately steep (5-25% slopes), occur between 2417 and 2850 m elevation, and are oriented to southwest-facing aspects. The unvegetated surface has low to high cover of litter, large and small rocks, and exposure of bare soil. Downed wood is relatively common, with cover up to 6%. Soils are moderately well-drained and are sandy loam derived from Quaternary alluvium.

Globally
This association occurs on gentle to moderate slopes, ridges, depressions and plateaus between 1370 and 2850 m (4500-9350 feet) elevation. The lower elevations tend to occur at the northern end of the association's range. Soils are derived from alluvium, eolian sands or loess, are deep and range in texture from clay loam to sandy loams.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This mountain big sagebrush / needle-and-thread shrubland association is rare in the park and recreation area. The total vegetation cover ranges from 70 to 90% in these densely vegetated stands. This shrub herbaceous association is characterized by the bunchgrass *Hesperostipa comata* that provides from 1 to 40% cover, and the short shrub *Artemisia tridentata ssp. vaseyana* that provides from 30 to 75% cover. The herbaceous layer is very diverse, typically dominated by graminoids, and contributes from 10 to 45% cover. Other graminoids provide low to moderate total cover and include *Achnatherum hymenoides, Achnatherum pinetorum, Carex geyeri, Elymus elymoides, Festuca thurberi, Koeleria macrantha, Poa fendleriana*, and *Poa secunda*. Forbs are diverse and provide low cover, including *Antennaria parvifolia, Erigeron pumilus, Eriogonum racemosum, Lupinus* spp., and *Penstemon teucrioides*. The shrub layer is somewhat variable in cover and composition. Short and dwarf-shrubs are diverse but typically contribute less than 5% cover per species; the more common include *Ericameria parryi, Opuntia fragilis*, and *Symphoricarpos rotundifolius*. Cryptogam cover of less than 5% may be present in some stands.

Globally
Total vegetation cover usually exceeds 60% in these moderately to densely vegetated communities. *Artemisia tridentata ssp. vaseyana* is the dominant shrub, with between 1 and 40% cover. *Purshia tridentata, Symphoricarpos oreophilus, Ericameria* sp., *Artemisia tripartita*, and *Amelanchier alnifolia* may be present at upper elevations, and at lower altitudes *Chrysothamnus viscidiflorus, Cercocarpus montanus*, and *Tetradymia canescens* can be common. *Hesperostipa comata (= Stipa comata)* is the principal understory species. *Festuca idahoensis, Pseudoroegneria spicata (= Agropyron spicatum)*, and *Koeleria macrantha* may be present in small amounts. Other herbaceous species that may be present include *Bouteloua gracilis, Poa fendleriana, Muhlenbergia* spp., *Carex rossii, Achnatherum lettermanii, Achnatherum nelsonii, Pseudoroegneria spicata, Poa pratensis, Antennaria microphylla*, and *Eriogonum umbellatum*.

MOST ABUNDANT SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Short shrub/sapling	*Artemisia tridentata* ssp. *vaseyana*

Herb (field)	*Hesperostipa comata*, *Poa fendleriana*

Globally

Stratum	Species
Short shrub/sapling	*Purshia tridentata*
Short shrub/sapling	*Artemisia tridentata* ssp. *vaseyana*
Herb (field)	*Antennaria microphylla*, *Eriogonum umbellatum*
Herb (field)	*Hesperostipa comata*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Exotic/Invasive: *Bromus tectorum* (exotic, High), *Poa pratensis* (exotic, Medium), *Taraxacum officinale* (exotic)

Globally
Other: *Arenaria congesta* var. *wheelerensis* (G5T2T3Q)

CONSERVATION STATUS RANK
Global Rank & Reasons: GNR (14-Aug-2001).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
The global description is based on Hironaka et al. (1983) and Grand Teton National Park and Zion National Park local descriptions. Of all the references for this association, only Hironaka et al. (1983) clearly reference an *Artemisia tridentata ssp. vaseyana / Stipa comata* vegetation type. All the others (Poulton 1955, Tueller et al. 1966, Blackburn 1967, Blackburn et al. 1968c, 1971, McLean 1970, Tueller and Blackburn 1974, DeVelice and Lesica 1993) do not provide information as to the subspecies of *Artemisia tridentata*. Further clarification of which published materials relate to this association is needed. Based on habitat information and photos available for the study areas in Nevada, these could reference *Artemisia tridentata ssp. tridentata / Stipa comata* vegetation types.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Some grazing is evident; stands have dense herbaceous layer.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (3 plots, 13 observation points): (Plots: CURE.0313, CURE.0363, CURE.0372. Observation Points: BLCA_AA.706, CURE_AA.0038, CURE_AA.0042, CURE_AA.0168, CURE_AA.0173, CURE_AA.0175, CURE_AA.0178, CURE_AA.0180, CURE_AA.0183, CURE_AA.0186, CURE_AA.0296, CURE_AA.0328, CURE_AA.0834).
Local Description Authors: J. Von Loh, mod. J. Coles
Global Description Authors: G. Kittel, mod. J. Coles

REFERENCES: Bell et al. 2009, Blackburn 1967, Blackburn et al. 1968c, Blackburn et al. 1971, Bramble-Brodahl 1978, CONHP unpubl. data 2003, Cogan et al. 2004, DeVelice and Lesica 1993, Hironaka et al. 1983, McLean 1970, Poulton 1955, Tueller and Blackburn 1974, Tueller et al. 1966, Western Ecology Working Group n.d.

Artemisia tridentata ssp. vaseyana / Pascopyrum smithii Shrubland

Mountain Big Sagebrush / Western Wheatgrass Shrubland

CODE	CEGL001028
PHYSIOGNOMIC CLASS	Shrubland (III)
PHYSIOGNOMIC SUBCLASS	Evergreen shrubland (III.A.)
PHYSIOGNOMIC GROUP	Microphyllous evergreen shrubland (III.A.4.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural microphyllous evergreen shrubland (III.A.4.N.)
FORMATION	Lowland microphyllous evergreen shrubland (III.A.4.N.a.)
ALLIANCE	*ARTEMISIA TRIDENTATA SSP. VASEYANA* SHRUBLAND ALLIANCE (A.831) Mountain Big Sagebrush Shrubland Alliance

ECOLOGICAL SYSTEM(S): Inter-Mountain Basins Montane Sagebrush Steppe (CES304.785)
Inter-Mountain Basins Big Sagebrush Shrubland (CES304.777)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY

Globally

This mesic sagebrush association occurs in upland areas where snow accumulates, including swales and valley bottoms. Documented stands are known from Wyoming, Montana and northern and western Colorado. Elevations range from 2200 to 2500 m (7200-8200 feet). Sites are level to gently sloping and may be oriented to any aspect. Soils may be derived from eolian sediments, sandstone or shale, and often have a silty loam or clay loam texture. The amount of litter on the ground surface is inversely proportional to the intensity of grazing. Total vegetation cover ranges from a low of around 20% to approximately 75%. *Artemisia tridentata ssp. vaseyana* dominates the shrub layer with 10 to 50% cover, and *Pascopyrum smithii* dominates a diverse herbaceous layer. Other shrubs comprise a minority of the shrub canopy, including *Symphoricarpos oreophilus, Amelanchier utahensis, Purshia tridentata, Ericameria nauseosa, Tetradymia canescens, Krascheninnikovia lanata*, and *Chrysothamnus viscidiflorus*. The grass component of the understory is often diverse and may include a combination of *Poa fendleriana, Achnatherum pinetorum, Achnatherum hymenoides, Bouteloua gracilis, Elymus lanceolatus, Leymus cinereus, Hesperostipa comata, Elymus elymoides*, and *Poa secunda*. Forbs such as *Artemisia frigida, Achillea millefolium*, and *Phlox hoodii ssp. muscoides (= Phlox bryoides)* generally contribute little cover.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association is rare in the recreation area and was sampled near State Highway 92 in the Curecanti National Recreation Area.

Globally

This association is known from Montana, northern and western Colorado, and Wyoming.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This short-shrub association occurs on slopes. The site is gently sloped (14%), occurs at 2453 m elevation, and is oriented to the northwest. The unvegetated surface has high cover of litter and high exposure of bare soil. Large and small rocks provide low cover. Downed wood is common, probably as a result of grazing. Parent materials are Mesozoic sandstone. Soils are sandy and well-drained.

Globally

This mesic sagebrush association occurs in uplands in areas where snow accumulates, including swales and valley bottoms. Documented stands are in Wyoming and in northern and western Colorado, but this association is likely to be widespread. Elevations range from 2200 to 2500 m (7200-8200 feet). Sites are level to gently sloping and may occur on any aspect. Soils may be derived from eolian deposits, sandstone or shale, and often have a silty loam or clay loam texture. The amount of litter on the ground surface is inversely proportional to the intensity of grazing.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This mountain big sagebrush / western wheatgrass association is rare within the recreation area. The total vegetation cover is approximately 85% for this densely vegetated stand. *Artemisia tridentata ssp. vaseyana* shrubs 1-2 m tall

form a moderately open to closed canopy and provide 50-75% cover, and the perennial, rhizomatous grass *Pascopyrum smithii* provides up to 5% cover. The shrub layer is low in diversity and provides moderate to dense cover. Additional short shrubs providing sparse cover include *Chrysothamnus viscidiflorus, Tetradymia canescens*, and *Purshia tridentata*. The dwarf-shrub layer is sparse in terms of cover and includes *Ericameria nauseosa* and *Gutierrezia sarothrae*. The herbaceous layer is diverse and provides moderate cover. Graminoids are moderately diverse and provide low cover, principally by the non-native grass *Poa pratensis*. Other graminoids present providing sparse cover include *Achnatherum hymenoides, Achnatherum pinetorum, Elymus elymoides*, and *Koeleria macrantha*. Forbs are diverse but sparse and include *Achillea millefolium var. occidentalis, Astragalus tenellus*, and *Orthocarpus luteus*. Species of moss provide sparse cover.

Globally
Total vegetation cover in these sagebrush shrublands ranges from 20% to approximately 75%. *Artemisia tridentata ssp. vaseyana* dominates the shrub layer with 10-50% cover, and *Pascopyrum smithii* dominates the diverse herbaceous layer. Other shrubs may comprise a minor component of the shrub canopy, including *Symphoricarpos oreophilus, Amelanchier utahensis, Purshia tridentata, Ericameria nauseosa, Tetradymia canescens, Krascheninnikovia lanata*, and *Chrysothamnus viscidiflorus*. The grass component of the understory is often diverse and may include a combination of *Poa fendleriana, Achnatherum pinetorum, Achnatherum hymenoides, Bouteloua gracilis, Elymus lanceolatus, Leymus cinereus, Hesperostipa comata, Elymus elymoides*, and *Poa secunda*. Forbs such as *Artemisia frigida, Achillea millefolium*, and *Phlox hoodii ssp. muscoides (= Phlox bryoides)* generally contribute little cover.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Short shrub/sapling	*Artemisia tridentata* ssp. *vaseyana*
Herb (field)	*Achillea millefolium* var. *occidentalis*, *Astragalus tenellus*, *Orthocarpus luteus*
Herb (field)	*Pascopyrum smithii*, *Poa pratensis*

Globally

Stratum	Species
Short shrub/sapling	*Artemisia tridentata* ssp. *vaseyana*
Herb (field)	*Pascopyrum smithii*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Exotic/Invasive: *Poa pratensis* (exotic, Medium)

Globally
Exotic/Invasive: *Poa pratensis* (exotic, Medium)

CONSERVATION STATUS RANK
Global Rank & Reasons: G3? (1-Feb-1996).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: The area is intensively grazed.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (1 plot, 21 observation points): (Plot: CURE.0079. Observation Points: BLCA_AA.264, BLCA_AA.266, BLCA_AA.270, BLCA_AA.273, BLCA_AA.320, BLCA_AA.326,

BLCA_AA.397, BLCA_AA.893, BLCA_AA.931, BLCA_AA.932, BLCA_AA.933, BLCA_AA.934, BLCA_AA.935, BLCA_AA.943, BLCA_AA.948, BLCA_AA.953, BLCA_AA.959, BLCA_AA.960, CURE_AA.0261, CURE_AA.0551, CURE_AA.0992).
Local Description Authors: J. Von Loh
Global Description Authors: J. Coles

REFERENCES: Baker 1984a, Bourgeron and Engelking 1994, CONHP unpubl. data 2003, Driscoll et al. 1984, Jones 1992b, MTNHP 2002b, Rzedowski 1981, Skull Point Mine Application n.d., Skull Point Mine Permit Renewal n.d., Smith 1966, Terwilliger and Smith 1978, Western Ecology Working Group n.d.

Artemisia tridentata ssp. vaseyana / Poa fendleriana Shrubland

Mountain Big Sagebrush / Muttongrass Shrubland

CODE	CEGL002812
PHYSIOGNOMIC CLASS	Shrubland (III)
PHYSIOGNOMIC SUBCLASS	Evergreen shrubland (III.A.)
PHYSIOGNOMIC GROUP	Microphyllous evergreen shrubland (III.A.4.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural microphyllous evergreen shrubland (III.A.4.N.)
FORMATION	Lowland microphyllous evergreen shrubland (III.A.4.N.a.)
ALLIANCE	*ARTEMISIA TRIDENTATA SSP. VASEYANA* SHRUBLAND ALLIANCE (A.831) Mountain Big Sagebrush Shrubland Alliance

ECOLOGICAL SYSTEM(S): Inter-Mountain Basins Montane Sagebrush Steppe (CES304.785)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY
Globally
This sagebrush shrubland covers medium to large patches on the slopes of mesas, valleys, plateaus, hills and ridges in western Colorado, eastern Utah and southwestern Wyoming. It often occurs in a mosaic with other sagebrush communities that cover very large areas. Elevations range from 2100 to 2875 m (6900-9430 feet). Slopes vary from gentle to steep and may be oriented to any aspect. Litter cover is generally high, and soils are deep and mostly relatively fine-textured clay loams or clays, with a few stands on sandy sites. Total vegetation cover ranges from approximately 35% to nearly 100%. The shrub layer is dominated by *Artemisia tridentata ssp. vaseyana* shrubs up to 1 m tall with between 20 and 50% cover. The bunchgrass *Poa fendleriana* is dominant in the herbaceous layer with 1 to 25% cover. Other shrub species present, in addition to the sagebrush, include *Purshia tridentata, Chrysothamnus viscidiflorus*, and *Symphoricarpos oreophilus*. The herbaceous layer may be sparse to dense and well-developed, diverse or depauperate, depending on location and grazing history. The grass component in particular is generally mixed, and common associated or codominant graminoids include *Koeleria macrantha, Poa secunda, Elymus lanceolatus, Bouteloua gracilis, Carex duriuscula (= Carex stenophylla), Elymus elymoides, Pseudoroegneria spicata*, and *Hesperostipa comata*. Forbs commonly present may include *Antennaria parvifolia, Castilleja linariifolia, Eriogonum umbellatum, Lupinus sericeus, Artemisia frigida*, and *Penstemon caespitosus*. Grazing has likely contributed to the increase in cover by mountain big sagebrush in these stands at the expense of native grasses. Fire would eliminate the mountain big sagebrush canopy in favor of a mixed graminoid and forb community. In the absence of fire over long periods, some stands show evidence of invasion by *Pinus edulis, Juniperus osteosperma*, or *Pseudotsuga menziesii*.

DISTRIBUTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This association is uncommon in the recreation area and was sampled on Carpenter Ridge in Curecanti National Recreation Area.

Globally
This association has been documented in the Colorado Plateau and Rocky Mountains in western Colorado, eastern Utah and southwestern Wyoming. It is likely to be significantly more common than is currently known.

ENVIRONMENTAL DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This shrubland association occurs on the slopes of mesas and ridges. Sites are moderate to steeply sloping (9-48%), occur at 2695 m elevation, and are oriented to north and east aspects. The unvegetated surface consists of litter and gravel. Parent materials include Tertiary volcanic rocks, and the soils are rapidly drained sandy loams and clay loams.

Globally
This sagebrush shrubland association covers medium to large patches on the slopes of mesas, valleys, plateaus, hills and ridges in western Colorado, eastern Utah and southwestern Wyoming. Elevations range from 2100 to 2875 m (6900-9430 feet). Slopes vary from gentle to steep and may be oriented to any aspect. Litter cover is generally high, and soils are deep and mostly relatively fine-textured clay loams or clays, with a few stands on sandy sites. Parent materials include volcanic rocks and shale from the Wasatch Formation.

VEGETATION DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This mountain big sagebrush / muttongrass association is rare within the recreation area. Total vegetation cover is approximately 50% in this moderately densely vegetated stand. *Artemisia tridentata ssp. vaseyana* shrubs up to 1 m tall provide 50% cover. The bunchgrass *Poa fendleriana* is dominant in the herbaceous layer with up to 25% cover. Other shrub species present, in addition to the sagebrush, include *Chrysothamnus viscidiflorus* and *Symphoricarpos oreophilus*. The herbaceous layer is limited and provides sparse cover, including *Artemisia frigida* and *Penstemon caespitosus*.

Globally
This Wyoming big sagebrush association occurs in a mosaic with other sagebrush communities that in aggregate may cover entire landscapes. Total vegetation cover ranges from approximately 35% to nearly 100%. The shrub layer is dominated by *Artemisia tridentata ssp. vaseyana* shrubs up to 1 m tall with between 20 and 50% cover. The bunchgrass *Poa fendleriana* is dominant in the herbaceous layer with 1 to 25% cover. Other shrub species present, in addition to the sagebrush, include *Purshia tridentata, Amelanchier utahensis, Artemisia arbuscula ssp. longiloba, Chrysothamnus viscidiflorus*, and *Symphoricarpos oreophilus*. The herbaceous layer may be sparse to dense and well-developed, diverse or depauperate, depending on location and grazing history. The grass component in particular is generally mixed, and common associated or codominant graminoids include *Koeleria macrantha, Poa secunda, Elymus lanceolatus, Bouteloua gracilis, Carex duriuscula (= Carex stenophylla), Elymus elymoides, Leymus cinereus, Pascopyrum smithii, Pseudoroegneria spicata*, and *Hesperostipa comata*. Forbs commonly present may include *Antennaria parvifolia, Castilleja linariifolia, Cirsium undulatum, Eriogonum umbellatum, Lupinus sericeus, Argentina anserina (= Potentilla anserina), Artemisia frigida*, and *Penstemon caespitosus*. The non-native annual *Bromus tectorum* and the non-native perennial *Poa pratensis* are common in some stands.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Short shrub/sapling	*Artemisia tridentata* ssp. *vaseyana*
Herb (field)	*Poa fendleriana*

Globally

Stratum	Species
Short shrub/sapling	*Artemisia tridentata* ssp. *vaseyana*
Herb (field)	*Poa fendleriana*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Exotic/Invasive: *Bromus tectorum* (exotic, High), *Poa pratensis* (exotic, Medium)

CONSERVATION STATUS RANK
Global Rank & Reasons: GNR (28-Jun-2005).

CLASSIFICATION COMMENTS

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Although *Poa fendleriana* is the dominant grass in the understory of this sagebrush association, it is often accompanied by other grasses, many with significant cover and indicator value. In a sagebrush landscape, the dominant grass in any given spot may depend on many variables, including grazing history and drought cycles, as well as subtle differences in soil, aspect, slope and slope position. In practice it may be difficult to distinguish this association in the field from many of the similar associations listed above.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: One stand has scattered *Pseudotsuga menziesii* trees.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (4 plots, 53 observation points): (Plots: CURE.0076, CURE.0218, CURE.0338, CURE.0341. Observation Points: BLCA_AA.204, BLCA_AA.245, BLCA_AA.305, BLCA_AA.308, BLCA_AA.324, BLCA_AA.325, BLCA_AA.339, BLCA_AA.344, BLCA_AA.406, BLCA_AA.407, BLCA_AA.434, BLCA_AA.438, BLCA_AA.472, BLCA_AA.713, BLCA_AA.814, BLCA_AA.828, BLCA_AA.929, BLCA_AA.930, BLCA_AA.940, BLCA_AA.945, BLCA_AA.946, BLCA_AA.951, BLCA_AA.952, BLCA_AA.954, BLCA_AA.957, BLCA_AA.958, CURE_AA.0011, CURE_AA.0013, CURE_AA.0029, CURE_AA.0030, CURE_AA.0152, CURE_AA.0154, CURE_AA.0169, CURE_AA.0172, CURE_AA.0193, CURE_AA.0194, CURE_AA.0203, CURE_AA.0235, CURE_AA.0300, CURE_AA.0353, CURE_AA.0388, CURE_AA.0456, CURE_AA.0496, CURE_AA.0505, CURE_AA.0614, CURE_AA.0644, CURE_AA.0821, CURE_AA.0822, CURE_AA.0849, CURE_AA.0910, CURE_AA.0941, CURE_AA.1022, CURE_AA.1094).
Local Description Authors: J. Coles
Global Description Authors: J. Coles, mod. K.A. Schulz

REFERENCES: Western Ecology Working Group n.d.

Artemisia tridentata ssp. wyomingensis / (Agropyron cristatum, Psathyrostachys juncea) Seeded Grasses Semi-natural Shrubland

Wyoming Big Sagebrush / (Crested Wheatgrass, Russian Wildrye) Seeded Grasses Semi-natural Shrubland

CODE	CEGL002185
PHYSIOGNOMIC CLASS	Shrubland (III)
PHYSIOGNOMIC SUBCLASS	Evergreen shrubland (III.A.)
PHYSIOGNOMIC GROUP	Microphyllous evergreen shrubland (III.A.4.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural microphyllous evergreen shrubland (III.A.4.N.)
FORMATION	Lowland microphyllous evergreen shrubland (III.A.4.N.a.)
ALLIANCE	*ARTEMISIA TRIDENTATA SSP. WYOMINGENSIS* SHRUBLAND ALLIANCE (A.832) Wyoming Big Sagebrush Shrubland Alliance

ECOLOGICAL SYSTEM(S): Inter-Mountain Basins Big Sagebrush Shrubland (CES304.777)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY
Globally
This shrubland association has been observed in western Colorado and eastern Utah, though it is very likely to be more widespread in the western U.S. It occurs on generally level topography that has been or is currently disturbed by land-management activities such as chaining or heavy grazing. Stands have been observed at mid-elevations, though more data are likely to expand this range. The unvegetated surfaces is generally dominated by litter and bare

soil. Dead shrubs can be abundant due to past land-treatment activities. Soils are poorly drained to moderately well-drained sandy loams or loamy sands. Most observed sites have been on eolian deposits derived from sandstone. There is a short (1-2 m) open shrub canopy dominated by *Artemisia tridentata ssp. wyomingensis* with other shrubs contributing low cover. Common associates are *Artemisia dracunculus, Artemisia frigida, Chrysothamnus viscidiflorus, Ericameria nauseosa, Gutierrezia sarothrae*, and *Opuntia* spp. Scattered short to medium-tall *Pinus edulis* and *Juniperus osteosperma* trees may be present. The herbaceous stratum has sparse to low cover and is characterized by seeded exotic species, especially *Agropyron cristatum* or *Psathyrostachys juncea*. *Bromus tectorum* is another common exotic species. Native species, which may have been seeded or migrated from nearby seed sources, include *Achnatherum hymenoides, Aristida purpurea, Bouteloua gracilis, Elymus elymoides, Hesperostipa comata, Poa fendleriana, Sporobolus cryptandrus*, and *Vulpia octoflora*. Nonvascular component is usually poor due to the disturbance of these sites.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This association is rare in the recreation area and was sampled in the vicinity of East Elk Creek in Curecanti National Recreation Area.

Globally
This association has been observed in western Colorado and eastern Utah, though it is very likely to occur elsewhere in the western U.S. *Psathyrostachys juncea* is particularly prevalent in northwestern Colorado, as a local seed-producer specialized in this species for revegetation of degraded rangelands.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This short-shrub association occurs on valley slopes. The site is gently sloped (12% slope), occurs at 2323 m elevation, and is oriented to the south. The unvegetated surface has low cover of litter, high cover of small rocks, and moderate to high exposure of bare soil. Downed wood is uncommon; there is some standing dead wood present. Parent materials are Quaternary alluvial deposits. Soils are rapidly drained sandy clay loams.

Globally
This association is found on generally level topography such as mesatops, benches, and plateau. Sites can be flat to gently sloping on any aspect. Observed sites in western Colorado have been at mid-elevations (2024-2128 m), though a wider range is certain as more data are available. The unvegetated surfaces is generally dominated by litter and bare soil. Dead shrubs can be abundant due to past land-treatment activities. Soils are poorly drained to moderately well-drained sandy loams or loamy sands. Most observed sites have been on eolian deposits derived from sandstone.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This Wyoming big sagebrush / crested wheatgrass association is rare within the recreation area. The total vegetation cover is 50% for this moderately vegetated stand. *Artemisia tridentata ssp. wyomingensis* shrubs form an open canopy that provides 30% cover, and the non-native, medium-tall, bunchgrass *Agropyron cristatum* provides 13% cover. The shrub layer is low in diversity and provides moderate cover. The dwarf-shrub layer provides sparse cover and includes *Gutierrezia sarothrae* and *Symphoricarpos rotundifolius* and the succulent *Opuntia polyacantha*. The herbaceous layer is diverse and provides moderate cover. Additional graminoids that provide low to moderate cover include *Leymus salinus, Achnatherum hymenoides, Bouteloua gracilis, Elymus elymoides, Hesperostipa comata*, and *Poa fendleriana*. Forbs are relatively diverse, provide sparse cover, and include *Arabis glabra, Astragalus convallarius, Astragalus drummondii, Erigeron engelmannii, Penstemon teucrioides, Phlox hoodii*, and *Physaria rollinsii*.

Globally
This shrubland has sparse to moderate total vegetation cover with an open short-shrub canopy. The dominant species in the shrub stratum is *Artemisia tridentata ssp. wyomingensis* which may have between 4 and 50% cover. *Artemisia dracunculus, Artemisia frigida, Chrysothamnus viscidiflorus, Ericameria nauseosa, Gutierrezia sarothrae*, and *Opuntia* spp. are common associates with low cover. Short to medium-tall trees, typically *Juniperus osteosperma* or *Pinus edulis*, may be scattered throughout stands of this association. The herbaceous stratum is dominated by exotic species that have been seeded at some time in the past, most commonly *Agropyron cristatum* or *Psathyrostachys*

juncea with 1-25% cover. *Bromus tectorum* is another common exotic species. Native species, which may have been seeded or migrated from nearby seed sources, include *Achnatherum hymenoides, Aristida purpurea, Bouteloua gracilis, Elymus elymoides, Hesperostipa comata, Poa fendleriana, Sporobolus cryptandrus*, and *Vulpia octoflora*. Nonvascular component is usually poor due to the disturbance of these sites.

MOST ABUNDANT SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Short shrub/sapling	*Artemisia tridentata* ssp. *wyomingensis*
Herb (field)	*Achnatherum hymenoides*, *Agropyron cristatum*, *Bouteloua gracilis*, *Elymus elymoides*, *Leymus salinus*

Globally

Stratum	Species
Short shrub/sapling	*Artemisia tridentata* ssp. *wyomingensis*
Herb (field)	*Agropyron cristatum*

OTHER NOTEWORTHY SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (ruderal) (6-Jan-2005).

CLASSIFICATION COMMENTS

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CLASSIFICATION CONFIDENCE:

ELEMENT SOURCES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Site was manipulated historically, possibly to guide runoff, resulting in 1-m wide ridges occurring across the slope at regular intervals.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (1 plot, 15 observation points): (Plot: CURE.0377. Observation Points: BLCA_AA.348, CURE_AA.0241, CURE_AA.0242, CURE_AA.0251, CURE_AA.0307, CURE_AA.0346, CURE_AA.0393, CURE_AA.0488, CURE_AA.0523, CURE_AA.0535, CURE_AA.0629, CURE_AA.0636, CURE_AA.0637, CURE_AA.0727, CURE_AA.0733).
Local Description Authors: J. Von Loh
Global Description Authors: J. Drake

REFERENCES: Western Ecology Working Group n.d.

Artemisia tridentata ssp. wyomingensis / Disturbed Understory Semi-natural Shrubland

Wyoming Big Sagebrush / Disturbed Understory Semi-natural Shrubland

CODE	CEGL002083
PHYSIOGNOMIC CLASS	Shrubland (III)
PHYSIOGNOMIC SUBCLASS	Evergreen shrubland (III.A.)
PHYSIOGNOMIC GROUP	Microphyllous evergreen shrubland (III.A.4.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural microphyllous evergreen shrubland (III.A.4.N.)

FORMATION	Lowland microphyllous evergreen shrubland (III.A.4.N.a.)
ALLIANCE	*ARTEMISIA TRIDENTATA SSP. WYOMINGENSIS* SHRUBLAND ALLIANCE (A.832) Wyoming Big Sagebrush Shrubland Alliance

ECOLOGICAL SYSTEM(S): Inter-Mountain Basins Big Sagebrush Shrubland (CES304.777)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY

Globally

This Wyoming big sagebrush shrubland has been found in northern Arizona, western Colorado, eastern Utah and southwestern Wyoming and is likely widespread in other parts of the interior western U.S. It can occur on a variety of landscape positions on sites that are flat to moderately steep. This association has been sampled at elevations between 1455 and 2372 m (4770-7777 feet) but is probably found elsewhere. The unvegetated surface is mostly composed of litter, bare soil, and rocks. Soils are typically eolian, alluvial, or colluvial loamy sands to clay loams. This shrubland association has moderately open to dense vegetation cover with an open to closed short-shrub layer. The dominant shrub is *Artemisia tridentata ssp. wyomingensis* with low to moderate cover. Scattered *Pinus edulis, Juniperus osteosperma*, and *Juniperus scopulorum* trees (2-5 m tall) may be present with sparse cover. Other tall, short, and dwarf-shrubs that may be found are *Ericameria nauseosa, Ephedra viridis, Gutierrezia sarothrae, Sarcobatus vermiculatus*, and succulents. The herbaceous stratum has low to high cover and diversity, but weedy, exotic and invasive species, such as *Aristida purpurea, Astragalus nuttallianus, Bromus tectorum, Chenopodium album, Descurainia pinnata, Elymus elymoides, Erodium cicutarium, Lappula occidentalis, Lepidium* sp., *Phacelia crenulata*, or *Vulpia octoflora*, tend to dominate.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association was observed and sampled in the park near Elk Park Campground and Loop, Chukar Trailhead, Bostwick Park and the North Rim Entrance Road and south of Highway 50, east of Cimarron Visitor Center, and west of Lake Fork Arm in the recreation area.

Globally

This association has been observed in northern Arizona, western Colorado, eastern Utah and southwestern Wyoming. It is very likely to occur in other parts of the western U.S.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This shrubland association was often observed in valley bottoms, but it was also found on midslopes of hills and ridges, terraces, and plains. Elevations range from 1978-2372 m. Sites are typically flat to gently sloping (0-11 degrees), occasionally steep (29-degree slope), and include all aspects. The ground surface has moderate to high cover of bare soil and low to high cover of rock or litter. Sites are disturbed by a variety of things such as grazing and vehicles.

Globally

This association has been found on a variety of landscape features, including mesatops, mid- and low slopes of canyons, hills, valleys, stream terraces and alluvial flats on the Colorado Plateau and in southwestern Wyoming. Sites can be flat to moderately steep (0-15 degrees) and have any aspect. Sampled sites have elevations between 1455 and 2372 m (4770-7777 feet). The unvegetated surface can be composed of variable amounts of litter, bare soil, and large or small rocks. Soils are typically eolian, alluvial, or colluvial loamy sands to clay loams. Finer-textured soils may include rapidly drained silt loams or clay loams derived from alluvium. Biological soil crust cover is absent to low (up to 15%).

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This Wyoming big sagebrush / disturbed understory shrubland association is characterized by an open to relatively closed short-shrub canopy of *Artemisia tridentata ssp. wyomingensis* that generally ranges in cover from 10 to 40%. Cover of *Artemisia tridentata ssp. wyomingensis* may be less than 10% on relatively sparse, heavily disturbed sites. Scattered trees, such as *Pinus edulis, Juniperus osteosperma*, and *Juniperus scopulorum*, are occasionally present and provide up to 10% cover. The shrub layer is low in diversity and may include low cover of *Amelanchier utahensis, Artemisia dracunculus, Artemisia frigida, Atriplex canescens, Chrysothamnus viscidiflorus, Ericameria*

nauseosa, Gutierrezia sarothrae, Krascheninnikovia lanata, Peraphyllum ramosissimum, and *Quercus gambelii*. Cacti such as *Opuntia polyacantha* or *Opuntia fragilis* are not uncommon. The generally sparse to moderate herbaceous layer occasionally provides high cover of weedy vegetation. Common introduced species include *Agropyron cristatum, Bromus tectorum, Poa pratensis*, and forbs *Erodium cicutarium, Chenopodium album*, and *Lepidium* sp. Common native species typically include the perennial grasses *Achnatherum hymenoides, Elymus elymoides, Hesperostipa comata, Pleuraphis jamesii, Poa fendleriana*, or *Sporobolus* sp.

Globally
This shrubland association has moderately open to dense herbaceous cover (28-89%) with an open to closed short-shrub layer. The dominant shrub, *Artemisia tridentata ssp. wyomingensis*, typically has 5-45% cover, though some stands may have more or less. Scattered *Pinus edulis, Juniperus osteosperma*, and *Juniperus scopulorum* trees (2-5 m tall) may provide up to 5-10% cover. In addition to *Artemisia tridentata ssp. wyomingensis*, other tall, short, and dwarf-shrubs that may be found are *Atriplex gardneri, Chrysothamnus viscidiflorus, Ericameria nauseosa, Ephedra viridis, Gutierrezia sarothrae, Sarcobatus vermiculatus*, and succulents such as *Opuntia* spp. The herbaceous stratum has low to high cover and diversity and tends to be dominated by weedy and exotic species, especially *Bromus tectorum*. Common graminoids include *Achnatherum hymenoides, Alyssum desertorum, Aristida purpurea, Bouteloua gracilis, Bromus tectorum, Vulpia octoflora, Elymus elymoides, Elymus lanceolatus, Hesperostipa comata, Pascopyrum smithii, Poa fendleriana*, and *Pleuraphis jamesii*. Forbs provide sparse to high cover and include *Astragalus nuttallianus, Ceratocephala testiculata (= Ranunculus testiculatus), Chenopodium album, Descurainia pinnata, Erigeron concinnus, Erodium cicutarium, Lappula occidentalis, Lepidium* sp., *Phacelia crenulata, Plantago patagonica, Sphaeralcea coccinea, Taraxacum officinale*, and *Trifolium gymnocarpon*. Biological soil crust cover is sparse.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tree canopy	*Juniperus osteosperma*
Short shrub/sapling	*Ericameria nauseosa*
Short shrub/sapling	*Artemisia tridentata* ssp. *wyomingensis*
Herb (field)	*Erodium cicutarium*
Herb (field)	*Bromus tectorum*

Globally

Stratum	Species
Short shrub/sapling	*Artemisia tridentata* ssp. *wyomingensis*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CONSERVATION STATUS RANK
Global Rank & Reasons: GNA (invasive) (14-Dec-2004).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
This association is closely related to *Artemisia tridentata - (Ericameria nauseosa) / Bromus tectorum* Semi-natural Shrubland (CEGL002699), and there may be overlap between the two. Clear criteria need to be developed to distinguish these associations from one another.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Data are not available.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (2 plots, 16 observation points): (Plots: CURE.0278, CURE.0382. Observation Points: BLCA_AA.290, BLCA_AA.384, BLCA_AA.385, BLCA_AA.423, BLCA_AA.612, BLCA_AA.667, BLCA_AA.738, BLCA_AA.758, BLCA_AA.928, CURE_AA.0119, CURE_AA.0121, CURE_AA.0209, CURE_AA.0338, CURE_AA.0653, CURE_AA.0823, CURE_AA.1367).
Local Description Authors: K.A. Schulz
Global Description Authors: J. Drake, mod. J. Coles and K.A. Schulz

REFERENCES: Western Ecology Working Group n.d.

Artemisia tridentata ssp. wyomingensis / Hesperostipa comata Colorado Plateau Shrubland

Wyoming Big Sagebrush / Needle-and-Thread Colorado Plateau Shrubland

CODE	CEGL002761
PHYSIOGNOMIC CLASS	Shrubland (III)
PHYSIOGNOMIC SUBCLASS	Evergreen shrubland (III.A.)
PHYSIOGNOMIC GROUP	Microphyllous evergreen shrubland (III.A.4.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural microphyllous evergreen shrubland (III.A.4.N.)
FORMATION	Lowland microphyllous evergreen shrubland (III.A.4.N.a.)
ALLIANCE	*ARTEMISIA TRIDENTATA SSP. WYOMINGENSIS* SHRUBLAND ALLIANCE (A.832) Wyoming Big Sagebrush Shrubland Alliance

ECOLOGICAL SYSTEM(S): Inter-Mountain Basins Big Sagebrush Shrubland (CES304.777)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY
Globally
This shrubland association occurs on deep soils on the slopes and summits of plateaus, ridges, hills and mesas throughout the Colorado Plateau in eastern Utah and western Colorado. The type is likely to occur in southwestern Wyoming as well. Elevations range from 1450 to 2419 m (4750-7940 feet). Slopes are level to moderately steep (0-50%). Substrates include eolian sands, loess and landslide deposits; most often soils are not residual but develop from these secondary sources. Total vegetation cover ranges from 25 to 75%, dominated by *Artemisia tridentata ssp. wyomingensis*. Other shrubs provide little additional cover but may include *Chrysothamnus viscidiflorus, Gutierrezia sarothrae, Leptodactylon pungens, Opuntia polyacantha*, and *Yucca harrimaniae*. *Hesperostipa comata* dominates the sparse to moderately dense herbaceous layer. Other grass species present depend on the soil texture, with *Achnatherum hymenoides, Elymus elymoides*, and *Koeleria macrantha* more common on sandy soils, whereas *Pleuraphis jamesii, Bouteloua gracilis*, and *Poa fendleriana* are more common on silty soils. Forbs provide little total cover but may include *Arenaria fendleri, Calochortus gunnisonii, Lepidium montanum, Linum lewisii, Phlox hoodii, Penstemon teucrioides*, and *Sphaeralcea coccinea*. *Bromus tectorum* may be codominant in heavily disturbed sites. Scattered young *Juniperus osteosperma* and *Pinus edulis* trees are often present. Cryptobiotic soil crusts are common in this type, but development is uneven and tends to be sparse in sites that have been grazed by domestic livestock.

DISTRIBUTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This association is common in the recreation area and was sampled at Haystack, Steuben Creek, Soap Creek Road, Dillon Pinnacles, South Willow Creek Area, Dry Creek Area, Cimarron and South Willow Creek in the Curecanti National Recreation Area.

Globally
This shrubland association occurs on deep soils on the slopes and summits of plateaus, ridges, hills and mesas throughout the Colorado Plateau in eastern Utah and western Colorado, and may extend into Wyoming.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This shrubland association occurs on active slopes as well as on shoulders, midslopes, toeslopes and ridgetops. Sites are gentle to moderately steep (8-51% slopes), occur between 2134 and 2419 m elevation, and are oriented to south and northwest aspects. The unvegetated surface has sparse to moderate cover of litter and low cover of mosses and lichens. Large and small rocks, bedrock, and exposures of bare soil comprise most of the unvegetated surface on all but one stand. Downed wood is uncommon, although one stand has 15% cover. Parent materials are metamorphic/granitic rocks, Tertiary volcanic rocks, Mesozoic sandstone, and Quaternary landslide deposits. Soils are rapidly drained sandy loams and loams.

Globally

This widespread shrubland association occurs on deep soils on the slopes and summits of plateaus, ridges, hills and mesas throughout the Colorado Plateau in eastern Utah and western Colorado. The type is likely to occur in southwestern Wyoming as well. Elevations range from 1450 to 2419 m (4750-7940 feet). Slopes are level to moderately steep (0-50%). Substrates include eolian sands, loess and landslide deposits; most often soils are not residual but develop from these secondary sources. In sparsely vegetated stands, there is usually an abundance of exposed soil on the ground surface, whereas in denser stands litter covers most of the ground.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This Wyoming big sagebrush association is relatively common in the recreation area. The total vegetation cover ranges from 55% to more than 100% in these relatively sparse to densely vegetated stands. *Hesperostipa comata* forms an open to closed herbaceous layer that ranges in cover from 1 to 75%. The short shrub *Artemisia tridentata ssp. wyomingensis* forms open to closed canopies and provides 5 to 95% cover. Short and dwarf-shrubs are diverse in terms of species composition and contribute low to moderate cover. Other short and dwarf-shrubs present include *Gutierrezia sarothrae, Opuntia polyacantha*, and *Yucca harrimaniae*. The herbaceous layer is diverse in terms of species composition and provides low to moderately dense cover. Other graminoids commonly present provide sparse to low cover and include *Achnatherum hymenoides* and *Elymus elymoides*. Forbs commonly present with sparse cover include *Cryptantha flavoculata, Erigeron concinnus, Penstemon teucrioides*, and *Sphaeralcea coccinea*. Sapling *Juniperus scopulorum* trees that are 2-5 m tall and contribute sparse cover occupy one stand. Cryptogam cover is sparse in this association.

Globally

This sagebrush association is widespread throughout the northern Colorado Plateau and is abundant in northwestern Colorado. Total vegetation cover ranges from 14 to 75% and is dominated by *Artemisia tridentata ssp. wyomingensis* with between 5 and 65% cover. Other shrubs provide little additional cover but may include *Chrysothamnus viscidiflorus, Gutierrezia sarothrae, Leptodactylon pungens, Opuntia polyacantha*, and *Yucca harrimaniae*. Scattered *Pinus edulis* and *Juniperus osteosperma* trees and seedlings may be present but do not form a layer. *Hesperostipa comata* dominates the sparse to moderately dense herbaceous layer. Other grass species present depend on the soil texture, with *Achnatherum hymenoides, Elymus elymoides*, and *Koeleria macrantha* more common on sandy soils, whereas *Pleuraphis jamesii, Bouteloua gracilis*, and *Poa fendleriana* are more common on silty soils. Forbs provide little total cover but may include *Arenaria fendleri, Calochortus gunnisonii, Eriogonum cernuum, Lepidium montanum, Linum lewisii, Machaeranthera canescens, Oenothera albicaulis, Phlox hoodii, Penstemon teucrioides*, and *Sphaeralcea coccinea*. *Bromus tectorum* may be codominant in heavily disturbed sites. Scattered young *Juniperus osteosperma* and *Pinus edulis* trees are often present. Cryptobiotic soil crusts are common in this type, but development is uneven and tends to be sparse in sites that have been grazed by domestic livestock.

MOST ABUNDANT SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Short shrub/sapling	*Artemisia tridentata* ssp. *wyomingensis*
Herb (field)	*Achnatherum hymenoides*, *Bouteloua gracilis*, *Hesperostipa comata*

Globally

Stratum	Species
Short shrub/sapling	*Artemisia tridentata* ssp. *wyomingensis*
Herb (field)	*Hesperostipa comata*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Exotic/Invasive: *Agropyron cristatum* (exotic, Medium/Low), *Bromus tectorum* (exotic noxious weed, High), *Cirsium arvense* (exotic noxious weed, High/Medium), *Melilotus officinalis* (exotic, Medium/Low), *Poa pratensis* (exotic, Medium)

Globally
Vulnerable: *Penstemon teucrioides* (vulnerable, G2G3Q)

CONSERVATION STATUS RANK
Global Rank & Reasons: GNR (12-Apr-2005).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
A similar association, *Artemisia tridentata ssp. wyomingensis / Hesperostipa comata* Shrubland (CEGL001051), describes a shrubland type of the Columbia River Basin of Oregon and Washington and the Snake River Plain of Idaho that is restricted to dry calcareous hardpan sites. However, little is known of the specifics of this association and its possible relationship to the Colorado Plateau shrubland. Baker's (1984a) concept of *Artemisia tridentata ssp. wyomingensis / Stipa comata* Association includes both the Colorado and Columbia Basin/Snake River Plain communities. As more data become available, and especially as the range of the Colorado Plateau shrubland type is better known, these two associations should be revisited and compared to justify their separation.

CLASSIFICATION CONFIDENCE: 1 - Strong

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Data are not available.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (16 plots, 27 observation points): (Plots: BLCA.0104, CURE.0011, CURE.0022, CURE.0037, CURE.0041, CURE.0045, CURE.0047, CURE.0049, CURE.0055, CURE.0057, CURE.0060, CURE.0069, CURE.0092, CURE.0140, CURE.0366, CURE.0386. Observation Points: BLCA_AA.590, BLCA_AA.656, BLCA_AA.705, BLCA_AA.747, BLCA_AA.927, BLCA_AA.939, BLCA_AA.941, BLCA_AA.942, BLCA_AA.944, CURE_AA.0019, CURE_AA.0170, CURE_AA.0188, CURE_AA.0380, CURE_AA.0528, CURE_AA.0529, CURE_AA.0539, CURE_AA.0540, CURE_AA.0554, CURE_AA.0561, CURE_AA.0567, CURE_AA.0604, CURE_AA.0610, CURE_AA.0697, CURE_AA.0701, CURE_AA.0708, CURE_AA.0735, CURE_AA.0949).
Local Description Authors: J. Von Loh
Global Description Authors: J. Coles, mod. K.A. Schulz

REFERENCES: Baker 1984a, Western Ecology Working Group n.d.

Ericameria nauseosa Shrubland

Rubber Rabbitbrush Shrubland

CODE	CEGL002713
PHYSIOGNOMIC CLASS	Shrubland (III)
PHYSIOGNOMIC SUBCLASS	Evergreen shrubland (III.A.)
PHYSIOGNOMIC GROUP	Microphyllous evergreen shrubland (III.A.4.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural microphyllous evergreen shrubland (III.A.4.N.)
FORMATION	Lowland microphyllous evergreen shrubland (III.A.4.N.a.)
ALLIANCE	*ERICAMERIA NAUSEOSA* SHRUBLAND ALLIANCE (A.835) Rubber Rabbitbrush Shrubland Alliance

ECOLOGICAL SYSTEM(S): Inter-Mountain Basins Big Sagebrush Shrubland (CES304.777)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY

Globally

This is a broadly defined, semi-arid upland shrubland currently described from western Colorado, Nevada, and Utah and is likely more widespread. Elevations range from 1191 to 2420 m (3900-8000 feet). Stands occur on flat to gently sloping (<8%), dry alluvial terraces above ephemeral washes or perennial stream and river channels or may form a band in the alluvial flats above playas. Substrates are deep, moderately well- to well-drained silty clay loam to sandy loam soils derived from stratified alluvium. The ground surface has moderate to high cover of bare soil. The vegetation is characterized by a moderately dense to dense (40-70% cover) shrub canopy dominated by *Ericameria nauseosa* shrubs 0.5-3 m tall, with a relatively sparse herbaceous layer. Some stands have low diversity, others have additional associated short and dwarf-shrubs such as *Artemisia frigida, Artemisia tridentata ssp. wyomingensis, Atriplex canescens, Chrysothamnus viscidiflorus, Gutierrezia sarothrae, Psorothamnus polydenius, Rosa woodsii, Sarcobatus vermiculatus*, and *Tetradymia tetrameres*. The sparse herbaceous layer is a mixture of grasses and forbs. Grass cover is generally low and may include native species such as *Achnatherum lettermanii, Achnatherum hymenoides, Distichlis spicata, Pseudoroegneria spicata, Sporobolus airoides*, and *Elymus elymoides*. Non-native grasses include *Bromus tectorum* and *Poa pratensis*. Common forbs may include the native species *Erigeron flagellaris, Tragopogon dubius, Achillea millefolium, Agoseris glauca, Potentilla crinita, Artemisia ludoviciana, Eriogonum hookeri, Rumex salicifolius*, and *Verbesina encelioides*.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association is uncommon on disturbed sites in the recreation area and was sampled near the mouth of North Willow Creek and in the vicinity of Elk Creek in Curecanti National Recreation Area.

Globally

This is a broadly defined upland shrubland association currently described from western Colorado, Utah and Nevada, but it likely occurs more widely in the western U.S.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This short- or tall-shrub association occurs on toeslopes of the Gunnison River Valley, on what would have originally been terraces 15-30 m above the river channel, near Blue Mesa Reservoir. Sites are gently sloped (5-8%), occur between 2291 m and 2312 m elevation, and are oriented to all aspects. The unvegetated surface has moderate to high exposure of bare soil and cover of litter. Parent materials are Quaternary alluvium. Soils are moderately well-drained silty clay loams and sandy loams. A few abandoned or active Gunnison's prairie dog burrows may be present.

Globally

This is a broadly defined, semi-arid upland shrubland association currently described from western Colorado , Nevada, and Utah and is likely more widespread. Elevations range from 1191-2420 m (3900-8000 feet). Stands occur on flat to gently sloping (<8%), dry alluvial terraces above ephemeral washes or perennial stream and river channels or may form a band in the alluvial flats above playas. Substrates are deep, moderately well- to well-drained

silty clay loam to sandy loam soils derived from stratified alluvium. Sand or other coarse-textured material may underlay finer-textured layers (Bundy et al. 1996). The ground surface has moderate to high cover of bare soil.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This rubber rabbitbrush shrubland association is uncommon in the recreation area. The total vegetation cover ranges from 60 to 75% in these densely vegetated stands. *Ericameria nauseosa* shrubs 0.5-3 m tall form a moderately closed to closed canopy that provides from 54 to 70% cover. The shrub layer is low in diversity and provides dense cover. Additional short and dwarf-shrubs providing sparse cover include *Artemisia frigida, Artemisia tridentata ssp. wyomingensis*, and *Rosa woodsii*. The herbaceous layer provides sparse cover and consists predominantly of forbs. The short bunchgrass *Elymus elymoides* provides sparse cover. Forbs provide sparse cover and include the non-natives *Cirsium arvense, Descurainia incana ssp. incisa, Erodium cicutarium, Lepidium campestre*, and *Sisymbrium altissimum*, and the natives *Eriogonum hookeri, Rumex salicifolius*, and *Verbesina encelioides*.

Globally

The vegetation is characterized by a moderately dense to dense (40-70% cover) shrub canopy dominated by *Ericameria nauseosa* shrubs 0.5-3 m tall, with a relatively sparse herbaceous layer. In Colorado, stands have low diversity. Additional associated short and dwarf-shrubs are *Artemisia frigida, Artemisia tridentata ssp. wyomingensis*, and *Rosa woodsii*. In Nevada, stands are more diverse, and several other shrubs, such as *Atriplex canescens, Psorothamnus polydenius, Sarcobatus vermiculatus*, and *Tetradymia tetrameres*, may be important. The sparse herbaceous layer is a mixture of grasses and forbs. Native grasses include *Achnatherum hymenoides, Distichlis spicata*, and *Elymus elymoides*. Common forbs may include the non-natives *Cirsium arvense, Descurainia incana ssp. incisa, Erodium cicutarium, Lepidium campestre, Iva axillaris, Salsola tragus*, and *Sisymbrium altissimum*, and the natives *Eriogonum hookeri, Rumex salicifolius*, and *Verbesina encelioides*. The introduced annual grass *Bromus tectorum* and native grasses *Pseudoroegneria spicata* and *Sporobolus airoides* are typically absent or have low cover.

MOST ABUNDANT SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tall shrub/sapling	*Ericameria nauseosa*
Short shrub/sapling	*Ericameria nauseosa*
Herb (field)	*Artemisia frigida*, *Rosa woodsii*
Herb (field)	*Cirsium arvense*, *Lepidium campestre*

Globally

Stratum	Species
Short shrub/sapling	*Ericameria nauseosa*

OTHER NOTEWORTHY SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Exotic/Invasive: *Cirsium arvense* (exotic, High/Medium), *Erodium cicutarium* (exotic, Medium/Low), *Lepidium campestre* (exotic), *Sisymbrium altissimum* (exotic)

Globally

Exotic/Invasive: *Bromus tectorum* (invasive/exotic, High), *Cirsium arvense* (invasive/exotic, High/Medium), *Descurainia pinnata* (invasive/exotic), *Erodium cicutarium* (invasive/exotic, Medium/Low), *Iva axillaris* (invasive/exotic), *Lepidium campestre* (invasive/exotic), *Poa pratensis* (invasive/exotic, Medium), *Salsola tragus* (invasive/exotic), *Sisymbrium altissimum* (invasive/exotic), *Taraxacum officinale* (invasive/exotic), *Tragopogon dubius* (invasive/exotic, Medium/Low)

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (26-Jun-2001).

CLASSIFICATION COMMENTS

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Data are not available.

Globally
This broadly defined upland *Ericameria nauseosa* association is not limited to washes or dune/sandsheet shrubland. Diagnostic of this type is a sparse herbaceous layer that is not dominated by the widespread introduced annual grass *Bromus tectorum* or the native grasses *Pseudoroegneria spicata* or *Sporobolus airoides*. One of the stands classified by Bundy et al. (1996) is codominated by *Tetradymia tetrameres*. These transitional types are difficult to classify, and further survey and classification work are needed to fully characterize this association.

CLASSIFICATION CONFIDENCE: 3 - Weak

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Some confusion may exist between this type and those dominated by *Ericameria parryi*. Both associations tend to occur in disturbed areas, and the species are somewhat difficult to separate. It would be useful to know if the species tend to be segregated by the type of disturbance, or if they are more cosmopolitan, occurring in mixed stands.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (2 plots, 13 observation points): (Plots: CURE.0380, CURE.0383. Observation Points: BLCA_AA.169, BLCA_AA.234, BLCA_AA.375, CURE_AA.0268, CURE_AA.0303, CURE_AA.0305, CURE_AA.0306, CURE_AA.0309, CURE_AA.0310, CURE_AA.0313, CURE_AA.0519, CURE_AA.0609, CURE_AA.0890).
Local Description Authors: J. Von Loh, mod. G. Bradshaw
Global Description Authors: K.A. Schulz, mod. G. Kittel

REFERENCES: Bundy et al. 1996, FEIS 2006, McArthur et al. 1997, USFS 1937, Western Ecology Working Group n.d.

Ericameria parryi / Achnatherum hymenoides Shrubland

Parry's Rabbitbrush / Indian Ricegrass Shrubland

CODE	CEGL003751
PHYSIOGNOMIC CLASS	Shrubland (III)
PHYSIOGNOMIC SUBCLASS	Evergreen shrubland (III.A.)
PHYSIOGNOMIC GROUP	Microphyllous evergreen shrubland (III.A.4.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural microphyllous evergreen shrubland (III.A.4.N.)
FORMATION	Lowland microphyllous evergreen shrubland (III.A.4.N.a.)
ALLIANCE	*ERICAMERIA PARRYI* SHRUBLAND ALLIANCE (A.818) Parry's Rabbitbrush Shrubland Alliance

ECOLOGICAL SYSTEM(S): Inter-Mountain Basins Semi-Desert Shrub-Steppe (CES304.788)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY
Globally
This shrubland association is described from Middle Park in central Colorado and Black Canyon National Park and Curecanti National Recreation Area in the Gunnison River valley and likely occurs elsewhere in western Colorado. Stands occur on flats, slopes, ridges, shaly badlands and cut-and-fill slopes. Sites are flat to steep (0-75%), occur between 2191 and 2650 m elevation, and include all aspects, especially westerly and southerly. Stands occur in a variety of disturbed areas, including burned areas, highway cut-and-fill slopes, naturally eroded shale outcrops, and prairie dog towns with varying attributes. The roadcut sites have high cover of bedrock, rocks and gravel. The burned sites have low to high cover of litter and low to moderate exposure of bare soil. The prairie dog town localities have low to high cover of litter and low to high exposure of bare soil. Soils are shallow, rapidly drained to well-drained sandy loams, silty loams, or silty clay loams derived from Quaternary alluvium, Pierre shale and metamorphic rocks or poorly drained clays derived from Pierre shale. The vegetation is characterized by an open to closed canopy of *Ericameria parryi* shrubs (1-2 m tall) that ranges in cover from 5 to 50% with total vegetation cover ranging from 20 to 80%. The remaining shrub layer is low in diversity and cover and includes the short and dwarf-shrubs *Amelanchier alnifolia, Artemisia frigida, Artemisia tridentata ssp. vaseyana, Artemisia tridentata ssp. wyomingensis, Chrysothamnus viscidiflorus, Mahonia repens*, and *Symphoricarpos rotundifolius*. The herbaceous

layer is diverse and variable among sites, providing sparse to low cover. Common graminoids provide low cover and include *Achnatherum hymenoides, Elymus elymoides, Juncus balticus, Pascopyrum smithii*, and introduced annual *Bromus tectorum*. Forbs provide sparse to low cover, including *Artemisia dracunculus, Chaenactis douglasii, Eriogonum brevicaule, Eriogonum cernuum, Lupinus argenteus, Oenothera caespitosa*, and introduced species such as *Melilotus officinalis* and *Verbascum thapsus*.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association is uncommon in the park and recreation area, occupying disturbed sites (road cut-and-fill slopes, burns, prairie dog colonies) and was observed and sampled along East Portal Road in the park and on Cooper's Ranch, near Ponderosa Campground, near Soap Creek Campground, and along North Willow Creek in the recreation area.

Globally

This shrubland association is described from Middle Park in central Colorado and Black Canyon National Park and Curecanti National Recreation Area in the Gunnison River valley and likely occurs elsewhere in western Colorado.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This short-shrub association was observed on flats, slopes, ridges, and cut-and-fill slopes. Sites are flat to moderately steep (0-70%), occur between 2191 and 2444 m elevation, and include all aspects. Stands occur in a variety of disturbed areas, including burned areas, highway cut-and-fill slopes, and prairie dog towns with varying attributes. The unvegetated surface of the roadcut sites has high cover of bedrock, rocks and gravel. The unvegetated surface of the burned sites has low to high cover of litter and low to moderate exposure of bare soil. The unvegetated surface of the prairie dog town localities has low to high cover of litter and low to high exposure of bare soil. Soils are rapidly drained to well-drained sandy loams, silty loams, or silty clay loams derived from Quaternary alluvium and metamorphic rocks.

Globally

This shrubland association is described from Middle Park in central Colorado and Black Canyon National Park and Curecanti National Recreation Area in the Gunnison River valley and likely occurs elsewhere in western Colorado. Stands occur on flats, slopes, ridges, shaly badlands and cut-and-fill slopes. Sites are flat to steep (0-75%), occur between 2191 and 2650 m elevation, and include all aspects, especially westerly and southerly. Stands occur in a variety of disturbed areas, including burned areas, highway cut-and-fill slopes, naturally eroded shale outcrops, and prairie dog towns with varying attributes. The roadcut sites have high cover of bedrock, rocks and gravel. The burned sites have low to high cover of litter and low to moderate exposure of bare soil. The prairie dog town localities have low to high cover of litter and low to high exposure of bare soil. Soils are shallow, rapidly drained to well-drained sandy loams, silty loams, or silty clay loams derived from Quaternary alluvium, Pierre shale and metamorphic rocks or poorly drained clays derived from Pierre shale (Tiedemann et al. 1987).

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This Parry's rabbitbrush shrubland association is uncommon within the park and recreation area. The total vegetation cover ranges from 20 to 80% in these sparsely to densely vegetated stands. This shrubland association is characterized by an open to closed canopy, typically 1-2 m tall, of *Ericameria parryi* shrubs that ranges in cover from 5 to 50%. The remaining shrub layer is low in diversity and cover and includes the short and dwarf-shrubs *Amelanchier alnifolia, Artemisia frigida, Artemisia tridentata ssp. vaseyana, Artemisia tridentata ssp. wyomingensis, Chrysothamnus viscidiflorus*, and *Symphoricarpos rotundifolius*. The herbaceous layer is diverse and variable among sites, providing sparse to low cover. Common graminoids provide low cover and include *Achnatherum hymenoides, Bromus tectorum, Elymus elymoides, Juncus balticus*, and *Pascopyrum smithii*. Forbs tend to be weedy and provide sparse to low cover, including *Artemisia dracunculus, Eriogonum cernuum, Lupinus argenteus, Melilotus officinalis*, and *Verbascum thapsus*.

Globally

This association is characterized by an open to moderately dense canopy of *Ericameria parryi* shrubs (0.5-2 m tall) that ranges in cover from 5 to 50% with total vegetation cover ranging from 20 to 80%. The remaining shrub layer is low in diversity and cover and includes the short and dwarf-shrubs *Amelanchier alnifolia, Artemisia frigida,*

Artemisia tridentata ssp. vaseyana, Artemisia tridentata ssp. wyomingensis, Chrysothamnus viscidiflorus, Mahonia repens, and *Symphoricarpos rotundifolius* (Tiedemann et al. 1987). The herbaceous layer is diverse and variable among sites, providing sparse to low cover with *Achnatherum hymenoides* typically present to dominant. Other common graminoids provide low cover and include *Elymus elymoides, Juncus balticus, Pascopyrum smithii*, and introduced annual *Bromus tectorum*. Forbs provide sparse to low cover, including *Artemisia dracunculus, Chaenactis douglasii, Eriogonum brevicaule, Eriogonum cernuum, Lupinus argenteus, Oenothera caespitosa*, and introduced species such as *Melilotus officinalis*, and *Verbascum thapsus*.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Short shrub/sapling	*Ericameria parryi*
Herb (field)	*Artemisia frigida*
Herb (field)	*Eriogonum cernuum*
Herb (field)	*Achnatherum hymenoides*, *Achnatherum lettermanii*, *Juncus balticus*

Globally

Stratum	Species
Short shrub/sapling	*Ericameria parryi*
Herb (field)	*Eriogonum brevicaule*, *Eriogonum cernuum*
Herb (field)	*Achnatherum hymenoides*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Exotic/Invasive: *Bromus tectorum* (exotic, High)

Globally
Exotic/Invasive: *Bromus tectorum* (exotic, High)

CONSERVATION STATUS RANK
Global Rank & Reasons: GNR (27-Feb-2006).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Some confusion may exist between this type and those dominated by *Ericameria nauseosa*. Both associations tend to occur in disturbed areas, and the species are somewhat difficult to separate. It would be useful to know if the species tend to be segregated by the type of disturbance, or if they are more cosmopolitan, occurring in mixed stands. Sites with high cover of *Achnatherum hymenoides* may be difficult to distinguish from *Achnatherum hymenoides* Shale Barren Herbaceous Vegetation (CEGL001651), which may have a sparse layer of *Ericameria parryi*.

Globally
This association includes a variety of human- and naturally disturbed stands on a variety of substrates. More survey and classification work are needed to clarify the role of substrates in this type.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Data are not available.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points:
The description is based on field data (6 plots, 3 observation points): (Plots: BLCA.0079, BLCA.0081, CURE.0233, CURE.0276, CURE.0279, CURE.0304. Observation Points: BLCA_AA.167, BLCA_AA.172, CURE_AA.0016).
Local Description Authors: J. Von Loh, mod. G. Bradshaw and J. Coles
Global Description Authors: K.A. Schulz

REFERENCES: Tiedemann et al. 1987, Western Ecology Working Group n.d.

Atriplex canescens - Artemisia tridentata Shrubland

Fourwing Saltbush - Basin Big Sagebrush Shrubland

CODE	CEGL001282
PHYSIOGNOMIC CLASS	Shrubland (III)
PHYSIOGNOMIC SUBCLASS	Evergreen shrubland (III.A.)
PHYSIOGNOMIC GROUP	Extremely xeromorphic evergreen shrubland (III.A.5.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural extremely xeromorphic evergreen shrubland (III.A.5.N.)
FORMATION	Facultatively deciduous extremely xeromorphic subdesert shrubland (III.A.5.N.b.)
ALLIANCE	*ATRIPLEX CANESCENS* SHRUBLAND ALLIANCE (A.869) Fourwing Saltbush Shrubland Alliance

ECOLOGICAL SYSTEM(S): Inter-Mountain Basins Mixed Salt Desert Scrub (CES304.784)
Sonora-Mojave Mixed Salt Desert Scrub (CES302.749)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY

Globally

This shrubland is found on the western slope of the Colorado Rocky Mountains, Colorado Plateau, Great Basin, and Mojave Desert. Elevation ranges from 1160-2100 m (3800-6900 feet). Stands occur on level plains, valley bottoms, alluvial flats, stream terraces, low and midslopes . Slopes are typically less than 25%, but this shrubland has been documented on steep slopes as well. It occurs on all aspects, Substrates are well-drained, typically fine-textured soils (silty loam and clay) but may include coarser-textured soils (loamy sand). The vegetation is characterized by a sparse to moderately dense (10-35% cover) short-shrub layer that is codominated by *Atriplex canescens* and *Artemisia tridentata*. On some sites, *Pinus edulis* and/or *Juniperus osteosperma* canopy trees provide sparse cover. Associated shrubs include *Chrysothamnus viscidiflorus, Ephedra nevadensis, Ericameria nauseosa, Gutierrezia sarothrae, Gutierrezia microcephala, Krascheninnikovia lanata, Lycium* spp., and *Opuntia* spp. *Sarcobatus vermiculatus* and *Suaeda moquinii* may be present with low cover on more saline sites. The sparse to moderate herbaceous layer (10-20% cover) is dominated by graminoids with scattered forbs. *Achnatherum hymenoides, Bouteloua gracilis, Elymus elymoides*, and *Pascopyrum smithii* are common grasses. Forbs may include *Cirsium neomexicanum, Eriogonum inflatum, Eriogonum racemosum, Penstemon* spp., or *Sphaeralcea coccinea*. Introduced species are common in disturbed stands.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association is rare and was observed and sampled in the Red Rock Canyon of the park.

Globally

This shrubland is found on the western slope of the Colorado Rocky Mountains, Colorado Plateau, Great Basin, and Mojave Desert.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association was observed on the first terrace of a small perennial stream which seasonally carries irrigation runoff in addition to groundwater pumped for irrigation. The site is nearly level (1% slope), occurs at 2048 m elevation, and is oriented to the northwest. The unvegetated surface has high cover of litter and low cover of livestock manure. The soils are moderately well-drained silty loams derived from alluvium.

Globally

This shrubland is found on the western slope of the Colorado Rocky Mountains, Colorado Plateau, Great Basin, and Mojave Desert. Elevation ranges from 1160-2100 m (3800-6900 feet). Stands occur on level plains, canyon floors, valley bottoms, alluvial flats, stream terraces, benches, low and midslopes. Slopes are typically less than 25%, but this shrubland has been documented on steep slopes. It occurs on all aspects, but northwest-, east- and southeast-facing slopes are common. Substrates are well-drained, typically fine-textured soils (silty loam and clay) but may include coarser-textured soils (loamy sand). Some stands may be subject to periodic flooding. Evidence of erosion, such as rills and gullies, is common (Warren et al. 1982).

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This fourwing saltbush - basin big sagebrush shrubland is very rare in the park. The total vegetation cover is 71% for this densely vegetated stand. This short-shrub association is characterized by an open canopy, typically 1-2 m tall, of *Atriplex canescens* and *Artemisia tridentata* shrubs that together provide 30% cover. The remaining short- and dwarf-shrub layer provides sparse cover and includes *Ericameria nauseosa* and *Opuntia fragilis*. The herbaceous layer is diverse but consists predominantly of introduced species, including five Colorado noxious weeds. Graminoids provide moderate cover and include *Agropyron cristatum, Bromus tectorum*, and *Pascopyrum smithii*. The forb layer provides sparse cover and includes *Arctium minus*, Asteraceae spp. (= *Aster* spp.), *Carduus nutans, Chenopodium album, Cirsium arvense, Convolvulus arvensis, Medicago sativa, Sphaeralcea coccinea*, and *Tragopogon dubius*.

Globally

This association is characterized by a sparse to moderately dense (10-35% cover) short-shrub layer (1-2 m tall) that is codominated by *Atriplex canescens* and *Artemisia tridentata*. On some sites, *Pinus edulis* and/or *Juniperus osteosperma* canopy trees provide sparse cover. Associated shrubs include *Chrysothamnus viscidiflorus, Ephedra viridis, Ephedra nevadensis, Eriogonum corymbosum, Ericameria nauseosa, Gutierrezia sarothrae, Gutierrezia microcephala, Krascheninnikovia lanata, Lycium* spp., and *Opuntia* spp. (Warren et al. 1982, Roberts et al. 1992). *Sarcobatus vermiculatus* and *Suaeda moquinii* may be present with low cover on more saline sites. The sparse to moderately dense (10-20% cover) herbaceous layer is dominated by graminoids with scattered forbs. *Achnatherum hymenoides, Bouteloua gracilis, Elymus elymoides, Leymus salinus, Pleuraphis jamesii, Pascopyrum smithii*, and *Sporobolus cryptandrus* are common grasses. Forbs may include *Abronia fragrans, Cirsium neomexicanum, Eriogonum inflatum, Eriogonum racemosum, Heliomeris longifolia (= Viguiera longifolia), Lappula occidentalis, Machaeranthera canescens, Mentzelia multiflora, Oenothera caespitosa, Penstemon* spp., *Rumex hymenosepalus*, or *Sphaeralcea coccinea*. Introduced species such as *Agropyron cristatum, Arctium minus, Bromus rubens, Bromus tectorum, Carduus nutans, Chenopodium album, Cirsium arvense, Convolvulus arvensis, Descurainia sophia, Erodium cicutarium, Lactuca serriola, Lappula occidentalis, Medicago sativa, Salsola tragus*, and *Tragopogon dubius* are common in disturbed stands. Cryptogams are generally sparse but one sampled plot had 25% cover.

MOST ABUNDANT SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Short shrub/sapling	*Artemisia tridentata*, *Atriplex canescens*
Herb (field)	*Bromus tectorum*

Globally

Stratum	Species
Short shrub/sapling	*Artemisia tridentata*, *Atriplex canescens*

OTHER NOTEWORTHY SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Exotic/Invasive: *Arctium minus* (exotic, Medium/Insignificant), *Bromus tectorum* (exotic, High), *Carduus nutans* (exotic, High/Low), *Cirsium arvense* (exotic, High/Medium), *Convolvulus arvensis* (exotic, Medium/Low)

Globally

Exotic/Invasive: *Agropyron cristatum* (invasive/exotic, Medium/Low), *Arctium minus* (invasive/exotic, Medium/Insignificant), *Bromus rubens* (invasive/exotic), *Bromus tectorum* (invasive/exotic, High), *Carduus nutans* (invasive/exotic, High/Low), *Chenopodium album* (invasive/exotic), *Cirsium arvense* (invasive/exotic, High/Medium), *Convolvulus arvensis* (invasive/exotic, Medium/Low), *Descurainia sophia* (invasive/exotic, Medium/Low), *Erodium cicutarium* (invasive/exotic, Medium/Low), *Lactuca serriola* (invasive/exotic, Low/Insignificant), *Lappula occidentalis* (invasive/exotic), *Medicago sativa* (invasive/exotic, Insignificant), *Salsola tragus* (invasive/exotic), *Tragopogon dubius* (invasive/exotic, Medium/Low)

CONSERVATION STATUS RANK

Global Rank & Reasons: G4 (20-Sep-2000).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: This stand is heavily grazed and lies on a terrace adjacent to a perennial water source. Further quantitative data are needed to describe this association. It is unknown whether other examples exist in this project area.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on 2002 field data (1 plot): (Plot: BLCA.0062).
Local Description Authors: J. Von Loh, mod. G. Bradshaw and J. Coles
Global Description Authors: K.A. Schulz, mod. G. Kittel

REFERENCES: Bourgeron and Engelking 1994, Bunting 1987, Cogan et al. 2004, Driscoll et al. 1984, Everett 1987, Howard 1999, Howard 2003, Roberts et al. 1992, Tirmenstein 1999c, Warren et al. 1982, Western Ecology Working Group n.d., Wright 1980, Wright et al. 1979

Atriplex confertifolia Wyoming Basins Shrubland

Shadscale Wyoming Basins Shrubland

CODE	CEGL001293
PHYSIOGNOMIC CLASS	Shrubland (III)
PHYSIOGNOMIC SUBCLASS	Evergreen shrubland (III.A.)
PHYSIOGNOMIC GROUP	Extremely xeromorphic evergreen shrubland (III.A.5.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural extremely xeromorphic evergreen shrubland (III.A.5.N.)
FORMATION	Facultatively deciduous extremely xeromorphic subdesert shrubland (III.A.5.N.b.)
ALLIANCE	*ATRIPLEX CONFERTIFOLIA* SHRUBLAND ALLIANCE (A.870) Shadscale Shrubland Alliance

ECOLOGICAL SYSTEM(S): Inter-Mountain Basins Mixed Salt Desert Scrub (CES304.784)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY
Globally
These open to sparse shrublands are dominated by *Atriplex confertifolia* but lack other diagnostic species. It is widespread across western and central Wyoming north to the Bighorn Basin in Montana and also occurs in shaly sites in western Colorado and eastern Utah. Stands occur on hills, ridges and toeslopes, and often on badland sites in the Uinta Basin and Colorado Plateau. Soils are often shallow clays or clay loams derived from marine shales, with a high percentage of bare ground and gravel at the surface. Some examples are on sandy soils. Total vegetation cover generally does not exceed 35%. The short-shrub canopy is dominated by *Atriplex confertifolia*, usually accompanied by other species, including *Eriogonum corymbosum, Atriplex corrugata, Atriplex gardneri, Chrysothamnus viscidiflorus*, and *Tetradymia spinosa*. The herbaceous layer is generally sparse but ranges to moderately dense and may be relatively diverse. Common species include *Achnatherum hymenoides, Pseudoroegneria spicata, Poa secunda, Xylorhiza venusta*, and *Penstemon caespitosus*.

DISTRIBUTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This association is rare in the park and was observed and sampled on badlands formations in the Red Rocks area near the BLM and NPS boundary.

Globally
This association has been described from the eastern Uinta Basin and the western Colorado Plateau in Colorado and Utah and is widespread across western and central Wyoming north to the Bighorn Basin into south-central Montana.

ENVIRONMENTAL DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This short-shrub association was observed on midslopes of drainages, on upper slopes of badland ridges, and on toeslopes of alluvial flats. Sites are nearly level to steep (8-50% slopes), occur between 1886 and 1973 m elevation, and are oriented to southeastern and northwestern aspects. The unvegetated surface has low cover of litter and high cover of small rocks and exposure of bare soil. Soils are rapidly drained clays, silty clays, and silty clay loams derived from Mancos and other Mesozoic shales.

Globally
This shrubland is widespread across western and central Wyoming north to the Bighorn Basin in Montana and also occurs in shaly sites in western Colorado and eastern Utah where it is known from hills, ridges and toeslopes in the Uinta Basin and the Colorado Plateau. Sites range from nearly level to very steep (to 85% slopes) and occur at 1886-2253 m elevation. Some examples occur on the slopes of shale badlands. Soils are usually clays, silty clays, or clay loams derived from marine shales, but they may be sandy and usually have a high percentage of gravel on the soil surface. The parent material includes marine shales such as the Fossil Butte Member of the Wasatch Formation, the Mancos Formation and other Mesozoic shales.

VEGETATION DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Vegetation: This shadscale short-shrub association is uncommon on the western edge of the park and adjacent U.S. Bureau of Land Management lands but common on the badlands topography farther west. The total vegetation cover ranges from 18 to 23% in these sparsely vegetated stands. This short-shrub association is characterized by a sparse canopy of *Atriplex confertifolia* shrubs that range in cover from 1 to 12%. Other short and dwarf-shrubs that provide sparse cover include *Atriplex corrugata, Atriplex gardneri, Chrysothamnus viscidiflorus, Gutierrezia sarothrae, Tetradymia spinosa*, and *Yucca harrimaniae*. The herbaceous layer is sparse in terms of cover and is low in diversity. Graminoids provide sparse cover and include *Bromus tectorum, Elymus elymoides*, and *Poa secunda*. Forbs are diverse and include *Calochortus nuttallii, Crepis modocensis, Cryptantha* sp., *Cymopterus bulbosus, Cymopterus purpureus, Descurainia pinnata, Eriogonum umbellatum, Erysimum inconspicuum, Lappula occidentalis, Penstemon caespitosus*, and *Xylorhiza venusta*. Sparse cover by moss and lichen is present in one stand.

Globally
Total vegetation cover generally does not exceed 35% and is often sparse (<10%). The open short-shrub canopy is dominated by *Atriplex confertifolia* (1-12% cover) and is usually accompanied by other species, including *Eriogonum corymbosum, Atriplex corrugata, Atriplex gardneri, Amelanchier utahensis, Artemisia frigida, Chrysothamnus viscidiflorus*, and *Tetradymia spinosa*. The herbaceous layer is generally sparse but may be diverse. Common herbaceous species include grasses *Achnatherum hymenoides, Elymus elymoides, Elymus lanceolatus, Leymus cinereus, Poa fendleriana, Poa secunda, Pseudoroegneria spicata*, and forbs, *Calochortus nuttallii, Crepis modocensis, Cryptantha* sp., *Cymopterus bulbosus, Cymopterus purpureus, Descurainia pinnata, Eriogonum brevicaule, Eriogonum umbellatum, Erysimum inconspicuum, Lappula occidentalis, Penstemon caespitosus, Streptanthus cordatus*, and *Xylorhiza venusta*. The exotic annual grass *Bromus tectorum* may have high cover in areas that have been disturbed.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Short shrub/sapling	*Atriplex confertifolia*, *Atriplex corrugata*

Globally

Stratum	Species
Short shrub/sapling	*Atriplex confertifolia*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Exotic/Invasive: *Bromus tectorum* (exotic, High)

Globally
Exotic/Invasive: *Bromus tectorum* (exotic, High)

CONSERVATION STATUS RANK
Global Rank & Reasons: G5 (23-Feb-1994).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
This open shrubland association includes sparsely vegetated sites based on floristics.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: During visits in May 2004, photo-interpreters noted an apparent increase in cheatgrass (*Bromus tectorum*) cover in this and neighboring communities. The observed increase was likely a result of a wetter spring than in the previous years of sampling and may or may not represent a departure from the norms of non-drought years.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (3 plots, 9 observation points): (Plots: BLCA.0084, BLCA.0092, BLCA.0124. Observation Points: BLCA_AA.354, BLCA_AA.355, BLCA_AA.357, BLCA_AA.358, BLCA_AA.362, BLCA_AA.363, BLCA_AA.372, BLCA_AA.391, BLCA_AA.808).
Local Description Authors: J. Von Loh and G. Bradshaw, mod. J. Coles
Global Description Authors: J. Coles, mod. K.A. Schulz

REFERENCES: Bourgeron and Engelking 1994, Brotherson and Brotherson 1979, Driscoll et al. 1984, MTNHP 2002b, MTNHP unpubl. data, Western Ecology Working Group n.d.

Amelanchier (utahensis, alnifolia) - Cercocarpus montanus Shrubland

(Utah Serviceberry, Saskatoon Serviceberry) - Alderleaf Mountain-mahogany Shrubland

CODE	CEGL001070
PHYSIOGNOMIC CLASS	Shrubland (III)
PHYSIOGNOMIC SUBCLASS	Deciduous shrubland (III.B.)
PHYSIOGNOMIC GROUP	Cold-deciduous shrubland (III.B.2.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural cold-deciduous shrubland (III.B.2.N.)
FORMATION	Temperate cold-deciduous shrubland (III.B.2.N.a.)
ALLIANCE	*AMELANCHIER UTAHENSIS* SHRUBLAND ALLIANCE (A.916) Utah Serviceberry Shrubland Alliance

ECOLOGICAL SYSTEM(S): Rocky Mountain Lower Montane-Foothill Shrubland (CES306.822)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY
Globally
The description for this association is based on information from Colorado and Utah; its characteristics in Nevada are unknown and will be described when more information becomes available. This plant association is found on moderate to steeply sloping colluvial slopes, canyons, ridges and in alcoves. Sites may be oriented to any aspect. Elevation ranges between 1586 and 2595 m (5200-8500 feet). Relative to other mixed mountain shrub types, it is found on the driest sites with the least soil development and relatively low diversity. Soils range from shallow to deep but are generally always rocky with a high cover of surface rock. The vegetation is characterized by a more

open shrub layer and a sparse understory relative to other mixed mountain shrub types. Total vegetation cover often does not exceed 50%. *Amelanchier utahensis* and *Cercocarpus montanus* are the dominants of as many as 16 shrub species in this association. Typical associated shrub species include *Artemisia bigelovii, Artemisia tridentata, Chrysothamnus viscidiflorus, Ephedra viridis, Ericameria nauseosa, Eriogonum corymbosum, Peraphyllum ramosissimum, Purshia tridentata, Rhus trilobata, Fraxinus anomala*, and *Tetradymia canescens*. *Symphoricarpos oreophilus* can dominate the lower shrub layer, which may also include *Brickellia microphylla, Eriogonum microthecum, Gutierrezia sarothrae, Mahonia repens*, and *Paxistima myrsinites*. Succulents such as *Opuntia* spp. or *Yucca* spp. may also have minor cover. If *Quercus gambelii* is present, cover is low (<5%). Scattered trees of *Juniperus osteosperma, Juniperus scopulorum*, or *Pinus edulis* may be present in some stands. *Achnatherum hymenoides (= Oryzopsis hymenoides)* is the most common species in the diverse herbaceous layer. Other graminoid species may include *Poa fendleriana, Koeleria macrantha, Achnatherum lettermanii, Pseudoroegneria spicata, Elymus lanceolatus, Hesperostipa comata*, and *Leymus salinus*. Forb species may include *Arenaria fendleri, Chaenactis douglasii, Cryptantha flava, Cymopterus purpureus, Balsamorhiza sagittata, Eriogonum umbellatum, Galium coloradoense, Heterotheca villosa, Lepidium montanum, Lithospermum ruderale, Petradoria pumila, Phlox longifolia, Physaria acutifolia, Senecio integerrimus, Sphaeralcea coccinea, Stanleya pinnata, Stenotus acaulis*, and *Streptanthella longirostris*. Disturbed sites may have high cover of *Bromus tectorum*.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This association was sampled in side canyons near Kneeling Camel View and on a hillside near the North Rim in the national park and was not sampled in the recreation area.

Globally
This association is documented from stands in western Colorado and southern and eastern Utah. It has been reported from Nevada and is likely to occur in xeric areas of mixed mountain shrubland throughout the plateaus and foothills of Colorado and in higher elevations of the Colorado Plateau, western Rocky Mountains and Intermountain West.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This montane shrubland association is found mid- and high slope in side canyons and on a midslope of a hill. Sites are moderate to steep (18- to 32-degree slopes), occur at 2414 and 2595 m elevation, and are oriented to southerly aspects. The unvegetated ground surface is rocky with moderate to high cover of bare ground (40-60% cover), moderate cover of litter (20-50%), and lower cover of gravel and bare ground (10-20%). An abundance of cheatgrass suggests previous disturbance such as fire or grazing.

Globally
The description for this association is based on information from Colorado and Utah; its characteristics in Nevada are unknown and will be described when more information becomes available. This plant association is found on moderate to steeply sloping colluvial slopes, canyons, ridges and in alcoves. Sites may be oriented to any aspect. Elevations range between 1586 and 2500 m (5200-8200 feet). Relative to other mixed mountain shrub types, it is found on the driest sites with the least soil development and relatively low diversity. Exposed ground is moderate to extensive, averaging 40%. Soils range from shallow to deep, from loams to silty clays, but are generally always rocky with a high cover of surface rock.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This mixed mountain shrubland association is codominated by the shrubs *Amelanchier utahensis* and *Cercocarpus montanus*. Shrub canopy is typically a moderately dense mixture of tall, short and dwarf-shrubs with cover ranging from 30 to 60% and heights reaching 1-2 m. Several other shrubs that may be present include *Artemisia frigida, Artemisia tridentata ssp. vaseyana, Mahonia fremontii*, and *Opuntia fragilis*. Scattered trees of *Juniperus osteosperma, Juniperus scopulorum*, or *Pinus edulis* may be present in some stands. If *Quercus gambelii* is present, cover is low (<5%). Total herbaceous vegetation cover ranges from 30 to 70%, with the introduced annual grass *Bromus tectorum* abundant. Native herbs present include *Achnatherum hymenoides, Balsamorhiza sagittata*, and *Poa fendleriana*.

Globally
The vegetation is characterized by a more open shrub layer with a sparse understory relative to other mixed mountain shrub types. Total vegetation cover often does not exceed 50%. *Amelanchier utahensis* and *Cercocarpus montanus* are the dominants of as many as 16 shrub species in this association. Typical shrub species include *Artemisia bigelovii, Artemisia tridentata, Chrysothamnus viscidiflorus, Ephedra viridis, Ericameria nauseosa, Eriogonum corymbosum, Peraphyllum ramosissimum, Purshia tridentata, Rhus trilobata, Fraxinus anomala*, and *Tetradymia canescens*. *Symphoricarpos oreophilus* can dominate the lower shrub layer, which may also include *Brickellia microphylla, Eriogonum microthecum, Gutierrezia sarothrae, Mahonia repens*, and *Paxistima myrsinites*. Scattered individuals of *Juniperus osteosperma* and *Pinus edulis* may occur. Succulents such as *Opuntia* spp. or *Yucca* spp. may also have minor cover. *Achnatherum hymenoides (= Oryzopsis hymenoides)* is the most common species in the diverse herbaceous layer. Other graminoid species may include *Poa fendleriana, Koeleria macrantha, Achnatherum lettermanii, Cymopterus purpureus, Pseudoroegneria spicata, Elymus lanceolatus, Hesperostipa comata*, and *Leymus salinus*. Forb species may include *Arenaria fendleri, Chaenactis douglasii, Cryptantha flava, Balsamorhiza sagittata, Eriogonum umbellatum, Galium coloradoense, Heterotheca villosa, Lepidium montanum, Lithospermum ruderale, Petradoria pumila, Phlox longifolia, Physaria acutifolia, Senecio integerrimus, Sphaeralcea coccinea, Stanleya pinnata, Stenotus acaulis*, and *Streptanthella longirostris, Tetraneuris acaulis (= Hymenoxys acaulis)*. Disturbed sites may have high cover of *Bromus tectorum*.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tall shrub/sapling	*Amelanchier utahensis*
Tall shrub/sapling	*Cercocarpus montanus*

Globally

Stratum	Species
Tall shrub/sapling	*Amelanchier utahensis*
Tall shrub/sapling	*Cercocarpus montanus*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Exotic/Invasive: *Bromus tectorum* (exotic, High)

Globally
Vulnerable: *Sclerocactus whipplei* (globally imperiled, G1G3); **Exotic/Invasive**: *Bromus tectorum* (invasive/exotic, High)

CONSERVATION STATUS RANK
Global Rank & Reasons: G2? (12-Nov-2008). This association is well-known from Colorado and throughout Utah. It also occurs in Nevada, but no information is available on its conservation status there. Very little is known about the larger scale abiotic factors that contribute to the distribution. The global rank should be at least a G3 based on the numbers of sites documented at several National Park Service units.

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Data are not available.

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (1 plot, 4 observation points): (Plot: BLCA.0021. Observation Points: BLCA_AA.388, BLCA_AA.409, BLCA_AA.915, BLCA_AA.916).
Local Description Authors: K.A. Schulz
Global Description Authors: L. Tasker, mod. J. Coles and G. Kittel

REFERENCES: Bourgeron and Engelking 1994, CONHP unpubl. data, CONHP unpubl. data 2003, Driscoll et al. 1984, Tiedemann 1978, Vories 1974, Western Ecology Working Group n.d.

Amelanchier utahensis - Mixed Shrub / *Carex geyeri* Shrubland

Utah Serviceberry - Mixed Shrub / Geyer's Sedge Shrubland

CODE	CEGL001068
PHYSIOGNOMIC CLASS	Shrubland (III)
PHYSIOGNOMIC SUBCLASS	Deciduous shrubland (III.B.)
PHYSIOGNOMIC GROUP	Cold-deciduous shrubland (III.B.2.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural cold-deciduous shrubland (III.B.2.N.)
FORMATION	Temperate cold-deciduous shrubland (III.B.2.N.a.)
ALLIANCE	*AMELANCHIER UTAHENSIS* SHRUBLAND ALLIANCE (A.916) Utah Serviceberry Shrubland Alliance

ECOLOGICAL SYSTEM(S): Rocky Mountain Gambel Oak-Mixed Montane Shrubland (CES306.818)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY
Globally
This association occurs on the rocky slopes and summits of hills and ridges in western and north-central Colorado. A few stands occur in the bottom of dry gullies. Elevations range from 2225 to 2765 m (7300-9070 feet), and stands tend to occur on gentle to moderately steep north- or east-facing slopes. Substrates include volcanic or sedimentary rock as well as landslides. The moderately dense to dense shrub layer is variable in its composition and dominance, but is characterized by relatively high cover of *Amelanchier utahensis*, a lack of *Quercus gambelii* and relatively low cover by *Artemisia tridentata* (ssp. *vaseyana* or ssp. *wyomingensis*). Other shrubs, including *Cercocarpus montanus, Chrysothamnus viscidiflorus, Symphoricarpos oreophilus*, and *Purshia tridentata*, may be present and sometimes may be codominant with the *Amelanchier*. The herbaceous layer tends to be relatively sparse, rarely exceeding 20% total cover. *Carex geyeri* has at least 5% cover, and many other graminoids and forbs may be present in small amounts, including *Achnatherum lettermanii, Balsamorhiza sagittata, Galium boreale, Lupinus* sp., *Lathyrus lanszwertii var. leucanthus, Poa pratensis, Allium acuminatum, Achillea millefolium*, and *Pseudostellaria jamesiana*. Grazing by domestic animals decreases the cover of *Carex geyeri* and increases the cover of *Poa pratensis*, and browsing by elk may hedge the dominant shrub species.

DISTRIBUTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This association is widely distributed and was observed across the road from Tomichi Point Overlook, in the west portion of the South Rim, Poison Spring Gulch, U.S. Bureau of Land Management-administered land east of Black Canyon Road and north of the Gravel Pit Road, Grizzly Gulch, Dead Horse Mesa Trail, and Hermit's Rest in the park and on a dry tributary of Red Creek, above South Willow Creek, on Pine Creek, on West Elk on the east side of Arm I, in Long Gulch, and on Carpenter Ridge in the recreation area.

Globally
This association is known to occur in western and north-central Colorado. It is likely to occur in southwestern Wyoming and northeastern Utah on similar substrates (especially Green River Shale and Uinta Formation).

ENVIRONMENTAL DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This tall-shrub association was observed on plains, midslopes and shoulders of ridges and on ridgetops, shoulders and slopes in gulches, on hillslopes, and in drainage channels. Sites are gentle to steep (6-62% slopes), occur between 2340 and 2765 m elevation, and are oriented to all aspects. The unvegetated surface has low to high cover

of litter, bedrock, and large and small rocks, and exposure of bare soil across stands. Cryptogam cover is up to 10% on one stand. Downed wood may contribute up to 5% cover. The underlying geology is variable and includes metamorphic/granitic rocks, Quaternary alluvium and landslide deposits, Mesozoic sandstones and shale, and Tertiary volcanic rocks. Soils are rapidly drained silty clay loams, silt loams, sandy clay loams, and sandy loams. Peat is present on one site.

Globally
This association occurs on the slopes and summits of hills and ridges in western and north-central Colorado. A few stands occur in the bottom of dry gullies. Elevations range from 2225 to 2765 m (7300-9070 feet), and stands tend to occur on gentle to moderately steep north- or east-facing slopes. Substrates include volcanic or sedimentary rock as well as landslides. Soil textures vary, but soils are often quite rocky.

VEGETATION DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This Utah serviceberry - mixed shrub / elk sedge tall-shrub association is widely distributed within the park and recreation area. The total vegetation cover ranges from 40 to 162% in these moderately to densely vegetated stands. This tall-shrub association is characterized by an open to closed canopy, typically 2-5 m tall, of *Amelanchier utahensis* and/or *Cercocarpus montanus* shrubs that range in cover from 0 to 50% and 0 to 55%, respectively. *Pseudotsuga menziesii* was present in one stand as saplings up to 2 m tall and contributes sparse cover. The shrub layer is variable in cover and composition. Other tall shrubs and sapling trees commonly present, but typically with less than 5% cover, include *Juniperus scopulorum, Pinus edulis*, and *Quercus gambelii* that are 1-5 m tall. Short and dwarf-shrubs can contribute moderate cover for each species; species commonly present include *Amelanchier utahensis, Artemisia nova, Artemisia tridentata ssp. vaseyana, Artemisia tridentata ssp. wyomingensis, Cercocarpus montanus, Chrysothamnus depressus, Chrysothamnus viscidiflorus, Mahonia repens, Quercus gambelii, Peraphyllum ramosissimum, Purshia tridentata*, and *Symphoricarpos rotundifolius*. The succulents *Opuntia fragilis, Opuntia polyacantha, Pediocactus simpsonii*, and *Yucca harrimaniae* are occasionally present but provide sparse cover. The herbaceous layer typically provides moderate cover and is present with moderate to high species richness. The characteristic graminoid is *Carex geyeri* that contributes from 0 to 25% cover. Other graminoids commonly present and providing sparse to moderate cover include *Achnatherum hymenoides, Achnatherum pinetorum, Carex vallicola, Elymus elymoides, Koeleria macrantha, Pascopyrum smithii, Poa compressa, Poa fendleriana, Poa pratensis*, and *Poa secunda*. Forbs commonly present include *Achillea millefolium var. occidentalis, Allium* sp., *Antennaria parvifolia, Arabis* spp., *Astragalus* spp., *Balsamorhiza sagittata, Castilleja* spp., *Chaenactis douglasii, Comandra umbellata, Cryptantha* spp., *Erigeron* spp., *Eriogonum* spp., *Lupinus* spp., *Penstemon teucrioides, Petradoria pumila, Phlox* spp., *Senecio* spp., *Sphaeralcea coccinea*, and *Stenotus armerioides*. Mosses and lichens provide sparse cover, up to 5% cover in some stands.

Globally
This tall shrubland association is variable in its shrub composition and dominance but is characterized by relatively high cover of *Amelanchier utahensis*, a lack of *Quercus gambelii* and relatively low cover by *Artemisia tridentata* (ssp. *vaseyana* or ssp. *wyomingensis*). Other shrubs, including *Cercocarpus montanus, Chrysothamnus viscidiflorus, Symphoricarpos oreophilus*, and *Purshia tridentata*, may be present and sometimes may be codominant with the *Amelanchier*. Total shrub cover ranges from 25% to more than 100% in these moderately dense to dense stands, and the shrub layer may be 1-2 m tall. Because of the dense shade cast by the shrub layer, the herbaceous layer tends to be relatively sparse, rarely exceeding 20% total cover. *Carex geyeri* has at least 5% cover, and many other graminoids and forbs may be present, including *Achnatherum lettermanii, Balsamorhiza sagittata, Galium boreale, Lupinus* sp., *Lathyrus lanszwertii var. leucanthus, Poa pratensis, Allium acuminatum, Achillea millefolium*, and *Pseudostellaria jamesiana*.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tall shrub/sapling	*Amelanchier utahensis*
Tall shrub/sapling	*Cercocarpus montanus*
Short shrub/sapling	*Amelanchier utahensis*, *Symphoricarpos rotundifolius*
Short shrub/sapling	*Artemisia tridentata* ssp. *vaseyana*, *Artemisia tridentata* ssp. *wyomingensis*, *Cercocarpus montanus*

Herb (field)	*Balsamorhiza sagittata*, *Phlox hoodii*, *Stenotus armerioides*
Herb (field)	*Achnatherum hymenoides*, *Carex geyeri*, *Poa fendleriana*

Globally

Stratum	Species
Tall shrub/sapling	*Amelanchier utahensis*
Tall shrub/sapling	*Cercocarpus montanus*
Short shrub/sapling	*Symphoricarpos rotundifolius*
Short shrub/sapling	*Artemisia tridentata* ssp. *vaseyana*
Herb (field)	*Carex geyeri*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Exotic/Invasive: *Bromus inermis* (exotic, High/Medium), *Bromus tectorum* (exotic, High), *Cirsium arvense* (exotic, High/Medium), *Melilotus officinalis* (exotic, Medium/Low), *Poa compressa* (exotic, High/Low), *Poa pratensis* (exotic, Medium), *Sisymbrium altissimum* (exotic)

Globally
Exotic/Invasive: *Cirsium arvense* (exotic, High/Medium), *Melilotus officinalis* (exotic, Medium/Low), *Poa pratensis* (exotic, Medium)

CONSERVATION STATUS RANK
Global Rank & Reasons: G2G3 (23-Feb-1994).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Tiedemann et al. (1987) describe a community dominated by *Amelanchier alnifolia*. The other references used in this description describe communities dominated by *Amelanchier utahensis*. Because it can be difficult to distinguish the two species, it makes sense to include all stands dominated by either species of *Amelanchier* in this association.

CLASSIFICATION CONFIDENCE: 1 - Strong

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: The ranges of *Amelanchier utahensis* and *Amelanchier alnifolia* overlap here and the species intergrade. While every effort was made to identify and separate these species, there is a possibility that some *Amelanchier alnifolia* stands were misidentified and placed in this class.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (16 plots, 45 observation points): (Plots: BLCA.0007, BLCA.0013, BLCA.0014, BLCA.0043, BLCA.0048, BLCA.0049, BLCA.0050, BLCA.0056, CURE.0017, CURE.0048, CURE.0099, CURE.0129, CURE.0156, CURE.0340, CURE.0370, CURE.0392. Observation Points: BLCA_AA.191, BLCA_AA.192, BLCA_AA.194, BLCA_AA.195, BLCA_AA.197, BLCA_AA.199, BLCA_AA.201, BLCA_AA.210, BLCA_AA.225, BLCA_AA.240, BLCA_AA.272, BLCA_AA.288, BLCA_AA.337, BLCA_AA.340, BLCA_AA.352, BLCA_AA.383, BLCA_AA.389, BLCA_AA.396, BLCA_AA.408, BLCA_AA.416, BLCA_AA.417, BLCA_AA.418, BLCA_AA.419, BLCA_AA.429, BLCA_AA.430, BLCA_AA.439, BLCA_AA.440, BLCA_AA.447, BLCA_AA.449, BLCA_AA.453, BLCA_AA.461, BLCA_AA.462, BLCA_AA.470, BLCA_AA.477, BLCA_AA.483, BLCA_AA.489, BLCA_AA.497, BLCA_AA.503, BLCA_AA.508, BLCA_AA.556, BLCA_AA.596, BLCA_AA.725, BLCA_AA.890, BLCA_AA.964, CURE_AA.1092).
Local Description Authors: J. Von Loh and G. Bradshaw, mod. J. Coles
Global Description Authors: J. Coles

REFERENCES: Baker 1982b, Bourgeron and Engelking 1994, CONHP unpubl. data 2003, Current 1984, Driscoll et al. 1984, Keammerer and Peterson 1981, Tiedemann et al. 1987, Vories 1974, Western Ecology Working Group n.d.

Cercocarpus montanus Shale Shrubland

Mountain-mahogany Shale Shrubland

CODE	CEGL002798
PHYSIOGNOMIC CLASS	Shrubland (III)
PHYSIOGNOMIC SUBCLASS	Deciduous shrubland (III.B.)
PHYSIOGNOMIC GROUP	Cold-deciduous shrubland (III.B.2.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural cold-deciduous shrubland (III.B.2.N.)
FORMATION	Temperate cold-deciduous shrubland (III.B.2.N.a.)
ALLIANCE	*CERCOCARPUS MONTANUS* SHRUBLAND ALLIANCE (A.896) Alderleaf Mountain-mahogany Shrubland Alliance

ECOLOGICAL SYSTEM(S): Rocky Mountain Lower Montane-Foothill Shrubland (CES306.822)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY

Globally

This shrubland association is uncommon and known only from one site sampled at Curecanti National Recreation Area in the Gunnison River Valley in western Colorado. The stands occur on steep (48% slope), active slopes at 2314 m elevation on a northwest aspect. Soils are rapidly drained clays derived from Mesozoic shale. The unvegetated surface has moderate cover of litter and high cover of large and small rocks. There is low to moderate exposure of bare soil. The vegetation is characterized by a dense to closed canopy of tall shrubs (1-2 m) dominated by *Cercocarpus montanus*. The associated shrub layer is low in species diversity and provides sparse cover. Short and dwarf-shrubs include *Artemisia frigida, Artemisia tridentata ssp. wyomingensis, Chrysothamnus viscidiflorus, Krascheninnikovia lanata*, and *Symphoricarpos rotundifolius*. The herbaceous layer is moderately diverse and provides moderate cover. Graminoids provide low cover and include *Achnatherum hymenoides, Achnatherum pinetorum*, and *Elymus elymoides*. Forbs provide low to moderate cover and include *Antennaria parvifolia, Arabis crandallii, Arabis X divaricarpa, Eriogonum lonchophyllum, Penstemon teucrioides, Phlox hoodii*, and *Stenotus armerioides*.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This type is known from a single location near Highway 50 and the lake shoreline in the vicinity of Elk Creek.

Globally

This shrubland association is uncommon and known only from one sampled site at Curecanti National Recreation Area in the Gunnison River Valley in western Colorado.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This tall-shrub association occurs on active slopes. The site is steep (48% slope), occurs at 2314 m elevation, and is oriented to a northwest aspect. The unvegetated surface has moderate cover of litter and high cover of large and small rocks. There is low to moderate exposure of bare soil. Downed wood is uncommon. Parent materials are Mesozoic shale. Soils are rapidly drained clays.

Globally

Data are not available.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This mountain-mahogany tall shrubland association is rare within the recreation area. The total vegetation cover is 85 to 130% in this densely vegetated stand. *Cercocarpus montanus* tall shrubs (1-2 m tall) form a closed canopy of 75 to 100% cover. The associated shrub layer is low in species diversity and provides sparse cover. Short and

dwarf-shrubs include *Artemisia frigida, Artemisia tridentata ssp. wyomingensis, Chrysothamnus viscidiflorus, Krascheninnikovia lanata*, and *Symphoricarpos rotundifolius*. The herbaceous layer is moderately diverse and provides moderate cover. Graminoids provide low cover and include *Achnatherum hymenoides, Achnatherum pinetorum*, and *Elymus elymoides*. Forbs provide low to moderate cover and include *Antennaria parvifolia, Arabis crandallii, Arabis X divaricarpa, Eriogonum lonchophyllum, Penstemon teucrioides, Phlox hoodii*, and *Stenotus armerioides*.

Globally
Data are not available.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tall shrub/sapling	*Cercocarpus montanus*
Herb (field)	*Stenotus armerioides*

Globally

Stratum	Species
Tall shrub/sapling	*Cercocarpus montanus*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Vulnerable: *Arabis crandallii* (globally imperiled, G2), *Penstemon teucrioides* (vulnerable, G2G3Q)

CONSERVATION STATUS RANK
Global Rank & Reasons: GNR (22-Jun-2005).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CLASSIFICATION CONFIDENCE:

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Slope is subject to slides and has a high degree of erosion.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (1 plot, 15 observation points): (Plot: CURE.0009. Observation Points: BLCA_AA.168, BLCA_AA.171, BLCA_AA.176, BLCA_AA.177, BLCA_AA.180, BLCA_AA.431, BLCA_AA.616, CURE_AA.0207, CURE_AA.0213, CURE_AA.0217, CURE_AA.0218, CURE_AA.0224, CURE_AA.0225, CURE_AA.0233, CURE_AA.0234).
Local Description Authors: J. Von Loh
Global Description Authors: K.A. Schulz

REFERENCES: Western Ecology Working Group n.d.

Quercus gambelii - Cercocarpus montanus / (Carex geyeri) Shrubland

Gambel Oak - Alderleaf Mountain-mahogany / (Geyer's Sedge) Shrubland

CODE	CEGL001113
PHYSIOGNOMIC CLASS	Shrubland (III)
PHYSIOGNOMIC SUBCLASS	Deciduous shrubland (III.B.)
PHYSIOGNOMIC GROUP	Cold-deciduous shrubland (III.B.2.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural cold-deciduous shrubland (III.B.2.N.)
FORMATION	Temperate cold-deciduous shrubland (III.B.2.N.a.)
ALLIANCE	*QUERCUS GAMBELII* SHRUBLAND ALLIANCE (A.920) Gambel Oak Shrubland Alliance

ECOLOGICAL SYSTEM(S): Rocky Mountain Gambel Oak-Mixed Montane Shrubland (CES306.818)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY

Globally

This mixed montane shrubland is reported from foothills, mountains and mesatops in western Colorado and Utah. Stands occur on gentle, moderate and steep slopes. Aspect varies with elevation with low-elevation stands restricted to more mesic northern and eastern aspects, and higher elevation stands occurring on southern and western aspects. Substrates are typically shallow and rocky, derived from sandstone and shale parent materials, and range from sandy- to clayey-textured soil. The vegetation is characterized by a moderately dense to dense thicket of tall (2-5 m) deciduous shrubs (on unstable, eroding or talus slopes the shrub canopy may be open). Codominance of *Quercus gambelii* and *Cercocarpus montanus* (at least 10% cover of each) is diagnostic of this plant association, but *Amelanchier utahensis* is often also abundant to codominant. Low cover of other mixed shrub associates is common. *Arctostaphylos patula, Arctostaphylos pungens, Artemisia tridentata, Fendlera rupicola, Fraxinus anomala, Peraphyllum ramosissimum, Physocarpus monogynus, Purshia tridentata, Prunus virginiana, Rhus trilobata, Rosa woodsii, Quercus turbinella, Symphoricarpos oreophilus*, and *Yucca* spp. may be present depending on geography. Occasional *Juniperus osteosperma* and *Pinus edulis* trees may also be present. The herbaceous layer is generally sparse because of the dense overstory, but *Carex geyeri* may provide low to moderate cover.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association is uncommon and was observed and sampled above the East Portal 1 hairpin curve, northeast of the Kneeling Camel on North Rim Drive, and northeast of the North Rim/Black Canyon Road intersection in the park, and across from the Pine Creek entrance and near the East Portal in the recreation area.

Globally

This montane shrubland association occurs in the foothills, mountains and mesatops of Utah and western Colorado.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This tall shrubland association was observed on the midslopes of swales, gorges, active slopes, and ridges. Sites are moderately steep to steep (15-75% slopes), occur between 2163 and 2451 m, and include all aspects. The unvegetated surface has moderate to high cover of litter and low to moderate cover of bedrock, large and small rocks, and exposure of bare soil. Downed wood can have cover as high as 10%. Soils are rapidly drained sandy loam, loamy sand, and clay loam derived from landslide material; one site was considered rich in gravel and another was termed very rocky with little soil.

Globally

This mixed montane shrubland association is reported from foothills, mountains and mesa tops in western Colorado and Utah. Elevation ranges from 1550-2500 m (5850-8200 feet). Stands occur on flat to steep slopes. Aspect varies with elevation with low elevation stands restricted to more mesic northern and eastern aspects, and higher elevation stands occurring on southern and western aspects. Substrates range from shallow and rocky, derived from sandstone, shale and alluvium or colluvium parent materials. Soil textures range from sandy to clayey to rapidly drained loamy sands.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This Gambel oak - mountain-mahogany / Geyer sedge association is uncommon on steep talus slopes in the park and recreation area. The total vegetation cover ranges from 40 to 85% in these moderately to densely vegetated stands. This shrubland association is characterized by an open to closed tall-shrub canopy, typically 2-5 m tall, of *Quercus gambelii, Cercocarpus montanus*, and *Amelanchier utahensis* shrubs that each range in cover from 5 to 50%. These tall-shrub species are also present in the short-shrub layer and contribute up to 25% cover. Additional tall shrubs provide sparse to low cover, including *Juniperus osteosperma, Prunus virginiana*, and *Pinus edulis*. Short and dwarf-shrubs are diverse, provide low to moderate cover, and include *Amelanchier alnifolia, Artemisia tridentata ssp. vaseyana, Chrysothamnus viscidiflorus, Fendlerella utahensis, Gutierrezia sarothrae, Mahonia repens, Opuntia fragilis, Peraphyllum ramosissimum, Philadelphus microphyllus*, and *Symphoricarpos rotundifolius*. The herbaceous layer is diverse and provides low to moderate cover within stands. Common graminoids include *Achnatherum hymenoides, Bromus tectorum, Carex geyeri, Elymus elymoides*, and *Poa fendleriana*. Forbs are diverse, provide sparse cover, and include *Arenaria congesta, Artemisia frigida, Artemisia michauxiana, Balsamorhiza sagittata, Petradoria pumila*, and *Phlox austromontana*. Seedling *Artemisia tridentata ssp. vaseyana* and *Cercocarpus montanus* provide sparse cover in one stand. Cryptogams provide sparse cover, typically less than 5%.

Globally

This association is characterized by a moderately dense to dense thicket of tall deciduous shrubs 2-5 m tall (on unstable, eroding or talus slopes the shrub canopy may be more open). Codominance of *Quercus gambelii* and *Cercocarpus montanus* (at least 10% cover of each) is diagnostic of this plant association, but *Amelanchier utahensis* is often also abundant to codominant. Low cover of other mixed shrub associates is common. *Arctostaphylos patula, Arctostaphylos pungens, Artemisia bigelovii, Artemisia tridentata, Ephedra viridis, Fendlera rupicola, Fraxinus anomala, Mahonia fremontii, Peraphyllum ramosissimum, Physocarpus monogynus, Purshia tridentata, Rhus trilobata, Rosa woodsii, Quercus turbinella, Symphoricarpos oreophilus, Tetradymia canescens*, and *Yucca* spp. may be present depending on geography. Occasional *Juniperus osteosperma, Juniperus scopulorum*, and *Pinus edulis* trees may be present also. The herbaceous layer is generally sparse because of dense overstory. It is typically composed of scattered graminoids such as *Achnatherum hymenoides, Carex geyeri, Pleuraphis jamesii, Poa fendleriana, Sporobolus cryptandrus*, and forbs such as *Artemisia ludoviciana, Chaetopappa ericoides, Cirsium neomexicanum, Erigeron utahensis, Heterotheca villosa, Hymenopappus filifolius, Lathyrus* spp., *Lepidium montanum, Lupinus* spp., *Packera multilobata (= Senecio multilobatus), Pedicularis centranthera, Tetraneuris acaulis (= Hymenoxys acaulis)*, and *Vicia americana*. The non-native grass *Bromus tectorum* may also be present to abundant in disturbed stands.

MOST ABUNDANT SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tall shrub/sapling	*Amelanchier utahensis*, *Quercus gambelii*
Tall shrub/sapling	*Cercocarpus montanus*
Short shrub/sapling	*Symphoricarpos rotundifolius*
Short shrub/sapling	*Artemisia tridentata* ssp. *vaseyana*, *Cercocarpus montanus*
Herb (field)	*Artemisia michauxiana*, *Balsamorhiza sagittata*
Herb (field)	*Achnatherum hymenoides*, *Carex geyeri*, *Poa fendleriana*

Globally

Stratum	Species
Tall shrub/sapling	*Amelanchier utahensis*, *Quercus gambelii*
Tall shrub/sapling	*Cercocarpus montanus*

OTHER NOTEWORTHY SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Data are not available.

Globally

Exotic/Invasive: *Bromus tectorum* (invasive/exotic, High)

CONSERVATION STATUS RANK
Global Rank & Reasons: G3 (23-Feb-1994).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
This plant association is similar to other montane Gambel oak shrublands except for the codominance of *Cercocarpus montanus* (10% cover or more). Other shrubs species may be present to codominant.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: There are some scree and landslide slopes in this type. Large mammal use is notable, including heavy browsing.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (5 plots, 18 observation points): (Plots: BLCA.0009, BLCA.0031, BLCA.0041, CURE.0029, CURE.0245. Observation Points: BLCA_AA.268, BLCA_AA.309, BLCA_AA.878, CURE_AA.0078, CURE_AA.0249, CURE_AA.0340, CURE_AA.0341, CURE_AA.0371, CURE_AA.0483, CURE_AA.0559, CURE_AA.0592, CURE_AA.0600, CURE_AA.0685, CURE_AA.0790, CURE_AA.0853, CURE_AA.0858, CURE_AA.0927, CURE_AA.1181).
Local Description Authors: J. Von Loh, mod. J. Coles
Global Description Authors: K.A. Schulz, mod. J. Coles and G. Kittel

REFERENCES: Baker 1982b, Bourgeron and Engelking 1994, Bradley et al. 1992, CONHP unpubl. data 2003, Clary 1992, Cogan et al. 2004, Dillinger 1970, Driscoll et al. 1984, Ellis and Hackney 1981, Erdman 1962, Ferchau 1973, Hanson and Ball 1928, Keammerer and Peterson 1981, Muldavin et al. 1998b, Pase and Lindenmuth 1971, Schmoll 1935, Vories 1974, Western Ecology Working Group n.d.

Quercus gambelii - Holodiscus dumosus Shrubland

Gambel Oak - Rockspirea Shrubland

CODE	CEGL002341
PHYSIOGNOMIC CLASS	Shrubland (III)
PHYSIOGNOMIC SUBCLASS	Deciduous shrubland (III.B.)
PHYSIOGNOMIC GROUP	Cold-deciduous shrubland (III.B.2.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural cold-deciduous shrubland (III.B.2.N.)
FORMATION	Temperate cold-deciduous shrubland (III.B.2.N.a.)
ALLIANCE	*QUERCUS GAMBELII* SHRUBLAND ALLIANCE (A.920) Gambel Oak Shrubland Alliance

ECOLOGICAL SYSTEM(S): Rocky Mountain Gambel Oak-Mixed Montane Shrubland (CES306.818)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY
Globally
This uncommon tall-shrub association occurs in scattered small patches on rock outcrops and landslide deposits on the slopes of mesas and canyons. Sites are moderately steep to steep and occur between 1700 and 2550 m elevation. The unvegetated surface has moderate to high cover of litter, bedrock, rocks, and bare soil. The underlying geology includes Tertiary volcanic rocks, metamorphic and granitic rocks, and Quaternary landslide deposits. Total vegetation cover ranges from 60 to 90%. The tall-shrub canopy is typically 1-2 m tall and characteristically consists of *Quercus gambelii* with 5 to 100% cover, *Amelanchier utahensis* with 1 to 15% cover, and *Holodiscus dumosus* with 1 to 50% cover. Other shrubs that contribute to the total cover can include *Acer negundo, Artemisia tridentata ssp. wyomingensis, Mahonia repens, Prunus virginiana, Philadelphus microphyllus, Quercus gambelii, Rhus trilobata, Ribes cereum*, and *Symphoricarpos rotundifolius*. The herbaceous layer provides up to 15% total cover and may include *Achnatherum hymenoides, Carex geyeri, Elymus trachycaulus, Poa fendleriana, Artemisia frigida,*

Artemisia ludoviciana, Galium boreale, Geranium sp., *Hymenopappus filifolius, Maianthemum stellatum, Solidago velutina*, and *Toxicodendron rydbergii*. Lichens and mosses provide up to 45% cover.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association was observed and sampled near East Portal 2 above the hairpin turn, near the bottom of East Portal across from the picnic area, along the Warner Route in Black Canyon, and on Dillon Mesa in the park and recreation area.

Globally

This association is known only from Black Canyon of the Gunnison National Park and Curecanti National Recreation Area.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This tall-shrub association was observed on the midslopes to upper slopes of slopes, mesas, and landslides and on the low slope of a canyon. Sites are moderately steep to steep (19-73% slopes), occur between 1719 and 2552 m elevation, and are oriented to all aspects. The unvegetated surface has moderate to high cover of litter, bedrock, large and small rocks, and exposure of bare soil. Downed wood is common, up to 15%. The underlying geology includes Tertiary volcanic rocks, metamorphic, granitic rocks, and Quaternary landslide deposits. Soils are sandy loams or are rocky with no soil present.

Globally

This tall-shrub association occurs on the slopes of mesas, canyons and landslides. Sites are moderately steep to steep (19-73% slopes), occur between 1719 and 2552 m elevation, and are oriented to all aspects. The unvegetated surface has moderate to high cover of litter, bedrock, large and small rocks, and exposure of bare soil. Downed wood has up to 15% cover. The underlying geology includes Tertiary volcanic rocks, metamorphic and granitic rocks, and Quaternary landslide deposits. Soils are sandy loams or are rocky with no soil available to sample.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This Gambel oak / rock spiraea tall-shrub association is uncommon to common along the boundary between the park and recreation area. The total vegetation cover ranges from 60 to 90% in these densely vegetated stands. This tall-shrub association is characterized by a closed canopy that is typically 1-2 m tall of *Quercus gambelii* shrubs that range in cover from 5 to 100%. Another tall shrub present is *Amelanchier utahensis* that provides 1 to 15% cover. The short- and dwarf-shrub layer is high in diversity and is characterized by *Holodiscus dumosus* that provides 1 to 50% cover. Other short and dwarf-shrubs contribute low to high total cover and include *Acer negundo, Amelanchier utahensis, Artemisia tridentata ssp. wyomingensis, Mahonia repens, Prunus virginiana, Philadelphus microphyllus, Quercus gambelii, Rhus trilobata, Ribes cereum, Ribes leptanthum*, and *Symphoricarpos rotundifolius*. The herbaceous layer is relatively diverse and provides low total cover, up to 15%. Graminoids provide sparse to low cover and include *Achnatherum hymenoides, Bromus tectorum, Carex geyeri, Elymus elymoides, Elymus trachycaulus*, and *Poa fendleriana*. Forbs provide sparse to low cover and include *Arabis* spp., *Artemisia frigida, Artemisia ludoviciana, Artemisia michauxiana, Chenopodium foliosum, Galium aparine, Galium boreale, Gayophytum diffusum, Geranium* sp., *Hymenopappus filifolius, Maianthemum stellatum, Solidago velutina*, and *Toxicodendron rydbergii*. Lichens and mosses provide up to 40% cover and up to 2% cover, respectively.

Globally

This tall-shrub association is uncommon. The total vegetation cover ranges from 60 to 90% in these densely vegetated stands. This association is characterized by a tall-shrub canopy that is typically 1-2 m tall of *Quercus gambelii* shrubs that range in cover from 5 to 100%. Another tall shrub present is *Amelanchier utahensis* that provides 1 to 15% cover. The short-shrub layer is diverse and characterized by *Holodiscus dumosus* with between 1 and 50% cover. Other shrubs that contribute to the total cover include *Acer negundo, Artemisia tridentata ssp. wyomingensis, Mahonia repens, Prunus virginiana, Philadelphus microphyllus, Quercus gambelii, Rhus trilobata, Ribes cereum, Ribes leptanthum*, and *Symphoricarpos rotundifolius*. The herbaceous layer is relatively diverse and provides up to 15% total cover. Graminoids provide sparse to low cover and include *Achnatherum hymenoides, Carex geyeri, Elymus elymoides, Elymus trachycaulus*, and *Poa fendleriana*. Forbs provide sparse to low cover and include *Artemisia frigida, Artemisia ludoviciana, Galium boreale, Gayophytum diffusum, Geranium* sp.,

Hymenopappus filifolius, Maianthemum stellatum, Solidago velutina, and *Toxicodendron rydbergii*. Lichens and mosses provide up to 45% cover.

MOST ABUNDANT SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tall shrub/sapling	*Amelanchier utahensis*, *Quercus gambelii*
Short shrub/sapling	*Holodiscus dumosus*
Herb (field)	*Galium aparine*
Herb (field)	*Carex geyeri*

Globally

Stratum	Species
Tall shrub/sapling	*Amelanchier utahensis*, *Quercus gambelii*
Short shrub/sapling	*Holodiscus dumosus*
Herb (field)	*Carex geyeri*

OTHER NOTEWORTHY SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Exotic/Invasive: *Bromus tectorum* (exotic, High)

Globally
Data are not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (20-Jan-2005).

CLASSIFICATION COMMENTS

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CLASSIFICATION CONFIDENCE: 3 - Weak

ELEMENT SOURCES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: This association is likely to be found in similar habitats within the park and recreation area, such as on small outcroppings of rock. Many of these occurrences are likely to be small, however, and not conducive to sampling.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (4 plots, 13 observation points): (Plots: BLCA.0008, BLCA.0113, CURE.0046, CURE.0202. Observation Points: CURE_AA.0155, CURE_AA.0438, CURE_AA.0441, CURE_AA.0442, CURE_AA.0443, CURE_AA.0445, CURE_AA.0450, CURE_AA.0454, CURE_AA.0476, CURE_AA.0477, CURE_AA.0484, CURE_AA.0713, CURE_AA.1018).
Local Description Authors: J. Von Loh and G. Bradshaw, mod. J. Coles
Global Description Authors: J. Coles

REFERENCES: Western Ecology Working Group n.d.

Quercus gambelii / Amelanchier alnifolia Shrubland

Gambel Oak / Saskatoon Serviceberry Shrubland

CODE	CEGL001109
PHYSIOGNOMIC CLASS	Shrubland (III)
PHYSIOGNOMIC SUBCLASS	Deciduous shrubland (III.B.)
PHYSIOGNOMIC GROUP	Cold-deciduous shrubland (III.B.2.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural cold-deciduous shrubland (III.B.2.N.)
FORMATION	Temperate cold-deciduous shrubland (III.B.2.N.a.)
ALLIANCE	*QUERCUS GAMBELII* SHRUBLAND ALLIANCE (A.920) Gambel Oak Shrubland Alliance

ECOLOGICAL SYSTEM(S): Rocky Mountain Gambel Oak-Mixed Montane Shrubland (CES306.818)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY

Globally

This montane shrubland association has been described from mountains and plateaus of Utah and western Colorado. Elevation ranges from 1830-2745 m (6000-9000 feet). Sites include nearly level mesas to steep mountain slopes (to 40%). Soils are gravelly loams. Litter usually dominates the ground surface (about 60% cover), with rock cover also abundant. The vegetation is characterized by a moderately dense to dense tall-shrub layer (2-5 m tall) that is dominated by *Quercus gambelii* (10-90% cover) with a sparse to moderately dense short-shrub layer dominated by *Amelanchier alnifolia* or *Amelanchier pallida*. If *Amelanchier utahensis* is present, it is subdominant. *Arctostaphylos patula, Artemisia tridentata ssp. vaseyana*, and *Cercocarpus montanus* may also be present with low cover (<10%) and do not codominate. Other shrubs and dwarf-shrubs present may include *Arctostaphylos uva-ursi, Artemisia nova, Chrysothamnus viscidiflorus, Mahonia repens, Prunus virginiana, Purshia tridentata, Opuntia* spp., *Rosa* spp., and *Symphoricarpos* spp. The relatively sparse to moderately dense herbaceous layer is a diverse mixture of grasses and forbs. Graminoids commonly present are *Bromus porteri, Carex* spp., *Elymus elymoides, Festuca thurberi, Koeleria macrantha, Poa fendleriana, Pseudoroegneria spicata*, and *Sporobolus cryptandrus*. Common forbs include *Achillea millefolium, Astragalus* sp., *Erigeron speciosus, Eriogonum* sp., *Galium* spp., *Ipomopsis aggregata, Ligusticum porteri, Lathyrus* spp., *Lupinus argenteus, Phlox longifolia, Penstemon palmeri, Potentilla pulcherrima, Solidago velutina (= Solidago sparsiflora), Thalictrum fendleri*, or *Vicia americana*. Introduced species such as *Bromus tectorum* and *Poa pratensis* are frequently present.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association is rare to uncommon in the recreation area and was sampled along East Portal Road and East of Myers Gulch near State Highway 92 in the Curecanti National Recreation Area.

Globally

This montane shrubland association has been described from mountains and plateaus of Utah and western Colorado.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This tall-shrub association occurs midslope in gorges and on the slopes of ridges or interfluves. Sites are steep (44-52%), occur between 2208 and 2744 m elevation, and are oriented to southern and western aspects. The unvegetated surface has high cover of litter and low to moderate cover of large rocks. Downed wood is common. Parent materials are Tertiary volcanic and metamorphic/granitic rocks. Soils are rapidly drained silty clay loams and sandy clay loams.

Globally

This montane shrubland association has been described from mountains and plateaus of Utah and western Colorado. Elevation ranges from 1830-2745 m (6000-9000 feet). Sites include nearly level mesas to steep mountain slopes (to 40%). Soils are gravelly loams. Litter usually dominates the ground surface (about 60% cover), with rock cover also abundant.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This Gambel oak / Saskatoon serviceberry tall-shrub association is rare in the recreation area. The total vegetation cover ranges from 95 to 100% in these densely vegetated stands. *Quercus gambelii* and *Amelanchier alnifolia* tall shrubs (2-10 m tall) form an open to relatively closed canopy and provide 25 to 65% and 13 to 16% cover, respectively. The shrub layer is diverse and provides dense cover. The relatively diverse and dense short-shrub stratum includes *Artemisia tridentata ssp. vaseyana, Chrysothamnus viscidiflorus, Pinus edulis, Prunus virginiana, Rosa woodsii*, and *Symphoricarpos rotundifolius*. Dwarf-shrubs are low in species diversity and provide sparse cover, including *Arctostaphylos uva-ursi* and *Mahonia repens*. The herbaceous layer is diverse in terms of species composition and provides sparse to moderate cover. Graminoids providing sparse to moderate cover include *Bromus porteri, Bromus tectorum, Carex geyeri, Festuca thurberi, Poa fendleriana*, and *Poa pratensis*. Forbs provide sparse to low cover and include *Achillea millefolium var. occidentalis, Erigeron speciosus, Ligusticum porteri, Linum lewisii, Lupinus* sp., *Potentilla pulcherrima*, and *Thalictrum fendleri*. *Quercus gambelii* seedlings provide sparse cover in one stand. Species of moss and lichen provide sparse to low cover, up to 5%.

Globally
This association is characterized by a moderately dense to dense tall-shrub layer (2-5 m tall) that is dominated by *Quercus gambelii* (10-90% cover) with a sparse to moderately dense short-shrub layer dominated by *Amelanchier alnifolia* or *Amelanchier pallida*. If *Amelanchier utahensis* is present, it is subdominant. *Arctostaphylos patula, Artemisia tridentata ssp. vaseyana*, and *Cercocarpus montanus* may also be present with low cover (<10%) and do not codominate. Other shrubs and dwarf-shrubs present may include *Arctostaphylos uva-ursi, Artemisia nova, Chrysothamnus viscidiflorus, Mahonia repens, Prunus virginiana, Purshia tridentata, Opuntia* spp., *Rosa* spp., and *Symphoricarpos* spp. The relatively sparse to moderately dense herbaceous layer is a diverse mixture of grasses and forbs. Graminoids commonly present are *Bromus porteri, Carex siccata (= Carex foenea), Carex geyeri, Carex hoodii, Carex rossii, Elymus elymoides, Festuca thurberi, Koeleria macrantha, Poa fendleriana, Pseudoroegneria spicata*, and *Sporobolus cryptandrus*. Common forbs include *Achillea millefolium, Astragalus* sp., *Erigeron speciosus, Eriogonum* sp., *Galium* spp., *Ipomopsis aggregata, Ligusticum porteri, Linum lewisii, Lathyrus lanszwertii var. leucanthus (= Lathyrus leucanthus), Lathyrus pauciflorus, Lupinus argenteus, Phlox longifolia, Penstemon palmeri, Potentilla pulcherrima, Solidago velutina (= Solidago sparsiflora), Thalictrum fendleri*, or *Vicia americana*. Introduced species such as *Bromus tectorum* and *Poa pratensis* are frequently present.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tall shrub/sapling	*Amelanchier alnifolia*, *Quercus gambelii*
Short shrub/sapling	*Amelanchier alnifolia*, *Chrysothamnus viscidiflorus*, *Prunus virginiana*, *Quercus gambelii*, *Rosa woodsii*, *Symphoricarpos rotundifolius*
Short shrub/sapling	*Artemisia tridentata* ssp. *vaseyana*
Herb (field)	*Achillea millefolium* var. *occidentalis*, *Ligusticum porteri*, *Thalictrum fendleri*
Herb (field)	*Bromus porteri*, *Carex geyeri*, *Festuca thurberi*, *Poa fendleriana*, *Poa pratensis*

Globally

Stratum	Species
Tall shrub/sapling	*Amelanchier alnifolia*, *Quercus gambelii*
Short shrub/sapling	*Amelanchier alnifolia*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Exotic/Invasive: *Bromus tectorum* (exotic noxious weed, High), *Poa pratensis* (exotic, Medium)

Globally
Data are not available.

CONSERVATION STATUS RANK
Global Rank & Reasons: G3G5 (23-Feb-1994).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: This association occupies moderate to steep slopes with talus or scree, also areas of deeper soils.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (3 plots, 18 observation points): (Plots: CURE.0195, CURE.0247, CURE.0298. Observation Points: BLCA_AA.404, BLCA_AA.405, BLCA_AA.414, BLCA_AA.452, BLCA_AA.473, BLCA_AA.579, CURE_AA.0088, CURE_AA.0140, CURE_AA.0149, CURE_AA.0156, CURE_AA.0270, CURE_AA.0374, CURE_AA.0407, CURE_AA.0474, CURE_AA.0601, CURE_AA.0607, CURE_AA.0659, CURE_AA.0711).
Local Description Authors: J. Von Loh
Global Description Authors: K.A. Schulz

REFERENCES: Baker 1984a, Blackburn et al. 1969d, Bourgeron and Engelking 1994, Bunting 1987, Christensen 1949, Clary 1992, Driscoll et al. 1984, Evans 1926, Evans 1936, Everett 1987, Forsling and Storm 1929, Johnston 1987, Johnston 2001, Kartesz 1999, Komarkova 1986, Kunzler et al. 1981, McKell 1950, Ream 1960, Ream 1964, Steinhoff 1978, Western Ecology Working Group n.d., Wright et al. 1979

Quercus gambelii / Amelanchier utahensis Shrubland

Gambel Oak / Utah Serviceberry Shrubland

CODE	CEGL001110
PHYSIOGNOMIC CLASS	Shrubland (III)
PHYSIOGNOMIC SUBCLASS	Deciduous shrubland (III.B.)
PHYSIOGNOMIC GROUP	Cold-deciduous shrubland (III.B.2.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural cold-deciduous shrubland (III.B.2.N.)
FORMATION	Temperate cold-deciduous shrubland (III.B.2.N.a.)
ALLIANCE	*QUERCUS GAMBELII* SHRUBLAND ALLIANCE (A.920) Gambel Oak Shrubland Alliance

ECOLOGICAL SYSTEM(S): Rocky Mountain Gambel Oak-Mixed Montane Shrubland (CES306.818)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY
Globally
This mixed mountain shrubland occurs in southern Utah and western Colorado. Stands occur in canyons, or on mesas, benches, plateaus, ridges, foothills scarps and mountains. Elevation ranges from 1525 to 2700 m (5000-8860 feet). Slopes are gentle to steep (1-100%) and may be oriented to any aspect. Soil are generally deep, well-developed and are derived from a variety of sources, including sandstones, shales and metamorphic rocks. The vegetation is characterized by a sparse to dense (10-100+% cover) tall-shrub layer (2-5 m tall) codominated by *Quercus gambelii* and *Amelanchier utahensis*. Common shrub associates include *Artemisia tridentata* and *Symphoricarpos oreophilus*. *Cercocarpus montanus* is absent or poorly represented (<5% cover). Other shrubs and dwarf-shrubs present with low cover may include *Chrysothamnus viscidiflorus, Ephedra viridis, Gutierrezia sarothrae, Mahonia repens, Opuntia* spp., *Purshia tridentata*, and *Prunus virginiana*. Graminoids, such as *Pascopyrum smithii, Achnatherum hymenoides, Carex geyeri, Hesperostipa comata*, or *Poa fendleriana*, dominate the sparse herbaceous layer (<10% total cover). Common forbs include *Achillea millefolium, Artemisia ludoviciana, Allium acuminatum, Comandra umbellata, Erigeron speciosus, Lathyrus lanszwertii, Balsamorhiza sagittata, Packera multilobata, Phlox austromontana, Thalictrum fendleri*, or *Vicia americana*. Occasionally, scattered individual trees are present in the overstory, including *Pinus edulis, Pseudotsuga menziesii*, or *Juniperus osteosperma*.

DISTRIBUTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association is widely distributed on the deeper soils of the park and recreation area and was observed and sampled on Cedar Point, along the Deadhorse Mesa Trail, on the flat west of Poison Spring Hill, in Poison Spring Gulch, on the east side of Black Canyon Road, northeast of the North Rim - Black Canyon Road intersection, across the road from the Tomichi Point lookout, along Oak Flat Trail on the South Rim of the park, and along Crystal Trail near the trailhead in the recreation area.

Globally
This montane shrubland occurs in southern Utah and western Colorado. It occurs in small scattered patches on Dry Bench in Capitol Reef National Park, and on high alluvial terraces in the canyons of Natural Bridges National Monument. It is one of the most abundant and widespread shrubland types in Black Canyon of the Gunnison National Park and Curecanti National Recreation Area.

ENVIRONMENTAL DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This tall-shrub association was observed on plains and on midslopes and upper midslopes of active slopes, scarp slopes, swales and valley sides, large hills, and mesas, shoulders of gulches, bottoms of draws, gentle slopes on canyon rims, and on ridgetops. Sites are nearly flat to moderately steep (1-51% slopes), occur from 2350 to 2708 m elevation, and include all aspects. The unvegetated surface has moderate to high cover of litter and low to moderate exposure of bare soil. Downed wood is variable but may be as high as 15%. Soils are moderately well-drained to rapidly drained silty clay loams, silt loams, loams, sandy loams, and sandy clay loams derived from a variety of sources, including Mesozoic sandstones and shale and metamorphic granitic rocks.

Globally
This mountain shrubland occurs in southern Utah and western Colorado. Elevation ranges from 1525 to 2700 m (5000-8860 feet). Stands occur in canyons or on mesas, benches, plateaus, ridges, foothills scarps and mountains. Slopes are gentle to steep (1-100%) and may be oriented to any aspect. Soil are generally deep, well-developed and are derived from a variety of sources, including sandstones, shales and metamorphic rocks.

VEGETATION DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This Gambel oak - Utah serviceberry tall-shrub association is widely distributed in middle elevations in the park and recreation area. The total vegetation cover ranges from 66 to 145% in these densely vegetated stands. This tall-shrub association is characterized by a closed canopy that is typically 2-5 m tall of *Quercus gambelii* and *Amelanchier utahensis* shrubs that range in cover from 5 to 90% and 3 to 40%, respectively. The canopy trees *Juniperus osteosperma* and *Pseudotsuga menziesii* are from 2 to 10 m tall, present in one stand each, and provide sparse to low cover. Short and dwarf-shrubs provide low to moderate cover and include *Artemisia tridentata ssp. vaseyana, Mahonia repens, Quercus gambelii*, and *Symphoricarpos rotundifolius*. The herbaceous layer provides low to moderate cover and has high diversity. Common graminoids include *Carex geyeri, Elymus elymoides, Poa fendleriana*, and *Poa pratensis*. Forbs commonly present include *Achillea millefolium var. occidentalis, Allium acuminatum, Arabis drummondii, Balsamorhiza sagittata, Comandra umbellata, Erigeron speciosus*, and *Lathyrus lanszwertii var. leucanthus*. Seedling *Artemisia tridentata ssp. vaseyana* and *Quercus gambelii* shrubs provide sparse cover in some stands. Cryptogams are rare in this association and provide sparse to low cover.

Globally
This association is characterized by a sparse to dense (10-100+% cover) tall-shrub layer (2-5 m tall) that is dominated by *Quercus gambelii* and codominated by *Amelanchier utahensis*. Sparse stands tend to occur in areas that have burned recently. Common associates include *Artemisia tridentata* and *Symphoricarpos oreophilus*. *Cercocarpus montanus* is absent or poorly represented (<5% cover). Other shrubs and dwarf-shrubs present with low cover may include *Chrysothamnus viscidiflorus, Ephedra viridis, Gutierrezia sarothrae, Mahonia repens, Opuntia* spp., *Purshia tridentata*, and *Prunus virginiana*. Graminoids, such as *Pascopyrum smithii, Achnatherum hymenoides, Carex geyeri, Hesperostipa comata*, or *Poa fendleriana*, dominate the sparse herbaceous layer (<10% total cover). Common forbs include *Achillea millefolium, Artemisia ludoviciana, Allium acuminatum, Comandra umbellata, Erigeron speciosus, Lathyrus lanszwertii, Balsamorhiza sagittata, Packera multilobata, Phlox austromontana, Thalictrum fendleri*, or *Vicia americana*. Occasionally, tree species are present in the overstory, including *Pinus edulis, Pseudotsuga menziesii*, or *Juniperus osteosperma*.

MOST ABUNDANT SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tall shrub/sapling	*Amelanchier utahensis*, *Quercus gambelii*
Short shrub/sapling	*Quercus gambelii*, *Symphoricarpos rotundifolius*
Short shrub/sapling	*Artemisia tridentata* ssp. *vaseyana*
Herb (field)	*Achillea millefolium* var. *occidentalis*, *Lathyrus lanszwertii* var. *leucanthus*
Herb (field)	*Carex geyeri*, *Poa fendleriana*, *Poa pratensis*

Globally

Stratum	Species
Tall shrub/sapling	*Amelanchier utahensis*, *Quercus gambelii*

OTHER NOTEWORTHY SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: G3G5 (23-Feb-1994).

CLASSIFICATION COMMENTS

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
This plant association is similar to other montane Gambel oak shrublands except for the codominance of *Amelanchier utahensis* with only minor amounts (<10% or 5% cover, respectively) of *Artemisia tridentata* or *Cercocarpus montanus*.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Most stands are very dense. Some stands have small openings throughout. There is cattle grazing throughout the area resulting in many trails and causing some hummocking of soil.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (16 plots, 106 observation points): (Plots: BLCA.0002, BLCA.0006, BLCA.0016, BLCA.0024, BLCA.0025, BLCA.0044, BLCA.0045, BLCA.0046, BLCA.0051, BLCA.0052, BLCA.0055, BLCA.0058, BLCA.0064, BLCA.0075, CURE.0270, CURE.0293. Observation Points: BLCA_AA.193, BLCA_AA.198, BLCA_AA.206, BLCA_AA.231, BLCA_AA.232, BLCA_AA.236, BLCA_AA.238, BLCA_AA.239, BLCA_AA.247, BLCA_AA.248, BLCA_AA.249, BLCA_AA.252, BLCA_AA.259, BLCA_AA.260, BLCA_AA.269, BLCA_AA.292, BLCA_AA.295, BLCA_AA.331, BLCA_AA.346, BLCA_AA.380, BLCA_AA.410, BLCA_AA.420, BLCA_AA.459, BLCA_AA.460, BLCA_AA.463, BLCA_AA.464, BLCA_AA.471, BLCA_AA.491, BLCA_AA.492, BLCA_AA.507, BLCA_AA.509, BLCA_AA.510, BLCA_AA.519, BLCA_AA.522, BLCA_AA.533, BLCA_AA.534, BLCA_AA.539, BLCA_AA.548, BLCA_AA.557, BLCA_AA.560, BLCA_AA.561, BLCA_AA.562, BLCA_AA.565, BLCA_AA.629, BLCA_AA.633, BLCA_AA.639, BLCA_AA.648, BLCA_AA.649, BLCA_AA.652, BLCA_AA.655, BLCA_AA.659, BLCA_AA.661, BLCA_AA.665, BLCA_AA.672, BLCA_AA.680, BLCA_AA.681, BLCA_AA.682, BLCA_AA.683, BLCA_AA.684, BLCA_AA.685, BLCA_AA.686, BLCA_AA.687, BLCA_AA.688, BLCA_AA.693, BLCA_AA.732, BLCA_AA.736, BLCA_AA.743, BLCA_AA.745, BLCA_AA.746, BLCA_AA.752, BLCA_AA.762, BLCA_AA.765, BLCA_AA.774, BLCA_AA.777, BLCA_AA.787, BLCA_AA.815, BLCA_AA.819, BLCA_AA.824, BLCA_AA.876, BLCA_AA.879, BLCA_AA.880, BLCA_AA.881, BLCA_AA.882, BLCA_AA.887, BLCA_AA.892, BLCA_AA.961, CURE_AA.0128, CURE_AA.0141, CURE_AA.0278, CURE_AA.0285, CURE_AA.0297, CURE_AA.0343, CURE_AA.0415, CURE_AA.0679, CURE_AA.0686, CURE_AA.0712,

CURE_AA.0809, CURE_AA.0813, CURE_AA.0863, CURE_AA.0866, CURE_AA.0867, CURE_AA.0959, CURE_AA.1061, CURE_AA.1087, CURE_AA.1147, CURE_AA.1151).
Local Description Authors: J. Von Loh, mod. J. Coles
Global Description Authors: K.A. Schulz, mod. J. Coles

REFERENCES: Bourgeron and Engelking 1994, CONHP unpubl. data 2003, Carmichael et al. 1978, Cedar Creek Associates, Inc. 1987, Clary 1992, Cogan et al. 2004, Crane 1982, Driscoll et al. 1984, Muldavin et al. 1998b, Western Ecology Working Group n.d.

Quercus gambelii / Artemisia tridentata Shrubland

Gambel Oak / Basin Big Sagebrush Shrubland

CODE	CEGL001111
PHYSIOGNOMIC CLASS	Shrubland (III)
PHYSIOGNOMIC SUBCLASS	Deciduous shrubland (III.B.)
PHYSIOGNOMIC GROUP	Cold-deciduous shrubland (III.B.2.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural cold-deciduous shrubland (III.B.2.N.)
FORMATION	Temperate cold-deciduous shrubland (III.B.2.N.a.)
ALLIANCE	*QUERCUS GAMBELII* SHRUBLAND ALLIANCE (A.920) Gambel Oak Shrubland Alliance

ECOLOGICAL SYSTEM(S): Rocky Mountain Gambel Oak-Mixed Montane Shrubland (CES306.818)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY
Globally
This montane shrubland association has been described from mountains and plateaus of Utah and western Colorado. Sites are on nearly level mesas to steep hillslopes (to 75%). Elevation ranges from 1830-2506 m (6000-8215 feet). Soils are rapidly drained sandy loam, loamy sand, and gravelly loams. There is typically high cover of litter and low to moderate cover by bedrock, large and small rocks, and bare ground. The vegetation is characterized by a moderately dense to dense (10-65% cover) tall-shrub layer (2-5 m tall) that is dominated by *Quercus gambelii*, with a sparse to moderately dense short-shrub layer dominated by *Artemisia tridentata*, often forming a mosaic of oak and sagebrush. If present, *Amelanchier* spp. and *Cercocarpus montanus* occur in minor amounts (<10% cover). Other shrubs that may be present include *Chrysothamnus viscidiflorus, Purshia tridentata, Opuntia* spp., *Rosa* spp., *Symphoricarpos* spp., and *Tetradymia canescens*. The relatively sparse herbaceous layer is a mixture of grasses and forbs. In stands with a relatively sparse mixed shrub layer (<25% total shrub cover), *Artemisia tridentata* needs to strongly dominate (have twice the cover of other short shrubs such as *Amelanchier* spp. and *Cercocarpus montanus*) to separate from similar associations.

DISTRIBUTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This association is relatively common and was observed and sampled northeast of the North Rim intersection with Black Canyon Road in the park, east of Red Creek Road, north of State Highway 92 above the Pine Creek dock, in the Soap Creek area, off Big Road near Coal Creek, in Dry Gulch, near the Lake Fork Bridge, near West Elk Creek on the west side of the arm, and near the mouth of the West Elk Arm in the recreation area.

Globally
This montane shrubland association occurs in mountains and plateaus of Utah and western Colorado.

ENVIRONMENTAL DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This tall shrubland association was observed on the midslopes of mesas, active slopes, slopes, and gulches, and in drainages. Sites are moderately steep to steep (11-71% slopes), occur between 2313 and 2506 m, and include all aspects. The unvegetated surface typically has high cover of litter and low to moderate cover by bedrock, large and small rocks, and exposures of bare ground. Downed wood is common and can be up to 10% cover. Soils are rapidly drained sandy loam, loamy sand, and gravelly loam derived from Mesozoic sandstones and shales reworked by landslides.

Globally
This shrubland association has been described from mountains and plateaus of Utah and western Colorado. Elevation ranges from 1830-2506 m (6000-8215 feet). Sites are on nearly level mesas to steep hillslopes (to 75%). Soils are rapidly drained sandy loam, loamy sand, and gravelly loams. There is typically high cover of litter and low to moderate cover by bedrock, large and small rocks, and bare ground.

VEGETATION DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This Gambel oak / big sagebrush tall-shrub association is relatively common within the park and recreation area. The total vegetation cover ranges from 50 to 155% in these moderately to densely vegetated stands. This shrubland association is characterized by an open to closed tall-shrub canopy, typically 2-5 m tall, of *Quercus gambelii* that ranges in cover from 15 to 65%. Three stands had sparse cover of the canopy tree *Juniperus scopulorum* that was 2-5 m tall. The shrub layer is variable in cover and composition. *Artemisia tridentata* (*ssp. vaseyana, ssp. wyomingensis*) is present in all stands, ranging in cover from 3 to 40%. Another tall shrub providing less than 5% cover is *Amelanchier utahensis*. Short and dwarf-shrubs can contribute moderate cover; species present in most stands include *Amelanchier utahensis, Artemisia tridentata ssp. vaseyana, Artemisia tridentata ssp. wyomingensis, Cercocarpus montanus, Chrysothamnus viscidiflorus, Purshia tridentata, Quercus gambelii*, and *Symphoricarpos rotundifolius*. The herbaceous layer is typically low in cover, but a diverse group of species can occur across stands. Common graminoids include *Achnatherum hymenoides, Achnatherum pinetorum, Carex geyeri, Elymus elymoides*, and *Poa fendleriana*. Forbs are diverse, but sparse in terms of cover, including *Achillea millefolium var. occidentalis, Astragalus drummondii, Ipomopsis aggregata*, and *Penstemon teucrioides*. Seedling shrubs provided sparse cover from a variety of species, including *Amelanchier alnifolia, Amelanchier utahensis, Artemisia tridentata ssp. wyomingensis, Chrysothamnus viscidiflorus, Quercus gambelii*, and *Purshia tridentata*. Cryptogams provide sparse cover, typically less than 5%.

Globally
This association is characterized by a moderately dense to dense (10-65% cover) tall-shrub layer (2-5 m tall) that is dominated by *Quercus gambelii*, with a sparse to moderately dense short-shrub layer dominated by *Artemisia tridentata*, often forming a mosaic of oak and sagebrush. Scattered *Juniperus scopulorum* trees may be present with low cover. If present, *Amelanchier* spp. and *Cercocarpus montanus* occur in minor amounts (<10% cover). Other shrubs that may be present include *Chrysothamnus viscidiflorus, Purshia tridentata, Opuntia* spp., *Rosa* spp., *Symphoricarpos* spp., and *Tetradymia canescens*. In stands with a relatively sparse mixed shrub layer (<25% total shrub cover), *Artemisia tridentata* needs to strongly dominate (have twice the cover of other short shrubs such as *Amelanchier* spp. and *Cercocarpus montanus*) to separate from similar associations. The relatively sparse herbaceous layer is a mixture of grasses and forbs. Graminoids commonly present are *Achnatherum hymenoides, Achnatherum pinetorum, Carex geyeri, Carex rossii, Elymus elymoides, Poa fendleriana, Pseudoroegneria spicata*, and *Sporobolus cryptandrus*. Common forbs include *Achillea millefolium, Artemisia ludoviciana, Astragalus drummondii, Penstemon teucrioides, Thalictrum fendleri*, or *Vicia americana*.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tall shrub/sapling	*Quercus gambelii*
Short shrub/sapling	*Chrysothamnus viscidiflorus*, *Symphoricarpos rotundifolius*
Short shrub/sapling	*Artemisia tridentata* ssp. *vaseyana*, *Artemisia tridentata* ssp. *wyomingensis*
Herb (field)	*Achnatherum hymenoides*, *Carex geyeri*, *Elymus elymoides*

Globally

Stratum	Species
Tall shrub/sapling	*Quercus gambelii*
Tall shrub/sapling	*Artemisia tridentata*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Vulnerable: *Penstemon teucrioides* (vulnerable, G2G3Q)

CONSERVATION STATUS RANK
Global Rank & Reasons: G4G5 (23-Feb-1994).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
This plant association is similar to other montane Gambel oak shrublands, except for the codominance of *Artemisia tridentata* with only minor amounts (<10% cover) of *Amelanchier utahensis* or *Cercocarpus montanus*. In stands with a relatively sparse mixed shrub layer (<25% total shrub cover), *Artemisia tridentata* needs to strongly dominate (have twice the cover of other short shrubs such as *Amelanchier* spp. and *Cercocarpus montanus*) to separate from similar associations.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Some stands are dense in terms of cover. One stand had a number of dead stems nearby, possibly from a fire.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on 2001 and 2002 field data (12 plots, 182 observation points): (Plots: BLCA.0040, CURE.0018, CURE.0027, CURE.0068, CURE.0074, CURE.0081, CURE.0101, CURE.0114, CURE.0154, CURE.0226, CURE.0280, CURE.0290. Observation Points: BLCA_AA.170, BLCA_AA.244, BLCA_AA.246, BLCA_AA.256, BLCA_AA.275, BLCA_AA.456, BLCA_AA.542, BLCA_AA.549, BLCA_AA.563, BLCA_AA.564, BLCA_AA.585, BLCA_AA.609, BLCA_AA.625, BLCA_AA.660, BLCA_AA.666, BLCA_AA.671, BLCA_AA.678, BLCA_AA.679, BLCA_AA.692, BLCA_AA.694, BLCA_AA.700, BLCA_AA.709, BLCA_AA.730, BLCA_AA.737, BLCA_AA.740, BLCA_AA.788, BLCA_AA.825, BLCA_AA.877, BLCA_AA.884, BLCA_AA.885, BLCA_AA.889, BLCA_AA.947, BLCA_AA.967, CURE_AA.0015, CURE_AA.0028, CURE_AA.0035, CURE_AA.0044, CURE_AA.0123, CURE_AA.0124, CURE_AA.0127, CURE_AA.0129, CURE_AA.0137, CURE_AA.0147, CURE_AA.0151, CURE_AA.0162, CURE_AA.0197, CURE_AA.0206, CURE_AA.0208, CURE_AA.0238, CURE_AA.0247, CURE_AA.0257, CURE_AA.0265, CURE_AA.0271, CURE_AA.0277, CURE_AA.0281, CURE_AA.0301, CURE_AA.0320, CURE_AA.0321, CURE_AA.0322, CURE_AA.0329, CURE_AA.0330, CURE_AA.0342, CURE_AA.0367, CURE_AA.0389, CURE_AA.0390, CURE_AA.0397, CURE_AA.0403, CURE_AA.0425, CURE_AA.0429, CURE_AA.0434, CURE_AA.0452, CURE_AA.0453, CURE_AA.0459, CURE_AA.0461, CURE_AA.0462, CURE_AA.0479, CURE_AA.0486, CURE_AA.0487, CURE_AA.0489, CURE_AA.0490, CURE_AA.0494, CURE_AA.0501, CURE_AA.0571, CURE_AA.0572, CURE_AA.0580, CURE_AA.0583, CURE_AA.0624, CURE_AA.0641, CURE_AA.0645, CURE_AA.0646, CURE_AA.0649, CURE_AA.0650, CURE_AA.0658, CURE_AA.0661, CURE_AA.0662, CURE_AA.0667, CURE_AA.0668, CURE_AA.0669, CURE_AA.0670, CURE_AA.0671, CURE_AA.0673, CURE_AA.0674, CURE_AA.0675, CURE_AA.0681, CURE_AA.0682, CURE_AA.0684, CURE_AA.0688, CURE_AA.0692, CURE_AA.0704, CURE_AA.0705, CURE_AA.0715, CURE_AA.0716, CURE_AA.0718, CURE_AA.0719, CURE_AA.0720, CURE_AA.0723, CURE_AA.0724, CURE_AA.0725, CURE_AA.0726, CURE_AA.0739, CURE_AA.0740, CURE_AA.0743, CURE_AA.0746, CURE_AA.0750, CURE_AA.0753, CURE_AA.0757, CURE_AA.0764, CURE_AA.0776, CURE_AA.0778, CURE_AA.0779, CURE_AA.0784, CURE_AA.0785, CURE_AA.0788, CURE_AA.0795, CURE_AA.0797, CURE_AA.0798, CURE_AA.0802, CURE_AA.0815, CURE_AA.0824, CURE_AA.0835, CURE_AA.0843, CURE_AA.0844, CURE_AA.0847, CURE_AA.0864, CURE_AA.0865, CURE_AA.0870, CURE_AA.0898, CURE_AA.0903, CURE_AA.0912, CURE_AA.0932, CURE_AA.0933, CURE_AA.0971, CURE_AA.0975, CURE_AA.0976, CURE_AA.0977, CURE_AA.0981, CURE_AA.0987, CURE_AA.0988, CURE_AA.0990, CURE_AA.0994, CURE_AA.0997, CURE_AA.0999, CURE_AA.1003, CURE_AA.1007, CURE_AA.1009, CURE_AA.1011, CURE_AA.1013, CURE_AA.1015, CURE_AA.1019, CURE_AA.1037, CURE_AA.1042, CURE_AA.1044, CURE_AA.1074, CURE_AA.1100, CURE_AA.1114, CURE_AA.1228, CURE_AA.1266, CURE_AA.1302, CURE_AA.1308, CURE_AA.1364, CURE_AA.1437, CURE_AA.1454).
Local Description Authors: J. Von Loh, mod. J. Coles

Global Description Authors: K.A. Schulz

REFERENCES: Blackhawk Coal Company 1981, Boucek 1986, Bourgeron and Engelking 1994, Bunting 1987, Christensen 1955, Clary 1992, Cogan et al. 2004, Driscoll et al. 1984, Everett 1987, Western Ecology Working Group n.d., Wright et al. 1979

Quercus gambelii / Carex geyeri Shrubland

Gambel Oak / Geyer's Sedge Shrubland

CODE	CEGL005995
PHYSIOGNOMIC CLASS	Shrubland (III)
PHYSIOGNOMIC SUBCLASS	Deciduous shrubland (III.B.)
PHYSIOGNOMIC GROUP	Cold-deciduous shrubland (III.B.2.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural cold-deciduous shrubland (III.B.2.N.)
FORMATION	Temperate cold-deciduous shrubland (III.B.2.N.a.)
ALLIANCE	*QUERCUS GAMBELII* SHRUBLAND ALLIANCE (A.920) Gambel Oak Shrubland Alliance

ECOLOGICAL SYSTEM(S): Rocky Mountain Gambel Oak-Mixed Montane Shrubland (CES306.818)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY

Globally

This tall shrubland association is known from the Black Canyon of the Gunnison National Park and Curecanti National Recreation Area where it was observed on the midslopes of canyons, hills, ridges, ridgetops, gullies, and lower slope hills. Sites are moderately steep to steep (3-43 degrees), occur between 2229 and 2698 m elevation, and include all aspects. The unvegetated surface has moderate to high cover of litter and bare soil and low to moderate cover of bedrock, large and small rocks. The vegetation is characterized by a moderately dense to dense tall-shrub layer (2-5 m tall) that is dominated by *Quercus gambelii* with a moderately dense to dense herbaceous layer dominated or codominated by *Carex geyeri*. Short shrubs are typically sparse and do not form a layer. Scattered trees (*Pseudotsuga menziesii, Juniperus osteosperma, Juniperus scopulorum*, and *Pinus edulis*) may be present with low cover. If *Amelanchier alnifolia, Amelanchier utahensis, Artemisia tridentata, Cercocarpus montanus, Prunus virginiana*, or *Symphoricarpos oreophilus* shrubs are present, they have low cover (<5% cover) in the short-shrub layer. Other scattered shrubs species may include *Fendlera rupicola, Mahonia repens, Philadelphus microphyllus, Ribes cereum*, and *Rosa woodsii*. The herbaceous layer is moderately dense to dense and characterizes the understory. *Poa fendleriana* is frequently present and often codominates with *Carex geyeri*. Other common species include graminoids, such as *Achnatherum hymenoides, Achnatherum pinetorum, Bromus porteri (= Bromus anomalus), Deschampsia caespitosa, Elymus elymoides*, and *Pleuraphis jamesii*, and forbs, including *Aquilegia* spp., *Balsamorhiza sagittata, Erigeron speciosus, Heterotheca villosa*, and *Lathyrus lanszwertii*.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association was observed and sampled at four sites on the North Rim of Black Canyon, including near Kneeling Camel and North Vista Trail. At Curecanti National Recreation Area, stands where sampled south of Morrow Point Reservoir, southeast of Hermit's Trailhead, southwest of Pioneer Point and south, north and west of State Highway 92.

Globally

This association is currently only known from the Black Canyon of the Gunnison National Park and Curecanti National Recreation Area in western Colorado. Global information is not available.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This tall shrubland association was observed on the midslopes of canyons, hills, ridges, ridgetops, gullies, and lower slope hills. Sites are moderately steep to steep (3-43 degrees), occur between 2229 and 2698 m elevation, and include all aspects. The unvegetated surface has moderate to high cover of litter and bare soil and low to moderate cover of bedrock, large and small rocks.

Globally
This association is only known from the Black Canyon of the Gunnison National Park and Curecanti National Recreation Area. Global information is not available.

VEGETATION DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This Gambel Oak / Geyer's sedge association is characterized by a moderately dense to dense tall-shrub layer (2-5 m tall) that is dominated by *Quercus gambelii* with a moderately dense to dense herbaceous layer dominated or codominated by *Carex geyeri*. Short shrubs are typically sparse and do not form a layer. Scattered trees (*Pseudotsuga menziesii, Juniperus osteosperma, Juniperus scopulorum*, and *Pinus edulis*) may be present with low cover. If *Amelanchier alnifolia, Amelanchier utahensis, Artemisia tridentata, Cercocarpus montanus, Prunus virginiana*, or *Symphoricarpos oreophilus* shrubs are present, they have low cover (<5% cover) in the short-shrub layer. Other scattered shrubs species may include *Fendlera rupicola, Mahonia repens, Philadelphus microphyllus, Ribes cereum*, and *Rosa woodsii*. The herbaceous layer is moderately dense to dense and characterizes the understory. *Poa fendleriana* is frequently present and often codominates with *Carex geyeri*. Other common species include graminoids, such as *Achnatherum hymenoides, Achnatherum pinetorum, Bromus porteri (= Bromus anomalus), Deschampsia caespitosa, Elymus elymoides*, and *Pleuraphis jamesii*, and forbs, including *Aquilegia* spp., *Balsamorhiza sagittata, Erigeron speciosus, Heterotheca villosa*, and *Lathyrus lanszwertii*. Introduced species such as *Bromus inermis* or *Poa pratensis* are frequently present.

Globally
This association is only known from the Black Canyon of the Gunnison National Park and Curecanti National Recreation Area. Global information is not available.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tall shrub/sapling	*Quercus gambelii*
Herb (field)	*Carex geyeri*, *Poa fendleriana*

Globally

Stratum	Species
Tall shrub/sapling	*Quercus gambelii*
Herb (field)	*Carex geyeri*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CONSERVATION STATUS RANK
Global Rank & Reasons: GNR (23-May-2007).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This provisional shrubland association is based on data from 16 accuracy assessment points from Black Canyon of the Gunnison National Park and Curecanti National Recreation Area in the Gunnison River Valley in western Colorado. More survey and classification work are needed to fully characterized the concept of this provisional type.

Globally
Data are not available.

CLASSIFICATION CONFIDENCE: 3 - Weak

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Data are not available.

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points:
The description is based on field data collected in 2004 during accuracy assessment (13 observation points): (Observation Points: BLCA_AA.271, BLCA_AA.719, BLCA_AA.724, BLCA_AA.729, CURE_AA.0422, CURE_AA.0460, CURE_AA.0513, CURE_AA.0570, CURE_AA.0648, CURE_AA.0702, CURE_AA.0830, CURE_AA.0862, CURE_AA.1452).
Local Description Authors: K.A. Schulz
Global Description Authors: K.A. Schulz

REFERENCES: Western Ecology Working Group n.d.

Quercus gambelii / Poa fendleriana Shrubland

Gambel Oak / Muttongrass Shrubland

CODE	CEGL002949
PHYSIOGNOMIC CLASS	Shrubland (III)
PHYSIOGNOMIC SUBCLASS	Deciduous shrubland (III.B.)
PHYSIOGNOMIC GROUP	Cold-deciduous shrubland (III.B.2.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural cold-deciduous shrubland (III.B.2.N.)
FORMATION	Temperate cold-deciduous shrubland (III.B.2.N.a.)
ALLIANCE	*QUERCUS GAMBELII* SHRUBLAND ALLIANCE (A.920) Gambel Oak Shrubland Alliance

ECOLOGICAL SYSTEM(S): Rocky Mountain Gambel Oak-Mixed Montane Shrubland (CES306.818)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY
Globally
This montane shrubland association has been described from the Colorado Plateau and the western slope of the southern Rocky Mountains. Elevation ranges from 1770-2337 m (5800-7660 feet). Sites are on nearly level mesas to steep hillslopes (to 59%). Soils are rapidly drained loamy sand and sandy loam derived from sandstones. There is typically high cover of litter and moderate cover of large rocks and bare ground. The vegetation is characterized by an open to moderately dense (10-65% cover) tall-shrub layer (2-5 m tall) that is dominated by *Quercus gambelii*. Other shrubs may be present with low cover and do not form a separate short-shrub layer (generally <10% total). Species include *Amelanchier utahensis, Artemisia tridentata ssp. wyomingensis, Purshia tridentata, Mahonia repens*, and *Symphoricarpos* spp. The herbaceous layer may be diverse and provides low to high cover depending on overstory canopy density. The bunchgrass *Poa fendleriana* is usually dominant (to 30% cover) and occurs consistently. Additional graminoids provide sparse to low cover, such as *Achnatherum hymenoides, Bouteloua gracilis, Carex geyeri*, and *Hesperostipa comata*. Forbs typically have low cover but may be diverse. Common forbs include *Arenaria* spp., *Artemisia ludoviciana, Eriogonum* spp., *Petradoria pumila*, and *Phlox austromontana*.

DISTRIBUTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This association was observed and sampled on the west side of the West Elk Arm of Blue Mesa Reservoir.

Globally
This montane shrubland association has been described from the Colorado Plateau and the western slope of the southern Rocky Mountains in southwestern Utah and west-central Colorado.

ENVIRONMENTAL DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This tall-shrub association was observed on the midslopes of a gulch. The site is steep (59% slope) and at 2337 m elevation. The unvegetated surface has a high cover of litter and moderate cover of large rocks. Exposure of bare soil is moderate. Downed wood is moderate, with up to 10% cover. The soil is a sandy loam derived from local sandstones.

Globally

This montane shrubland association has been described from the Colorado Plateau and the western slope of the southern Rocky Mountains. Elevation ranges from 1770-2337 m (5800-7660 feet). Sites are on nearly level mesas to steep hillslopes (to 59%). Soils are rapidly drained loamy sand and sandy loam derived from sandstones. There is typically high cover of litter and moderate cover of large rocks and bare ground.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This Gambel oak / muttongrass tall-shrub association is uncommon along the boundary between the park and recreation area. The total vegetation cover is around 65% in these moderately vegetated stands. This tall-shrub association is characterized by a relatively closed canopy, typically 1-5 m tall, of *Quercus gambelii* shrubs with up to 60% cover. The sampled stand has canopy *Juniperus scopulorum* trees that are 2-5 m tall and provide up to 5% cover. Additional shrubs provide low to moderate cover and include *Amelanchier utahensis, Artemisia tridentata ssp. wyomingensis, Purshia tridentata*, and *Mahonia repens.* The herbaceous layer is diverse and provides low to high cover depending on overstory canopy density. The herbaceous layer is characterized by the bunchgrass *Poa fendleriana* that contributes up to 25% cover. Additional graminoids provide sparse to low cover and include *Carex geyeri* and *Phlox austromontana*.

Globally

The vegetation is characterized by an open to moderately dense (10-65% cover) tall-shrub layer (2-5 m tall) that is dominated by *Quercus gambelii*. Other shrubs may be present with low cover and do not form a separate short-shrub layer (generally <10% total). Species include *Amelanchier utahensis, Artemisia tridentata ssp. wyomingensis, Purshia tridentata, Mahonia repens*, and *Symphoricarpos* spp. The herbaceous layer may be diverse and provides low to high cover depending on overstory canopy density. The bunchgrass *Poa fendleriana* is usually dominant (to 30% cover) and occurs consistently. Additional graminoids provide sparse to low cover, such as *Achnatherum hymenoides, Bouteloua gracilis, Carex geyeri*, and *Hesperostipa comata*. Forbs typically have low cover but may be diverse. Common forbs include *Arenaria fendleri, Arenaria macradenia, Artemisia ludoviciana, Eriogonum racemosum, Eriogonum umbellatum, Petradoria pumila*, and *Phlox austromontana*.

MOST ABUNDANT SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tall shrub/sapling	*Amelanchier utahensis*, *Quercus gambelii*
Short shrub/sapling	*Symphoricarpos rotundifolius*
Herb (field)	*Poa fendleriana*

Globally

Stratum	Species
Tall shrub/sapling	*Quercus gambelii*
Short shrub/sapling	*Symphoricarpos rotundifolius*
Herb (field)	*Poa fendleriana*

OTHER NOTEWORTHY SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Data are not available.

Globally

Data are not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: GNR (14-Aug-2001).

CLASSIFICATION COMMENTS

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Data are not available.

Globally

Data are not available.

CLASSIFICATION CONFIDENCE:

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Stands are mesic and dense. Graminoids dominate the understory.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (4 plots, 9 observation points): (Plots: BLCA.0039, CURE.0036, CURE.0091, CURE.0131. Observation Points: BLCA_AA.215, BLCA_AA.657, BLCA_AA.721, CURE_AA.0139, CURE_AA.0214, CURE_AA.0370, CURE_AA.0531, CURE_AA.0640, CURE_AA.0703).
Local Description Authors: J. Von Loh, mod. J. Coles
Global Description Authors: K.A. Schulz

REFERENCES: Cogan et al. 2004, Western Ecology Working Group n.d.

Quercus gambelii / Symphoricarpos oreophilus Shrubland

Gambel Oak / Mountain Snowberry Shrubland

CODE	CEGL001117
PHYSIOGNOMIC CLASS	Shrubland (III)
PHYSIOGNOMIC SUBCLASS	Deciduous shrubland (III.B.)
PHYSIOGNOMIC GROUP	Cold-deciduous shrubland (III.B.2.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural cold-deciduous shrubland (III.B.2.N.)
FORMATION	Temperate cold-deciduous shrubland (III.B.2.N.a.)
ALLIANCE	*QUERCUS GAMBELII* SHRUBLAND ALLIANCE (A.920) Gambel Oak Shrubland Alliance

ECOLOGICAL SYSTEM(S): Madrean Lower Montane Pine-Oak Forest and Woodland (CES305.796)
Rocky Mountain Gambel Oak-Mixed Montane Shrubland (CES306.818)
Southwestern Great Plains Canyon (CES303.664)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY
Globally
This shrubland association is found in foothills, plateaus and mountains from western Texas to southern and western Colorado and throughout southern Utah north into the Wasatch Range, and likely occurs in northern Arizona. It is a mesic upland and non-obligate riparian community. Some stands appear to be transitional between riparian areas and drier upland communities such as *Artemisia* spp. It occurs on cool, moist sites, such as along drainages in canyons and steep draws in more xeric areas, and as a mesic upland shrubland forming extensive stands on cooler northern slopes. Substrates are typically deep, well-drained sandy loam to clay loam derived from alluvium or colluvium. The vegetation is characterized by an open to closed, typically tall-shrub layer (2-5 m tall) that is dominated by *Quercus gambelii*. The understory is composed of a short-shrub layer that is dominated by *Symphoricarpos oreophilus* or a closely related local *Symphoricarpos* species such as *Symphoricarpos rotundifolius* or *Symphoricarpos palmeri*. Other mesic shrubs may be present, including *Amelanchier* spp., *Prunus virginiana, Robinia neomexicana*, and *Brickellia* sp. In some stands, the *Quercus gambelii* develop into small trees that form a tree canopy. These "woodlands" are included in this association because their floristic composition is identical to the tall shrublands. In other stands the oak is mostly under 2 m tall, forming a short-shrub layer. The herbaceous layer is sparse to moderately dense, depending on density of woody canopy, and is often dominated by graminoids, such as species of *Achnatherum, Bromus, Elymus, Poa*, and *Koeleria*. Common forbs include *Vicia americana, Thalictrum fendleri*, and *Achillea millefolium*. Occasionally, tree species are present in the overstory.

DISTRIBUTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This association is uncommon and was observed and sampled in Jones Draw in Black Canyon of the Gunnison National Park and in Long Gulch, south of Crystal Trail, and Crystal Trail across State Highway 92 from the parking area in Curecanti National Recreation Area.

Globally
This shrubland is reported from foothills, plateaus and mountains of western Texas to southern and western Colorado, southern Utah north into the Wasatch Range, and likely occurs in Arizona.

ENVIRONMENTAL DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This tall-shrub association was observed on the midslope of slopes, ridges, ravines, and shoulders of hills. Sites are moderately steep (30-51% slopes), occur between 2390 and 2745 m elevation, and include all aspects. The unvegetated surface has high cover of litter and low to moderate exposure of bare soil. Downed wood is common, up to 10% cover. Soils are rapidly drained sandy loams, silty loams, and silty clay loams derived from local sandstones, shales, and granite.

Globally
This shrubland is found in foothills, plateaus and mountains from western Texas to southern and western Colorado, throughout southern Utah north into the Wasatch Range, and likely occurs in northern Arizona. Elevation ranges from 1750-2745 m (6000-8600 feet). It is a mesic upland and non-obligate riparian community. Some stands appear to be transitional between riparian areas and drier upland communities such as *Artemisia* shrublands. It occurs on hills, high slopes, ridges, mesas, canyon rims, knolls and valley floors typically on cooler, moist sites at lower elevations, such as along drainages in canyons and steep draws in more xeric areas, and as a mesic upland shrubland forming extensive stands on cooler northern slopes. Higher-elevation stands occur on all aspects. Substrates are typically deep, well-drained sandy loam to silty clay loam derived from alluvium or colluvium. Parent materials include sandstone, shale, and granite conglomerate.

VEGETATION DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This Gambel oak / roundleaf snowberry association is uncommon along the eastern boundary of the park. The total vegetation cover ranges from 35 to 185% in these moderately to densely vegetated stands. This tall shrubland association is characterized by a closed canopy, typically 2-5 m tall, of *Quercus gambelii* shrubs that range in cover from 5 to 100%, and *Symphoricarpos rotundifolius* short shrubs that range in cover from <1 to 50%. In one stand *Quercus gambelii* is tree-like, with dbh measurements up to 20 cm and with cover to 65%. The short-shrub layer provides low to moderate cover and includes *Amelanchier utahensis, Artemisia tridentata ssp. vaseyana, Prunus virginiana*, and *Quercus gambelii*. The herbaceous layer provides low to high cover and is extremely diverse. Common graminoids include *Bromus porteri, Carex geyeri, Poa fendleriana*, and *Poa pratensis*. Forbs commonly present include *Achillea millefolium var. occidentalis, Balsamorhiza sagittata, Galium aparine, Lathyrus lanszwertii, Ligusticum porteri, Taraxacum officinale*, and *Wyethia amplexicaulis*. Seedling shrubs provide sparse cover and include *Rosa woodsii, Amelanchier alnifolia, Quercus gambelii*, and *Prunus virginiana*. Sparse cover is provided by cryptogams.

Globally
The vegetation is characterized by an open to closed, tall-shrub layer (2-5 m tall) that is dominated by *Quercus gambelii*. The understory is composed of a short-shrub layer that is dominated by *Symphoricarpos oreophilus* or a closely related local *Symphoricarpos* species such as *Symphoricarpos rotundifolius* or *Symphoricarpos palmeri*. Other shrubs may be present, including *Amelanchier* spp., *Artemisia nova, Artemisia tridentata, Chrysothamnus viscidiflorus, Ericameria nauseosa, Mahonia repens, Peraphyllum ramosissimum, Prunus virginiana, Purshia tridentata, Robinia neomexicana, Rosa woodsii*, and *Tetradymia canescens*. Occasionally, emergent trees such as *Pseudotsuga menziesii* or under canopy trees such as *Juniperus scopulorum* may be present. In some stands, *Quercus gambelii* develop into small trees that form a tree canopy. These "woodlands" are included in this association because their floristic composition is identical to the tall shrublands. In other stands, the oak is mostly under 2 m tall, forming a short-shrub layer. The herbaceous layer is sparse to moderately dense, depending on density of woody canopy, and is often dominated by graminoids, such as species of *Achnatherum, Bromus, Elymus, Poa, Pseudoroegneria spicata*, and *Koeleria macrantha*. Common forbs include *Achillea millefolium, Balsamorhiza sagittata, Chenopodium leptophyllum, Clematis ligusticifolia, Ligusticum porteri, Lupinus argenteus, Thalictrum fendleri*, and *Vicia americana*. Occasionally, tree species are present in the overstory, including *Pinus ponderosa, Juniperus scopulorum*, and *Pseudotsuga menziesii*. Introduced graminoids such as *Bromus inermis* and *Poa pratensis* are often common in stands that have been disturbed by heavy livestock grazing.

MOST ABUNDANT SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tree canopy	*Quercus gambelii*
Tall shrub/sapling	*Quercus gambelii*
Short shrub/sapling	*Amelanchier utahensis*, *Prunus virginiana*, *Quercus gambelii*, *Symphoricarpos rotundifolius*
Short shrub/sapling	*Artemisia tridentata* ssp. *vaseyana*
Herb (field)	*Achillea millefolium* var. *occidentalis*, *Balsamorhiza sagittata*, *Lathyrus lanszwertii*, *Wyethia amplexicaulis*
Herb (field)	*Carex geyeri*, *Poa fendleriana*, *Poa pratensis*

Globally

Stratum	Species
Tall shrub/sapling	*Quercus gambelii*
Tall shrub/sapling	*Symphoricarpos oreophilus*

OTHER NOTEWORTHY SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Exotic/Invasive: *Bromus inermis* (invasive, High/Medium), *Poa pratensis* (invasive, Medium)

CONSERVATION STATUS RANK

Global Rank & Reasons: G5 (23-Feb-1994).

CLASSIFICATION COMMENTS

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
This plant association is similar to other montane Gambel oak shrublands except for the codominance of *Symphoricarpos oreophilus* with only minor amounts (<10% cover) of *Amelanchier utahensis, Artemisia tridentata*, or *Cercocarpus montanus*.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Some Gambel oak stands are tree-like, to 20 cm dbh. Stands are often grazed by cattle.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (4 plots, 44 observation points): (Plots: BLCA.0138, CURE.0113, CURE.0264, CURE.0292. Observation Points: BLCA_AA.211, BLCA_AA.219, BLCA_AA.233, BLCA_AA.235, BLCA_AA.237, BLCA_AA.250, BLCA_AA.253, BLCA_AA.258, BLCA_AA.347, BLCA_AA.353, BLCA_AA.371, BLCA_AA.421, BLCA_AA.422, BLCA_AA.426, BLCA_AA.432, BLCA_AA.433, BLCA_AA.457, BLCA_AA.484, BLCA_AA.520, BLCA_AA.566, BLCA_AA.582, BLCA_AA.586, BLCA_AA.695, BLCA_AA.701, BLCA_AA.883, BLCA_AA.888, BLCA_AA.968, BLCA_AA.969, BLCA_AA.970, BLCA_AA.971, BLCA_AA.980, BLCA_AA.981, CURE_AA.0110, CURE_AA.0114, CURE_AA.0117, CURE_AA.0230, CURE_AA.0299, CURE_AA.0530, CURE_AA.0590, CURE_AA.0602, CURE_AA.0618, CURE_AA.0632, CURE_AA.0642, CURE_AA.1251).
Local Description Authors: J. Von Loh, mod. J. Coles
Global Description Authors: K.A. Schulz, mod. J. Coles

REFERENCES: Baker 1982b, Bourgeron and Engelking 1994, CONHP unpubl. data 2003, Clary 1992, Cogan et al. 2004, Crane 1982, Driscoll et al. 1984, Erdman 1962, Hess and Wasser 1982, Hoffman and Alexander 1980, Hoffman and Alexander 1983, Johnston 1987, Kittel et al. 1994, Kittel et al. 1999a, Kittel et al. 1999b, Komarkova

et al. 1988a, Muldavin 1994, Muldavin and Mehlhop 1992, Muldavin et al. 1994a, Muldavin et al. 1998b, Muldavin et al. 2000b, Soil Conservation Service 1978, Western Ecology Working Group n.d., Wright et al. 1979

Sarcobatus vermiculatus Disturbed Shrubland

Greasewood Disturbed Shrubland

CODE	CEGL001357
PHYSIOGNOMIC CLASS	Shrubland (III)
PHYSIOGNOMIC SUBCLASS	Deciduous shrubland (III.B.)
PHYSIOGNOMIC GROUP	Extremely xeromorphic deciduous shrubland (III.B.3.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural extremely xeromorphic deciduous shrubland (III.B.3.N.)
FORMATION	Intermittently flooded extremely xeromorphic deciduous subdesert shrubland (III.B.3.N.b.)
ALLIANCE	*SARCOBATUS VERMICULATUS* INTERMITTENTLY FLOODED SHRUBLAND ALLIANCE (A.1046) Greasewood Intermittently Flooded Shrubland Alliance

ECOLOGICAL SYSTEM(S): Inter-Mountain Basins Greasewood Flat (CES304.780)
Inter-Mountain Basins Wash (CES304.781)
Inter-Mountain Basins Playa (CES304.786)

USFWS WETLAND SYSTEM: Palustrine

CONCEPT SUMMARY

Globally

This greasewood shrubland occurs on saline soils of terraces, swales, alluvial fans and flats, valley floors, playas, toeslopes and ridges throughout the Colorado Plateau and Great Basin and extends to mountain valleys in the southern Rocky Mountains. It is distinguished from other *Sarcobatus vermiculatus* associations in that disturbance has removed most or all of the native herbaceous understory. Black greasewood will increase in density at the expense of grasses such as *Sporobolus airoides* under conditions of heavy grazing, since the shrub is only moderately palatable and is somewhat poisonous to livestock. Soil textures in these communities range from sandy loam to silty clay and may have a white salt crust on the soil surface. *Sarcobatus vermiculatus* dominates the sparse to moderately dense shrub layer, usually with a minor component of *Ericameria nauseosa, Suaeda moquinii (= Suaeda torreyana), Opuntia polyacantha, Atriplex canescens*, or *Atriplex confertifolia*. If *Artemisia tridentata* is present, it is with very low cover. The understory ranges from sparse to dense in cover, but native species typically have very low cover. The dominant herbaceous species tend to be weedy and/or exotic; *Vulpia octoflora, Bromus tectorum, Descurainia pinnata, Salsola tragus, Alyssum desertorum*, and *Halogeton glomeratus* are typical understory species.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This vegetation type was observed and sampled on private land adjacent to State Highway 50 and was observed in a drainage inside park boundaries near the Red Rocks area.

Globally

This association is likely to be widespread on floodplains and valley floors throughout the interior western United States. It is currently documented from the Colorado Plateau, Great Basin, Uinta Basin and San Luis Valley from northwestern New Mexico, southern and western Colorado, Utah, Nevada, and eastern California.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This shrubland association was observed on an alkaline terrace near and on private land and in a narrow drainage and adjacent slope near Red Rocks. The site is moderately steep (8% slope), occurs at 1869 m elevation, and has a southwestern aspect. The unvegetated surface has high cover of litter and moderate exposure of bare soil. The underlying geology is Mancos shale that erodes into badlands and fine alluvial deposits. Soils are rapidly drained clays.

Globally
This widespread but patchy shrubland occurs throughout the Colorado Plateau and Great Basin and extends to mountain valleys in the southern Rocky Mountains. Stands are found on terraces, swales, coppice dunes, playas, alluvial fans and flats, valley floors, toeslopes and ridges. Elevation ranges between 1200 and 2308 m (3940-7570 feet), and slopes tend to be gentle. Soils are typically derived from mixed alluvium (shale, sandstone and gneiss), from shale that erodes into moderate to steep gullies and slopes (badlands), or from eolian deposits. Soil textures range from sand to silty clay and tend to be alkaline and saline, often with a white salt crust on the soil surface. Sabkha substrates (carbonate cemented sand) occur on subirrigated areas near dunes in southern Colorado. Biological soil crusts are typically absent or provide low cover, but occasionally have higher (up to 25%) cover . Bare ground values tend to be high, up to 80%, unless *Bromus tectorum* is a major component of the system, in which case litter cover values are high.

VEGETATION DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This shrubland association is rare and distributed as a stand on the edge of the project area and a patch inside park boundaries. The total vegetation cover is 35% in this moderately vegetated stand. This shrubland association is characterized by an open tall- and short-shrub canopy of *Sarcobatus vermiculatus* that ranges in cover between 5 to 25% and 1 to 5% per strata, respectively. The dwarf-shrub *Opuntia polyacantha* provides sparse cover. Herbaceous species are sparse in terms of cover and species composition. The exotic annual grass *Bromus tectorum* provides up to 5% cover. Forbs are also exotic annuals providing low cover and include *Descurainia pinnata* and *Erodium cicutarium*. Lichens provide sparse cover.

Globally
This shrubland occurs where conditions support *Sarcobatus vermiculatus*, but disturbance has removed most or all of the native herbaceous understory. *Sarcobatus vermiculatus* dominates the sparse to moderately dense shrub layer with a cover of 10-60%. Other shrubs commonly present may include *Atriplex canescens, Atriplex confertifolia, Atriplex gardneri, Chrysothamnus viscidiflorus, Ericameria nauseosa, Grayia spinosa, Opuntia polyacantha, Picrothamnus desertorum, Suaeda moquinii (= Suaeda torreyana)*, and *Tetradymia canescens*. If *Artemisia tridentata* is present, it is with very low cover. The understory ranges from sparse to dense in cover, but native species typically have very low cover. The dominant herbaceous species tend to be weedy and/or exotic; *Vulpia octoflora, Bromus tectorum, Descurainia pinnata, Erodium cicutarium, Salsola tragus, Alyssum desertorum*, and *Halogeton glomeratus* are typical understory dominants.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Short shrub/sapling	*Sarcobatus vermiculatus*
Herb (field)	*Erodium cicutarium*
Herb (field)	*Bromus tectorum*

Globally

Stratum	Species
Short shrub/sapling	*Sarcobatus vermiculatus*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Exotic/Invasive: *Alyssum desertorum* (exotic), *Bromus tectorum* (exotic, High), *Descurainia pinnata* (weedy native), *Erodium cicutarium* (exotic, Medium/Low), *Halogeton glomeratus* (exotic, High/Medium), *Salsola tragus* (exotic)

CONSERVATION STATUS RANK
Global Rank & Reasons: G5 (23-Feb-1994).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Data are not available.

Globally
Stands included in this association are often affected by livestock grazing, and either lack an understory or possess an understory dominated by weedy or exotic herbaceous species.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Sampled stand occupies private land and is grazed. Occurs on the edge of the project environs. Soils are very alkaline.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (1 plot, 6 observation points): (Plot: BLCA.0122. Observation Points: BLCA_AA.392, BLCA_AA.399, BLCA_AA.583, BLCA_AA.584, BLCA_AA.587, BLCA_AA.588).
Local Description Authors: J. Von Loh, mod. J. Coles
Global Description Authors: J. Coles, mod. K.A. Schulz

REFERENCES: Bourgeron and Engelking 1994, Brotherson et al. 1986, Dastrup 1963, Donovan et al. 1996, Driscoll et al. 1984, Francis 1986, Ganskopp 1986, Graham 1937, Groeneveld and Crowley 1988, Salas et al. 2009, Shantz and Piemeisel 1940, Western Ecology Working Group n.d., Young et al. 1986

Krascheninnikovia lanata / Achnatherum hymenoides Dwarf-shrubland

Winterfat / Indian Ricegrass Dwarf-shrubland

CODE	CEGL001323
PHYSIOGNOMIC CLASS	Dwarf-shrubland (IV)
PHYSIOGNOMIC SUBCLASS	Evergreen dwarf-shrubland (IV.A.)
PHYSIOGNOMIC GROUP	Extremely xeromorphic evergreen dwarf-shrubland (IV.A.2.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural extremely xeromorphic evergreen dwarf-shrubland (IV.A.2.N.)
FORMATION	Extremely xeromorphic evergreen subdesert dwarf-shrubland (IV.A.2.N.a.)
ALLIANCE	*KRASCHENINNIKOVIA LANATA* DWARF-SHRUBLAND ALLIANCE (A.1104) Winterfat Dwarf-shrubland Alliance

ECOLOGICAL SYSTEM(S): Inter-Mountain Basins Mixed Salt Desert Scrub (CES304.784)

USFWS WETLAND SYSTEM: Palustrine

CONCEPT SUMMARY
Globally
This dwarf-shrubland occurs in the Great Basin, western and southern Colorado and western Wyoming. Sites include gently sloping valley bottoms and toeslopes, and steep, shaly windswept ridges. Soils are shallow, rapidly drained sandy loam to silty clay loam derived from alluvium and shale. The ground surface has moderate to high cover (40-85%) of bare soil; gravel cover is variable. This vegetation is characterized by an open to moderately dense (to 25% cover) dwarf-shrub canopy dominated by *Krascheninnikovia lanata*, with the medium-tall bunchgrass *Achnatherum hymenoides* in the understory. The dwarf-shrub layer is low in diversity. Other dwarf-shrubs may include *Artemisia tridentata ssp. wyomingensis, Atriplex canescens, Ericameria parryi*, and *Grayia spinosa*. Herbaceous vegetation is typically patchy and sparse, but may form an open to moderately dense herbaceous layer with low species diversity. *Achnatherum hymenoides* is a constant species with up to 10% cover. Other common species include *Elymus elymoides, Pascopyrum smithii, Pleuraphis jamesii*, and a variety of native forbs such as *Chenopodium* sp., *Eriogonum* spp., *Eriophyllum pringlei, Mentzelia multiflora, Opuntia polyacantha, Phacelia* sp., and *Sphaeralcea coccinea*. Introduced species *Bromus inermis, Bromus tectorum, Halogeton glomeratus*, and *Salsola tragus* are common in disturbed sites.

DISTRIBUTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This association is rare in the recreation area and was sampled in the Cimarron area east of the Visitor Center in Curecanti National Recreation Area.

Globally
This dwarf-shrubland is reported from the San Luis Valley and Western Slope in the southern Rocky Mountains, the northern Great Basin and western Wyoming. It likely is more widespread in the intermountain western U.S.

ENVIRONMENTAL DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This dwarf-shrub association occurs on a slope on an eroded ridge. The site is steep (40% slope), occurs at 2161 m elevation, and is oriented to the west. Parent materials are Morrison Formation shale. Soils are rapidly drained silty clay loams.

Globally
This dwarf-shrubland occurs in the Great Basin, western and southern Colorado and western Wyoming. Sites include gently sloping valley bottoms and toeslopes, and steep, shaly windswept ridges. Soils are shallow, sandy or silty clay loams, or less often loamy sand. Parent materials are alluvium and shale often derived from the Morrison or Wasatch formations. The ground surface has moderate to high cover (40-85%) of bare soil (Blackburn et al. 1968c, 1969c). Gravel cover is variable.

VEGETATION DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This winter-fat / Indian ricegrass dwarf-shrubland is rare within the recreation area. The total vegetation cover is up to 30% in this sparsely to moderately vegetated stand. *Krascheninnikovia lanata* forms an open canopy and provides up to 25% cover, and the medium-tall bunchgrass *Achnatherum hymenoides* provides up to 5% cover. The dwarf-shrub layer is low in diversity and provides low to moderate cover. Other dwarf-shrubs include *Artemisia tridentata ssp. wyomingensis, Atriplex canescens*, and *Ericameria parryi*. The herbaceous layer is low in species diversity and provides low cover. Additional grasses provide sparse cover and include the non-natives *Bromus inermis* and *Bromus tectorum* and the natives *Elymus elymoides* and *Pascopyrum smithii*. Forbs are low in diversity and provide sparse cover, including *Almutaster pauciflorus, Androsace septentrionalis*, and *Eriogonum lonchophyllum*.

Globally
This vegetation is characterized by an open to moderately dense (to 25% cover) dwarf-shrub canopy dominated by *Krascheninnikovia lanata*, with the medium-tall bunchgrass *Achnatherum hymenoides* in the understory. The dwarf-shrub layer is variable but generally low in diversity. Other dwarf-shrubs may include *Artemisia dracunculus, Artemisia frigida, Artemisia tridentata ssp. wyomingensis, Atriplex canescens, Atriplex confertifolia, Chrysothamnus viscidiflorus, Ericameria nauseosa, Ericameria parryi*, and *Grayia spinosa*. Herbaceous vegetation is typically patchy and sparse, but may form an open to moderately dense herbaceous layer with low species diversity . *Achnatherum hymenoides* is a constant species with up to 10% cover. Other species present with low cover may include other grasses such as *Bouteloua gracilis, Elymus elymoides, Elymus lanceolatus, Hesperostipa comata, Pascopyrum smithii, Pleuraphis jamesii, Poa secunda*, and *Pseudoroegneria spicata*, and forbs *Almutaster pauciflorus, Androsace septentrionalis, Astragalus jejunus, Astragalus spatulatus, Chenopodium leptophyllum, Eriogonum brevicaule, Eriogonum lonchophyllum, Eriophyllum pringlei, Machaeranthera canescens, Mentzelia multiflora, Opuntia polyacantha, Phacelia* sp., *Phlox hoodii, Pteryxia terebinthina (= Cymopterus terebinthinus)*, and *Sphaeralcea coccinea*. Introduced species *Bromus inermis, Bromus tectorum, Halogeton glomeratus*, and *Salsola tragus* are common in disturbed sites.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Short shrub/sapling	*Atriplex canescens*, *Ericameria parryi*, *Krascheninnikovia lanata*
Herb (field)	*Almutaster pauciflorus*
Herb (field)	*Achnatherum hymenoides*, *Pascopyrum smithii*

Globally

Stratum	Species
Short shrub/sapling	*Krascheninnikovia lanata*
Herb (field)	*Achnatherum hymenoides*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Exotic/Invasive: *Bromus inermis* (exotic, High/Medium), *Bromus tectorum* (exotic, High)

Globally
Exotic/Invasive: *Bromus inermis* (exotic, High/Medium), *Bromus tectorum* (exotic, High), *Halogeton glomeratus* (exotic, High/Medium), *Salsola tragus* (exotic)

CONSERVATION STATUS RANK
Global Rank & Reasons: G4 (23-Feb-1994).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Sampled site occupies a disturbed area above State Highway 50. Further quantitative plots are needed to define this association locally.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (1 plot, 7 observation points): (Plot: CURE.0070. Observation Points: BLCA_AA.707, BLCA_AA.710, CURE_AA.0185, CURE_AA.0553, CURE_AA.0860, CURE_AA.0872, CURE_AA.0884).
Local Description Authors: J. Von Loh, mod. G. Bradshaw
Global Description Authors: K.A. Schulz

REFERENCES: Baker 1984a, Blackburn et al. 1968c, Blackburn et al. 1969c, Bourgeron and Engelking 1994, CONHP unpubl. data 2003, Daubenmire 1970, DeVelice et al. 1995, Driscoll et al. 1984, Fautin 1946, Francis 1986, Soil Conservation Service 1978, Western Ecology Working Group n.d.

Atriplex corrugata Dwarf-shrubland

Mat Saltbush Dwarf-shrubland

CODE	CEGL001437
PHYSIOGNOMIC CLASS	Dwarf-shrubland (IV)
PHYSIOGNOMIC SUBCLASS	Evergreen dwarf-shrubland (IV.A.)
PHYSIOGNOMIC GROUP	Extremely xeromorphic evergreen dwarf-shrubland (IV.A.2.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural extremely xeromorphic evergreen dwarf-shrubland (IV.A.2.N.)
FORMATION	Facultatively deciduous subdesert dwarf-shrubland (IV.A.2.N.b.)
ALLIANCE	*ATRIPLEX CORRUGATA* DWARF-SHRUBLAND ALLIANCE (A.1109) Mat Saltbush Dwarf-shrubland Alliance

ECOLOGICAL SYSTEM(S): Inter-Mountain Basins Mat Saltbush Shrubland (CES304.783)
Inter-Mountain Basins Shale Badland (CES304.789)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY
Globally
This dwarf-shrubland association is found on lower hillslopes, clay barrens and alkaline flats on Colorado Plateau portions of northwestern New Mexico, western Colorado and Utah. Sites are gently sloping to moderately steep ridges and hills shaped into badlands by water and wind erosion. Soils are typically derived from Mancos shale or other marine shales. They are moderately deep, strongly saline, moderately alkaline, fine-textured (clayey), poorly developed and typically have high erosion rates. The soil surface is mostly barren. The vegetation is characterized

by a very sparse to moderate cover (5-25%) of woody vegetation that is dominated by the halophytic evergreen dwarf-shrub *Atriplex corrugata*. There is typically very low species diversity, but depending on soil salinity and moisture, other plants may be present, including the shrubs *Atriplex gardneri, Atriplex confertifolia, Tetradymia spinosa, Picrothamnus desertorum (= Artemisia spinescens), Suaeda calceoliformis (= Suaeda depressa)*, and *Krascheninnikovia lanata*. The herbaceous layer is very sparse. Only scattered perennial forbs, such as *Xylorhiza glabriuscula, Xylorhiza venusta*, and *Sphaeralcea grossulariifolia*, and the perennial grasses *Achnatherum hymenoides (= Oryzopsis hymenoides), Elymus elymoides*, and *Pleuraphis jamesii* have been reported. Annuals are seasonally present and may include *Eriogonum inflatum, Phacelia splendens, Plantago tweedyi*, and *Atriplex argentea*. Introduced species such as *Bromus tectorum* and *Salsola kali* are often present.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This association is absent from or rare in the park and was observed and sampled on the Mancos Shale Formation west of Red Rocks on BLM-managed lands.

Globally
Shrublands in this association are found on lower hillslopes and alkaline flats on Colorado Plateau portions of northwestern New Mexico, western Colorado and eastern Utah.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This dwarf-shrub association was observed on the midslopes to high slopes of badland ridges on the west side of the park. Sites are moderately steep to steep (14-45% slopes), occur between 1903 and 1973 m elevation, and consistently occupy southwestern aspects. The unvegetated surface has high exposure of bare soil and sparse cover by litter and gravel. Soils are rapidly drained clay, silty clay, or silty clay loam.

Globally
This dwarf-shrubland association is found on lower hillslopes, clay barrens and alkaline flats on Colorado Plateau portions of northwestern New Mexico, western Colorado and eastern Utah. Climate is semi-arid with most of the highly variable precipitation falling in July and August as high-intensity thunderstorms. Mean annual precipitation is approximately 23 cm. Elevation ranges from 1300-1975 m (4265-6480 feet). Sites are gently sloping to moderately steep ridges and hills shaped into badlands by water and wind erosion. Soils are typically derived from Mancos shale or, less often, from other Paleozoic or Mesozoic marine shales. They are moderately deep, strongly saline, moderately alkaline, fine-textured (clayey), poorly developed and typically have high erosion rates. The soil surface is mostly barren. In the Badger Wash Basin in Colorado, a relatively lush stand had 25% *Atriplex corrugata*, 60% bare ground, 8% litter and 8% algal crusts (Branson et al. 1976).

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This sparse mat saltbush dwarf-shrubland is rare in the park. The total vegetation cover ranges from 7 to 25% in these frequently sparse to moderately vegetated stands. This dwarf-shrub association is characterized by a sparse ground-hugging canopy of *Atriplex corrugata* that ranges in cover from 4 to 13%. This association is generally species-poor, averaging five species per plot, but with differing composition among sampling sites. Additional dwarf-shrubs present that provide sparse cover include *Gutierrezia sarothrae* and *Xylorhiza venusta*. The herbaceous layer is somewhat diverse and typically sparse, usually less than 1% total cover, but rarely attaining 10% cover on the highest elevation sites. Forbs provide sparse cover and include *Allium textile, Cymopterus purpureus, Eriogonum gordonii, Lappula occidentalis, Oenothera caespitosa, Phacelia constancei*, and *Stanleya albescens*.

Globally
These shrublands are found on the slopes of marine shale badlands and alkaline flats on the Colorado Plateau. Stands have very sparse to moderate cover (1-25%) of woody vegetation that is dominated by the halophytic evergreen dwarf-shrub *Atriplex corrugata*. Sparse stands are often solely dominated by this plant. Stands typically have very low species diversity. Depending on soil salinity and moisture, other plants may be present, including the shrubs *Atriplex gardneri, Atriplex confertifolia, Tetradymia spinosa, Gutierrezia sarothrae, Picrothamnus desertorum (= Artemisia spinescens), Suaeda calceoliformis (= Suaeda depressa)*, and *Krascheninnikovia lanata*. The herbaceous layer is very sparse. Scattered perennial forbs, such as *Xylorhiza glabriuscula, Xylorhiza venusta*, and *Sphaeralcea grossulariifolia*, and the perennial grasses *Achnatherum hymenoides (= Oryzopsis hymenoides),*

Aristida purpurea, Elymus elymoides, and *Pleuraphis jamesii* have been reported. Annuals are seasonally present and may include *Eriogonum inflatum, Phacelia splendens, Plantago tweedyi, Stenogonum salsuginosum*, and *Atriplex argentea*. Introduced species include *Bromus tectorum, Halogeton glomeratus, Malcolmia africana*, and *Salsola kali*. Perennial plants may be pedestalled because of high erosion on these sites.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Short shrub/sapling	*Atriplex corrugata*
Herb (field)	*Cymopterus purpureus*, *Xylorhiza venusta*

Globally

Stratum	Species
Short shrub/sapling	*Atriplex corrugata*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Exotic/Invasive: *Bromus tectorum* (exotic, High), *Malcolmia africana* (exotic)

CONSERVATION STATUS RANK
Global Rank & Reasons: G5 (23-Feb-1994).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Vegetation cover in this association may vary greatly depending on soil chemistry and slope. Some stands should be classified as shrublands with 25-30% shrub cover (Branson et al. 1976, Potter et al. 1985). However, most stands are in the 3-20% shrub cover range and should be classified in a sparsely vegetated alliance (West and Ibrahim 1968, Ibrahim et al. 1972, Harper and Jaynes 1986, Von Loh 2000). Further investigation is needed throughout its range to resolve this issue. *Atriplex corrugata* also occurs an as element in mat saltbush shrublands dominated by other species of *Atriplex* (e.g., *Atriplex gardneri* (including *Atriplex cuneata*) and *Atriplex confertifolia*). It is not always clear in the field where to draw the line between these three classes of mat saltbush shrublands, as the mix of the three species may change with small changes in slope, soil texture, topographic position and aspect.

CLASSIFICATION CONFIDENCE: 1 - Strong

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: More quantitative data would be useful in determining the locally characteristic species of this association. It is possible that two associations could emerge, given that the highest elevation plot (BLCA.0091) has a completely different species composition than the other two plots.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (3 plots, 1 observation point): (Plots: BLCA.0085, BLCA.0091, BLCA.0126. Observation Point: BLCA_AA.356).
Local Description Authors: G. Bradshaw, mod. J. Coles
Global Description Authors: K.A. Schulz, mod. J. Coles

REFERENCES: Baker 1984a, Bourgeron and Engelking 1994, Branson 1966, Branson et al. 1967, Branson et al. 1976, CONHP unpubl. data 2003, Collins 1984, Dastrup 1963, Driscoll et al. 1984, Graham 1937, Harper and Jaynes 1986, Ibrahim et al. 1972, Lusby et al. 1963, Potter et al. 1985, Romme et al. 1993, Shantz 1925, Shute and West 1978, Tuhy and MacMahon 1988, U.S. Bureau of Reclamation 1976, Von Loh 2000, Welsh 1957, West and Ibrahim 1968, Western Ecology Working Group n.d.

Atriplex gardneri Dwarf-shrubland

Gardner's Saltbush Dwarf-shrubland

CODE	CEGL001438
PHYSIOGNOMIC CLASS	Dwarf-shrubland (IV)
PHYSIOGNOMIC SUBCLASS	Evergreen dwarf-shrubland (IV.A.)
PHYSIOGNOMIC GROUP	Extremely xeromorphic evergreen dwarf-shrubland (IV.A.2.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural extremely xeromorphic evergreen dwarf-shrubland (IV.A.2.N.)
FORMATION	Facultatively deciduous subdesert dwarf-shrubland (IV.A.2.N.b.)
ALLIANCE	*ATRIPLEX GARDNERI* DWARF-SHRUBLAND ALLIANCE (A.1110) Gardner's Saltbush Dwarf-shrubland Alliance

ECOLOGICAL SYSTEM(S): Inter-Mountain Basins Mat Saltbush Shrubland (CES304.783)
Inter-Mountain Basins Shale Badland (CES304.789)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY

Globally

This dwarf-shrubland association is reported from northern and eastern Utah, western Colorado, Wyoming and Montana. Sites are flat to steep (58%). Soils are calcareous, alkaline, and typically saline and fine-textured. One site has a gravelly/cobbly substrate. Total vegetation cover is generally sparse, rarely exceeding 15%. The vegetation is composed solely of or dominated by *Atriplex gardneri* without an herbaceous layer. Associated shrubs may include minor cover of *Atriplex confertifolia, Atriplex corrugata, Chrysothamnus viscidiflorus, Ephedra torreyana, Eriogonum corymbosum, Gutierrezia sarothrae, Picrothamnus desertorum, Sarcobatus vermiculatus*, and/or *Tetradymia spinosa*. No herbaceous layer is reported, though scattered grasses such as *Achnatherum hymenoides, Pleuraphis jamesii (= Hilaria jamesii)*, and *Elymus elymoides* may be present. Invasive species such as *Bromus tectorum, Halogeton glomeratus*, and *Malcolmia africana* are present in some stands. Biological soil crusts may cover up to 50% of the ground surface. The dominance of *Atriplex gardneri* and the lack of a significant herbaceous layer are diagnostic of this association.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association is absent from or rare in the park and was observed and sampled west of Red Rocks on BLM-managed badlands formations.

Globally

This dwarf-shrubland association is reported from northern and eastern Utah, western Colorado, Wyoming and Montana, but likely has a wider distribution in the interior West. *Atriplex gardneri* is common on shales that cover large areas of the Colorado Plateau, such as the Moenkopi, Mancos, Wasatch, and Morrison formations.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This dwarf-shrub association was observed on the midslopes of badland ridges and hills. The site is steep (58% slope), occurs at 1901 m elevation, and is oriented to a southwestern aspect. The unvegetated surface has high exposure of bare soil, moderate cover of gravel, and sparse litter. Soils are rapidly drained clays derived from Mancos shale.

Globally

This dwarf-shrubland association is reported from northern and eastern Utah, western Colorado, Wyoming and Montana. Elevation ranges from 1196-2101 m. Climate is temperate and semi-arid. In Utah stands occur in Curlew Valley, a dry Pleistocene lakebed north of the Great Salt Lake, and alluvial fans and hillsides along the Green River and slopes of badland ridges and canyonsides, colluvial slopes, ridges, hills, badlands, mesas, and benches along the Colorado River. Sites are flat to steep (58%). Soils are calcareous, alkaline, and typically saline and fine-textured, often derived from alluvium or shale from Chinle, Moenkopi, Mancos, Morrison, and Wasatch formations. One site has a gravelly/cobbly substrate. Bare soil covers much of the unvegetated surface.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This Gardner's saltbush dwarf-shrubland was rarely observed in the badlands west of the park. The total vegetation cover on one site was 1% under drought conditions. This sparse dwarf-shrub association is characterized by widely spaced, ground-hugging *Atriplex gardneri* and *Atriplex confertifolia* dwarf-shrubs each providing less than 1% cover.

Globally
This association is broadly defined as a dwarf-shrubland composed solely of or dominated by *Atriplex gardneri* without a herbaceous layer. Total vegetation cover is generally sparse, rarely exceeding 15%, and sometimes as low as 1% or as high as 35%. Associated shrubs may include scattered *Artemisia arbuscula ssp. longiloba, Artemisia tridentata ssp. wyomingensis, Atriplex confertifolia, Atriplex corrugata, Chrysothamnus viscidiflorus, Ephedra torreyana, Eriogonum corymbosum, Gutierrezia sarothrae, Krascheninnikovia lanata, Picrothamnus desertorum, Sarcobatus vermiculatus*, and/or *Tetradymia spinosa*. No herbaceous layer is reported, though scattered clumps of grass such as *Achnatherum hymenoides, Pleuraphis jamesii (= Hilaria jamesii)*, and *Elymus elymoides* or occasional *Eriogonum inflatum* may be present. Invasive species such as *Agropyron cristatum, Bromus tectorum, Ceratocephala testiculata (= Ranunculus testiculatus), Halogeton glomeratus*, and *Malcolmia africana* are present in some stands. Biological soil crusts may cover up to 50% of the ground surface; those stands that are protected from grazing are advanced in development and include *Collema* sp., *Fulgensia* sp., *Psora* sp., mosses, and dark cyanobacteria. The dominance of *Atriplex gardneri* and the lack of a significant herbaceous layer are diagnostic of this association.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Short shrub/sapling	*Atriplex gardneri*

Globally

Stratum	Species
Short shrub/sapling	*Atriplex gardneri*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Exotic/Invasive: *Agropyron cristatum* (invasive, Medium/Low), *Bromus tectorum* (invasive, High), *Ceratocephala testiculata* (invasive), *Halogeton glomeratus* (invasive, High/Medium), *Malcolmia africana* (invasive)

CONSERVATION STATUS RANK
Global Rank & Reasons: G3G5 (23-Feb-1994).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
This association is poorly defined and is only referred to as a "pure, evidently stable stand of saltsage" in Mitchell et al. (1966). Mitchell et al. (1966) investigated the relatively sharp boundaries between the *Atriplex gardneri* and the *Krascheninnikovia lanata* communities at their study site; no edaphic factor was identified to explain the abrupt change. This association is separated from other *Atriplex gardneri*-dominated associations by the lack of codominant shrubs or significant herbaceous layer. It includes both sparse stands growing on harsh, windswept sites and/or strong saline/alkaline substrates, and occasional moderately dense to dense saltbush stands that lack an herbaceous layer because of disturbance. Some stands may be a seral community in areas with a history of over-grazing by livestock. More classification work is needed to further define this association.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Further quantitative data are needed to describe this association locally.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on 2003 field data (1 plot): (Plot: BLCA.0118).
Local Description Authors: J. Von Loh, mod. G. Bradshaw and J. Coles
Global Description Authors: K.A. Schulz, mod. J. Coles

REFERENCES: Bourgeron and Engelking 1994, Branson et al. 1976, Driscoll et al. 1984, Gates et al. 1956, Johnston 1987, MTNHP 2002b, MTNHP unpubl. data, Mitchell et al. 1966, Von Loh 2000, Western Ecology Working Group n.d.

Pascopyrum smithii Herbaceous Vegetation

Western Wheatgrass Herbaceous Vegetation

Western Wheatgrass Mixedgrass Prairie

CODE	CEGL001577
PHYSIOGNOMIC CLASS	Herbaceous Vegetation (V)
PHYSIOGNOMIC SUBCLASS	Perennial graminoid vegetation (V.A.)
PHYSIOGNOMIC GROUP	Temperate or subpolar grassland (V.A.5.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
FORMATION	Medium-tall sod temperate or subpolar grassland (V.A.5.N.c.)
ALLIANCE	*PASCOPYRUM SMITHII* HERBACEOUS ALLIANCE (A.1232) Western Wheatgrass Herbaceous Alliance

ECOLOGICAL SYSTEM(S):
Central Mixedgrass Prairie (CES303.659)
Northwestern Great Plains Mixedgrass Prairie (CES303.674)
Southern Rocky Mountain Montane-Subalpine Grassland (CES306.824)
Inter-Mountain Basins Semi-Desert Grassland (CES304.787)

USFWS WETLAND SYSTEM: Palustrine

CONCEPT SUMMARY
Globally
This midgrass prairie type is found in the northern and western Great Plains, Rocky Mountains, Colorado Plateau, and the interior western United States and Canada at elevations from 600-3000 m (1960-9850 feet). Stands occur on level to gently sloping terrain. They are found on alluvial fans, swales, river terraces, floodplains, valley floors and basins. The soils are typically clay, clay loam, and silt loam but may include sand or loamy sand. *Pascopyrum smithii* strongly dominates the open to dense (15-100% cover) mixedgrass herbaceous layer that grows 0.5-1 m tall. Other graminoids that co-occur and may achieve local dominance are *Koeleria macrantha, Eleocharis palustris*, and *Poa* spp. Many other species common in midgrass prairies and other grasslands are also found in this community, including *Artemisia ludoviciana, Eriogonum* spp., *Bouteloua gracilis, Nassella viridula*, and *Hesperostipa comata (= Stipa comata)*. Shrubs and dwarf-shrubs are rare in this community, but occasional woody plants, such as *Artemisia tridentata, Symphoricarpos* spp., *Ericameria nauseosa*, or *Krascheninnikovia lanata*, may be present. Introduced species, such as *Bromus tectorum, Bromus inermis, Poa pratensis, Melilotus* spp. or *Cirsium arvense*, are common in some stands, especially where disturbed.

DISTRIBUTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This association is uncommon in the recreation area and was sampled on Dillon Mesa and near Cimarron along the East Powerline Road in Curecanti National Recreation Area.

Globally

This midgrass prairie type is found in the northern and western Great Plains, Rocky Mountains, intermountain western United States and Canada, ranging from North Dakota and Saskatchewan, south to Nebraska and Colorado, and west to northern Arizona, Utah and Idaho.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This herbaceous vegetation association occurs on the lower slopes of ridges and in overflow channels. Sites are gently sloped (7-15%), occur between 2186 and 2708 m elevation, and are oriented to south-facing aspects. The unvegetated surface has high exposure of bare soil and low to moderate cover of litter and small rocks and gravel. Parent materials are Quaternary landslide deposits, alluvium and volcanic rocks. Soils are moderately well-drained loams and silty clays.

Globally

This grassland association is widespread in the northern and western Great Plains of the U.S. and Canada, Rocky Mountains, Colorado Plateau, and the intermountain western United States. Elevation ranges from 600-3000 m. Stands occur on level to gently sloping terrain. They are found on alluvial fans, swales, river terraces, floodplains, valley bottoms and basins. The soils are typically deep (40-100 cm), slightly alkaline and well-developed with clay, clay loam, and silt loam textures, but also coarser textures such as sand and loamy sand. Some stands occur on perched water tables. Parent materials include Quaternary landslide deposits, volcanic rocks, sandstones and shale that have eroded and deposited as secondary stream alluvium.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This western wheatgrass herbaceous vegetation association is rare to uncommon within the recreation area. The total vegetation cover ranges from 24 to 70% in these moderately to densely vegetated stands. The rhizomatous perennial *Pascopyrum smithii* forms scattered to open canopies and provides from 13 to 55% cover. The herbaceous layer is diverse and provides low to moderate cover. Additional graminoids include *Achnatherum hymenoides, Poa fendleriana*, and *Poa secunda*. Forbs commonly present and providing sparse to low cover include *Delphinium nuttallianum, Grindelia* sp., *Taraxacum officinale*, and *Trifolium gymnocarpon*. Short and dwarf-shrubs provide sparse cover and include *Artemisia tridentata ssp. wyomingensis, Ericameria parryi*, and *Gutierrezia sarothrae*.

Globally

This association is characterized by an open to dense (15-100% cover) mixedgrass herbaceous layer that grows 0.5-1 m tall and is strongly dominated by *Pascopyrum smithii*. Herbaceous cover may be significantly less on drier sites or after scarce cool-season precipitation. Other graminoids that co-occur and may achieve local dominance are *Bouteloua gracilis, Distichlis spicata, Eleocharis palustris, Koeleria macrantha*, and *Sporobolus airoides*. Many other species common in prairies and other grasslands are also found in this community, including *Achnatherum lettermanii, Achillea millefolium, Artemisia frigida, Artemisia ludoviciana, Bouteloua curtipendula, Carex* spp., *Eriogonum* spp., *Hesperostipa comata (= Stipa comata), Juncus balticus, Lupinus argenteus, Nassella viridula, Pleuraphis jamesii, Pseudoroegneria spicata (= Elymus spicatus), Poa fendleriana, Poa secunda, Schizachyrium scoparium*, and *Solidago* sp. Shrubs and dwarf-shrubs are rare in this community, but occasional woody plants, such as *Artemisia arbuscula ssp. longiloba, Artemisia tridentata, Artemisia tridentata ssp. vaseyana, Atriplex canescens, Ericameria nauseosa, Krascheninnikovia lanata, Rhus trilobata*, or *Symphoricarpos* spp., may be present. Introduced species, such as *Agropyron cristatum, Cirsium arvense, Bromus japonicus, Bromus tectorum, Ceratocephala testiculata, Conyza canadensis, Iva axillaris, Lactuca serriola, Melilotus* spp., *Poa pratensis, Salsola kali, Sisymbrium altissimum*, and *Taraxacum officinale*, are common in some stands, especially where disturbed.

MOST ABUNDANT SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Short shrub/sapling	*Ericameria parryi*
Short shrub/sapling	*Artemisia tridentata* ssp. *wyomingensis*
Herb (field)	*Gutierrezia sarothrae*
Herb (field)	*Grindelia arizonica*
Herb (field)	*Achnatherum hymenoides*, *Pascopyrum smithii*

Globally

Stratum	Species
Herb (field)	*Pascopyrum smithii*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Exotic/Invasive: *Melilotus officinalis* (exotic, Medium/Low)

Globally
Exotic/Invasive: *Agropyron cristatum* (exotic, Medium/Low), *Bromus japonicus* (exotic), *Bromus tectorum* (exotic, High), *Ceratocephala testiculata* (exotic), *Cirsium arvense* (exotic noxious weed, High/Medium), *Conyza canadensis* (introduced), *Iva axillaris* (introduced), *Lactuca serriola* (exotic, Low/Insignificant), *Poa pratensis* (exotic, Medium), *Salsola kali* (exotic), *Sisymbrium altissimum* (exotic), *Taraxacum officinale* (exotic)

CONSERVATION STATUS RANK
Global Rank & Reasons: G3G5Q (1-Feb-1996).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
This community is similar to several others that are dominated or codominated by *Pascopyrum smithii*. As currently defined, it represents a western Great Plains and foothills version of the western wheatgrass types in the central Great Plains. Further work needs to be done to refine the differences in composition and environmental characteristics. See recent descriptions by Thilenius et al. (1995) (*Pascopyrum smithii* sodgrass steppe, a more playa-like wheatgrass type) and by Steinauer and Rolfsmeier (2000). In Nebraska, Steinauer and Rolfsmeier (2000) suggest that their stands may resemble *Pascopyrum smithii - Nassella viridula* Herbaceous Vegetation (CEGL001583). In Alberta, this association is clearly dominated by dense, nearly pure stands of *Pascopyrum smithii* and tends to occur in depressions in areas of fine-textured saline soils with a hardpan layer. The hardpan holds rain and spring runoff.

CLASSIFICATION CONFIDENCE: 3 - Weak

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: More quantitative data are needed to define this association.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: Descriptions are based on field data (2 plots, 2 observation points): (Plots: CURE.0295, CURE.0332. Observation Points: BLCA_AA.950, BLCA_AA.956).
Local Description Authors: J. Von Loh, mod. G. Bradshaw
Global Description Authors: J. Drake, mod. K.A. Schulz and J. Coles

REFERENCES: ANHIC n.d., Aldous and Shantz 1924, Baker 1983c, Baker 1984a, Baker and Kennedy 1985, Bell et al. 2009, Bourgeron and Engelking 1994, Bunin 1985, CONHP unpubl. data 2003, Christensen and Welsh 1963, Driscoll et al. 1984, FEIS 2001, Godfread 1994, Hall and Hansen 1997, Hansen et al. 1991, Hansen et al. 1995, Hansen et al. 2004c, Hansen et al. 2004d, IDCDC 2005, Jones and Walford 1995, MTNHP 2002b, Marr and Buckner 1974, Ramaley 1916b, Ramaley 1919b, Ramaley 1942, Shanks 1977, Soil Conservation Service 1978, Steinauer and Rolfsmeier 2000, Thilenius et al. 1995, Thompson and Hansen 2002, Von Loh 2000, Vujnovic and Bentz 2001, Western Ecology Working Group n.d.

Achnatherum hymenoides Shale Barren Herbaceous Vegetation

Indian Ricegrass Shale Barren Herbaceous Vegetation

CODE	CEGL001651
PHYSIOGNOMIC CLASS	Herbaceous Vegetation (V)
PHYSIOGNOMIC SUBCLASS	Perennial graminoid vegetation (V.A.)
PHYSIOGNOMIC GROUP	Temperate or subpolar grassland (V.A.5.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
FORMATION	Medium-tall bunch temperate or subpolar grassland (V.A.5.N.d.)
ALLIANCE	*ACHNATHERUM HYMENOIDES* HERBACEOUS ALLIANCE (A.1262) Indian Ricegrass Herbaceous Alliance

ECOLOGICAL SYSTEM(S): Inter-Mountain Basins Shale Badland (CES304.789)
Columbia Plateau Ash and Tuff Badland (CES304.081)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY

Globally

This association is found on shale outcrops in Colorado and likely is more widespread. Elevations range from 2200-2321m (7200-7610 feet) in north-central Colorado and west-central Colorado to lower elevation sites at 1415 m (4640 feet) on mesatops in the Colorado Plateau. This association is described as a topo-edaphic climax, occurring on soils derived from shales or mudstones. It occupies stabilized badlands with rolling topography, commonly on ridgetops exposed to wind, desiccation and sheet erosion. Aspects are often southerly. Soils derived from shale and mudstone are typically shallow, calcareous, alkaline and clayey, often capped by a thin gravel layer. Total vegetative cover is relatively sparse, and bare soil ranges from 75% to near 100%. The vegetation has a relatively sparse (5-25% cover) herbaceous layer characterized by the perennial bunchgrass *Achnatherum hymenoides (= Oryzopsis hymenoides)*. The low mat-forming suffrutescent forb *Eriogonum brevicaule* may codominate some higher elevation stands. Scattered shrubs may be present, including *Artemisia nova, Artemisia tridentata ssp. wyomingensis, Ericameria nauseosa, Gutierrezia sarothrae, Krascheninnikovia lanata, Sarcobatus vermiculatus*, and *Tetradymia spinosa*. Associated grasses include *Achnatherum pinetorum, Elymus elymoides, Koeleria macrantha, Pascopyrum smithii*, and *Pleuraphis jamesii*. Forbs present and providing sparse cover include *Artemisia frigida, Eriogonum contortum, Eriogonum lonchophyllum*, and *Stenotus armerioides*. Other associated species are the non-native bunchgrass *Agropyron cristatum* and the exotic annual grass *Bromus tectorum*. As many as 40 species may occur in this association, but stands are highly variable.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association is rare to uncommon in the recreation area and was sampled at Cimarron and near Red Creek in Curecanti National Recreation Area.

Globally

This association has been described from the southern Rocky Mountains in north-central Colorado, in a high intermountain basin known as Middle Park in Grand and Eagle counties. It is also found in the Gunnison River valley and in Mesa County in western Colorado, where it was described as a large island surrounded by agricultural fields.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This herbaceous association occurs on the sides of ridges. Sites are moderately steep to steep (8-50% slopes), occur between 2188 and 2321 m elevation, and are oriented to south and southwest aspects. The unvegetated surface consists of bare soil exposures with sparse litter and low cover by small rocks. Parent materials are Mesozoic shale. Soils are rapidly drained silty clays.

Globally

This association is found on shale outcrops in Colorado and likely is more widespread. Elevations range from 2200 to 2321 m (7200-7610 feet) in north-central Colorado and west-central Colorado (Francis 1983, Tiedemann et al. 1987) to lower elevation sites at 1415 m (4640 feet) on mesatops in the Colorado Plateau. This association is

described as a topo-edaphic climax, occurring on soils derived from shales or mudstones. It occupies stabilized badlands with rolling topography, commonly on ridgetops exposed to wind, desiccation and sheet erosion. Aspects are often southerly. Soils derived from shale and mudstone are typically shallow, calcareous, alkaline and clayey, often capped by a thin gravel layer. Total vegetative cover is relatively sparse, and bare soil ranges from 75% to near 100%.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This Indian ricegrass herbaceous vegetation association is rare within the recreation area. The total vegetation cover is approximately 10 to 15% on these sparsely vegetated sites. The moderately tall bunchgrass *Achnatherum hymenoides* forms a sparse canopy that provides up to 5% cover. The herbaceous layer is low to moderately diverse and provides sparse cover. Associated grasses include the non-native bunchgrass *Agropyron cristatum* and the native grasses *Achnatherum pinetorum, Elymus elymoides, Koeleria macrantha*, and *Pascopyrum smithii*. Forbs present and providing sparse cover include *Artemisia frigida, Eriogonum lonchophyllum*, and *Stenotus armerioides*. The shrub layer is low in terms of species diversity and provides low cover. Scattered shrubs are present, including *Artemisia nova, Artemisia tridentata ssp. wyomingensis, Gutierrezia sarothrae*, and *Krascheninnikovia lanata*.

Globally

The vegetation of this association has a relatively sparse (5-25% cover) herbaceous layer characterized by the perennial bunchgrass *Achnatherum hymenoides (= Oryzopsis hymenoides)*. The low, mat-forming suffruticose forb *Eriogonum brevicaule* codominates some higher elevation stands. Scattered shrubs may be present, including *Artemisia nova, Artemisia tridentata ssp. wyomingensis, Gutierrezia sarothrae*, and *Krascheninnikovia lanata*. Associated grasses include the non-native bunchgrass *Agropyron cristatum* and the native grasses *Achnatherum pinetorum, Elymus elymoides, Koeleria macrantha*, and *Pascopyrum smithii*. Forbs present and providing sparse cover include *Artemisia frigida, Eriogonum lonchophyllum*, and *Stenotus armerioides* (Francis 1983, Tiedemann et al. 1987). The lower elevation, shaly ridge site in western Colorado had cover of 5-25% *Achnatherum hymenoides*, 5-25% *Gutierrezia sarothrae*, 10% *Pleuraphis jamesii (= Hilaria jamesii)*, 5% *Krascheninnikovia lanata*, and 1% each for *Sarcobatus vermiculatus, Ericameria nauseosa*, and *Tetradymia spinosa*. Other associated species were *Eriogonum contortum* and the exotic annual grass *Bromus tectorum* (P. Lyons pers. comm.). As many as 40 species may occur in this association, but stands are highly variable.

MOST ABUNDANT SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Short shrub/sapling	*Artemisia nova*, *Krascheninnikovia lanata*
Herb (field)	*Eriogonum lonchophyllum*, *Stenotus armerioides*
Herb (field)	*Achnatherum hymenoides*

Globally

Stratum	Species
Herb (field)	*Eriogonum brevicaule*
Herb (field)	*Achnatherum hymenoides*

OTHER NOTEWORTHY SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Exotic/Invasive: *Agropyron cristatum* (exotic, Medium/Low), *Bromus tectorum* (exotic, High)

Globally

Data are not available.

CONSERVATION STATUS RANK

Global Rank & Reasons: G2 (13-Nov-1997). This plant association is described as a topo-edaphic climax from a high intermountain basin known as Middle Park in north-central Colorado in Grand and Eagle counties. It has also been found in Mesa County in western Colorado where it is described as an large island surrounded by agricultural fields. This sparse grassland occupies stabilized badlands with rolling topography, commonly on ridgetops. It is found on uncommon substrates, occurring on soils derived from shales or mudstones. Improperly managed livestock

grazing could potentially increased soil erosion and decrease cover of palatable plant species in increase weedy species.

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
This is a relatively sparse, chasmophytic community with 25% total cover.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Steep clay slopes with soil creep. One site may have become established on fill material from a road cut.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (2 plots, 1 observation point): (Plots: CURE.0020, CURE.0305. Observation Point: BLCA_AA.641).
Local Description Authors: J. Von Loh
Global Description Authors: M.S. Reid, mod. K.A. Schulz

REFERENCES: Baker 1984a, Bourgeron and Engelking 1994, CONHP unpubl. data 2003, Driscoll et al. 1984, Francis 1983, Lyon pers. comm., Reid et al. 1994, Strong 1980, Terwilliger and Tiedemann 1978, Thorne Ecological Institute 1973a, Tiedemann et al. 1987, Western Ecology Working Group n.d.

Bromus inermis - (Pascopyrum smithii) Semi-natural Herbaceous Vegetation

Smooth Brome - (Western Wheatgrass) Semi-natural Herbaceous Vegetation

Smooth Brome Semi-natural Grassland

CODE	CEGL005264
PHYSIOGNOMIC CLASS	Herbaceous Vegetation (V)
PHYSIOGNOMIC SUBCLASS	Perennial graminoid vegetation (V.A.)
PHYSIOGNOMIC GROUP	Temperate or subpolar grassland (V.A.5.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
FORMATION	Medium-tall bunch temperate or subpolar grassland (V.A.5.N.d.)
ALLIANCE	*BROMUS INERMIS* SEMI-NATURAL HERBACEOUS ALLIANCE (A.3561) Smooth Brome Semi-natural Herbaceous Alliance

ECOLOGICAL SYSTEM(S): Inter-Mountain Basins Semi-Desert Grassland (CES304.787)
Southern Rocky Mountain Montane-Subalpine Grassland (CES306.824)
Rocky Mountain Lower Montane-Foothill Shrubland (CES306.822)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY
Globally
This smooth brome grassland type occurs widely throughout the northern Great Plains, in disturbed montane meadows in the Rocky Mountains, on relatively mesic sites in the semi-arid interior western United States, and perhaps more widely in the midwestern U.S. and Canada. Stands can occur in a wide variety of human-disturbed habitats, including highway rights-of-way, jeep trails, etc. The type is also widely planted for revegetating disturbed land, pasture and hay fields, and has escaped into a variety of habitats, including prairie, riparian grasslands, and mesic mountain meadows. The dominant grass is *Bromus inermis*, a naturalized species from Eurasia that forms moderately dense to dense stands that often develop into monocultures. Other weedy species such as *Cirsium arvense* and *Poa pratensis* may occur as well, but native species are generally less than 10% cover. Native species may include mixed-grass prairie and montane meadow grasses, such as *Pascopyrum smithii, Deschampsia caespitosa*, and *Hesperostipa comata (= Stipa comata)*, and sparse, scattered mesic shrubs such as *Symphoricarpos*

spp., as well as many others. However, the native species are not conspicuous enough to identify the native plant association that could occupy the site, or the stand would be typed as such.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association is rare in the recreation area and was sampled in the Gunnison River floodplain at Cooper's Ranch in Curecanti National Recreation Area. This site is former private ranchland, and stands with similar vegetation composition and hydrology are likely to occur on private lands adjacent to the NPS-managed property.

Globally

This type occurs widely throughout the northern Great Plains, montane meadows in the Rocky Mountains, in relatively mesic sites in Utah and Wyoming, and perhaps more widely in the midwestern and western U.S. and Canada, as well where *Bromus inermis* has escaped from revegetation and forage plantings.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This herbaceous association occurs on intermittently flooded sites in the floodplain of the Gunnison River. The site is nearly flat (2% slope), occurs at 2313 m elevation, and is oriented to the southeast. The unvegetated surface has high cover of litter and low exposure of bare soil. Parent materials are Quaternary alluvium. Soils are moderately well-drained silty clay loams.

Globally

This smooth brome grassland type occurs widely throughout the northern Great Plains, on relatively mesic sites in the semi-arid interior western United States, and perhaps more widely in the midwestern U.S. and Canada. Stands can occur in a wide variety of human-disturbed habitats, including highway rights-of-way, jeep trails, etc. The type is also widely planted for revegetating disturbed land, pasture and hay fields, and has escaped into a variety of habitats, including prairie, riparian grasslands, and mesic mountain meadows. This community is found at all elevational ranges with best examples occurring on mesic alluvial terraces. *Bromus inermis* grows best on moist, well-drained, finer-textured loam and clay loams, not heavy clays or sand, and does not tolerate prolonged flooding, however, it does persist quite well on well-drained sandy loam derived from granitic parent material. It also occurs in foothills and plains at lower elevations on relatively mesic sites. It occurs on poorly drained sites to rapidly drained sites with fine-textured alluvial soils derived from shale formations found in Utah. This community persists because it is rhizomatous, and once seeded, with enough moisture, will persist, regardless of elevation, soil or landform.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This smooth brome association is rare to uncommon within the recreation area. The total vegetation cover is 71% in this moderately to densely vegetated stand. The medium-tall, rhizomatous grass *Bromus inermis* forms a moderately closed stand and provides 65% cover. The remaining herbaceous layer is low to moderate in diversity and provides low cover. Additional graminoids include *Carex* sp. and *Juncus balticus*. Forbs common to this stand provide sparse cover and include *Achillea millefolium var. occidentalis, Cirsium arvense, Iris missouriensis, Solidago canadensis*, and *Thermopsis montana*. The shrub layer provides sparse cover, including tall shrubs of *Populus angustifolia* and *Salix exigua* and the short shrub *Rosa woodsii*.

Globally

This association is dominated by medium-tall (0.5-1 m) graminoids. The dominant grass is *Bromus inermis*, a naturalized species from Eurasia that forms moderately dense to dense stands that often develop into monocultures. Other weedy species, such as *Cirsium arvense, Poa pratensis*, and other introduced forage species, may occur as well, but native species are generally less than 10% cover. Native species may include mixed-grass prairie and montane meadow grasses, such as *Juncus balticus, Pascopyrum smithii, Deschampsia caespitosa*, and *Hesperostipa comata (= Stipa comata)*, and sparse scattered mesic shrubs, such as *Artemisia tridentata ssp. wyomingensis, Ericameria nauseosa*, and *Symphoricarpos* spp., and ruderal forbs, such as *Heterotheca villosa*, as well as many others. However, the native species are not conspicuous enough to identify the native plant association that could occupy the site, or the stand would be typed as such.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Tall shrub/sapling	*Populus angustifolia*
Short shrub/sapling	*Rosa woodsii*
Herb (field)	*Bromus inermis*, *Juncus balticus*

Globally

Stratum	Species
Herb (field)	*Bromus inermis*, *Pascopyrum smithii*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Exotic/Invasive: *Cirsium arvense* (exotic, High/Medium)

Globally
Exotic/Invasive: *Bromus inermis* (invasive, High/Medium), *Cirsium arvense* (exotic, High/Medium), *Poa pratensis* (invasive, Medium)

CONSERVATION STATUS RANK
Global Rank & Reasons: GNA (invasive) (17-Jun-1999). This is a naturalized type from Europe and Asia, widely planted for cover, pasture, and hay, and has escaped into a variety of habitats.

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Where native species are conspicuous enough to identify the native plant association that could occupy the site, the stand should be typed as such. *Bromus inermis* occurs widely throughout the midwestern and western U.S., and perhaps this association should be broadened to include almost any stand dominated almost exclusively by *Bromus inermis*.

CLASSIFICATION CONFIDENCE: 3 - Weak

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: The site is occasionally flooded and contains flood debris. More quantitative data are needed to describe this association locally.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (1 plot, 3 observation points): (Plot: CURE.0253. Observation Points: BLCA_AA.936, CURE_AA.0052, CURE_AA.0062).
Local Description Authors: J. Von Loh, mod. G. Bradshaw
Global Description Authors: D. Faber-Langendoen, mod. K.A. Schulz and J. Coles

REFERENCES: Butler et al. 2002, Cogan et al. 2004, Cooper 2003, Cronquist et al. 1977, Hansen et al. 1995, MTNHP 2002b, Midwestern Ecology Working Group n.d., NDNHI unpubl. data, Salas and Pucherelli 2002, Trammel and Butler 1995, Von Loh et al. 2000

Bunch *Hesperostipa comata* Great Basin Herbaceous Vegetation

Needle-and-Thread Great Basin Herbaceous Vegetation

CODE	CEGL001705
PHYSIOGNOMIC CLASS	Herbaceous Vegetation (V)
PHYSIOGNOMIC SUBCLASS	Perennial graminoid vegetation (V.A.)
PHYSIOGNOMIC GROUP	Temperate or subpolar grassland (V.A.5.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
FORMATION	Medium-tall bunch temperate or subpolar grassland (V.A.5.N.d.)
ALLIANCE	*HESPEROSTIPA COMATA* BUNCH HERBACEOUS ALLIANCE (A.1270) Needle-and-Thread Bunch Herbaceous Alliance

ECOLOGICAL SYSTEM(S): Inter-Mountain Basins Semi-Desert Grassland (CES304.787)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY

Globally

This semi-arid grassland occurs on the Great Basin and Colorado Plateau and high plateaus of southern Utah, east into the western slope of the southern Rocky Mountains. Stands are found on a variety of sites, such as on point bars, stream terraces, in sand-filled potholes in slickrock washes, on plains, valleys, canyon floors, gentle hillslopes, knolls and bluffs, mesatops, and plateau parks. Sites are generally flat to gently sloping, but occasionally are steep (to 53% slope). Soils are variable and range from sand to silty clay. The unvegetated surface has moderate to high cover of bare soil with sparse to moderate cover of litter. Biological soil crusts are often present with low cover. The vegetation is characterized by a relatively sparse to moderate herbaceous layer (10-40% cover) that is strongly dominated by the medium-tall, cool-season bunchgrass *Hesperostipa comata*, but it may also include stands with less than 10% total vegetation cover. Low cover of other grasses, such as *Achnatherum hymenoides, Achnatherum lettermanii, Aristida purpurea, Elymus elymoides, Koeleria macrantha, Leymus salinus, Pleuraphis jamesii, Poa fendleriana*, or *Sporobolus cryptandrus*, may be present. However, *Bouteloua eriopoda* is not present. Forb cover ranges from sparse to moderate and may be diverse. Associated forbs include *Balsamorhiza sagittata, Hymenopappus filifolius, Machaeranthera canescens, Sphaeralcea coccinea, Vicia americana*, and species of *Antennaria, Astragalus, Cryptantha, Eriogonum, Gilia*, and *Lappula*. Scattered shrubs and dwarf-shrubs may present with less than 5% total cover. Common species include *Artemisia tridentata, Chrysothamnus viscidiflorus, Ericameria nauseosa, Gutierrezia sarothrae, Krascheninnikovia lanata, Opuntia polyacantha*, and *Symphoricarpos oreophilus*. The widespread introduced annual grass *Bromus tectorum* often contributes significant cover in disturbed stands. Some stands have high cover of biological soil crusts.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association is widely distributed throughout the recreation area, at low to middle elevations and was sampled on the south side of Blue Mesa Reservoir, near Red Creek, at the base of the Dillon Pinnacles, south of Willow Creek near the Powerline Road, along the Beaver-Stueben Jeep Road, and on Big Game Hill in Curecanti National Recreation Area.

Globally

This grassland is found on the west slope of the Colorado Rocky Mountains, on the Colorado Plateau and in the Great Basin in Colorado and Utah, and probably occurs in adjacent states.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This herbaceous vegetation association occurs on the slopes of mesas, hills and ridges. Sites are gently to steeply sloped (5-53%), occur between 2286 and 2461 m elevation, and are oriented to all aspects. The unvegetated surface has high cover of large and small rocks, low cover of litter, and low to moderate exposure of sand and bare soil. Parent materials are Tertiary volcanic rocks, including West Elk breccia, and Quaternary terrace deposits. Soils are rapidly drained loams, sandy loams and sands. One stand is on a blow-out feature or deflation basin.

Globally
This grassland occurs on the Great Basin and Colorado Plateau east into the western slope of the southern Rocky Mountains. Stands are found a variety of sites, such as on point bars, stream terraces, in sand-filled potholes in slickrock washes, on plains, valleys, canyon floors, gentle hillslopes, knolls and bluffs, mesatops, and plateau parks. Sites are generally flat to gently sloping, but occasionally are steep (to 53% slope). Elevation ranges from 1250-2683 m. The unvegetated surface has moderate to high cover of bare soil with sparse to moderate cover of litter. Biological soil crusts are often present with low cover. Soils are variable and include sand, cobbles, sandy, silt and clay loams and silty clay. Common parent materials are sandstones and shale that have been eroded and redistributed in alluvial and eolian deposits, but include Tertiary volcanic rocks. Fires may be important in maintaining these grasslands by reducing woody cover, but burning during the growing season could also damage *Hesperostipa comata* plants.

VEGETATION DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This needle-and-thread herbaceous vegetation association is common in the recreation area. The total vegetation cover ranges from 20 to 70% in these moderately to densely vegetated stands. The medium-tall bunchgrass *Hesperostipa comata* forms a sparse to uniform canopy and provides from 2 to 63% cover. The herbaceous layer is diverse and provides moderate to dense cover. Other graminoid species contribute low to moderate cover and include *Achnatherum hymenoides, Bouteloua gracilis, Elymus elymoides, Koeleria macrantha, Pleuraphis jamesii*, and *Poa secunda*. Forbs are common and variable, providing sparse to low cover, and include *Arabis crandallii, Arabis lignifera, Balsamorhiza sagittata, Cryptantha flavoculata, Phlox hoodii, Packera tridenticulata*, and *Sphaeralcea coccinea*. The shrub layer provides sparse to low cover and includes the short and dwarf-shrubs *Artemisia frigida, Gutierrezia sarothrae, Krascheninnikovia lanata, Opuntia polyacantha, Pediocactus simpsonii*, and *Yucca harrimaniae*. Both crustose and foliose lichens are often present, usually contribute 1-2% cover, but may occasionally contribute up to 50% cover. The herbaceous layer is diverse and provides moderate cover. Additional graminoids provide sparse to low cover and include *Achnatherum hymenoides, Bromus tectorum, Carex geyeri, Elymus canadensis, Elymus elymoides*, and *Pascopyrum smithii*. Forbs provide sparse cover and include *Cryptantha flavoculata*. The shrub layer is low in diversity and provides sparse cover, including the short and dwarf-shrubs *Artemisia tridentata ssp. vaseyana, Chrysothamnus viscidiflorus*, and *Symphoricarpos rotundifolius*, and the succulents *Opuntia fragilis* and *Echinocereus triglochidiatus*.

Globally
This association is characterized by a relatively sparse to moderate herbaceous layer (10-40% cover) that is strongly dominated by the medium-tall, cool-season bunchgrass *Hesperostipa comata*, but it may also include stands with less than 10% total vegetation cover. Low cover of other grasses, such as *Achnatherum hymenoides, Achnatherum lettermanii, Aristida purpurea, Elymus elymoides, Koeleria macrantha, Leymus salinus, Pleuraphis jamesii, Poa fendleriana, Poa secunda, Sporobolus airoides*, or *Sporobolus cryptandrus*, may be present. However, *Bouteloua eriopoda* is not present. Forb cover ranges from sparse to moderate and may be diverse. Associated species include *Artemisia campestris, Artemisia dracunculus, Artemisia ludoviciana, Balsamorhiza sagittata, Cirsium arizonicum, Cryptantha crassisepala, Hymenopappus filifolius, Machaeranthera canescens, Sphaeralcea coccinea, Vicia americana*, and species of *Antennaria, Astragalus, Eriogonum, Gilia*, and *Lappula*. Scattered shrubs and dwarf-shrubs may present with less than 5% total cover. *Artemisia tridentata ssp. tridentata, Artemisia tridentata ssp. vaseyana, Atriplex canescens, Chrysothamnus depressus, Chrysothamnus viscidiflorus, Ericameria nauseosa, Gutierrezia sarothrae, Krascheninnikovia lanata, Opuntia polyacantha, Purshia tridentata, Ribes cereum*, and *Symphoricarpos oreophilus* have been reported from this grassland. The widespread introduced annual grass *Bromus tectorum* often contributes significant cover in disturbed stands. Several other exotic species may be present to abundant and include *Salsola tragus, Bassia scoparia (= Kochia scoparia), Poa pratensis, Sisymbrium altissimum*, and *Tragopogon dubius*. Some stands have high cover of cryptogams on the soil, including *Collema tenax, Tortula ruralis, Buellia papillata*, and *Fulgensia bracteata* (Kleiner and Harper 1977).

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Short shrub/sapling	*Artemisia tridentata* ssp. *vaseyana*
Short shrub/sapling	*Artemisia frigida*, *Gutierrezia sarothrae*, *Krascheninnikovia lanata*, *Opuntia polyacantha*, *Pediocactus simpsonii*, *Yucca harrimaniae*

Herb (field)	*Chrysothamnus viscidiflorus*
Herb (field)	*Cryptantha flavoculata*, *Packera tridenticulata*, *Phlox hoodii*, *Sphaeralcea coccinea*
Herb (field)	*Achnatherum hymenoides*, *Bouteloua gracilis*, *Elymus elymoides*, *Hesperostipa comata*, *Pleuraphis jamesii*, *Poa secunda*

Globally

Stratum	Species
Herb (field)	*Hesperostipa comata*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Vulnerable: *Astragalus anisus* (globally imperiled endemic, G2G3); **Exotic/Invasive**: *Bromus tectorum* (exotic, High)

Globally
Vulnerable: *Arabis crandallii* (globally imperiled, G2), *Astragalus anisus* (globally imperiled, G2G3), *Cirsium arizonicum* (UT state -vulnerable, G5); **Exotic/Invasive**: *Bassia scoparia* (exotic, Low), *Bromus tectorum* (exotic, High), *Poa pratensis* (exotic, Medium), *Salsola tragus* (exotic), *Sisymbrium altissimum* (exotic), *Tragopogon dubius* (exotic, Medium/Low)

CONSERVATION STATUS RANK
Global Rank & Reasons: G2G4 (23-Feb-1994).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
This association is composed of relatively pure *Hesperostipa comata* grasslands in the Intermountain West. The similar associations are distinguished by the codominance by other grass species or a shrub layer.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Sparse stands or those with significant *Bouteloua gracilis* may be difficult to separate from *Artemisia frigida - (Bouteloua gracilis, Achnatherum hymenoides, Poa secunda)* - Lichens Rocky Mesa Herbaceous Vegetation (CEGL002344).
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (7 plots, 2 observation points): (Plots: CURE.0004, CURE.0019, CURE.0024, CURE.0054, CURE.0119, CURE.0316, CURE.0375. Observation Points: BLCA_AA.435, CURE_AA.0548).
Local Description Authors: J. Von Loh, mod. G. Bradshaw and K.A. Schulz
Global Description Authors: K.A. Schulz, mod. J. Coles

REFERENCES: Bourgeron and Engelking 1994, CONHP unpubl. data 2003, Cogan et al. 2004, Coles pers. comm., Daubenmire 1970, Driscoll et al. 1984, FEIS 1998, Kleiner 1968, Kleiner 1983, Kleiner and Harper 1977, Thilenius et al. 1995, Western Ecology Working Group n.d.

Poa fendleriana Herbaceous Vegetation

Muttongrass Herbaceous Vegetation

CODE	CEGL001925
PHYSIOGNOMIC CLASS	Herbaceous Vegetation (V)
PHYSIOGNOMIC SUBCLASS	Perennial graminoid vegetation (V.A.)
PHYSIOGNOMIC GROUP	Temperate or subpolar grassland (V.A.5.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
FORMATION	Medium-tall bunch temperate or subpolar grassland (V.A.5.N.d.)
ALLIANCE	*POA FENDLERIANA* HERBACEOUS ALLIANCE (A.1336) Muttongrass Herbaceous Alliance

ECOLOGICAL SYSTEM(S): Southern Rocky Mountain Montane-Subalpine Grassland (CES306.824)

USFWS WETLAND SYSTEM: Palustrine

CONCEPT SUMMARY

Globally

This herbaceous association was observed on lower slopes of hills and midslopes of ridges and mesas in western Colorado, eastern and southern Utah and is likely more widespread. Sites are flat, moderately steep to steep (11-55% slopes), occur between 2339 to 2700 m elevation, and include all aspects. The unvegetated surface has sparse to low cover of litter and low to high cover by large and small rocks and exposures of bare soil. Parent materials are Tertiary volcanic rocks that have eroded to colluvium or talus on slopes. Soils are rapidly drained and texturally range from loamy sand to sandy clay loam and sandy loam. This sparsely to moderately vegetated grassland is characterized by the bunchgrass *Poa fendleriana* that provides from up to 25% cover. The herbaceous layer is often diverse and may include low cover of graminoids such as *Achnatherum pinetorum, Agropyron cristatum, Bouteloua gracilis, Bromus tectorum*, and *Elymus elymoides*. Forbs commonly present include *Antennaria dimorpha, Eriogonum umbellatum, Lepidium montanum, Phlox hoodii, Senecio spartioides var. multicapitatus (= Senecio multicapitatus)*, and *Sphaeralcea parvifolia*. Scattered tall, short and dwarf-shrubs may be present, such as *Artemisia frigida, Chrysothamnus depressus, Fraxinus anomala, Gutierrezia sarothrae, Krascheninnikovia lanata, Mahonia fremontii*, and *Purshia tridentata*. Cryptogam cover is sparse for all sampled stands.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association is uncommon in the park and recreation area and was observed and sampled in the Red Rocks area of Black Canyon of the Gunnison National Park, on Tenderfoot Hill in Curecanti National Recreation Area, and in Kezar Basin on adjacent BLM land.

Globally

This herbaceous association was observed on lower slopes of hills and midslopes of ridges and mesas in western Colorado and eastern Utah and is likely more widespread.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This herbaceous association was observed on lower slopes of hills and midslopes of ridges and mesas. Sites are moderately steep to steep (11-55% slopes), occur between 2339 to 2640 m elevation, and include all aspects. The unvegetated surface has sparse to low cover of litter and low to high cover by large and small rocks and exposures of bare soil. Parent materials are Tertiary volcanic rocks that have eroded to colluvium or talus on slopes. Soils are rapidly drained and texturally range from loamy sand to sandy clay loam and sandy loam.

Globally

This herbaceous association was observed on lower slopes of hills and midslopes of ridges and mesas. Sites occur on moderately steep to steep (11-55%) slopes between 1750 and 2700 m elevation and include all aspects. The unvegetated surface has sparse to low cover of litter and low to high cover by large and small rocks and exposures of bare soil. Parent materials are Tertiary volcanic rocks that have eroded to colluvium or talus on slopes or sandstones that have been eroded to alluvium. Soils are well- to rapidly drained and texturally range from loamy sand to sandy clay loam and sandy loam. The cryptogamic soil community provides low cover.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This muttongrass herbaceous association is uncommon within the park and recreation area. The total vegetation cover ranges from 5 to 40% in these sparsely to moderately vegetated stands. This herbaceous association is characterized by the bunchgrass *Poa fendleriana* that provides from 1 to 25% cover. The herbaceous layer is diverse and provides low to moderate cover. Additional graminoids that provide sparse cover include *Achnatherum pinetorum, Agropyron cristatum, Bouteloua gracilis, Bromus tectorum*, and *Elymus elymoides*. Forbs commonly present and providing sparse cover include *Antennaria dimorpha, Eriogonum umbellatum*, and *Phlox hoodii*. The short and dwarf-shrubs provide sparse cover and include *Chrysothamnus depressus, Gutierrezia sarothrae*, and *Purshia tridentata*. Cryptogam cover is sparse for all sampled stands.

Globally
This herbaceous association is characterized by a sparse to moderately dense herbaceous layer (5-40% total cover) that is typically dominated by the bunchgrass *Poa fendleriana* that provides from up to 25% cover. The herbaceous layer is often diverse and may include graminoids that provide low cover of *Achnatherum pinetorum, Agropyron cristatum, Bouteloua gracilis, Bromus tectorum*, and *Elymus elymoides*. Forbs commonly present include *Antennaria dimorpha, Eriogonum umbellatum, Lepidium montanum, Phlox hoodii, Senecio spartioides var. multicapitatus (= Senecio multicapitatus)*, and *Sphaeralcea parvifolia*. Scattered tall, short and dwarf-shrubs may be present, such as *Artemisia frigida, Chrysothamnus depressus, Fraxinus anomala, Gutierrezia sarothrae, Krascheninnikovia lanata, Mahonia fremontii*, and *Purshia tridentata*. The cryptogamic soil community provides low cover and includes dark cyanobacteria, moss, *Collema* sp., and *Fulgensia* sp.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Short shrub/sapling	*Gutierrezia sarothrae*
Herb (field)	*Crepis acuminata*, *Eriogonum umbellatum*, *Phlox hoodii*
Herb (field)	*Bouteloua gracilis*, *Poa fendleriana*

Globally

Stratum	Species
Herb (field)	*Poa fendleriana*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Exotic/Invasive: *Agropyron cristatum* (invasive/exotic, Medium/Low), *Bromus tectorum* (invasive/exotic, High)

CONSERVATION STATUS RANK
Global Rank & Reasons: GU (23-Feb-1994).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data from Loder (1964) and Olgeirson (1972, 1974) indicate that this association may also occur in the subalpine/alpine zones. The data contained in these references do not give enough information to say for certain that this is a valid association. More field inventories are needed.

CLASSIFICATION CONFIDENCE: 3 - Weak

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Data are not available.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points:
The description is based on field data (3 plots, 3 observation points): (Plots: BLCA.0099, CURE.0221, CURE.0342. Observation Points: BLCA_AA.289, BLCA_AA.640, BLCA_AA.789).
Local Description Authors: J. Von Loh, mod. G. Bradshaw
Global Description Authors: K.A. Schulz, mod. G. Kittel

REFERENCES: Bourgeron and Engelking 1994, CONHP unpubl. data 2003, Driscoll et al. 1984, Loder 1964, Olgeirson 1972, Olgeirson 1974, Western Ecology Working Group n.d.

Poa pratensis - (Pascopyrum smithii) Semi-natural Herbaceous Vegetation

Kentucky Bluegrass - (Western Wheatgrass) Semi-natural Herbaceous Vegetation

Kentucky Bluegrass Semi-natural Grassland

CODE	CEGL005265
PHYSIOGNOMIC CLASS	Herbaceous Vegetation (V)
PHYSIOGNOMIC SUBCLASS	Perennial graminoid vegetation (V.A.)
PHYSIOGNOMIC GROUP	Temperate or subpolar grassland (V.A.5.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
FORMATION	Medium-tall bunch temperate or subpolar grassland (V.A.5.N.d.)
ALLIANCE	*POA PRATENSIS* SEMI-NATURAL HERBACEOUS ALLIANCE (A.3562) Kentucky Bluegrass Semi-natural Herbaceous Alliance

ECOLOGICAL SYSTEM(S): Southern Rocky Mountain Montane-Subalpine Grassland (CES306.824)

USFWS WETLAND SYSTEM: Palustrine

CONCEPT SUMMARY

Globally

This Kentucky bluegrass type is widespread throughout the Great Plains, the midwestern United States and plains of Canada, throughout montane elevations in the Colorado Plateau and southern Rocky Mountains. Stands can occur in a wide variety of upland human-disturbed and native habitats. Stands are typically found on fine-textured, poorly drained, often alluvial or well-developed soils that are topographically situated to receive supplemental moisture, such as flat areas, swales, creek bottoms, riparian areas, moist toeslopes of upland draws and drainages. The vegetation is dominated by medium-tall (0.5-1 m) graminoids. The dominant grass is *Poa pratensis*, considered to be both a native and naturalized species from Eurasia. Other native species may occur as well, but they are generally less than 10% cover. Native species may include mixed-grass prairie grasses, such as *Pascopyrum smithii* and *Hesperostipa comata (= Stipa comata)*, as well as others. Where native species are conspicuous enough to identify the native plant association that could occupy the site, the stand should be typed as such. This type includes only naturalized examples of *Poa pratensis* stands. Maintained lawns are treated as cultural types.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association is rare and was only observed and sampled on private lands of the Curecanti Ranch, occupying a nearly level, irrigated terrace.

Globally

This Kentucky bluegrass type is potentially widespread throughout the Great Plains and into the midwestern United States and Canada. Stands are also found on upland sites in the northwestern Great Plains and occur elsewhere in the western U.S. where *Poa pratensis* has invaded native western rangeland.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This herbaceous vegetation association occurs in a swale on a high terrace above Curecanti Creek on Curecanti Ranch. The site is nearly flat (3% slope), occurs at 2574 m elevation, and is oriented to the northwest. The unvegetated surface has high cover of litter and moderate cover of large rocks and cattle and elk scat. Parent materials are Mesozoic shale. Soils are poorly drained sandy loams.

Globally

This Kentucky bluegrass type is potentially widespread throughout the Great Plains and into the midwestern United States and Canada, at montane elevations in the Colorado Plateau and southern Rocky Mountains, and elsewhere in the western U.S. where the introduced perennial *Poa pratensis* has invaded native western rangeland. Stands can occur in a wide variety of upland human-disturbed and native habitats. Stands in western North Dakota are found on deep, well-developed, fine-textured soils that are topographically situated to receive supplemental moisture in the form of runoff from adjacent slopes. Such conditions exist in the toeslopes of upland draws and drainages, and in shallow depressions on north- and east-facing, nearly level slopes. Stands in the semi-arid western U.S. are typically found at montane elevations (1800-3250 m) on lowland and relatively mesic upland sites, such as canyon floors and

swales on high terraces with permanently saturated soils. Substrates are also typically finer-textured, poorly drained alluvial soils. The unvegetated surface has a moderate to high cover of litter.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This Kentucky bluegrass - western wheatgrass herbaceous vegetation type is rare on the Curecanti Ranch. The total vegetation cover is 65% on this densely vegetated stand. The non-native grass *Poa pratensis* forms an open canopy and provides up to 25% cover, along with the native graminoids *Juncus balticus* and *Pascopyrum smithii* that provide 15% and 5% cover, respectively. The herbaceous layer is somewhat diverse and provides moderate cover. Forbs provide low to moderate cover and include *Taraxacum officinale, Achillea millefolium var. occidentalis*, and Asteraceae sp. (= *Aster* sp.). The short shrub *Artemisia tridentata ssp. vaseyana* provides sparse cover.

Globally

The vegetation is dominated by medium-tall (0.5-1 m) graminoids. The dominant grass is *Poa pratensis*, considered to be both a native and naturalized species from Eurasia (Great Plains Flora Association 1986, Gleason and Cronquist 1991). Other native species may occur as well, but they are generally less than 10% cover. Native species may include mixedgrass prairie grasses, such as *Pascopyrum smithii* and *Hesperostipa comata (= Stipa comata)*, as well as other mesic forbs, such as *Achillea millefolium* and exotic *Taraxacum officinale*.

MOST ABUNDANT SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Herb (field)	*Achillea millefolium* var. *occidentalis*, *Taraxacum officinale*
Herb (field)	*Juncus balticus*, *Pascopyrum smithii*, *Poa pratensis*

Globally

Stratum	Species
Herb (field)	*Poa pratensis*

OTHER NOTEWORTHY SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Exotic/Invasive: *Tragopogon dubius* (exotic, Medium/Low)

Globally

Exotic/Invasive: *Poa pratensis* (invasive, Medium), *Taraxacum officinale* (exotic)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (invasive) (17-Jun-1999). This is primarily a naturalized type from Europe and Asia, widely planted for lawns and pasture, and it has escaped into a variety of habitats (Great Plains Flora Association 1986, Gleason and Cronquist 1991). Although native populations do exist and may be integral parts of some prairie and other native habitats, most stands that are thoroughly dominated by *Poa pratensis* are a result of human modifications to the habitat.

CLASSIFICATION COMMENTS

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Data are not available.

Globally

The debate over whether *Poa pratensis* is either native or introduced appears to be resolved in favor of it being both (Great Plains Flora Association 1986, Gleason and Cronquist 1991). The Great Plains Flora Association (1986) cites Boivin and Love (1960) as the source of this decision. Gleason and Cronquist (1991) state that in most parts of their Manual's range (Northeast and Midwest United States and adjacent Canada), the species is introduced, but that it is probably native along their northern boundary and in Canada.

This type could be narrowly restricted to mixed-grass prairie stands where *Poa pratensis* dominates to the exclusion of most other species, or it could be expanded to include almost any naturalized stand dominated by *Poa pratensis*. Where native species are conspicuous enough to identify the native plant association that could occupy the site, the

stand should be typed as such. This type includes only naturalized examples of *Poa pratensis* stands. Maintained lawns are treated as cultural types.

CLASSIFICATION CONFIDENCE: 3 - Weak

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Stand occurs below an irrigated pasture and associated ditch.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (1 plot, 7 observation points): (Plot: CURE.0300. Observation Points: BLCA_AA.450, BLCA_AA.891, BLCA_AA.949, CURE_AA.0158, CURE_AA.0475, CURE_AA.0537, CURE_AA.0595).
Local Description Authors: J. Von Loh
Global Description Authors: D. Faber-Langendoen, mod. K.A. Schulz

REFERENCES: Butler et al. 2002, Gleason and Cronquist 1991, Great Plains Flora Association 1986, MTNHP 2002b, Midwestern Ecology Working Group n.d., NDNHI unpubl. data, Trammell 1994, USFS 1937, Von Loh et al. 2000

Pleuraphis jamesii Herbaceous Vegetation

James' Galleta Herbaceous Vegetation

CODE	CEGL001777
PHYSIOGNOMIC CLASS	Herbaceous Vegetation (V)
PHYSIOGNOMIC SUBCLASS	Perennial graminoid vegetation (V.A.)
PHYSIOGNOMIC GROUP	Temperate or subpolar grassland (V.A.5.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
FORMATION	Short sod temperate or subpolar grassland (V.A.5.N.e.)
ALLIANCE	*PLEURAPHIS JAMESII* HERBACEOUS ALLIANCE (A.1287) James' Galleta Herbaceous Alliance

ECOLOGICAL SYSTEM(S): Inter-Mountain Basins Semi-Desert Grassland (CES304.787)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY
Globally
This widespread grassland association is found on alluvial flats, plateau parks, mesas and plains in the Colorado Plateau and elsewhere in the southwestern U.S. Landforms vary from mesatops and slopes to basin floors. Stands may be small woodland parks or more extensive grasslands on the plains. Soils in bottomland stands tend to be fine-textured; however, stands also occur on a variety of substrates. Vegetation is characterized by a relatively sparse to moderately dense (10-60% cover) perennial herbaceous layer that is strongly dominated by the warm-season bunchgrass *Pleuraphis jamesii*. Low cover of other grasses, such as *Achnatherum hymenoides, Bouteloua eriopoda, Bouteloua gracilis, Hesperostipa comata, Muhlenbergia porteri, Sporobolus airoides*, or *Sporobolus cryptandrus*, may be present. Forb cover is usually sparse and includes species of *Plantago, Gilia, Lappula*, and prickly pear cacti (*Opuntia* spp.). Many species of shrubs and dwarf-shrubs may be present; however, they are not dense enough to form a shrub layer. Some stands have high cover of cryptogams on the soil surface.

DISTRIBUTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This association is uncommon and was observed and sampled near Red Rocks and at the Chukar Trailhead Road in the Black Canyon of the Gunnison National Park and above the Middle Bridge Boat Ramp, in Kezar Basin, and below Morrow Point Dam in Curecanti National Recreation Area.

Globally
This widespread grassland association is found on alluvial flats, plateau parks and plains in the Colorado Plateau and elsewhere in the southwestern U.S.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This herbaceous vegetation association was observed on the toe- and midslopes of ridges, ridgetops, valley sides and benches, and lower slopes of gorges in the park and recreation area. Sites are moderately sloping to steep (7-65% slopes), occur between 1875 and 2423 m elevation, and are oriented to all aspects. The unvegetated surface has low to high litter cover and often has moderate to high cover of large and small rocks and exposure of bare soil. The sites are underlain by a diversity of geologic substrate, including Tertiary volcanic and Mesozoic shale rocks and Quaternary landslide deposits. Soils reflect the diversity of substrate, ranging from rapidly drained clay loams and sandy loams to sandy clay loams and loamy sands.

Globally

This widespread grassland association is found on a variety of sites, including alluvial flats, toeslopes, valley floors, benches, hillsides, washes, colluvial slopes, plateau parks, mesas and plains in the Colorado Plateau and elsewhere in the southwestern U.S. Elevation ranges from 1220-1930 m, with a few sites on the western edge of the southern Rocky Mountains extending to 2400 m. Landforms vary from mesatops and slopes to basin floors. Sites are flat to moderately steep (up to 53% slope). Stands may be small woodland parks or more extensive on the plains. Soils are variable. In bottomland stands, soils tend to be fine-textured; however, stands also occur on sandy loams derived from sandstone, remnant lavaflow, basaltic cobbles, black or red cinders, or alluvium derived from relict Pleistocene river cobbles, sandstone, sand, or clay soils.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This James' galleta herbaceous association is uncommon in the park and recreation area. The total vegetation cover ranges from 7 to 90% in these sparsely to densely vegetated stands. This herbaceous association is characterized by the short bunchgrass *Pleuraphis jamesii* that ranges in cover from 5 to 75%. The herbaceous layer is moderately diverse and can provide moderate cover. Additional graminoids commonly present and providing sparse to low cover include *Bromus tectorum, Bouteloua gracilis*, and *Hesperostipa comata*. Forbs are diverse but typically provide sparse cover and include the exotic annuals *Erodium cicutarium* and *Descurainia pinnata*. Short and dwarf-shrubs are diverse and provide sparse cover, including *Opuntia fragilis* and *Opuntia polyacantha*. Cryptogams are absent or sparse and typically provide less than 1% cover.

Globally

This association is characterized by a sparse to moderately dense perennial herbaceous layer (5-60% cover) that is strongly dominated by the warm-season bunchgrass *Pleuraphis jamesii*. Low cover of other grasses, such as *Aristida* spp., *Achnatherum hymenoides, Achnatherum speciosum, Bouteloua eriopoda, Bouteloua gracilis, Hesperostipa comata, Muhlenbergia porteri, Sporobolus airoides*, or *Sporobolus cryptandrus*, may be present. Forb cover is usually sparse and includes *Artemisia campestris, Cymopterus newberryi, Eriogonum inflatum, Phacelia crenulata, Plantago patagonica, Sphaeralcea parvifolia*, and *Townsendia annua* along with species of *Gilia, Lappula, Zinnia*, and prickly-pear cacti (*Opuntia* spp.). Many species of shrubs and dwarf-shrubs may be present, but they are not abundant enough to form a shrub layer. Woody species may include *Artemisia bigelovii, Artemisia filifolia, Atriplex canescens, Atriplex confertifolia, Brickellia oblongifolia, Ephedra torreyana, Ephedra viridis, Ericameria nauseosa, Fallugia paradoxa, Gutierrezia* spp., *Krascheninnikovia lanata, Tetradymia* spp., and occasional *Juniperus* spp. trees. The widespread introduced annual grass *Bromus tectorum* and several other exotic species, such as *Salsola kali, Bassia scoparia (= Kochia scoparia)*, and *Sisymbrium altissimum*, may be present to abundant, especially on disturbed sites. Some stands have high cover of cryptogams on the soil, including *Collema tenax, Tortula ruralis, Buellia papillata*, and *Fulgensia bracteata*.

MOST ABUNDANT SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Short shrub/sapling	*Opuntia fragilis*, *Opuntia polyacantha*
Herb (field)	*Erodium cicutarium*
Herb (field)	*Bromus tectorum*, *Hesperostipa comata*, *Pleuraphis jamesii*

Globally

Stratum	Species
Herb (field)	*Pleuraphis jamesii*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Exotic/Invasive: *Bassia scoparia* (exotic, Low), *Bromus tectorum* (exotic, High), *Salsola kali* (exotic), *Sisymbrium altissimum* (exotic)

CONSERVATION STATUS RANK
Global Rank & Reasons: G2G4 (23-Feb-1994).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
This association is defined by the dominance of *Pleuraphis jamesii* in the graminoid layer without codominance of other grass species or the presence of a shrub layer.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Sites are moderately grazed, and signs of sheep and elk are abundant. Type occurs on deeper soils of exposed ridgetops.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (6 plots, 1 observation point): (Plots: BLCA.0098, BLCA.0106, BLCA.0112, CURE.0040, CURE.0134, CURE.0190. Observation Point: CURE_AA.0516).
Local Description Authors: J. Von Loh, mod. J. Coles
Global Description Authors: K.A. Schulz, mod. J. Coles and G. Kittel

REFERENCES: Bourgeron and Engelking 1994, CONHP unpubl. data 2003, Cannon 1960, Cogan et al. 2004, Collins 1984, Driscoll et al. 1984, Francis 1986, Francis and Aldon 1983, Hansen et al. 2004b, Helm 1981, Kleiner 1968, Kleiner 1983, Kleiner and Harper 1972, Kleiner and Harper 1977, Marr et al. 1973a, Nichol 1937, Salas et al. 2009, Stewart et al. 1940, USFS 1937, Utah Environmental and Agricultural Consultants 1973, Von Loh et al. 2002, Weaver and Albertson 1956, West et al. 1972, Western Ecology Working Group n.d.

Juncus balticus Herbaceous Vegetation

Baltic Rush Herbaceous Vegetation

Baltic Rush Wet Meadow

CODE	CEGL001838
PHYSIOGNOMIC CLASS	Herbaceous Vegetation (V)
PHYSIOGNOMIC SUBCLASS	Perennial graminoid vegetation (V.A.)
PHYSIOGNOMIC GROUP	Temperate or subpolar grassland (V.A.5.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
FORMATION	Seasonally flooded temperate or subpolar grassland (V.A.5.N.k.)
ALLIANCE	*JUNCUS BALTICUS* SEASONALLY FLOODED HERBACEOUS ALLIANCE (A.1374) Baltic Rush Seasonally Flooded Herbaceous Alliance
ECOLOGICAL SYSTEM(S):	Inter-Mountain Basins Interdunal Swale Wetland (CES304.059) Boreal Wet Meadow (CES103.873) North American Arid West Emergent Marsh (CES300.729) Northern Columbia Plateau Basalt Pothole Pond (CES304.058)

Western Great Plains Open Freshwater Depression Wetland (CES303.675)
Rocky Mountain Alpine-Montane Wet Meadow (CES306.812)
Temperate Pacific Subalpine-Montane Wet Meadow (CES200.998)
Rocky Mountain Lower Montane-Foothill Riparian Woodland and Shrubland (CES306.821)

USFWS WETLAND SYSTEM: Palustrine

CONCEPT SUMMARY

Globally

This Baltic rush community is found widely throughout the western United States and into western Canada. This herbaceous wet meadow occurs as small to extensive, open to typically dense patches on flat stream benches, along overflow channels, and near springs. Habitats are often alkaline meadows and may have long-term grazing disturbance. Soils are variable and range from poorly to well-drained, sandy clay loam to fine sand-textured and are usually mottled or gleyed. Stands are characterized by dense swards of *Juncus balticus*. In montane zones and the Great Basin, minor cover of *Carex* species, including *Carex aquatilis, Carex praegracilis, Carex nebrascensis*, or *Carex utriculata*, is often present; other common species include *Deschampsia caespitosa, Distichlis spicata, Glyceria striata, Hordeum jubatum, Muhlenbergia asperifolia, Pascopyrum smithii, Phleum alpinum*, and *Sporobolus airoides*. The introduced perennial sod grasses *Poa pratensis* or *Agrostis stolonifera* codominate some stands. Forb cover is generally low and includes wetland species such as *Caltha leptosepala, Rumex aquaticus*, and *Dodecatheon pulchellum*. *Iris missouriensis* can be common in heavily grazed stands. Shrubs are not common. This association is often considered to be a grazing-induced community since it increases with disturbance, though it can be a stable late-seral community.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association is uncommon in the recreation area and was sampled on historically irrigated floodplain terraces of the Gunnison River within Curecanti National Recreation Area.

Globally

This Baltic rush wet meadow community is found widely throughout the western United States, ranging from South Dakota and Nebraska west to Washington, south to California, and east to New Mexico. It also occurs in western Canada.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This herbaceous vegetation association occurs on floodplain terraces of the Gunnison River. Sites are flat to gently sloped (1-4% slopes), occur between 2311 and 2314 m elevation, and are oriented to all aspects. The unvegetated surface has high cover of litter and low to moderate exposure of bare soil. Parent materials are Quaternary alluvium. Soils are well-drained silt loams and silty clay loams. The soils contain orange mottles at one site.

Globally

This broadly defined and widespread herbaceous wetland community is found throughout western North America. Elevation ranges from 138 to 3500 m (454-11,475 feet). Far northern stands in the Boreal Plains are at about 800 m (2625 feet). Stands usually occur as small, dense patches on flat to gently sloping sites near seeps and streams. Stream channels are highly variable in size and type, ranging from narrow to moderately wide, and from deeply entrenched to very sinuous (Kittel et al. 1999b). In the boreal regions, this community occurs more commonly on gradual sandy shorelines. Soils are also variable and range from sandy well-drained to poorly drained silty clay loam or silty clay alluvium to organic muck; however, soils tend to be finer-textured, alkaline and may be saline (Brotherson and Barnes 1984, Padgett et al. 1989, Kittel et al. 1999b). Sites with sandy soils are usually saturated for part of the growing season or have high water tables. Cobbles and gravel are common on many sites, and gleyed and mottled horizons are often present because of flooding or high water tables (Kittel et al. 1999b).

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This Baltic rush herbaceous vegetation association is rare to uncommon within the recreation area. The total vegetation cover ranges from 20 to 60% in these moderately vegetated stands. The graminoid *Juncus balticus* forms open, patchy stands and provides from 9 to 55% cover. The herbaceous layer is moderately diverse and provides

moderate to dense cover. Other graminoid species contribute low cover and include *Bromus inermis, Muhlenbergia richardsonis*, and *Pascopyrum smithii*. Forbs have low diversity, provide sparse to low cover, and include *Cirsium arvense, Equisetum laevigatum, Iris missouriensis*, and *Solidago* sp.

Globally
This broadly defined association is characterized by a low (<50 cm), open to typically dense graminoid layer dominated by the rhizomatous perennial *Juncus balticus*. In montane zones and the Great Basin, minor cover of *Carex* species, including *Carex aquatilis, Carex praegracilis, Carex microptera, Carex nebrascensis*, or *Carex utriculata*, is often present. Other common graminoids include *Deschampsia caespitosa, Distichlis spicata, Glyceria striata, Hordeum brachyantherum, Hordeum jubatum, Muhlenbergia andina, Muhlenbergia asperifolia, Pascopyrum smithii, Poa nemoralis ssp. interior, Phleum alpinum*, and *Sporobolus airoides*. Forb cover is generally low but may include *Achillea millefolium, Artemisia ludoviciana, Caltha leptosepala, Cirsium scariosum (= Cirsium tioganum), Dodecatheon pulchellum, Glaux maritima, Iris missouriensis, Maianthemum stellatum, Rumex aquaticus, Polygonum bistortoides, Potentilla plattensis*, and *Solidago canadensis*. Many other forb species may be present, given the wide elevational amplitude and broad geographic spread of this type. Shrubs and dwarf-shrubs are not common; however, *Artemisia frigida* cover may be significant in some stands, and occasional *Artemisia cana, Artemisia tridentata ssp. tridentata, Dasiphora fruticosa ssp. floribunda, Ericameria nauseosa, Populus* spp., *Rosa woodsii, Salix* spp., or *Sarcobatus vermiculatus* shrubs may occur. Some stands may be codominated by the introduced perennial sod grasses *Poa pratensis, Bromus inermis*, or *Agrostis stolonifera*. Other introduced species, such as *Cirsium arvense, Cirsium vulgare, Erodium cicutarium, Iva axillaris, Lactuca serriola, Phleum pratense, Taraxacum officinale, Thinopyrum intermedium, Trifolium* spp., *Tragopogon dubius, Xanthium strumarium*, and others, may occur in disturbed stands.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Herb (field)	*Cirsium arvense*, *Iris missouriensis*
Herb (field)	*Bromus inermis*, *Juncus balticus*, *Muhlenbergia richardsonis*
Herb (field)	*Equisetum laevigatum*

Globally

Stratum	Species
Herb (field)	*Juncus balticus*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Exotic/Invasive: *Bromus inermis* (exotic, High/Medium), *Cirsium arvense* (exotic, High/Medium), *Medicago sativa* (exotic, Insignificant), *Phalaris arundinacea* (exotic, High), *Poa pratensis* (exotic, Medium)

Globally
Exotic/Invasive: *Agrostis stolonifera* (weedy native, Medium/Low), *Bromus inermis* (exotic, High/Medium), *Cirsium arvense* (exotic noxious weed, High/Medium), *Cirsium vulgare* (exotic noxious weed, Medium/Low), *Erodium cicutarium* (exotic, Medium/Low), *Iva axillaris* (noxious weed), *Lactuca serriola* (exotic, Low/Insignificant), *Phleum pratense* (exotic, Medium), *Poa pratensis* (invasive, Medium), *Taraxacum officinale* (exotic), *Thinopyrum intermedium* (exotic, Medium/Insignificant), *Tragopogon dubius* (exotic, Medium/Low), *Xanthium strumarium* (noxious weed)

CONSERVATION STATUS RANK
Global Rank & Reasons: G5 (1-Feb-1996).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
This association is often considered to be a grazing-induced community since it increases with grazing disturbance. Based on the extensive geographic and environmental range (from alpine meadows to sagebrush-dominated landscapes), it verges on astonishing that any number of *Juncus balticus* associations have not been recognized.

CLASSIFICATION CONFIDENCE: 1 - Strong

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Some stands persist on previously irrigated pastures, and others are patches among sedge associations.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (5 plots, 10 observation points): (Plots: BLCA.0003, CURE. 0176, CURE.0181, CURE.0183, CURE.0277. Observation Points: BLCA_AA.323, CURE_AA.0049, CURE_AA.0050, CURE_AA.0056, CURE_AA.0082, CURE_AA.0087, CURE_AA.0091, CURE_AA.0092, CURE_AA.0856, CURE_AA.1432).
Local Description Authors: J. Von Loh, mod. G. Bradshaw
Global Description Authors: J. Drake, mod. D. Faber-Langendoen, K.A. Schulz, L. Allen, G. Kittel

REFERENCES: ANHIC n.d., Baker 1984a, Bell et al. 2009, Bourgeron and Engelking 1994, Brotherson and Barnes 1984, Bunin 1985, Butler et al. 2002, CONHP unpubl. data 2003, Carsey et al. 2003a, Carsey et al. 2003b, Christy 2004, Cogan et al. 2004, Cowardin et al. 1979, Crowe and Clausnitzer 1997, Crowe et al. 2004, Donnelly et al. 2006, Driscoll et al. 1984, Evans 1989b, Evenden 1990, Faber-Langendoen 2001, Flowers 1962, Hall and Hansen 1997, Hansen et al. 1995, Henderson and McAllister 1983, Hess 1981, IDCDC 2005, Jankovsky-Jones et al. 1999, Jankovsky-Jones et al. 2001, Johnston 1987, Jones 1992b, Jones and Walford 1995, Kagan et al. 2000, Kartesz 1994a, Kierstead and Pogson 1976, Kittel and Lederer 1993, Kittel et al. 1997a, Kittel et al. 1999a, Kittel et al. 1999b, Klein et al. 2007, Komarkova 1986, Kovalchik 1987, Kunze 1994, MTNHP 2002b, Manning 1988, Manning and Padgett 1991, Manning and Padgett 1992, Muldavin et al. 2000a, Muldavin et al. 2003, Muldavin et al. 2006, Murray 2000, Mutel 1973, Mutz and Graham 1982, Olson and Gerhart 1982, Padgett 1981, Padgett 1982, Padgett et al. 1989, Rector 1979, Richard et al. 1996, Shupe et al. 1986, Stewart 1940, Taylor 1980, Taylor and Teare 1979a, Thompson and Hansen 2002, Titus and Christy 1996a, Tuhy and Jensen 1982, Volland 1976, WNHP unpubl. data, Wasser and Hess 1982, Western Ecology Working Group n.d., Youngblood et al. 1985a

Phalaris arundinacea Western Herbaceous Vegetation

Reed Canarygrass Western Herbaceous Vegetation

Reed Canarygrass Wet Meadow

CODE	CEGL001474
PHYSIOGNOMIC CLASS	Herbaceous Vegetation (V)
PHYSIOGNOMIC SUBCLASS	Perennial graminoid vegetation (V.A.)
PHYSIOGNOMIC GROUP	Temperate or subpolar grassland (V.A.5.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar grassland (V.A.5.N.)
FORMATION	Seasonally flooded temperate or subpolar grassland (V.A.5.N.k.)
ALLIANCE (A.1381)	*PHALARIS ARUNDINACEA* SEASONALLY FLOODED HERBACEOUS ALLIANCE Reed Canarygrass Seasonally Flooded Herbaceous Alliance

ECOLOGICAL SYSTEM(S):
North American Arid West Emergent Marsh (CES300.729)
Northern Columbia Plateau Basalt Pothole Pond (CES304.058)
Western Great Plains Open Freshwater Depression Wetland (CES303.675)
Rocky Mountain Lower Montane-Foothill Riparian Woodland and Shrubland (CES306.821)

USFWS WETLAND SYSTEM: Palustrine

CONCEPT SUMMARY

Globally

This herbaceous association is reported from throughout Washington, Colorado, Nebraska, Montana, Idaho, and into northeastern Utah, but is likely more widespread in the western United States. It also occurs in Canada , in the southern two-thirds of British Columbia in areas with warm and relatively dry summers and in Alberta, from the Great Plains north into the Boreal Plains. Its distribution as a natural type is complicated because this native species is widely cultivated as a forage crop and has escaped and established in wetlands and riparian areas, displacing the local flora. Elevations range from near sea level to 2307 m. Stands are found along riparian areas, pond and lake margins, wet meadows, and intermittent drainages. The poorly drained alluvial soils are commonly fine-textured (occasionally coarse-textured) and may be flooded for brief to extended periods. The vegetation is characterized by a dense, tall herbaceous layer (often >80% canopy cover and 1.5-2 m tall) that is dominated by *Phalaris arundinacea*, which tends to occur in monocultures. Associated species may include *Equisetum arvense, Muhlenbergia asperifolia, Mentha arvensis, Schoenoplectus acutus (= Scirpus acutus)*, and many other species in trace amounts where disturbed. Introduced species such as *Agrostis gigantea, Bromus inermis, Bromus tectorum, Cirsium arvense, Elymus repens, Euphorbia esula, Hordeum brachyantherum, Lepidium latifolium, Melilotus officinalis, Phleum pratense, Poa pratensis*, and *Sonchus oleraceus* are common in some disturbed stands.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association is limited to perennial streams carrying runoff irrigation water and was observed and sampled on the Gunnison River near the Warner Route into Black Canyon and on drainages tributary to the Gunnison River at the border with the Sandberg property and at Cooper's Ranch in the recreation area.

Globally

This association is reported from Colorado, Nebraska, Montana, Idaho, Washington and northeastern Utah and is likely more widespread in the western United States. It has been documented to occur in British Columbia and Alberta, Canada, and is likely widespread elsewhere in southern parts of Canadian provinces. Its distribution as a natural type is complicated because this native species is widely cultivated as a forage crop and has escaped and established in many wetlands and riparian areas.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This tall herbaceous vegetation association was observed in both narrow and broad floodplains of the Gunnison River and its tributaries. Sites are nearly flat (1-6% slopes), between 1723 and 2307 m elevation, and are oriented to the direction of the drainage and its slopes. The unvegetated surface always has high cover of litter. Downed wood in the form of driftwood can be locally common. Soils are poorly drained, usually saturated sandy loams or loamy sands derived from local alluvium.

Globally

This association is reported from throughout Washington, Colorado, Nebraska, Montana, Idaho, and northeastern Utah, but is likely more widespread in the western United States. It also occurs in Alberta, Canada. Elevations range from near sea level to 2307 m (7564 feet). Stands are found along riparian areas, pond and lake margins, wet meadows, and intermittent drainages. Sites are flat to rolling. The poorly drained soils are derived from alluvium and are commonly fine-textured but can also be coarser in texture. Subsoil is often mottled and gleyed (Crawford 2001). Sites are generally flooded from brief to extended periods, and soils remain saturated throughout the growing season.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This reed canarygrass herbaceous association is rare within the park and recreation area. The total vegetation cover ranges from 81 to 100% in these densely vegetated stands. This tall-grass association is characterized by *Phalaris arundinacea* that provides 65 to 98% cover. Another grass, *Agrostis gigantea*, sometimes provides up to 10% cover, while other graminoid species are sparse, including the exotics *Bromus inermis, Bromus tectorum*, and *Elymus repens*. Forbs are mostly exotic, uncommon and variable between sites, provide sparse to low cover, and include *Artemisia dracunculus, Cirsium arvense, Melilotus officinalis*, and *Rumex crispus*. Occasional tall or short shrubs provide sparse cover, including *Salix exigua, Amelanchier utahensis*, and *Quercus gambelii*. The canopy tree *Acer negundo* is present along the Gunnison River and provides sparse cover.

Globally
This association is characterized by a dense, tall herbaceous layer (often >90% canopy cover and 1.5-2 m tall) that is dominated by *Phalaris arundinacea*, which tends to occur in monocultures. Associated species such as *Equisetum arvense, Muhlenbergia asperifolia, Mentha arvensis, Schoenoplectus acutus (= Scirpus acutus), Polygonum amphibium, Solidago canadensis, Urtica dioica*, and many other species may be present in trace amounts especially where disturbed. Occasional *Populus tremuloides, Salix exigua, Rubus idaeus*, or *Symphoricarpos albus* may be present is some stands. Introduced species such as *Agrostis gigantea, Bromus inermis, Bromus tectorum, Cirsium arvense, Elymus repens, Euphorbia esula, Hordeum brachyantherum, Lepidium latifolium, Melilotus officinalis, Phleum pratense, Poa pratensis*, and *Sonchus oleraceus* are common in some disturbed stands.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Herb (field)	*Artemisia dracunculus*
Herb (field)	*Agrostis gigantea*, *Phalaris arundinacea*

Globally

Stratum	Species
Herb (field)	*Phalaris arundinacea*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Exotic/Invasive: *Bromus inermis* (exotic, High/Medium), *Bromus tectorum* (exotic, High), *Cirsium arvense* (exotic, High/Medium), *Elymus repens* (exotic, High/Medium), *Melilotus officinalis* (exotic, Medium/Low), *Phleum pratense* (exotic, Medium), *Poa pratensis* (exotic, Medium), *Rumex crispus* (exotic, Low/Insignificant), *Thlaspi arvense* (exotic, Low/Insignificant)

Globally
Exotic/Invasive: *Agrostis gigantea* (exotic, Medium/Low), *Bromus inermis* (exotic, High/Medium), *Bromus tectorum* (exotic, High), *Cirsium arvense* (exotic, High/Medium), *Elymus repens* (exotic, High/Medium), *Euphorbia esula* (exotic, High/Medium), *Lepidium latifolium* (exotic, High), *Melilotus officinalis* (exotic, Medium/Low), *Phleum pratense* (exotic, Medium), *Poa pratensis* (exotic, Medium), *Sonchus oleraceus* (exotic)

CONSERVATION STATUS RANK
Global Rank & Reasons: G5 (3-Mar-1999).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Other natural associations included in this alliance are found throughout the northeastern United States, but this western association's distribution as a natural type is not clear because of extensive planting as a forage crop (Hansen et al. 1995, Hall and Hansen 1997). The species is native and widespread in Alberta, although some introduced genotypes may be present. Further work is required to resolve the natural versus introduced nature of this type in western North America.

CLASSIFICATION CONFIDENCE: 1 - Strong

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: This tall grass has been introduced into agriculture and is escaping into the park and recreation area along perennial streams fed by waste irrigation water.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (3 plots, 9 observation points): (Plots: BLCA.0063, BLCA.0111, CURE.0251. Observation Points: BLCA_AA.443, BLCA_AA.544, BLCA_AA.550, BLCA_AA.558, BLCA_AA.573, BLCA_AA.576, CURE_AA.0027, CURE_AA.0253, CURE_AA.0620).
Local Description Authors: J. Von Loh, mod. G. Bradshaw and J. Coles

Global Description Authors: K.A. Schulz, mod. L. Allen and G. Kittel

REFERENCES: ANHIC n.d., Bourgeron and Engelking 1994, Carsey et al. 2003a, Cooper et al. 1995, Crawford 2001, Driscoll et al. 1984, Hall and Hansen 1997, Hansen et al. 1995, IDCDC 2005, MTNHP 2002b, MacKenzie and Moran 2004, Muldavin et al. 2000a, Salas and Pucherelli 2002, Thompson and Hansen 2002, Von Loh 2000, Western Ecology Working Group n.d., Willoughby et al. 2004

Artemisia tridentata ssp. vaseyana / Poa (pratensis, compressa) Semi-natural Shrub Herbaceous Vegetation

Mountain Big Sagebrush / (Kentucky Bluegrass, Canada Bluegrass) Semi-natural Shrub Herbaceous Vegetation

CODE	CEGL002339
PHYSIOGNOMIC CLASS	Herbaceous Vegetation (V)
PHYSIOGNOMIC SUBCLASS	Perennial graminoid vegetation (V.A.)
PHYSIOGNOMIC GROUP	Temperate or subpolar grassland with a sparse shrub layer (V.A.7.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar grassland with a sparse shrub layer (V.A.7.N.)
FORMATION	Medium-tall temperate or subpolar grassland with a sparse needle-leaved or microphyllous evergreen shrub
ALLIANCE	*ARTEMISIA TRIDENTATA SSP. VASEYANA* SHRUB HERBACEOUS ALLIANCE (A.1526) layer (V.A.7.N.e.) Mountain Big Sagebrush Shrub Herbaceous Alliance

ECOLOGICAL SYSTEM(S): Inter-Mountain Basins Montane Sagebrush Steppe (CES304.785)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY

Globally

This shrub herbaceous association is known only from Black Canyon of the Gunnison National Park. Stands occur on toeslopes, plateaus, ridgetops, and in valley bottoms between 2311 and 2456 m elevation. Sites are flat to gently sloping with cooler northern to southeastern aspects. The unvegetated surface has moderate to dense cover of litter and exposure of bare soil. The underlying geology is varied and includes Mesozoic sandstone, metamorphic granitic rocks, and Quaternary alluvium. Soils are moderately well-drained and range from silty clay loams to sandy loams depending on parent materials. The vegetation is characterized by an open to relatively closed short-shrub canopy, from 0.5-2 m tall, of *Artemisia tridentata ssp. vaseyana* (5-50% cover), with a moderately dense herbaceous layer dominated by exotic grasses *Poa pratensis* and *Poa compressa*. The associated shrubs and dwarf-shrubs are diverse and provide low cover, including *Amelanchier utahensis, Artemisia tridentata ssp. wyomingensis, Chrysothamnus viscidiflorus, Ericameria parryi, Gutierrezia sarothrae, Mahonia repens, Opuntia fragilis, Peraphyllum ramosissimum, Rosa woodsii, Symphoricarpos oreophilus*, and *Symphoricarpos rotundifolius*. The herbaceous layer has moderate to sometimes low cover and is very diverse. The associated graminoids include *Achnatherum lettermanii, Elymus elymoides*, and *Hesperostipa comata*. Forb cover is diverse but sparse.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association is uncommon and was observed and sampled on the North Rim near the "Y" intersection off North Rim Drive and in Grizzly Gulch and also along the Deadhorse Mesa Trail in Black Canyon of the Gunnison National Park and in Big Draw on adjacent private land.

Globally

This association is known only from Black Canyon of the Gunnison National Park, Colorado.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This shrub herbaceous association was observed on toeslopes, plateaus, ridgetops, and in valley bottoms. Sites are nearly level (0-7% slopes), occur between 2311 and 2456 m elevation, and are oriented to northern to southeastern

aspects. The unvegetated surface has moderate to dense cover of litter and exposure of bare soil. Downed wood is uncommon to common. The underlying geology is varied and includes Mesozoic sandstone, metamorphic granitic rocks, and Quaternary alluvium. Soils are moderately well-drained silty clay loams, silt loams, and sandy loams derived from mixed sources.

Globally
Data are not available.

VEGETATION DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This mountain big sagebrush / Kentucky bluegrass - Canada bluegrass shrub herbaceous association is uncommon on mesic sites within the park. The total vegetation cover ranges from 45 to 95% in these densely vegetated stands. This shrub herbaceous association is characterized by an open to relatively closed short-shrub canopy, from 0.5-2 m tall, of *Artemisia tridentata ssp. vaseyana* that ranges in cover from 5 to 50%, and the exotic grasses *Poa pratensis* and *Poa compressa* that range in cover from 0 to 40% and 0 to 25%, respectively. The associated shrubs are diverse and provide low cover, including the tall shrub *Amelanchier utahensis* and the short and dwarf-shrubs *Artemisia tridentata ssp. wyomingensis, Chrysothamnus viscidiflorus, Ericameria parryi, Gutierrezia sarothrae, Mahonia repens, Opuntia fragilis, Peraphyllum ramosissimum, Rosa woodsii, Symphoricarpos oreophilus*, and *Symphoricarpos rotundifolius*. The herbaceous layer is very diverse and provides low to moderate cover. The associated graminoids include *Achnatherum lettermanii, Elymus elymoides*, and *Hesperostipa comata*. Forbs are diverse, contribute sparse cover, and the most common include *Achillea millefolium var. occidentalis, Antennaria parvifolia, Artemisia ludoviciana, Astragalus* spp., *Castilleja* spp., *Cirsium undulatum var. tracyi, Comandra umbellata, Eriogonum racemosum, Ipomopsis aggregata, Lupinus* spp., and *Phlox longifolia*. Mosses provide less than 1% cover.

Globally
Data are not available.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Short shrub/sapling	*Peraphyllum ramosissimum*
Short shrub/sapling	*Artemisia tridentata* ssp. *vaseyana*
Herb (field)	*Achnatherum lettermanii*, *Poa compressa*, *Poa pratensis*

Globally

Stratum	Species
Short shrub/sapling	*Artemisia tridentata* ssp. *vaseyana*
Herb (field)	*Poa compressa*, *Poa pratensis*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Exotic/Invasive: *Bromus tectorum* (exotic, High)

Globally
Data are not available.

CONSERVATION STATUS RANK
Global Rank & Reasons: GNA (ruderal) (19-Jan-2005).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CLASSIFICATION CONFIDENCE:

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Data are not available.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (5 plots, 11 observation points): (Plots: BLCA.0012, BLCA.0027, BLCA.0054, BLCA.0134, CURE.0291. Observation Points: BLCA_AA.937, BLCA_AA.938, BLCA_AA.955, BLCA_AA.962, BLCA_AA.963, BLCA_AA.965, BLCA_AA.966, CURE_AA.0080, CURE_AA.0400, CURE_AA.0408, CURE_AA.0626).
Local Description Authors: J. Von Loh, mod. G. Bradshaw and J. Coles
Global Description Authors: J. Coles, mod. K.A. Schulz

REFERENCES: Western Ecology Working Group n.d.

Aquilegia micrantha - Calamagrostis scopulorum Herbaceous Vegetation

Mancos Columbine - Ditch Reedgrass Herbaceous Vegetation

CODE	CEGL002592
PHYSIOGNOMIC CLASS	Herbaceous Vegetation (V)
PHYSIOGNOMIC SUBCLASS	Perennial forb vegetation (V.B.)
PHYSIOGNOMIC GROUP	Temperate or subpolar perennial forb vegetation (V.B.2.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar perennial forb vegetation (V.B.2.N.)
FORMATION	Saturated temperate perennial forb vegetation (V.B.2.N.f.)
ALLIANCE	*AQUILEGIA MICRANTHA* SATURATED HANGING GARDEN HERBACEOUS ALLIANCE (A.2506) Mancos Columbine Saturated Hanging Garden Herbaceous Alliance

ECOLOGICAL SYSTEM(S): Colorado Plateau Hanging Garden (CES304.764)

USFWS WETLAND SYSTEM: Palustrine

CONCEPT SUMMARY
Globally
This association is confined to seeps emerging from sandstone cliffs in the Colorado Plateau and lower elevation canyons in adjacent southern Rocky Mountains where it may occur on metamorphic substrates. Elevations are below 2000 m. Aspect is not important in determining the distribution of this association. Instead, seeps will tend to occur on the side of the canyon where gravity and hydrology combine to force groundwater out. The unvegetated surface often has high cover of bare soil, sometimes coated with a white calcareous crust or bedrock. For the most part, soils are derived from dissolution of sandstone grains and fragments from adjacent slopes and ledges and are saturated year-round from water seeping between sedimentary rock layers. In the case of a stand in the Black Canyon of the Gunnison, a north-facing alcove with a seep and overhanging ledge is cut into Black Canyon schist and gneiss. Total vegetation cover ranges from 20 to 75% and is characterized by clumps of *Calamagrostis scopulorum* and *Aquilegia micrantha*. In drier gardens, *Schizachyrium scoparium* may be dominant. Other herbaceous species occurring frequently in this association include *Zigadenus vaginatus, Epipactis gigantea, Platanthera zothecina, Cirsium ownbeyi, Petrophyton caespitosum, Dodecatheon pulchellum, Clematis ligusticifolia, Solidago nana, Pellaea glabella, Zigadenus elegans*, and *Solidago velutina*. There is no developed shrub or tree layer, but most occurrences include scattered woody plants such as *Pinus edulis, Amelanchier utahensis, Prunus virginiana, Paxistima myrsinites, Cercocarpus intricatus, Glossopetalon spinescens var. meionandrum, Betula occidentalis, Brickellia* sp., *Ericameria* sp., *Symphoricarpos rotundifolius, Holodiscus dumosus*, and *Rhus trilobata*.

DISTRIBUTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This association was observed on the Warner Route in Black Canyon of the Gunnison National Park. This association is likely to be found in similar sites throughout the park.

Globally
This association has been documented from the Colorado Plateau and Uinta Basin of western Colorado and eastern Utah. It may also occur at Zion National Park (Malanson 1980, 1982), although it was not documented there during a recent (2003) NPS vegetation mapping effort.

ENVIRONMENTAL DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This herbaceous vegetation occurs in a hanging garden near the Warner Route in the Black Canyon of the Gunnison National Park. The site is nearly vertical and is oriented to the aspect of the cliff face (359 degrees). The elevation is 1730 m. The alcove supporting the garden is cut into Black Canyon schist and gneiss and is approximately 22 m high and 20 m wide with a rock overhang above it. Water seeps out from cracks about 10 m above the ledge. Vegetation grows in cracks in the alcove and also on the ledge that forms the floor of the alcove. The unvegetated surface is composed of bedrock (98%) and litter (2%).

Globally
This hanging garden association occurs on ledges and in crevices and alcoves in near-vertical sandstone canyon walls in southeastern Utah and northwestern Colorado and in Black Canyon on the Gunnison metamorphic substrate in west-central Colorado. Elevations are below 2000 m. Sandy soils that accumulate in the cliff crevices or at the bases of canyon alcoves are saturated year-round from water seeping between sedimentary rock layers or in the case of Black Canyon, a north-facing alcove with a seep and overhanging ledge is cut into Black Canyon schist and gneiss. Aspect is not important in determining the distribution of this association. Instead, seeps will tend to occur on the side of the canyon where gravity and hydrology combine to force water out. The unvegetated surface often has high cover of bare soil, sometimes coated with a white calcareous crust or bedrock. For the most part, soils are derived from dissolution of sandstone grains and fragments from adjacent slopes and ledges.

VEGETATION DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Hanging gardens supporting this herbaceous vegetation are rare and difficult to access in Black Canyon of the Gunnison National Park. This hanging garden is comprised of short-statured (<0.5 m tall) herbaceous species and is moderately dense in terms of foliar cover (20%). Graminoid species are limited to *Calamagrostis scopulorum* (approximately 10% cover). Forbs dominate the community, with *Aquilegia micrantha* contributing 8% cover. *Mimulus eastwoodiae* is absent from this plot, replaced by the rare plant *Sullivantia hapemanii var. purpusii* (<1% cover). The cosmopolitan forbs *Artemisia ludoviciana, Heterotheca villosa*, and *Lepidium montanum* are also present (<1%). Shrubs contribute low cover (<1 to 1%) and include *Brickellia* sp., *Ericameria* sp., *Symphoricarpos rotundifolius*, and *Holodiscus dumosus*.

Globally
This association is confined to seeps emerging from sandstone cliffs in the Colorado Plateau. Total vegetation cover ranges from 20 to 75% and is characterized by clumps of *Calamagrostis scopulorum* and *Aquilegia micrantha*. In drier gardens, *Schizachyrium scoparium* may be dominant. Other herbaceous species occurring frequently in this association include *Zigadenus vaginatus, Epipactis gigantea, Platanthera zothecina, Cirsium ownbeyi, Petrophyton caespitosum, Dodecatheon pulchellum, Clematis ligusticifolia, Solidago nana, Pellaea glabella, Zigadenus elegans*, and *Solidago velutina*. There is no developed shrub or tree layer, but most occurrences include scattered woody plants such as *Pinus edulis, Amelanchier utahensis, Prunus virginiana, Paxistima myrsinites, Cercocarpus intricatus, Glossopetalon spinescens var. meionandrum, Betula occidentalis, Brickellia* sp., *Ericameria* sp., *Symphoricarpos rotundifolius, Holodiscus dumosus*, and *Rhus trilobata*.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Short shrub/sapling	*Holodiscus dumosus*
Herb (field)	*Aquilegia micrantha*
Herb (field)	*Calamagrostis scopulorum*

Globally

Stratum	Species
Herb (field)	*Aquilegia micrantha*

Herb (field) *Calamagrostis scopulorum*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Vulnerable: *Sullivantia hapemanii* var. *purpusii* (globally vulnerable, G3T3)

Globally
Vulnerable: *Carex curatorum* (globally imperiled; endemic to hanging gardens, G2), *Cirsium ownbeyi* (vulnerable; endemic to hanging gardens, G3), *Platanthera zothecina* (globally imperiled, G2), *Sullivantia hapemanii* var. *purpusii* (vulnerable, G3T3), *Zigadenus vaginatus* (globally imperiled, G2); **Other**: *Epipactis gigantea* (G4)

CONSERVATION STATUS RANK
Global Rank & Reasons: GNR (7-Apr-2005).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This hanging garden association occurs on ledges on near-vertical, northerly aspects of metamorphic cliff faces. The availability of water from a seep and the gradual building of soil caught and held by the moist rock surface are key to this association's survival. This stand may be vulnerable to casual climbing, due to its location near a popular hiking route accessing the inner canyon and the relative ease of accessing it. This association in general is vulnerable to both casual and sport climbing activities, as well as changes and fluctuations in water availability due to drought and changing land uses on the canyon rim.

It would be nice to have a sense of how the vegetation is distributed between the wet cracks in the alcove wall and the floor of the alcove, and which species occur where.

Globally
This association is part of a complex of herbaceous communities collectively known as "hanging gardens." Few systematic studies of these communities have been completed (e.g., Welsh and Toft 1981, Welsh 1989, Fowler 1995), and even fewer quantitative data are available, partly because stands can be difficult or dangerous to access. The National Park Service is undertaking systematic surveys of vegetation, particularly spring and seep communities, throughout the Colorado Plateau (Evenden pers. comm. 2005). As more data become available, the various hanging garden associations should be revisited. John Spence, botanist at Glen Canyon National Recreation Area, is reported to be in the process of publishing a comprehensive study and classification of hanging gardens in the Colorado Plateau (J. Spence pers. comm. 2005).

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Because of the general inaccessibility of this association, only one site has been sampled. Due to the conservation status of the community and of the species *Sullivantia hapemanii var. purpusii*, and of the potential for damage to this and other hanging garden communities by recreational users, sampling these communities should be a priority. Sampling outside the project area should take place in order to identify other hanging garden associations and to increase the classification confidence. One further consideration for future sampling of this and other sparsely distributed communities is the method by which plot data are collected. Since traditional plots are not practical in vertical environments, alternative methods need to be developed and guidelines distributed.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points:
The description is based on field data (1 plot): (Plot: BLCA.117).
Local Description Authors: J. Von Loh, mod. G. Bradshaw
Global Description Authors: J. Coles, mod. K.A. Schulz

REFERENCES: Evenden pers. comm., Fowler 1995, Malanson 1980, Malanson 1982, Spence pers. comm., Welsh 1989, Welsh and Toft 1981, Western Ecology Working Group n.d.

Erodium cicutarium Semi-natural Annual Herbaceous Vegetation

Redstem Stork's-bill Semi-natural Annual Herbaceous Vegetation

CODE	CEGL002085
PHYSIOGNOMIC CLASS	Herbaceous Vegetation (V)
PHYSIOGNOMIC SUBCLASS	Annual graminoid or forb vegetation (V.D.)
PHYSIOGNOMIC GROUP	Temperate or subpolar annual grasslands or forb vegetation (V.D.2.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar annual grasslands or forb vegetation (V.D.2.N.)
FORMATION	Tall temperate or subpolar annual forb vegetation (V.D.2.N.b.)
ALLIANCE	*ERODIUM CICUTARIUM* HERBACEOUS ALLIANCE (A.2647) Redstem Stork's-bill Herbaceous Alliance

ECOLOGICAL SYSTEM(S): Inter-Mountain Basins Semi-Desert Grassland (CES304.787)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY

Globally

This small-patch annual exotic herbaceous association occurs on ridges and valley bottoms in highly disturbed sites in the Colorado Plateau. Sites occupied by this association are generally associated with severe disturbance, such as annual grazing by sheep and/or cattle, mining or a very hot fire. Elevations range from 1692 to 2306 m (5550-7565 feet), and sites occur on level to moderate slopes with south to west exposures. Soils are generally sandy and derived from eolian or alluvial deposits. Cryptobiotic crusts may cover much of the unvegetated surface in sites that have not been grazed recently. Total vegetation cover is sparse to moderate (16-40%), depending on the amount of winter/spring precipitation and the time of year a site is sampled. The exotic annual forb *Erodium cicutarium* provides most of the vegetative cover, but other weedy and exotic species are also generally present, including *Bromus tectorum, Descurainia pinnata, Sisymbrium altissimum, Carduus nutans*, and *Tragopogon dubius*. A few scattered shrubs typical of sandy alkaline conditions may be present, including *Atriplex canescens, Opuntia polyacantha, Ephedra viridis, Lycium pallidum*, and *Quercus gambelii*.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association is rare and occupies a 1994 burn in the Red Rocks area of Black Canyon of the Gunnison National Park.

Globally

This association is of limited extent in northern Arizona, southeastern Utah, and western Colorado. It has been documented from western Colorado and southeastern Utah and has been observed, but not sampled, on the floor of Canyon del Muerto and Canyon de Chelly at Canyon de Chelly National Monument.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This annual exotic herbaceous vegetation association occupies the upper midslope of a ridge on a site that had burned in 1994. The site is moderately steep (18% slope), occurs at 2306 m elevation, and is oriented to the southwest. The unvegetated surface has low cover of litter but moderately high cover (40%) of cryptobiotic crust. Bedrock, large rocks, small rocks, and bare soil comprise nearly one-half of the unvegetated surface. Downed wood is common. The soils are sandy loams derived from the local sandstone.

Globally

This small-patch annual herbaceous association occurs on ridges and valley bottoms in highly disturbed sites in the Colorado Plateau. Elevations range from 1692 to 2306 m (5550-7565 feet), and sites occur on level to moderate slopes with south to west exposures. Soils are generally sandy and derived from eolian or alluvial deposits. Cryptobiotic crusts may cover much of the unvegetated surface in sites that have not been grazed in a number of years; in grazed sites, bare ground and rocks cover most of the surface.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This crane's-bill annual herbaceous association is limited to the site of a burn that occurred in 1994. The total vegetation cover is low, 16% cover. This herbaceous association is characterized by low-growing crane's-bill that provides 15% cover. Additional exotic forbs that have invaded this site and contributed sparse cover include *Carduus nutans, Descurainia pinnata ssp. nelsonii, Taraxacum officinale*, and *Tragopogon dubius*. Graminoids provide sparse cover and include the perennial bunch grasses *Elymus elymoides* and *Achnatherum hymenoides* and the exotic annual *Bromus tectorum*. The shrub layer is sparse and includes short-statured *Ephedra viridis* and *Quercus gambelii*. The cryptobiotic crust is in the process of forming into pedicels above the normal ground surface and provides dense cover.

Globally
This annual herbaceous association indicates sites that have experienced severe or chronic disturbance. Total vegetation cover in this annual herbaceous type is sparse to moderate (16-40%), depending on the amount of winter/spring precipitation and the time of year a site is sampled. The exotic annual forb *Erodium cicutarium* provides most of the vegetative cover, but other weedy and exotic species are also generally present, including *Bromus tectorum, Descurainia pinnata, Sisymbrium altissimum, Carduus nutans*, and *Tragopogon dubius*. A few scattered shrubs may be present, including *Opuntia polyacantha, Ephedra viridis, Lycium pallidum, Atriplex canescens*, and *Quercus gambelii*.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Herb (field)	*Elymus elymoides*

Globally

Stratum	Species
Herb (field)	*Erodium cicutarium*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Exotic/Invasive: *Bromus tectorum* (exotic, High), *Carduus nutans* (exotic, High/Low), *Descurainia pinnata* ssp. *nelsonii* (exotic), *Taraxacum officinale* (exotic), *Tragopogon dubius* (exotic, Medium/Low)

Globally
Exotic/Invasive: *Erodium cicutarium* (exotic, Medium/Low)

CONSERVATION STATUS RANK
Global Rank & Reasons: GNA (invasive) (14-Dec-2004).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
The classification and description of this type are based on data from one vegetation plot sampled in the Red Rocks area of Black Canyon of the Gunnison National Park.

Globally
Data are not available.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: Apparently rare on historic burns.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points:
The description is based on field data (1 plot, 3 observation points): (Plot: BLCA.0094. Observation Points: BLCA_AA.310, BLCA_AA.321, BLCA_AA.374).
Local Description Authors: J. Von Loh, mod. J. Coles
Global Description Authors: J. Coles

REFERENCES: Bentley and Talbot 1948, Felger n.d., Wagner et al. 1978, Western Ecology Working Group n.d.

Bromus tectorum Semi-natural Herbaceous Vegetation

Cheatgrass Semi-natural Herbaceous Vegetation

Cheatgrass Annual Grassland

CODE	CEGL003019
PHYSIOGNOMIC CLASS	Herbaceous Vegetation (V)
PHYSIOGNOMIC SUBCLASS	Annual graminoid or forb vegetation (V.D.)
PHYSIOGNOMIC GROUP	Temperate or subpolar annual grasslands or forb vegetation (V.D.2.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural temperate or subpolar annual grasslands or forb vegetation (V.D.2.N.)
FORMATION	Short temperate annual grassland (V.D.2.N.d.)
ALLIANCE	*BROMUS TECTORUM* SEMI-NATURAL HERBACEOUS ALLIANCE (A.1814) Cheatgrass Semi-natural Herbaceous Alliance

ECOLOGICAL SYSTEM(S): Inter-Mountain Basins Semi-Desert Grassland (CES304.787)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY

Globally

This herbaceous vegetation type is found throughout much of western North America from the western Great Plains to the Intermountain West. It occurs most often after disturbance of a natural shrub- or grass-dominated community that results in the replacement of the natural vegetation by non-native, annual grass species of *Bromus*. *Bromus tectorum* typically dominates the community with over 80-90% of the total vegetation cover, making it difficult to determine what natural community was formerly present. This vegetation also includes grasslands dominated or codominated by other Eurasian introduced annual *Bromus* species such as *Bromus hordeaceus, Bromus madritensis, Bromus japonicus, Bromus rigidus*, or *Bromus rubens*. It is distinct from the annual *Bromus* communities found along the Pacific Coast typical of the Mediterranean or maritime climates.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association occurs throughout developed and disturbed areas of the park and recreation area and was observed and sampled on the 1994 burn at Red Rocks, near the Pumphouse at the Red Rocks Campground, and on the burn in Jones Draw.

Globally

This alliance-level herbaceous vegetation type is found throughout much of western North America from the western Great Plains to intermountain and southwestern U.S.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This herbaceous association was observed on the midslopes of swales, ridges and hills and on ridgetops. It is found principally on disturbed areas throughout the park and recreation area, apparently without regard to slope, aspect, elevation or geomorphology. Sites are moderately steep to steep (9-42% slopes), occur between 1905 and 2499 m elevation, and include all aspects. The unvegetated surface has low to moderately high cover of litter and exposure of bare soil. Large and small rocks may be absent or provide high cover. Downed wood can provide low to moderate cover in some stands. Soils are rapidly drained sandy clay loam, sandy loams, and loams derived from Quaternary alluvium, metamorphic rocks and Mesozoic shales.

Globally

This herbaceous vegetation type is found throughout much of western North America from the western Great Plains to the Intermountain and southwestern U.S. Elevation ranges from sea level to 2200 m. Stands occur after disturbance of a natural shrub- or grass-dominated community, resulting in the replacement of the natural vegetation by non-native, annual grass species of *Bromus*, although invasion of undisturbed sites has also been reported (e.g., Evans et al. 2001). At Wind Cave National Park in South Dakota, weedy non-native graminoid vegetation occurs on recently disturbed areas, most commonly along roads. Small stands also occur in prairie dog towns (H. Marriott pers. comm. 1999). In the Great Basin, *Bromus tectorum* grasslands have invaded large areas of burned-over

sagebrush steppe. *Bromus tectorum* increases the fire frequency of steppe communities, which eventually eliminates sagebrush (FEIS 2001).

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This cheatgrass herbaceous association is uncommon in the park and recreation area. The total vegetation cover ranges from 15 to 75% in these sparsely to densely vegetated stands. This herbaceous association is characterized by the exotic annual *Bromus tectorum* that provides cover ranging from 15 to 50%. Other graminoids may contribute up to 25%, but usually less than 5% cover, including *Achnatherum hymenoides, Elymus elymoides, Pleuraphis jamesii*, and *Poa secunda*. Forbs are variable among sites, generally provide sparse cover, and include *Descurainia pinnata, Lappula occidentalis var. occidentalis*, and *Sphaeralcea coccinea*. The shrub layer is typically present, provides sparse to low cover, and includes *Amelanchier utahensis, Artemisia tridentata ssp. vaseyana, Artemisia tridentata ssp. wyomingensis, Opuntia polyacantha, Quercus gambelii*, and *Symphoricarpos rotundifolius*. In most cases the shrubs survived the fire or resprouted from the root crown.

Globally

This vegetation type is characterized by a sparse to dense, short, annual graminoid layer that is typically dominated by *Bromus tectorum* with over 80-90% of the total vegetation cover. Other Eurasian introduced annual species of *Bromus* which may alternatively dominate or codominate are *Bromus carinatus, Bromus hordeaceus, Bromus madritensis, Bromus japonicus, Bromus rigidus*, or *Bromus rubens*. Although there may be remnant species of the former native vegetation, the high cover of annual bromes makes it difficult to determine what natural community was formerly present. Weedy and exotic annual forbs may also have significant cover in some stands. Scattered shrubs and dwarf-shrubs, especially *Chrysothamnus viscidiflorus, Ericameria nauseosa, Ephedra viridis, Gutierrezia sarothrae*, and *Opuntia polyacantha*, may be present with low cover. At Wind Cave National Park in South Dakota, this weedy non-native graminoid vegetation is usually dominated by several perennial and annual brome grasses, including *Bromus inermis, Bromus japonicus*, and *Bromus tectorum*. Cover is variable (H. Marriott pers. comm. 1999), and in drought years, *Bromus tectorum* may be sparse or absent.

MOST ABUNDANT SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Short shrub/sapling	*Artemisia tridentata* ssp. *wyomingensis*
Herb (field)	*Opuntia polyacantha*
Herb (field)	*Achnatherum hymenoides*, *Bromus tectorum*

Globally

Stratum	Species
Herb (field)	*Bromus hordeaceus*, *Bromus japonicus*, *Bromus madritensis*, *Bromus rigidus*, *Bromus rubens*, *Bromus tectorum*

OTHER NOTEWORTHY SPECIES

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Exotic/Invasive: *Alyssum minus* var. *micranthum* (= Alyssum minus; exotic), *Erodium cicutarium* (exotic, Medium/Low), *Melilotus officinalis* (exotic, Medium/Low), *Tragopogon dubius* (exotic, Medium/Low)

Globally

Exotic/Invasive: *Bromus carinatus* (weedy native), *Bromus hordeaceus* (exotic), *Bromus japonicus* (exotic), *Bromus madritensis* (exotic), *Bromus rigidus* (exotic), *Bromus rubens* (exotic), *Bromus tectorum* (exotic, High)

CONSERVATION STATUS RANK

Global Rank & Reasons: GNA (invasive) (1-Dec-1997).

CLASSIFICATION COMMENTS

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Data are not available.

Globally
This alliance also includes grasslands dominated or codominated by other Eurasian introduced annual *Bromus* species. It is distinct from the annual *Bromus* communities found along the Pacific Coast with Mediterranean or maritime climates because it does not have the introduced annual oatgrass (*Avena barbata* and *Avena fatua*), or other species typical of the California annual grassland (Sawyer and Keeler-Wolf 1995).

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: This type may be related to *Ericameria nauseosa / Bromus tectorum* Semi-natural Shrubland (CEGL002937) identified from Utah. It may also be difficult to separate from the native communities that have been invaded by cheatgrass.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (5 plots, 32 observation points): (Plots: BLCA.0095, BLCA.0120, BLCA.0132, CURE.152, CURE.0153. Observation Points: BLCA_AA.175, BLCA_AA.241, BLCA_AA.242, BLCA_AA.251, BLCA_AA.254, BLCA_AA.255, BLCA_AA.257, BLCA_AA.261, BLCA_AA.262, BLCA_AA.390, BLCA_AA.627, BLCA_AA.628, BLCA_AA.634, BLCA_AA.635, BLCA_AA.636, BLCA_AA.662, BLCA_AA.663, BLCA_AA.669, BLCA_AA.670, BLCA_AA.676, BLCA_AA.677, BLCA_AA.689, BLCA_AA.697, BLCA_AA.775, BLCA_AA.778, BLCA_AA.784, BLCA_AA.792, BLCA_AA.910, BLCA_AA.911, BLCA_AA.912, BLCA_AA.913, CURE_AA.0025).
Local Description Authors: J. Von Loh, mod. G. Bradshaw and J. Coles
Global Description Authors: D. Faber-Langendoen, mod. K. Schulz and J. Coles

REFERENCES: Beatley 1976, Bell et al. 2009, Cogan et al. 2004, Daubenmire 1975, Englund 2004, Evans et al. 2001, FEIS 2001, Hansen et al. 2004d, Karl et al. 1999, Marriott pers. comm., Naumann pers. comm., Redente et al. 1992, Sawyer and Keeler-Wolf 1995, Western Ecology Working Group n.d., Young and Evans 1973, Young and Evans 1978

Holodiscus dumosus Rock Outcrop Sparse Vegetation

Rockspirea Rock Outcrop Sparse Vegetation

CODE	CEGL002801
PHYSIOGNOMIC CLASS	Sparse Vegetation (VII)
PHYSIOGNOMIC SUBCLASS	Consolidated rock sparse vegetation (VII.A.)
PHYSIOGNOMIC GROUP	Sparsely vegetated cliffs (VII.A.1.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural sparsely vegetated cliffs (VII.A.1.N.)
FORMATION	Cliffs with sparse vascular vegetation (VII.A.1.N.a.)
ALLIANCE	ROCK OUTCROP SPARSELY VEGETATED ALLIANCE (A.1838) Rock Outcrop Sparsely Vegetated Alliance

ECOLOGICAL SYSTEM(S): Rocky Mountain Cliff, Canyon and Massive Bedrock (CES306.815)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY
Globally
This sparsely vegetated association is described from Curecanti National Recreation Area and nearby Gunnison National Forest in western Colorado, but it likely occurs elsewhere in the southern Rocky Mountains. Stands are found on the upper edges and ledges of mesa cliffs, talus deposits below cliffs, on cliffs in canyons or gorges, boulder fields and on ridgetop outcrops. Sites are moderately sloped to steep (20-140% slopes) and occur between 2205 and 3075 m (7230-10,080 feet) elevation. Stands occur on all aspects but are mostly southerly at higher elevations. The ground surface has high cover of bedrock, large and small rocks, and bare soil. Soils are rapidly drained gravelly sandy loams. The vegetation is characterized by a sparse to open canopy of *Holodiscus dumosus* up to 2 m tall. Scattered trees such as *Juniperus scopulorum, Pinus contorta, Pinus edulis, Pinus flexilis, Pinus ponderosa*, and *Pseudotsuga menziesii* are occasionally present as saplings from 1.5-3 m tall. The tall shrub *Acer glabrum* may be present and provide sparse cover. The associated short and dwarf-shrubs are diverse and include *Amelanchier utahensis, Artemisia frigida, Brickellia grandiflora, Fendlera rupicola, Mahonia repens, Philadelphus microphyllus, Prunus virginiana, Ribes cereum, Ribes inerme*, and *Symphoricarpos oreophilus*. The herbaceous

layer is a moderately diverse to depauperate mixture of graminoids and forbs contributing low to moderate cover. Common graminoids include *Bouteloua gracilis, Bromus porteri, Carex geyeri, Elymus elymoides, Muhlenbergia montana, Piptatherum micranthum, Poa fendleriana, Poa pratensis*, and *Poa secunda*; various forbs may include *Antennaria parvifolia, Artemisia frigida, Artemisia ludoviciana, Artemisia michauxiana, Eriogonum cernuum, Galium* spp., *Heterotheca villosa, Penstemon teucrioides, Saxifraga bronchialis ssp. austromontana, Saxifraga odontoloma*, and *Selaginella* sp.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This association is uncommon in the recreation area and was sampled along the Pine Creek Trail, below Morrow Point Dam, along the Cimarron Utility Road, on Haystack Mesa, east of Myers Gulch, and east of the Lake Fork Arm of Blue Mesa Reservoir in Curecanti National Recreation Area.

Globally
This association is described from Curecanti National Recreation Area, Gunnison and Rio Grande national forests in south-central Colorado, but it likely occurs elsewhere in the southern Rocky Mountains.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This sparsely vegetated association occurs on the upper edges and ledges of mesa cliffs, talus deposits below cliffs, on cliffs in canyons or gorges, and on ridgetop outcrops. Sites are moderately sloped to steep (20-140% slopes), occur between 2205 and 2755 m elevation, and are oriented to all aspects. The unvegetated surface has sparse cover of litter, high exposure of bedrock and bare soil, and high cover of large and small rocks. Downed wood is absent or uncommon. Parent materials are variable and include Tertiary volcanic rocks, metamorphic/granitic rocks, and Quaternary landslide deposits. Soils are rapidly drained when present and are gravelly sandy loams.

Globally
This sparsely vegetated association is described from Curecanti National Recreation Area and nearby Gunnison National Forest in western Colorado, but it likely occurs elsewhere in the southern Rocky Mountains. Stands are found on the upper edges and ledges of mesa cliffs, talus deposits below cliffs, on cliffs in canyons or gorges, boulder fields and on ridgetop outcrops. Sites are moderately sloped to steep (20-140% slopes) and occur between 2205 and 3075 m (7230-10,080 feet) elevation. Stands occur on all aspects but are mostly southerly at higher elevations (Shepherd 1975). The ground surface has high cover of bedrock, large and small rocks, and bare soil. Soils are rapidly drained gravelly sandy loams. Parent materials are variable and include Tertiary volcanic rocks, metamorphic/granitic rocks, and Quaternary landslide deposits.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This sparsely vegetated association is uncommon within the recreation area. The total vegetation cover ranges from 5 to 41% in these sparsely to moderately vegetated stands. *Holodiscus dumosus* short shrubs, to 2 m tall, form an open canopy that ranges in cover from 1 to 25%. The tree species *Juniperus scopulorum, Pinus edulis*, and *Pseudotsuga menziesii* are occasionally present as saplings from 1.5-3 m tall, and together contribute sparse cover. The shrub layer provides sparse to moderate cover. The tall shrub *Acer glabrum* may be present and provide sparse cover. The associated short- and dwarf-shrub layer is diverse and includes *Amelanchier utahensis, Artemisia frigida, Fendlera rupicola, Mahonia repens, Philadelphus microphyllus, Prunus virginiana, Ribes cereum, Ribes inerme*, and *Symphoricarpos oreophilus*. The herbaceous layer is moderately diverse and contributes low to moderate cover. Graminoids are moderately diverse, provide sparse cover, and include *Bromus porteri, Carex geyeri, Elymus elymoides, Piptatherum micranthum, Poa fendleriana, Poa pratensis*, and *Poa secunda*. Forbs contribute sparse to low cover and include *Antennaria parvifolia, Artemisia frigida, Artemisia ludoviciana, Artemisia michauxiana, Brickellia grandiflora, Eriogonum cernuum, Galium boreale, Galium coloradoense, Heterotheca villosa, Penstemon teucrioides, Saxifraga bronchialis ssp. austromontana, Saxifraga odontoloma*, and *Selaginella* sp. One stand has seedling *Picea pungens* trees contributing sparse cover. Lichens and mosses are common on the rocks of this association and contribute 10 to 75% and <1 to 10% cover, respectively.

Globally
This vegetation is characterized by a sparse to open canopy of *Holodiscus dumosus* up to 2 m tall. Scattered trees such as *Juniperus scopulorum, Pinus contorta, Pinus edulis, Pinus flexilis, Pinus ponderosa*, and *Pseudotsuga*

menziesii are occasionally present as saplings from 1.5-3 m tall. The tall shrub *Acer glabrum* may be present and provide sparse cover. The associated short and dwarf-shrubs are diverse and include *Amelanchier utahensis, Artemisia frigida, Brickellia grandiflora, Fendlera rupicola, Mahonia repens, Philadelphus microphyllus, Prunus virginiana, Ribes cereum, Ribes inerme*, and *Symphoricarpos oreophilus*. The herbaceous layer is a moderately diverse to depauperate mixture of graminoids and forbs contributing low to moderate cover. Common graminoids include *Bouteloua gracilis, Bromus ciliatus, Bromus porteri, Carex geyeri, Elymus elymoides, Festuca arizonica, Muhlenbergia montana, Piptatherum micranthum, Poa fendleriana, Poa pratensis*, and *Poa secunda*; various forbs may include *Achillea millefolium, Antennaria parvifolia, Artemisia frigida, Artemisia ludoviciana, Artemisia michauxiana, Eriogonum cernuum, Galium* spp., *Heterotheca villosa, Penstemon teucrioides, Saxifraga bronchialis ssp. austromontana, Saxifraga odontoloma*, and *Selaginella* sp. Lichens and mosses are common to abundant on the rocks and bare soil.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Short shrub/sapling	*Holodiscus dumosus*, *Ribes cereum*
Herb (field)	*Poa fendleriana*

Globally

Stratum	Species
Short shrub/sapling	*Holodiscus dumosus*, *Ribes cereum*
Herb (field)	*Poa fendleriana*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Exotic/Invasive: *Poa pratensis* (exotic, Medium)

Globally
Vulnerable: *Penstemon teucrioides* (vulnerable, G2G3Q)

CONSERVATION STATUS RANK
Global Rank & Reasons: GNR (23-Jun-2005).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CLASSIFICATION CONFIDENCE:

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: This association occupies canyon wall crevices, fissures, ledges, and talus deposits. It is described using observation point data only and should be further sampled using more comprehensive vegetation plots.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: The description is based on field data (7 plots, 12 observation points): (Plots: CURE.0188, CURE.0191, CURE.0210, CURE.0228, CURE.0282, CURE.0302, CURE.0306. Observation Points: BLCA_AA.537, BLCA_AA.538, BLCA_AA.607, CURE_AA.0199, CURE_AA.0255, CURE_AA.0316, CURE_AA.0395, CURE_AA.0680, CURE_AA.0956, CURE_AA.0974, CURE_AA.1050, CURE_AA.1059).
Local Description Authors: J. Von Loh
Global Description Authors: K.A. Schulz

REFERENCES: Johnston 2001, Komarkova 1986, Shepherd 1975, Western Ecology Working Group n.d.

Leymus salinus Shale Sparse Vegetation

Saline Wildrye Shale Sparse Vegetation

Salinas Lyme Grass Tableland

CODE	CEGL002745
PHYSIOGNOMIC CLASS	Sparse Vegetation (VII)
PHYSIOGNOMIC SUBCLASS	Unconsolidated material sparse vegetation (VII.C.)
PHYSIOGNOMIC GROUP	Sparsely vegetated soil slopes (VII.C.3.)
PHYSIOGNOMIC SUBGROUP	Natural/Semi-natural sparsely vegetated soil slopes (VII.C.3.N.)
FORMATION	Dry slopes (VII.C.3.N.b.)
ALLIANCE	*LEYMUS SALINUS* SPARSELY VEGETATED ALLIANCE (A.1258) Saline Wildrye Sparsely Vegetated Alliance

ECOLOGICAL SYSTEM(S): Inter-Mountain Basins Cliff and Canyon (CES304.779)
Inter-Mountain Basins Shale Badland (CES304.789)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY

Globally

This generally sparse association typically occurs on cool, sparsely vegetated badland slopes of Mancos, Morrison, or other shale formations in the Colorado Plateau of southeastern Utah and western Colorado. Elevations range between 1341 and 1971 m (4400-6465 feet), and slopes tend to be north- to east-facing and moderately steep to steep (38-71% slope). The physical appearance of the community is characterized by a moderate cover of colluvial rocks and blocks fallen from sandstone ledges above the stand. Total vegetation cover is characteristically sparse (<10%) but ranges widely, from 3 to 55% depending on aspect and slope. The tall bunchgrass *Leymus salinus* is visually dominant, with between 2 and 10% cover. Freeze-thaw, shrink-swell action, frequent rolling rocks and sheet erosion of the clay soils tend to create bare soils between the scattered bunches of *Leymus salinus* and dwarf-shrubs such as *Chrysothamnus viscidiflorus var. stenophyllus, Gutierrezia sarothrae*, and *Atriplex confertifolia*, which total between 1 and 5% cover.

DISTRIBUTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This association is rare within the park and was observed and sampled in the Mancos shale badlands near Red Rocks.

Globally

This association typically occurs on cool, sparsely vegetated badland slopes of Mancos, Morrison, or other shale formations in the Colorado Plateau of southeastern Utah and western Colorado.

ENVIRONMENTAL DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This herbaceous vegetation association was observed midslope on the low badlands ridges typical of the Mancos shale geological formation. Sites are moderately steep (35% slope), occur between 1883 and 1964 m elevation, and occupy northwest to northeast aspects. Soils are silty clays to clay loams derived from Mancos shale.

Globally

This association typically occurs on sparsely vegetated shale slopes in the Colorado Plateau of southeastern Utah and western Colorado between 1341 and 1971 m (4400-6465 feet). Slopes tend to be moderately steep to steep (38-71%) and are generally north- to east-facing. The soil surface usually has moderate cover of colluvial rocks and blocks from sandstone ledges above the stand. Soil textures range from clays to clay loams, and the effects of shrink-swell action and sheet erosion in these soils is evident in the high percentage of bare ground. Parent materials include Chinle Formation shale and Morrison Formation shale, including the Brushy Basin, Tidwell, and Salt Wash members.

VEGETATION DESCRIPTION

Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

This Salina wildrye herbaceous association is patchy within the mosaic of communities on the Mancos Shale Formation. The total vegetation cover ranges from 10 to 15% in these sparsely vegetated stands. This tall bunchgrass association is characterized by *Leymus salinus* that provides cover ranging from 5 to 10%. Other graminoids provide sparse cover and include *Bromus tectorum* and *Poa secunda*. Forbs are rare and provide sparse cover by *Cryptantha* sp., *Erodium cicutarium*, and *Sphaeralcea coccinea*. Dwarf-shrubs are varied and can provide sparse to low cover, usually 5% or less. *Atriplex confertifolia* and *Atriplex corrugata* are typically present. Scattered *Juniperus osteosperma* trees that range in height from 1-2 m elevation occasionally provide sparse cover.

Globally
This generally sparse herbaceous association occurs throughout the northern Colorado Plateau in its characteristic habitat of steep, northerly shale slopes. Total vegetation cover is characteristically sparse (<10%) but ranges widely, from 3 to 55% locally depending on aspect and slope, with cooler north-facing slopes tending to support denser vegetation. The tall bunchgrass *Leymus salinus* is visually dominant, with between 2 and 10% cover. Other grasses and forbs may be present, usually with less than 1% cover except in wet years. Short and dwarf-shrubs may have nearly equal cover to the grass and include species such as *Chrysothamnus viscidiflorus var. stenophyllus, Atriplex confertifolia, Ephedra* spp., and *Gutierrezia sarothrae*. In some stands, scattered individuals of *Juniperus osteosperma* may be present.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Short shrub/sapling	*Atriplex confertifolia*, *Atriplex corrugata*

Globally

Stratum	Species
Short shrub/sapling	*Atriplex confertifolia*
Herb (field)	*Leymus salinus*

OTHER NOTEWORTHY SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Exotic/Invasive: *Bromus tectorum* (exotic, High), *Erodium cicutarium* (exotic, Medium/Low)

Globally
Data are not available.

CONSERVATION STATUS RANK
Global Rank & Reasons: GNR (26-Jun-2001).

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
Data are not available.

Globally
Data are not available.

CLASSIFICATION CONFIDENCE: 2 - Moderate

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: More quantitative data are needed to define this association. It is similar to *Juniperus osteosperma / Leymus salinus ssp. salmonis* Wooded Herbaceous Vegetation (CEGL001488), which is distinguished by a sparse canopy of *Juniperus osteosperma*.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Plots and Observation Points: This description is based on field data (2 plots, 3 observation points): (Plots: BLCA.0086, BLCA.0114. Observation Points: BLCA_AA.589, BLCA_AA.591, BLCA_AA.817).
Local Description Authors: J. Von Loh, mod. G. Bradshaw and J. Coles
Global Description Authors: J. Coles, mod. K.A. Schulz

REFERENCES: Comer pers. comm., Western Ecology Working Group n.d.

Glossopetalon spinescens var. *meionandrum* - *Atriplex confertifolia* Shrubland [Park Special]

Spiny Greasebush - Shadescale Shrubland [Park Special]

CODE	Park Special
PHYSIOGNOMIC CLASS	Not Applicable
PHYSIOGNOMIC SUBCLASS	Not Applicable
PHYSIOGNOMIC GROUP	Not Applicable
PHYSIOGNOMIC SUBGROUP	Not Applicable
FORMATION	Not Applicable
ALLIANCE	Not Applicable

ECOLOGICAL SYSTEM(S): Inter-Mountain Basins Mixed Salt Desert Scrub (CES304.784)

USFWS WETLAND SYSTEM: Not applicable

CONCEPT SUMMARY
Globally

DISTRIBUTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This association is rare and is present on the badlands hills west of Red Rocks Canyon on U.S. Bureau of Land Management allotments.

Globally
Data are not available.

ENVIRONMENTAL DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This shrubland association was observed on the low slope of an alluvial fan in badlands topography. The site is gentle (5% slope), occurs at 1895 m elevation, and is oriented to an aspect of 23 degrees. The unvegetated surface has moderate cover of litter (15%). Bare soil comprises the remainder of the unvegetated surface cover (85%). Soils are clays.

Globally
Data are not available.

VEGETATION DESCRIPTION
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
This short-shrub association is rare occupying badlands topography outside the park boundary. The total vegetation cover is 15 to 50% in this sparsely to moderately vegetated stand. This short-shrub association is characterized by an open canopy, typically <0.5-1 m tall, of *Glossopetalon spinescens var. meionandrum* and *Atriplex confertifolia* shrubs that each range in cover from 5 to 25%. A dwarf-shrub layer is present with each species providing sparse cover and including *Atriplex corrugata, Chrysothamnus viscidiflorus*, and *Gutierrezia sarothrae* and the succulent *Opuntia polyacantha*. The herbaceous layer provides sparse cover and is moderately diverse. The graminoids include *Bromus tectorum, Elymus elymoides*, and *Poa secunda*. The most abundant forb is *Penstemon caespitosus* that provides up to 5% cover in the stand. Additional forb species include *Eriogonum umbellatum, Descurainia pinnata, Sphaeralcea coccinea*, and *Xylorhiza venusta*. Cryptogams provide sparse cover.

Globally
Data are not available.

MOST ABUNDANT SPECIES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area

Stratum	Species
Short shrub/sapling	*Glossopetalon spinescens var. meionandrum, Atriplex confertifolia*
Herb (field)	*Penstemon caespitosus*

Globally
Data are not available.

OTHER NOTEWORTHY SPECIES
Capitol Reef National Park

Bromus tectorum

Globally
Data are not available.

CONSERVATION STATUS RANK
Global Rank & Reasons: Not applicable.

CLASSIFICATION COMMENTS
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area
The *Glossopetalon spinescens var. meionandrum* and *Atriplex confertifolia* short-shrub stand occupies a more mesic, north-facing slope in badlands topography that does not appear to be grazed. This stand would be most affected by prolonged drought and would likely trend toward a mat saltbush association.

Globally
Data are not available.

CLASSIFICATION CONFIDENCE: Not applicable

ELEMENT SOURCES
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area Inventory Notes: This association is likely to be represented by other occurrences in the vicinity in similar habitats. The rugged, inaccessible nature of the area hindered extensive sampling.
Black Canyon of the Gunnison National Park - Curecanti National Recreation Area The description is based on 2003 field data (1 plot): (Plot: BLCA.0128).
Local Description Authors: J. Von Loh and G. Bradshaw, mod. J. Coles
Global Description Authors:
REFERENCES: Western Ecology Working Group n.d.

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Appendix G. Illustrated Keys to the Plant Associations of Black Canyon of the Gunnison National Park

The vegetation of Black Canyon of the Gunnison National Park was sampled and classified in under the US Geological Survey and National Park Service Vegetation Mapping Program. This dichotomous key, illustrated with images taken during the vegetation sampling, has been prepared to assist in the accurate field identification of 77 plant associations described from Black Canyon of the Gunnison National Park. Eighteen associations were added to the key and to the final classification following accuracy assessment.

This key is structured to facilitate identification of plant associations using one or more dominant or characteristic species in concert with habitat information. Because of natural variation within plant associations, it is possible that a community can be keyed using more than one of the physiognomic keys. Ecotonal communities (areas where dominant species from several associations mix) may be difficult to key. This guide also allows the user to crosswalk plant associations directly to the Black Canyon of the Gunnison National Park vegetation map so that all subsequent research may have a common focal point relative to the baseline years of aerial photography (2002) and field data collection (2000 to 2004).

HOW TO USE THE KEY:

The key approaches plant association identification at two levels. The first level is physiognomic, and allows the user to determine which major group is being evaluated, e.g., Forest and Woodland; Tall and Short Shrub, and Dwarf-Shrub and Shrub Herbaceous Vegetation; Graminoid; or Forb. The second level allows identification to plant association based on dominant species foliar cover, usually assisted by a brief description of the typical habitat. As an aid to observers in the field, representative photographs demonstrating variation within vegetation types are included.

It is possible that in using this key, you will have difficulty arriving at an association that describes your community. There are several potential reasons for this, and each has a solution:

1. You are observing vegetation that you think is an herbaceous or shrubland community, but it has some tree cover. In this case, try keying the vegetation through the woodland key as well as the herbaceous or shrubland key. In general with any layer, if it does not cover at least 10% (tree layer) or 5% (shrub or herbaceous layers), it is ignored. The exception is in very sparse communities (see #2 below).
2. Communities that are sparsely vegetated (e.g., < 15% total vascular plant cover) should be run through multiple keys. Even though they contain trees or shrubs,

   they may not fall cleanly into a “woodland “or “shrubland” category. "Sparse" vegetation is defined as having total vascular plant cover of < 10%.

3. You can follow a key to a certain point, but you clearly have something not described in the key. This is not unexpected, as a plant association could be missed during the sampling phases of the project or have too low of a classification confidence to include in the final classification and field key. Check the list of additional vegetation types found during AA that were not included in the Final Classification at the end of each key. Document new types with plot sampling.

Key I: Major Physiognomic Groups

1a Vegetation woody or appearing woody; composed predominantly of trees or shrubs, dwarf-shrubs; total vegetation cover may range from sparse to dense. Included here are savannas, which are stands with relatively low cover of trees (5-15%) with a high cover of graminoids and are treated as woodlands in this key **(2)**

1b Vegetation non-woody; composed predominantly of grasses, grass-like herbs (graminoids), and broad-leaf herbs (forbs), which may be tall and coarse; total vegetation cover may range from sparse to dense. If woody plants are present, they are a minor part of the total foliar cover (<5%, i.e. only one to two individuals, not dominant and not characteristic. If boarder-line, key both ways.) **(3)**

2a (1) Vegetation of forest (predominantly interlocking tree canopies) or woodland or savanna (predominantly open, non-interlocking tree canopies); characteristic genera include *Acer*, *Juniperus*, *Pinus*, *Populus*, and *Pseudotsuga* **(Key II)**

2b Vegetation of tall shrubs, short shrubs, or dwarf-shrubs; canopies may interlock, but are more commonly less dense and includes shrub herbaceous associations with 10-25% cover of shrubs with herbaceous cover exceeding shrub cover. Some stands may have less shrub cover (5-9%) when total vegetation cover is low (10-20%), but not sparse (<10% cover). Characteristic genera include *Amelanchier*, *Artemisia*, *Atriplex*, *Cercocarpus*, *Ericameria*, *Glossopetalon*, *Holodiscus*, *Krascheninnikovia*, *Quercus*, *Salix*, *Sarcobatus,* and *Symphoricarpos* **(Key III)**

3 (1) Vegetation herbaceous and composed of forb or graminoid species, although scattered shrubs or trees may be present and contribute a low amount of cover; wetland or upland habitats; characteristic genera include *Achnatherum*, *Aquilegia, Bromus*, *Erodium Hesperostipa*, *Juncus*, *Leymus*, *Pascopyrum*, *Phalaris*, *Pleuraphis*, or *Poa* **(Key IV)**

Key II: Forest and Woodland Vegetation

1a Forest or woodland associations of evergreen trees with interlocking or open tree canopies; typically providing 15-100% canopy cover; characterized by the genera *Juniperus*, *Pinus* or *Pseudotsuga*. Includes savannas (relatively low cover of trees and high cover of graminoids) and sparse woodlands where trees dominate the low total vegetation (10-15% cover). Open canopy stands often have scattered sapling trees or shrubs present in canopy openings **(2)**

1b Forest or woodland associations of deciduous trees with interlocking or open tree canopies; providing 15-100% canopy cover; characterized by the genera *Acer* or *Populus.* Open canopy stands often have scattered sapling trees or shrubs present in canopy openings **(25)**

2a (from couplet 1) Forest or woodland associations dominated by *Pseudotsuga* **(3)**

2b Forest or woodland associations dominated by *Pinus or Juniperus* **(8)**

3a (2) *Pseudotsuga menziesii* forest or woodland stands with an herbaceous understory composed of *Carex geyeri* – ***Pseudotsuga menziesii* / *Carex geyeri*** **(Douglas-fir / Geyer's Sedge) Forest [Map Class 62]**



3b *Pseudotsuga menziesii* forest stands with sparse to no understory or with an understory composed of short or tall shrub layers **(4)**

4a (3) *Pseudotsuga menziesii* forest or woodland stands typically occurring on steep talus and scree slopes with a sparse understory or with a shrub layer dominated by the species *Holodiscus dumosus* **(5)**

4b *Pseudotsuga menziesii* forest or woodland stands with a short or tall shrub understory composed of the genera *Mahonia, Quercus*, or *Symphoricarpos* **(6)**

5a (4) *Pseudotsuga menziesii* forest or woodland stands with sparse to no understory and typically occurring on steep, scree slopes – ***Pseudotsuga menziesii*** **(Douglas-fir) Scree Woodland [Map Class 60]**



5b *Pseudotsuga menziesii* forest or woodland stands of steep, scree slopes with a short shrub understory of *Holodiscus dumosus* – ***Pseudotsuga menziesii*** **/** ***Holodiscus dumosus*** **(Douglas-fir / Rockspirea) Woodland [Map Class 60]**



6a (4) *Pseudotsuga menziesii* forest stands with a *Mahonia repens* understory – ***Pseudotsuga menziesii*** **/** ***Mahonia repens*** **(Douglas-fir / Creeping Barberry) Forest [Map Class 62]**



6b *Pseudotsuga menziesii* forest or woodland stands with a short or tall shrub understory composed of the genera *Quercus* or *Symphoricarpos* **(7)**

7a (6) *Pseudotsuga menziesii* forest and woodland stands with a tall shrub understory characterized by *Quercus gambelii*, generally with at least 5% cover by oak – ***Pseudotsuga menziesii* / *Quercus gambelii* (Douglas-fir / Gambel Oak) Forest [Map Class 62]**





7b *Pseudotsuga menziesii* forest stands with a *Symphoricarpos oreophilus* understory – ***Pseudotsuga menziesii* / *Symphoricarpos oreophilus* (Douglas-fir / Mountain Snowberry) Forest [Map Class 62]**

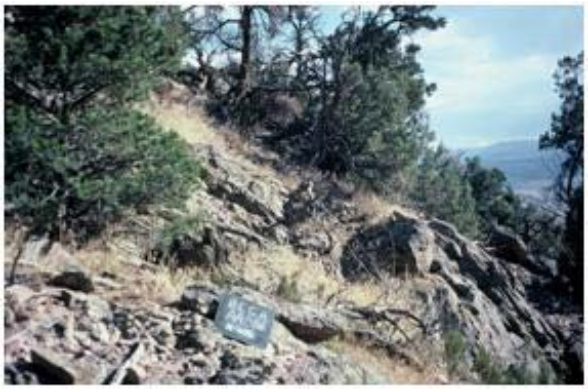


8a (2) Vegetation of evergreen trees with overlapping scale-like leaves; composed of *Juniperus osteosperma.* If species of *Pinus* are present, their cover is very low (<5% cover) **(9)**

8b Vegetation of evergreen trees of the genera *Pinus* with needles borne in fascicles of 2 or 3; may also be associated with species of *Juniperus,* but *Pinus* species are present with at least 5% cover **(12)**

9a (8) *Juniperus osteosperma* woodland stands characterized by an understory composed of the exotic annual grass *Bromus tectorum* – ***Juniperus osteosperma* / *Bromus tectorum*** **(Utah Juniper / Cheatgrass) Semi-natural Woodland [Map Classes 74 & 78]**





9b *Juniperus osteosperma* woodland stands with an understory characterized by the short shrubs *Artemisia* (*nova* or *tridentata* ssp. *wyomingensis*) or mixed shrubs on talus with or without *Leymus salinus* **(10)**

10a (9) *Juniperus osteosperma* woodland stands with an understory characterized by the short shrubs *Artemisia tridentata* (ssp. *wyomingensis*) with or without *Leymus salinus* **(11)**

10b *Juniperus osteosperma* woodland stands of shale soils and/or badland habitats with an understory of the short shrub *Artemisia nova* – ***Juniperus osteosperma* / *Artemisia nova* (Utah Juniper / Black Sagebrush) Woodland [Map Class 72]**



11a (10) *Juniperus osteosperma* woodland stands with an understory of *Artemisia tridentata* ssp. *wyomingensis* – ***Juniperus osteosperma* / *Artemisia tridentata* ssp. *wyomingensis* (Utah Juniper / Wyoming Big Sagebrush) Woodland [Map Class 78]**





11b Woodland / wooded herbaceous associations characterized by short stature Utah juniper trees and the tall, native perennial bunchgrass, *Leymus salinus*, and occupying xeric shale soils of badlands landscapes – ***Juniperus osteosperma* / *Leymus salinus* (Utah Juniper / Salina Wildrye) Woodland [Map Class 87]**



12a (8) *Pinus edulis* stands characterized by a sparse understory or by an understoryof graminoids, including the genera *Bromus, Hesperostipa, Leymus*, *Poa*, and *Pseudoroegneria*; *Juniperus* spp. are usually present, but some stands may have only *Pinus edulis* foliar cover **(13)**

12b *Pinus edulis - Juniperus osteosperma* stands with an understory of shrubs including *Atriplex, Artemisia*, *Amelanchier*, *Cercocarpus*, *Holodiscus*, or *Quercus*; some stands may have a mix of these genera and other shrubs present in the understory **(18)**

13a (12) *Pinus edulis* and *Juniperus osteosperma* woodlands with generally high tree cover growing in habitats (most commonly of shallow, rocky soils) supporting less than 5% total foliar cover by any combination of understory species – ***Pinus edulis - Juniperus osteosperma*** **(Two Needle Pinyon Pine - Utah Juniper) / Sparse Understory Woodland [Map Classes 69 & 74]**





13b *Pinus edulis,* usually accompanied by *Juniperus* spp., and characterized by an understory of the exotic annual grass *Bromus tectorum* or by the bunchgrasses *Leymus salinus, Hesperostipa comata*, *Poa fendleriana* or *Pseudoroegneria spicata* **(14)**

14a (13) Mature to old growth stands of *Pinus edulis* with or without *Juniperus* spp. characterized by an understory composed of the exotic annual grass *Bromus tectorum* – ***Pinus edulis – Juniperus osteosperma / Bromus tectorum*** **(Two Needle Pinyon Pine - Utah Juniper / Cheatgrass) Semi-natural Woodland [Map Class 74]**





14b *Pinus edulis,* usually accompanied by *Juniperus* spp., and characterized by an understory of the bunchgrasses *Leymus salinus, Hesperostipa comata, Poa fendleriana* or *Pseudoroegneria spicata* **(15)**

15a (14) *Pinus edulis* and *Juniperus osteosperma* stands growing in badland habitats and characterized by an understory dominated by the large bunch grass *Leymus salinus* – ***Pinus edulis - Juniperus osteosperma*** / ***Leymus salinus*** **(Two Needle Pinyon Pine - Utah Juniper/ Salina Wildrye) Woodland [Map Classes 74 & 87]**



15b *Pinus edulis,* usually accompanied by *Juniperus* spp., and characterized by the understory bunchgrasses *Hesperostipa comata, Poa fendleriana* or *Pseudoroegneria spicata* **(16)**

16a (15) Mature to old growth stands of *Pinus edulis* with or without *Juniperus* spp. with an understory of *Hesperostipa comata* – ***Pinus edulis – (Juniperus monosperma, Juniperus osteosperma) / Hesperostipa comata*** **(Two Needle Pinyon Pine – (Oneseed Juniper, Utah Juniper) / Needle&Thread Grass) Woodland [Map Class 69]**





16b *Pinus edulis*, usually accompanied by *Juniperus* spp., and characterized by the understory bunchgrasses *Poa fendleriana* or *Pseudoroegneria spicata* **(17)**

17a (16) Mature to old growth stands of *Pinus edulis* with or without *Juniperus* spp. with an understory of *Poa fendleriana* – ***Pinus edulis – Juniperus* spp. / *Poa fendleriana* (Two Needle Pinyon Pine – Juniper species / Muttongrass) Woodland [Map Class 74]**





17b *Pinus edulis* stands characterized by an understory of *Pseudoroegneria spicata* – ***Pinus edulis - Juniperus* spp. / *Pseudoroegneria spicata* (Two Needle Pinyon Pine - Juniper species / Bluebunch Wheatgrass) Woodland [Map Class 74]**



18a (12) *Pinus edulis* and *Juniperus osteosperma* stands found on talus slopes characterized by a mixture of understory shrubs with no clear dominant. Understory shrubs include *Amelanchier utahensis, Cercocarpus montanus, Ephedra viridis, Glossopetalon spinescens,* and *Gutierrezia sarothrae* – ***Pinus edulis – Juniperus osteosperma*** **(Two Needle Pinyon Pine - Utah Juniper) / Mixed Shrub Talus Woodland [Map Class 74]**





18b *Pinus edulis* and *Juniperus osteosperma* stands characterized by an understory of shrubs generally with only one clear dominant or with a single co-dominant, including the genera *Atriplex, Artemisia*, *Amelanchier*, *Cercocarpus*, *Holodiscus*, or *Quercus* **(19)**

19a (18)*Pinus edulis* and *Juniperus osteosperma* stands of shale soils and/or badland habitats characterized by the understory shrubs *Atriplex confertifolia* or *Atriplex canescens* – ***Pinus edulis - Juniperus osteosperma* / *Atriplex*** **spp. (Two Needle Pinyon Pine - Utah Juniper / Saltbush species) Woodland [Map Class 87]**





19b *Pinus edulis* and *Juniperus osteosperma* (or *scopulorum*) stands characterized by an understory of the short and tall shrub genera including *Artemisia*, *Amelanchier*, *Cercocarpus*, *Holodiscus*, or *Quercus* **(20)**

20a (19) *Pinus edulis* and *Juniperus* spp. stands growing on steep, scree slopes and characterized by a short shrub understory of *Holodiscus dumosus* – ***Pinus edulis* - (*Juniperus* spp.) / *Holodiscus dumosus* (Two Needle Pinyon Pine – (Juniper species) / Rockspirea) Woodland [Map Class 69]**



20b *Pinus edulis* and *Juniperus osteosperma* (or *scopulorum*) stands characterized by an understory of short and tall shrubs of the genera *Artemisia*, *Amelanchier*, *Cercocarpus*, or *Quercus* **(21)**

21a (20) *Pinus edulis* and *Juniperus osteosperma* (or *scopulorum*) stands characterized by a short shrub understory of the genera *Artemisia* **(22)**

21b *Pinus edulis* and *Juniperus osteosperma* (or *scopulorum*) stands characterized by the understory tall shrub species *Amelanchier utahensis*, *Cercocarpus montanus* or *Quercus gambelii* **(23)**

22a (21) *Pinus edulis* and *Juniperus* (*osteosperma, scopulorum*) stands characterized by a short shrub understory of *Artemisia tridentata* – ***Pinus edulis - Juniperus* spp. / *Artemisia tridentata* (ssp. *wyomingensis,* ssp. *vaseyana*) (Two Needle Pinyon Pine – Juniper species / Big Sagebrush) Woodland [Map Class 72]**





22b *Pinus edulis* and *Juniperus osteosperma* stands characterized by the understory dwarf-shrub *Artemisia nova* – ***Pinus edulis - Juniperus osteosperma* / *Artemisia nova* (Two Needle Pinyon Pine - Utah Juniper / Black Sagebrush) Woodland [Map Class 72]**



23a (21) *Pinus edulis* and *Juniperus* (*osteosperma, scopulorum*) stands characterized by a tall shrub understory of *Quercus gambelii* – ***Pinus edulis - Juniperus* spp. / *Quercus gambelii* (Two Needle Pinyon Pine - Juniper species / Gambel Oak) Woodland [Map Class 71]**





23b *Pinus edulis* and *Juniperus osteosperma* stands characterized by a tall shrub understory dominated by *Amelanchier utahensis* and/or *Cercocarpus montanus* **(24)**

24a (23) *Pinus edulis* and *Juniperus osteosperma* stands characterized predominantly by a tall shrub understory of *Amelanchier utahensis* – ***Pinus edulis - Juniperus osteosperma* / *Amelanchier utahensis*** **(Two Needle Pinyon Pine – Utah Juniper / Utah Serviceberry) Woodland [Map Class 74]**





24b *Pinus edulis* and *Juniperus osteosperma* stands with an understory characterized predominantly by the tall shrub *Cercocarpus montanus*, which can have sparse to moderate cover, and a mix of other montane shrubs (including *Amelanchier utahensis, Ephedra viridis*) with lower cover – ***Pinus edulis - Juniperus*** **spp. /** ***Cercocarpus montanus*** **– Mixed Shrub (Two Needle Pinyon Pine - Juniper species / Mountain Mahogany – Mixed Shrub) Woodland [Map Classes 69 & 74]**





<u>Deciduous Forest and Woodland</u>

25a (1) Woodland associations composed principally of the riparian tree species *Acer negundo* **(26)**

25b Forest and woodland associations composed principally of the upland tree species *Populus tremuloides* **(27)**

26a (25) Woodland association of *Acer negundo* trees with an understory of exotic herbaceous species or extremely sparse foliar cover – ***Acer negundo*** **(Box Elder) / Disturbed Understory Woodland [Map Class 5]**



26b Woodland association of *Acer negundo* trees with a subcanopy or tall shrub layer of *Quercus gambelii* present – ***Acer negundo*** **/** ***Quercus gambelii*** **(Box Elder / Gambel Oak) Woodland [Map Class 5]**

No Photos Available

27a (25) *Populus tremuloides* forest stands with an understory characterized by *Amelanchier alnifolia* and/or *Symphoricarpos oreophilus* shrubs, and including a perennial herbaceous layer composed of *Calamagrostis rubescens* or *Thalictrum fendleri* **(28)**

27b *Populus tremuloides* forest stands with *Quercus gambelii* in the subcanopy or tall shrub layer and with *Symphoricarpos oreophilus* forming a short shrub layer. In recently disturbed stands, *Quercus gambelii* may form a short shrub layer with as little as 5% cover – ***Populus tremuloides / Quercus gambelii / Symphoricarpos oreophilus*** **(Quaking Aspen / Gambel Oak / Mountain Snowberry) Forest [Map Class 52]**




28a (27) *Populus tremuloides* forest stands with an understory of the tall shrub *Amelanchier alnifolia*, the short shrub *Symphoricarpos oreophilus*, and the grass *Calamagrostis rubescens* – ***Populus tremuloides* / *Amelanchier alnifolia* - *Symphoricarpos oreophilus* / *Calamagrostis rubescens* (Quaking Aspen / Saskatoon Serviceberry - Mountain Snowberry / Pinegrass) Forest [Map Class 52]**

No Photos Available

28b *Populus tremuloides* forest stands with an understory of predominantly *Symphoricarpos oreophilus* short shrubs and the forb *Thalictrum fendleri* – ***Populus tremuloides* / *Symphoricarpos oreophilus* / *Thalictrum fendleri* (Quaking Aspen / Mountain Snowberry / Fendler's Meadow-rue) Forest [Map Class 52]**




Additional vegetation types documented in the Park:
Acer negundo / Philadelphus microphyllus Woodland
Juniperus osteosperma / Hesperostipa comata Woodland
Pinus edulis - Juniperus osteosperma / Ephedra viridis Woodland
Pinus edulis - Juniperus osteosperma / Petradoria pumila Woodland
Pinus edulis - Juniperus osteosperma / Pleuraphis jamesii Woodland
Pinus edulis - Juniperus spp. / Glossopetalon spinescens var. *meionandrum* Woodland
*Populus deltoides (*ssp. *wislizeni,* ssp. *monilifera) / Salix exigua* Woodland
Populus tremuloides / Prunus virginiana Forest

Key III: Shrubland Vegetation

1a Shrub and dwarf-shrub associations restricted to badlands habitats west of the Red Rocks formation; characterized by the genera *Atriplex (confertifolia, corrugata, gardneri)*, *Glossopetalon*, or *Sarcobatus* **(2)**

1b Tall, short, and dwarf-shrub associations growing in a variety of habitats throughout the Park and characterized by the genera *Amelanchier*, *Artemisia*, *Atriplex*, *Ceanothus*, *Cercocarpus*, *Chrysothamnus*, *Ericameria*, *Holodiscus*, *Krascheninnikovia*, or *Quercus* **(6)**

2a (1) Short shrub associations characterized by the species *Atriplex confertifolia*, *Glossopetalon spinescens* var. *meionandrum* or *Sarcobatus vermiculatus. Atriplex gardneri* and *Atriplex corrugata* are sparse to absent **(3)**

2b Dwarf-shrub associations characterized by the mat-forming species *Atriplex corrugata* or *Atriplex gardneri; Atriplex confertifolia* may be co-dominant **(5)**

3a (2) Shrub association, occurring in drainages and gullies within badlands habitats, dominated by *Sarcobatus vermiculatus* with at least 10% foliar cover – ***Sarcobatus vermiculatus*** **(Greasewood) Shrubland [Map Class 80]**





3b Shrub associations, occurring on slopes and ridges in badlands habitats, characterized by *Atriplex confertifolia* or *Glossopetalon spinescens* var. *meionandrum* with at least 5% foliar cover **(4)**

4a (3) Shrub association characterized by *Atriplex confertifolia* with at least 1% foliar cover – ***Atriplex confertifolia*** **(Shadscale) Wyoming Basins Shrubland [Map Class 80]**





4b Shrub association characterized by *Glossopetalon spinescens* var. *meionandrum* and *Atriplex confertifolia* with at least 5% foliar cover of each species – ***Glossopetalon spinescens* var. *meionandrum* – *Atriplex confertifolia* (Spiny Greasebush - Shadscale) Shrubland [Map Class 80]**



5a (2) Dwarf-shrub association characterized by *Atriplex gardneri* with trace to 3% foliar cover– ***Atriplex gardneri* (Gardner's Saltbush) Dwarf-shrubland** [**Map Class 80** - This unit includes barren slopes and those with sparse *Eriogonum gordonii* in the Mancos formation.]



5b Dwarf-shrub association characterized by *Atriplex corrugata* with at least 1% foliar cover – ***Atriplex corrugata* (Mat Saltbush) Dwarf-shrubland [Map Class 80]**



6a (1) Tall shrub associations of canyons, slopes, and mesas characterized by the genera *Amelanchier*, *Cercocarpus* and/or *Quercus* **(7)**

6b Short shrub and dwarf-shrub associations of canyons, slopes, mesas, and disturbed sites; characterized by the genera *Artemisia*, *Atriplex*, *Ericameria*, *Holodiscus*, or *Krascheninnikovia* **(18)**

7a (6) Tall shrub associations characterized by *Amelanchier utahensis* and/or *Cercocarpus montanus*; often in mixed stands with *Artemisia tridentata* **(8)**

7b Tall shrub associations characterized by at least 10% foliar cover of *Quercus gambelii* with a variety of understory co-dominants including species of the genera *Amelanchier*, *Artemisia*, *Carex, Cercocarpus*, *Holodiscus*, *Poa, Prunus* or *Symphoricarpos* **(11)**

8a (7) *Cercocarpus montanus* association with a combination of mixed short shrubs; generally associated with steep, south-facing talus slopes – ***Cercocarpus montanus*** **(Mountain Mahogany) Shale Shrubland [Map Classes 42 & 93]**





8b *Amelanchier utahensis* is dominant or co-dominant with *Artemisia tridentata* or other shrubs. Stands not associated with south-facing talus slopes **(9)**

9a (8) Shrubland co-dominated by *Amelanchier utahensis* and *Artemisia tridentata* – ***Artemisia tridentata*** **(ssp.** ***vaseyana,*** **ssp.** ***wyomingensis*****) –** ***Amelanchier utahensis*** **(Mountain Big Sagebrush, Wyoming Big Sagebrush) – Utah Serviceberry)) Shrubland [Map Classes 40 & 49]**





9b *Amelanchier utahensis* is dominant or co-dominant with other shrubs. Stands not associated with south-facing, talus slopes and *Artemisia tridentata* is not co-dominant, although it may be present in the mix of shrubs **(10)**

10a (9) *Amelanchier utahensis* association with a combination of mixed tall and short shrubs (*Quercus gambelii* may have sparse to moderate cover); the graminoid *Carex geyeri* is present in the herbaceous understory stratum – ***Amelanchier utahensis*** **- Mixed Shrub /** ***Carex geyeri*** **(Utah Serviceberry – Mixed Shrub / Geyer's Sedge) Shrubland [Map Classes 42 & 49]**





10b *Amelanchier utahensis* (or less commonly *Amelanchier alnifolia*) with *Cercocarpus montanus* co-dominant – ***Amelanchier (utahensis, alnifolia) - Cercocarpus montanus*** **(Serviceberry - Mountain mahogany) Shrubland [Map Class 42]**





11a (7) *Quercus gambelii* associations with a predominantly graminoid understory characterized by *Carex geyeri* or *Poa fendleriana* **(12)**

11b *Quercus gambelii* associations with a co-dominant tall or short shrub layer characterized by the genera *Amelanchier*, *Artemisia*, *Cercocarpus*, *Holodiscus*, or *Symphoricarpos* **(13)**

12a (11) *Quercus gambelii* association with the understory characterized by the dry site sedge *Carex geyeri* – ***Quercus gambelii / Carex geyeri*** **(Gambel Oak / Geyer's Sedge) Shrubland [Map Classes 42 & 43]**



12b *Quercus gambelii* association with the understory short bunch grass *Poa fendleriana* – ***Quercus gambelii* / *Poa fendleriana* (Gambel Oak / Muttongrass) Shrubland [Map Class 42]**





13a (11) *Quercus gambelii* associations with co-dominant shrubs in the genera *Amelanchier* or *Cercocarpus* forming a tall shrub layer. *Artemisia* may also be present **(14)**

13b *Quercus gambelii* associations with short shrubs in the genera *Artemisia*, *Holodiscus* or *Symphoricarpos* **(16)**

14a (13) *Quercus gambelii* associated predominantly with *Cercocarpus montanus* – ***Quercus gambelii* – *Cercocarpus montanus* / (*Carex geyeri*) (Gambel Oak – Mountain Mahogany / (Geyer's Sedge)) Shrubland [Map Class 42]**



14b *Quercus gambelii* associated predominantly with *Amelanchier alnifolia* or *Amelanchier utahensis* **(15)**

15a (14) *Quercus gambelii* associated predominantly with *Amelanchier alnifolia* – ***Quercus gambelii* / *Amelanchier alnifolia* (Gambel Oak / Saskatoon Serviceberry) Shrubland [Map Class 43]**





15b *Quercus gambelii* associated predominantly with *Amelanchier utahensis* – ***Quercus gambelii* / *Amelanchier utahensis* (Gambel Oak / Utah Serviceberry) Shrubland [Map Clas 42]**





16a (13) *Quercus gambelii* associated predominantly with *Artemisia tridentata* – ***Quercus gambelii* / *Artemisia tridentata* (Gambel Oak / Big Sagebrush) Shrubland [Map Class 40]**





16b *Quercus gambelii* associated predominantly with *Holodiscus dumosus* or *Symphoricarpos oreophilus* **(17)**

17a (16) *Quercus gambelii* associated predominantly with *Holodiscus dumosus* – ***Quercus gambelii* – *Holodiscus dumosus* (Gambel Oak – Rockspirea) Shrubland [Map Class 48]**

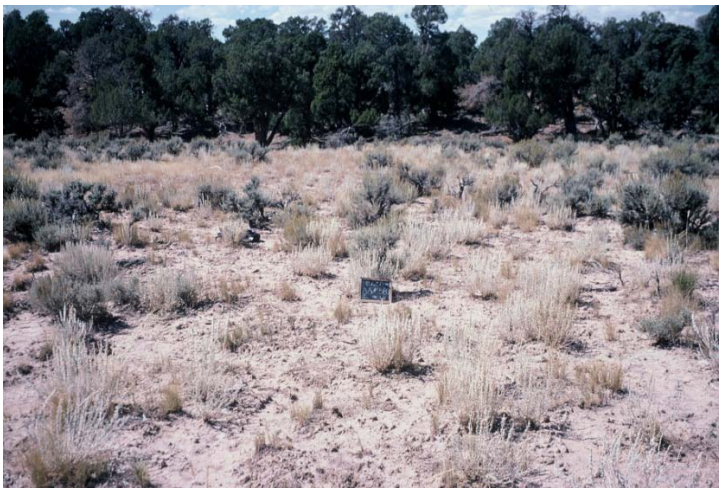


17b *Quercus gambelii* associated predominantly with *Symphoricarpos oreophilus* – ***Quercus gambelii* / *Symphoricarpos oreophilus* (Gambel Oak / Utah Snowberry) Shrubland [Map Class 43]**





18a (6) Dwarf-shrub association of slopes; characterized by *Krascheninnikovia lanata* contributing from 5 to 25% foliar cover and *Achnatherum hymenoides* contributing between 1 and 5% foliar cover – ***Krascheninnikovia lanata* / *Achnatherum hymenoides* (Winterfat / Indian Ricegrass) Dwarf-shrubland [Map Class 80]**



18b Short shrub associations in a variety of habitats characterized by the genera *Artemisia*, *Atriplex*, *Ericameria, or Holodiscus* **(19)**

19a (18) Short shrub association characterized by *Holodiscus dumosus* contributing between 1 and 75% foliar cover (often the most abundant single shrub species present) and occupying very steep slopes – ***Holodiscus dumosus* (Rockspirea) Sparsely Vegetated Rock Outcrop [Map Class 93]**



19b Short shrub associations occurring in a variety of habitats, including historic burns, and characterized by the genera *Artemisia*, *Atriplex*, and/or *Ericameria* **(20)**

20a (19) Short shrub associations of disturbed sites, including floodplains, road rights-of-way, old fields, and historic burns, characterized by the genera *Atriplex, Artemisia,* and/or *Ericameria* **(21)**

20b Short shrub associations in a variety of habitats lacking recent disturbance and characterized by the genus *Artemisia* **(23)**

21a (20) *Atriplex canescens* associated with *Artemisia tridentata*; each species contributing between 5 and 25% foliar cover; occurring on the first terrace of creeks – ***Atriplex canescens – Artemisia tridentata*** **(Fourwing Saltbush – Big Sagebrush) Shrubland [Map Class 80]**



21b Short shrub associations of disturbed sites, road rights-of-way, old fields, and historic burns, characterized by the genera *Ericameria* **(22)**

22a (21) *Ericameria parryi* associated with sites disturbed by road construction (cut and fill slopes) and historical fires with *Achnatherum hymenoides* typically present to dominant in the understory – ***Ericameria parryi / Achnatherum hymenoides*** **(Parry's Rabbitbrush / Indian Ricegrass) Shrubland [Map Classes 28 & 31]**



22b *Ericameria nauseosa* associated with sites disturbed by prairie dog burrowing and foraging, sometimes associated with sites disturbed by road construction (cut and fill slopes) as well – ***Ericameria nauseosa*** **(Rubber Rabbitbrush) Shrubland** [Map Classes 28 & 31]





23a (20) Associations characterized by the short shrub *Artemisia nova* and understory grass species of the genera *Poa* with or without *Achnatherum* **(24)**

23b Associations characterized by *Artemisia tridentata*; either *Artemisia tridentata* ssp. *tridentata, Artemisia tridentata* ssp. *vaseyana*, or *Artemisia tridentata* ssp. *wyomingensis* **(25)**

24a (23) *Artemisia nova* occurring with the short bunch grass *Poa secunda* with associated foliar cover exceeding 15% and 1%, respectively – ***Artemisia nova / Poa secunda*** **(Black Sagebrush / Sandberg Bluegrass) Shrubland [Map Class 31]**



24b *Artemisia nova* (5% - 75% cover) associated with the short bunchgrass *Poa fendleriana* (1 - 50% cover) with or without *Achnatherum pinetorum* (<1% cover) – ***Artemisia nova / Poa fendleriana*** **(Black Sagebrush / Muttongrass) Shrubland [Map Class 31]**



25a (23) Short shrub associations characterized by *Artemisia tridentata* ssp. *tridentata* or by *Artemisia tridentata* ssp. *wyomingensis* in association with the grass and shrub genera *Agropyron*, *Amelanchier*, *Bromus*, *Elymus* and/or *Hesperostipa* **(26)**

25b Short shrub associations characterized by *Artemisia tridentata* ssp. *vaseyana* **(30)**

26a (25) *Artemisia tridentata* occurring on a slope in association with the short bunch grass *Pleuraphis jamesii* – ***Artemisia tridentata* / *Pleuraphis jamesii*** **(Big Sagebrush / James' Galleta) Shrubland [Map Class 31]**



26b Short shrub associations characterized by *Artemisia tridentata* ssp. *wyomingensis* in association with the grass and shrub genera *Agropyron, Amelanchier, Bromus, Elymus* and/or *Hesperostipa* **(27)**

27a (26) *Artemisia tridentata* ssp. *wyomingensis* growing in areas disturbed by prairie dogs or in shallow swales and drainages, commonly accompanied by *Ericameria nauseosa,* with *Bromus tectorum* or other weedy species of disturbed sites dominant in the understory – ***Artemisia tridentata*** **ssp. wyomingensis (Wyoming Big Sagebrush) / Disturbed Understory Semi-natural Shrubland [Map Class 31]**





27b Short shrub associations characterized by *Artemisia tridentata* ssp. *wyomingensis* in association with the grass and shrub genera *Agropyron, Amelanchier, Elymus* and/or *Hesperostipa* **(28)**

28a (27) *Artemisia tridentata* (ssp. *vaseyana,* ssp. *wyomingensis*) and *Amelanchier utahensis* mixed mountain shrublands, often with a variety of other tall and short shrubs in the overstory and a well-developed herbaceous layer in the understory – ***Artemisia tridentata*** **(ssp. *vaseyana,* ssp. *wyomingensis*) – *Amelanchier utahensis* ((Mountain Big Sagebrush, Wyoming Big Sagebrush) – Utah Serviceberry) Shrubland [Map Classes 40 & 49]**





28b Short shrub associations characterized by *Artemisia tridentata* ssp. *wyomingensis* in association with the grass genera *Agropyron* and/or *Elymus* or *Hesperostipa* **(29)**

29a (28) *Artemisia tridentata* ssp. *wyomingensis* shrubland with greater than 1% cover by the exotic bunchgrass *Agropyron cristatum* – ***Artemisia tridentata* ssp. *wyomingensis* / (*Agropyron cristatum, Elymus junceus)* (Wyoming Big Sagebrush / Crested Wheatgrass) Seeded Grasses Semi-natural Shrubland [Map Class 31]**



29b Shrubland or shrub herbaceous vegetation of xeric, shallow to steeply sloping habitats characterized by the short shrub *Artemisia tridentata* ssp. *wyomingensis* and the bunch grass *Hesperostipa comata* – ***Artemisia tridentata* ssp. *wyomingensis* / *Hesperostipa comata* (Wyoming Big Sagebrush / Needle-and-Thread) Shrubland [Map Class 31]**





30a (25) Artemisia tridentata ssp. vaseyana growing on more gentle slopes in association with the forb *Balsamorhiza sagittata* – ***Artemisia tridentata*** **ssp.** ***vaseyana*** **/** ***Balsamorhiza sagittata*** **(Mountain Big Sagebrush / Arrowleaf Balsamroot) Shrubland [Map Class 33]**



30b *Artemisia tridentata* ssp. *vaseyana* associated with the grass genera *Achnatherum, Hesperostipa, Pascopyrum,* or *Poa* **(31)**

31a (30) *Artemisia tridentata* ssp. *vaseyana* growing on mild, mesic slopes in association with the rhizomatous grass *Pascopyrum smithii* – ***Artemisia tridentata*** **ssp.** ***vaseyana*** **/** ***Pascopyrum smithii*** **(Mountain Big Sagebrush / Western Wheatgrass) Shrubland [Map Class 33]**





31b *Artemisia tridentata* ssp. *vaseyana* associated with the grass genera *Achnatherum, Hesperostipa,* or *Poa* **(32)**

32a (31) Shrub herbaceous association composed of *Artemisia tridentata* ssp. *vaseyana* and *Hesperostipa comata* – ***Artemisia tridentata*** **ssp. *vaseyana* / *Hesperostipa comata* (Mountain Big Sagebrush / Needle-and-Thread) Shrubland [Map Classes 33 & 49]**



32b *Artemisia tridentata* ssp. *vaseyana* associated with the grass genera *Achnatherum* or *Poa* **(33)**

33a (32) *Artemisia tridentata* ssp. *vaseyana* associated with the grass genera *Poa* **(34)**

33b *Artemisia tridentata* ssp. *vaseyana* associated with the grass genera *Achnatherum* **(35)**

34a (35) *Artemisia tridentata* ssp. *vaseyana* growing on slopes, ridges, and mesas in association with the short bunchgrass *Poa fendleriana* – ***Artemisia tridentata*** **ssp. *vaseyana* / *Poa fendleriana* (Mountain Big Sagebrush / Muttongrass) Shrubland [Map Class 33]**





34b Shrub herbaceous association of shallowly sloping habitats characterized by *Artemisia tridentata* ssp. *vaseyana* and the rhizomatous graminoid species *Poa pratensis* and/or *Poa compressa* – ***Artemisia tridentata* ssp. *vaseyana* / *Poa* (*pratensis*, *compressa*) (Mountain Big Sagebrush / Bluegrass (Kentucky, Canada)) Semi-natural Shrub Herbaceous Vegetation [Map Classes 33 & 49]**





35a (33) Shrub herbaceous association composed of *Artemisia tridentata* ssp. *vaseyana* and *Achnatherum pinetorum* – ***Artemisia tridentata* ssp. *vaseyana* / *Achnatherum pinetorum* (Mountain Big Sagebrush / Pine Needlegrass) Shrubland [Map Class 33]**



35b Shrub herbaceous association occurring on xeric ridgetops characterized by the bunchgrass *Achnatherum lettermanii* and the short shrubs *Artemisia tridentata* ssp. *vaseyana* often accompanied by *Chrysothamnus viscidiflorus and Symphoricarpos oreophilus* – ***Artemisia tridentata ssp. vaseyana / Achnatherum lettermanii*** **(Mountain Big Sagebrush / Letterman's Needlegrass) Shrubland [Map Class 33]**



Additional vegetation types documented in the Park:
Amelanchier utahensis Shrubland
Artemisia tridentata - (Ericameria nauseosa) / Bromus tectorum Semi-natural Shrubland
Artemisia tridentata ssp. *vaseyana / Bromus inermis* Semi-natural Shrubland
Artemisia tridentata spp. *wyomingensis / Pascopyrum smithii* Shrub Herbaceous Vegetation
Artemisia tridentata ssp. *wyomingensis / Poa secunda* Shrubland
Atriplex canescens - Krascheninnikovia lanata Shrubland
Atriplex confertifolia / Pleuraphis jamesii Shrubland
Eriogonum microthecum Dwarf-shrubland Alliance
Krascheninnikovia lanata / Leymus salinus Dwarf-shrubland
Quercus gambelii / Sparse Understory Shrubland

Key IV: Herbaceous Vegetation

1a Forb associations of mesic or xeric sites and characterized by the species *Aquilegia micrantha*, *Calamagrostis rubescens,* and/or *Erodium cicutarium* **(2)**

1b Graminoid associations of mesic or xeric sites and characterized by the genera *Achnatherum*, *Bromus*, *Hesperostipa*, *Juncus, Leymus*, *Pascopyrum*, *Phalaris*, *Pleuraphis*, or *Poa* **(3)**

2a (1) Vegetation association characterized by mesic, native perennial species growing in hanging gardens or from bedrock fractures on cliff faces and characterized by *Aquilegia micrantha* and *Calamagrostis scopulorum* – ***Aquilegia micrantha – Calamagrostis scopulorum*** **(Mancos Columbine – Holm's Rocky Mountain Sedge) Herbaceous Vegetation [Map Class 99]**



2b Vegetation of caespitose forbs growing on xeric, disturbed upland sites, including burns, campgrounds, and abandoned agricultural areas and characterized by *Erodium cicutarium* and *Bromus tectorum* – ***Erodium cicutarium*** **(Redstem Stork's Bill) Semi-natural Annual Herbaceous Vegetation [Map Class 20]**





3a (1) Graminoid association of mesic to saturated habitats, sometimes persisting on abandoned irrigated hay meadows, characterized by the rush *Juncus balticus,* sometimes with high cover of Canada thistle – ***Juncus balticus*** **(Baltic Rush) Herbaceous Vegetation [Map Class 20]**



3b Graminoid associations of mesic to xeric grass species including the genera *Achnatherum*, *Bromus*, *Hesperostipa*, *Leymus*, *Pascopyrum*, *Phalaris*, *Pleuraphis*, or *Poa***(4)**

4a (3) Grassland associations occurring in mesic to xeric habitats and composed of native species; characteristic genera include *Achnatherum*, *Hesperostipa*, *Leymus*, *Pascopyrum*, *Pleuraphis*, or *Poa* **(5)**

4b Grassland associations occurring in mesic to xeric habitats and composed of exotic species; characteristic genera include *Bromus*, *Phalaris*, or *Poa* **(10)**

5a (4) Grassland association of mesic swales or saturated soils composed of the medium-tall, rhizomatous grass, *Pascopyrum smithii* – ***Pascopyrum smithii*** **(Western Wheatgrass) Herbaceous Vegetation [Map Class 20]**



5b Grassland associations of mesic slopes or xeric habitats characterized by bunch grass genera including *Achnatherum*, *Hesperostipa*, *Leymus*, *Pleuraphis*, or *Poa* **(6)**

6a (5) Grassland associations of sparse perennial bunchgrasses associated with shale soils and badlands topography and characterized by the genera *Achnatherum* or *Leymus* **(7)**

6b Grassland associations of sparse to moderate foliar cover composed of perennial bunchgrasses growing on a variety of soils and characterized by the genera *Hesperostipa*, *Pleuraphis*, or *Poa* **(8)**

7a (6) Grassland association occurring on the steep slopes of ridges and characterized by the short stature bunchgrass *Achnatherum hymenoides* – ***Achnatherum hymenoides*** **(Indian Ricegrass) Shale Barren Herbaceous Vegetation [Map Class 20]**



7b Grassland association occurring on badlands slopes and ridges characterized by the tall stature bunchgrass *Leymus salinus* – ***Leymus salinus*** **(Salina Wildrye) Herbaceous Shale Sparse Vegetation [Map Class 80]**





8a (6) Grassland association of shallow to steep slopes characterized by *Poa fendleriana* – ***Poa fendleriana*** **(Muttongrass) Herbaceous Vegetation [Map Class 20]**



8b Grassland associations of medium stature bunchgrasses occurring on a variety of slope, ridge and terrace habitats and characterized by the genera *Hesperostipa* and/or *Pleuraphis* **(9)**

9a (8) Grassland association of *Hesperostipa comata* with minor to moderate foliar cover provided by other grass species, including *Bouteloua gracilis* or *Pleuraphis jamesii* – ***Hesperostipa comata*** **(Needle-and-thread) Great Basin Herbaceous Vegetation [Map Class 20]**



9b Grassland association of shallow to steep slopes characterized by *Pleuraphis jamesii* – ***Pleuraphis jamesii*** **(James' galleta) Herbaceous Vegetation [Map Class 20]**





10a (4) Grassland association often occurring on burned sites and composed of the exotic annual grass *Bromus tectorum* – ***Bromus tectorum*** **(Cheatgrass) Semi-natural Herbaceous Vegetation [Map Class 20]**





10b Grassland associations of mesic, exotic, rhizomatous species, characterized by the genera *Bromus*, *Phalaris*, or *Poa* **(11)**

11a (10) Grassland association of mesic to saturated soils usually confined to drainage channels; characterized by the tall, coarse grass *Phalaris arundinacea* – ***Phalaris arundinacea*** **(Reed Canarygrass) Western Herbaceous Vegetation [Map Class 5]**





11b Grassland associations of mesic soils; characterized by the rhizomatous species *Bromus* or *Poa*, with or without *Pascopyrum smithii* **(12)**

12a (11) Grassland association occurring on low terraces associated with the floodplain of the Gunnison River and characterized by *Bromus inermis,* with or without *Pascopyrum smithii* – ***Bromus inermis* – *(Pascopyrum smithii)*** **(Smooth Brome – (Western Wheatgrass)) Semi-natural Herbaceous Vegetation [Map Class 20]**



12b Grassland association occurring on high terraces adjacent to creeks; characterized by *Poa pratensis* – ***Poa pratensis* - (*Pascopyrum smithii*) (Kentucky Bluegrass - (Western Wheatgrass)) Semi-natural Herbaceous Vegetation [Map Class 20]**





Additional vegetation types documented in the Park:
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Heterotheca villosa - Bromus tectorum Semi-natural Herbaceous Vegetation

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Appendix H. Modified Anderson Land Use/Land Cover Classification

This classification was used as the primary attribute for areas of developed land within and around Black Canyon of the Gunnison National Park. Every polygon was assigned an Anderson Land Use or Land Cover code in addition to its vegetation attributes.

Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
1.0 Water	1.1 Open Water	1.11 Stream/river			
		1.12 Canal/ditch	1.121 Lined canal/ditch		
			1.122 Unlined canal/ditch		
		1.13 Lake/pond			
		1.14 Reservoir			
		1.15 Bay/estuary			
		1.16 Sea/ocean			
	1.2 Perennial Ice/Snow	1.21 Snowfield			
		1.22 Glacier			
2.0 Developed	2.1 Residential	2.11 Single-family residential			
		2.12 Multi-family residential			
	2.2 Non-residential Developed	2.21 Commercial/Light Industry	2.211 Major Retail		
			2.212 Mixed/Minor Retail and Services		
			2.213 Office		
			2.214 Light industry		
		2.22 Heavy Industry	2.221 Petro-chemical Refinery		
		2.23 Communications and Utilities			
		2.24 Institutional	2.241 Schools		
			2.242 Cemeteries		
		2.25 Agricultural Business	2.251 Aquiculture		
			2.252 Confined feeding		
		2.26 Transportation	2.261 Airport		
		2.27 Entertainment/ Recreation	2.271 Golf Course		
			2.272 Urban Parks		
	2.3 Mixed Urban				
3.0 Bare	3.1 Transitional				
	3.2 Quarries/Strip mines/Gravel pits				
	3.3 Bare Rock/Sand				
	3.4 Flats				

Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
	3.5 Disposal				
4.0 Vegetated	4.1 Woody	4.11 Forested	4.111 Deciduous		
			4.112 Evergreen		
			4.113 Mixed		
		4.12 Shrub land	4.121 Deciduous		
			4.122 Evergreen		
			4.123 Mixed		
			4.124 Desert scrub		
		4.13 Orchards/vineyards/ groves	4.131 Irrigated Orchard/ vineyards/groves		
			4.132 Citrus		
			4.133 Non-managed Citrus		
		4.14 Mixed Forest/Shrub			
	4.2 Herbaceous	4.21 Natural Herbaceous	4.211 Natural Grassland		
		4.22 Planted/cultivated	4.221 Fallow/Bare Fields		
			4.222 Small Grains	4.2221 Irrigated small grains	
			4.223 Row Crops	4.2231 Irrigated row crops	
				4.2232 Sugar Cane	
			4.224 Planted grasses	4.2241 Pasture/ hay	4.22411 Irrigated Pasture/hay
				4.2242 Other grass	4.22421 Irrigated Other grass
			4.225 Irrigated Planted/ cultivated		
	4.3 Wetlands	4.31 Woody wetlands			
		4.32 Emergent wetlands			

Classification Definitions

1.0 WATER - area covered by water, snow, or ice with less than 25% vegetated or developed cover, unless specifically included in another category.

1.1 Open Water - all areas of open water with less than 25% vegetative or developed cover

1.11 Stream/river - a natural body of flowing water. Includes streams and rivers that have been channelized in order to control flooding or erosion or to maintain flow for

navigation.

1.12 Canal/ditch - a man-made open waterway constructed to transport water, to irrigate or drain land, to connect two or more bodies of water, or to serve as a waterway for watercraft. Collection should include the right of ways and associated dikes and levees.

1.121 Lined canal/ditch - a canal or ditch lined with concrete or other impervious material preventing passage of water into underlying strata.

1.122 Unlined canal/ditch - a canal or ditch constructed with dirt or other porous material allowing water to drain.

1.13 Lake/pond - a non-flowing, naturally-existing, body of water. Includes water impounded by natural occurrences and artificially regulated natural lakes. The delineation of a lake is based on the areal extent of water at the time the imagery was acquired.

1.14 Reservoir - any artificial body of water, unless specifically included in another category. It can lie in a natural basin or a man-constructed basin. The delineation of a reservoir is based on the areal extent of water at the time the imagery was acquired. (The water control structures are classified as Communications/Utilities).

2.0 DEVELOPED - Areas of the earth that have been improved by man. Includes all "built-up" and urban areas of the landscape. Does NOT include mining lands, croplands, or waste-disposal areas (dumps). This land use category takes precedence over a land cover category when the criteria for more than one category are met.

2.1 Residential - lands containing structures used for human habitation

2.11 Single-family Residential - Lands used for housing residents in single-family dwelling units. Includes trailer parks, mobile home parks, and entire "farmsteads" when there is a home in the complex. (If no home is in the complex, it should be classified as Agricultural Business.) Single-family residential buildings located within another category, such as military family housing, should be identified in this category.

2.12 Multi-family Residential - All lands devoted to housing more than one family on a permanent or semi-permanent basis, group living situations, and their associated grounds. Includes apartments, apartment complexes, duplexes, triplexes, attached row houses, condominiums, retirement homes, nursing homes, and residential hotels. Residential buildings located within another category, such as barracks and dormitories, should be identified in this category when possible, (except residential buildings within convents and monasteries - include these with Institutional).

2.2 Non-residential Developed - Any "developed" area or feature that is used for a purpose other than habitation.

2.21 Commercial/Light Industry - structures and associated grounds used for the sale of products and services, for business, or for light industrial activities. Includes all retail and wholesale operations. Include "industrial parks" and other features that cannot be clearly classified as either a retail service or light industry, such as heavy equipment yards, machinery repair, and junkyards.

2.211 Major Retail - This category includes shopping malls, retail "outlet centers," and "superstores" that draw clientele from a regional area. Major retail centers consist of extremely large single buildings or a complex of large buildings and their parking lots. Malls usually house one or two major department stores and numerous

small retail stores. Includes outlet centers, "superstores", multi-plex movie theaters, and huge warehouse-type stores. The structures themselves are often several acres in size and have extensive parking lots.

2.212 Mixed/Minor Retail and Services - Includes individual stores and services of various sizes and associated grounds and parking. Includes neighborhood strip malls and shopping centers, veterinarian services, small movie theaters, gas stations and auto repair shops, garden centers, motels, small auto dealerships, public parking lots, lumber yards, art galleries, farm supply stores, flea-markets, bars and restaurants, grocery stores, and commercial "truck stops". Many small office buildings will have no features to distinguish them from retail stores and will fall in this category.

2.213 Office - structures and their associated grounds and parking, that provide financial, professional, administrative, and informational type services. Includes administrative government offices (e.g., IRS and State Motor Vehicles offices) trade schools, professional medical office complexes, research facilities/centers, and banks. Usually only office buildings in office complexes or in downtown areas will be distinguishable as offices. Small, single-story office buildings may blend in with minor retail.

2.214 Light industry - structures and their associated grounds and facilities that are used primarily to produce or process some finished product; or as a wholesale distribution center. Activities include design, assembly, finishing, packaging, warehousing or shipping of products rather than processing raw materials. The materials used in light industry have generally been processed at least once. They are generally "clean" industries that do not produce lots of waste materials. Use this category as a default for those facilities with semi-truck and trailer activity around loading docks, but that cannot be classified as either retail services or heavy industry. Includes electronic firms, clothing and furniture manufacture, grain elevators, printing plants, commercial bakeries, shipping and distribution centers, sand/gravel sorting facilities, secondary buildings associated with a mining or quarrying site, and generic warehouses.

2.22 Heavy Industry - structures and their associated grounds used for heavy fabrication, manufacturing and assembling parts that are, in themselves, large and heavy; or for processing raw materials such as iron ore, timber, and animal products. Accumulated raw materials are subject to treatment by mechanical, chemical, or heat processing to render them suitable for further processing, or to produce materials from that finished products are created. Heavy industries generally require large amounts of energy and raw materials and produce a significant amount of waste products. Indicators of heavy industry may be stockpiles of raw materials, energy producing sources and fuels, waste disposal areas and ponds, transportation facilities capable of handling heavy materials, smokestacks, furnaces, tanks, and extremely large buildings that are complex in outline and roof structure. Include associated waste piles and waste ponds. Heavy industry is usually located away from residential areas. Includes steel mills, paper mills, lumber mills, cotton gins, chemical plants, cement and brick plants, smelters, rock crushing machinery, and ore-processing facilities associated with mining.

2.23 Communications and Utilities - structures or facilities and associated grounds used for the generation of power and communications, the treatment or storage of

drinking water, waste management, flood control, or the distribution and storage of gas and oil not associated with a unique feature. Includes pumping stations (oil, gas, or water), tank farms, power plants, electric substations, sewage treatment facilities and ponds, garbage collection facilities (not the final dumping ground - these are included in Bare), dams, levees, and spillways of appropriate dimensions, filtration plants, and heavy concentrations of antennas or satellite dishes; along with the related operational buildings.

2.24 Institutional - specialized government or private features that meet the educational, religious, medical, governmental, protective, and correctional needs of the public. Parking lots and associated grounds are included with these features. Includes public and private schools (not day care), state capitols, city halls, courthouses, libraries, churches, convents, monasteries, hospitals and training hospitals, post offices, police and fire departments, prisons, and military bases. Only the military-business areas of a military base are classified here; residential, airport, athletic fields, and vegetated areas are classified in the appropriate category.

2.241 Schools/Universities - public and private schools, seminaries, university campuses, and associated lands. Include the entire "core campus" area, along with athletic fields and vegetated areas. This category does not include day care centers or commercial trade schools, both of that are commercial uses.

2.242 Cemeteries - structures and lands devoted to burial of the dead. Includes mausoleums, service areas, and parking lots.

2.25 Agricultural Business - structures and all associated grounds used for raising plants or animals for food or fiber. Includes fish farms and hatcheries, feedlots, poultry farms, dairy farms, temporary shipping and holding pens, animal breeding or training facilities, and greenhouses. (Farmsteads including a dwelling are classified as residential, not agricultural business.)

2.251 Aquiculture site - a set of pools of water and related structures used for producing fish, shellfish, or aquatic plants.

2.252 Confined feeding operation - structures and associated pens, storage facilities, waste areas, and ponds that are used for raising meat and dairy cattle, hogs, poultry, or other animals. These features must have a relatively permanent and high animal population density. Temporary holding pens and thoroughbred horse farms usually do not qualify.

2.26 Transportation - Roads, railroads, airports, port facilities, and their associated lands. Roads and railroads include the right-of-way, interchanges, and median strips. Category includes railroad stations, railroad yards, bus stations, highway maintenance yards, school bus parking and service yards, and park-and-ride lots. Port facilities include loading and unloading facilities, docks, locks and, temporary storage areas. Associated warehousing and transfer stations for truck or rail are included only if they appear to be an integral part of the airport or port facility. Nearby but separate warehouses will be classified as light industry.

2.27 Entertainment and Recreational - areas and structures used predominantly for athletic or artistic events, or for leisure activities, and all associated lands and developed parking areas. Includes outdoor amphitheaters, drive-in theaters, campgrounds, zoos, sports arenas (including indoor arenas), developed parks and playgrounds, community recreation centers, museums, amusement parks, public swimming pools, fairgrounds,

and ski complexes (not the ski slopes). Marinas with over 25% of water surface covered by docks and boats are included here.

2.271 Golf Course - structures, associated grounds, driving ranges, and interspersed natural areas used for the game of golf.

2.272 Urban Parks - designated open space in urban settings used for outdoor recreation. Include grass fields and associated structures, parking lots, and facilities. Includes city parks, "green-belt" urban parks, and athletic fields not associated with a school. Does not include undeveloped "open space" on the periphery of urban areas or undeveloped regional, state, or national park areas.

2.3 Mixed Urban - developed areas that have such a mixture of residential and non-residential features where no single feature meets the minimum mapping unit specification. This category is used when more than one-third of the features in an area do not fit into a single category. Often applicable in the central, urban-core area of cities.

3.0 BARE - undeveloped areas of the earth not covered by water that exhibit less than 25% vegetative cover or less than 5% vegetative cover if in an arid area. The earth's surface may be composed of bare soil, rock, sand, gravel, salt deposits, or mud.

3.1 Transitional Bare - areas dynamically changing from one land cover/land use to another, often because of land use activities. Includes all construction areas, areas transitioning between forest and agricultural land, and urban renewal areas that are in a state of transition.

3.2 Quarries/Strip Mines/Gravel Pits - areas of extractive mining activities with significant surface disturbance. Vegetative cover and overburden are removed for the extraction of deposits such as coal, iron ore, limestone, copper, sand and gravel, or building and decorative stone. Current mining activity does not need to be identifiable. Inactive or unreclaimed mines and pits are included in this category until another land cover or land use has been established. Includes strip mines, open-pit mines, quarries, borrow pits, oil and gas drilling sites, and gravel pits with their associated structures, waste dumps, and stockpiles.

3.3 Bare Rock/Sand - includes bare bedrock, natural sand beaches, sand bars, deserts, desert pavement, scarps, talus, slides, lava, and glacial debris.

3.4 Flats - A level landform composed of unconsolidated sediments of mud, sand, gravel, or salt deposits. Includes coastal tidal flats and interior desert basin flats and playas.

3.5 Disposal - designated areas where refuse is dumped or exists, such as landfills, trash dumps, or hazardous-waste disposal sites. Reclaimed disposal areas or those covered with vegetation do not qualify.

4.0 VEGETATED - areas having generally 25% or more of the land or water with vegetation. Arid or semi-arid areas may have as little as 5% vegetation cover.

4.1 Woody Vegetation - land with at least 25% tree and (or) shrub canopy cover.

4.11 Forested - land where trees form at least 25% of the canopy cover.

4.111 Deciduous Forest - area dominated by trees where 75% or more of the canopy cover can be determined to be trees that loose all their leaves for a specific season of the year.

4.112 Evergreen Forest - area dominated by trees where 75% or more of the canopy cover can be determined to be trees that maintain their leaves all year.

4.113 Mixed Forest - areas dominated by trees where neither deciduous nor

evergreen species represent more than 75% of the canopy cover.

4.12 Shrub land - areas where trees have less than 25% canopy cover and the existing vegetation is dominated by plants that have persistent woody stems, a relatively low growth habit, and that generally produce several basal shoots instead of a single shoot. Includes true shrubs, trees that are small or stunted because of environmental conditions, desert scrub, and chaparral. In the eastern US, include former cropland or pasture lands that are now covered by brush to the extent that they are no longer identifiable or usable as cropland or pasture. Clear-cut areas will exhibit a stage of shrub cover during the regrowth cycle. Some common species that would be classified as shrub land are mountain mahogany, sagebrush, and scrub oaks.

4.121 Deciduous Shrub land - areas where 75% or more of the land cover can be determined to be shrubs that lose all their leaves for a specific season of the year.

4.122 Evergreen Shrub land - areas where 75% or more of the land cover can be determined to be shrubs that keep their leaves year round.

4.123 Mixed Shrub land - areas dominated by shrubs where neither deciduous nor evergreen species represent more than 75% of the land cover.

4.124 Desert Scrub - land areas predominantly in arid and semi-arid portions of the southwestern U.S. Existing vegetation is sparse and often covers only 5-25% of the land. Example species include sagebrush, creosotebush, saltbush, black greasewood, and cactus.

4.13 Planted/Cultivated Woody (Orchards/Vineyards/Groves) - areas containing plantings of evenly spaced trees, shrubs, bushes, or other cultivated climbing plants usually supported and arranged evenly in rows. Includes orchards, groves, vineyards, cranberry bogs, berry vines, and hops. Includes tree plantations planted for the production of fruit, nuts, Christmas tree farms, and commercial tree nurseries. Exclude pine plantations and other lumber or pulp wood plantings that will be classified as Forest.

4.131 Irrigated Planted/Cultivated Woody - orchards, groves, or vineyards where a visible irrigation system is in place to supply water.

4.14 Mixed Forest/Shrub – areas dominated by forest and shrub where neither species represent more than 75% of the canopy cover.

4.2 Herbaceous Vegetation - areas dominated by non-woody plants such as grasses, forbs, ferns and weeds, either native, naturalized, or planted. Trees must account for less than 25% canopy cover while herbaceous plants dominate all existing vegetation.

4.21 Natural Herbaceous - areas dominated by native or naturalized grasses, forbs, ferns and weeds. It can be managed, maintained, or improved for ecological purposes such as weed/brush control or soil erosion. Includes vegetated vacant lots and areas where it cannot be determined whether the vegetation was planted or cultivated such as in areas of dispersed grazing by feral or domesticated animals. Includes landscapes dominated by grass-like plants such as bunch grasses, Palouse grass, palmetto prairie areas, and tundra vegetation, as well as true prairie grasses.

4.211 Natural Grasslands - natural areas dominated by true grasses. Includes undisturbed tall-grass and short-grass prairie in the Great Plains of the U.S.

4.22 Planted/Cultivated Herbaceous - areas of herbaceous vegetation planted and/or cultivated by humans for agronomic purposes in developed settings. The majority of vegetation in these areas is planted and/or maintained for the production of food, feed,

fiber, pasture, or seed. Temporarily flooded are included in this category. Do not include harvested areas of naturally occurring plants such as wild rice and cattails.

4.221 Fallow/Bare Fields - areas within planted or cultivated regions that have been tilled or plowed and do not exhibit any visible vegetation cover.

4.222 Small Grains - areas used for the production of grain crops such as wheat, oats, barley, graham, and rice. Category is difficult to distinguish from cultivated grasses grown for hay and pasture. Indicators of small grains may be a less than 10% slope, annual plowing and seeding, distinctive field patterns and sizes, different timing of green-up and harvest, different harvesting practices, a very "even" texture and tone, or regional variations discovered during field checks.

4.223 Row Crops - areas used for the production of crops or plants such as corn, soybeans, vegetables, tobacco, flowers and cotton. Fields that exhibit characteristics similar to row crops, but that do not have any other distinguishing features for a more specific category may be included.

4.2231 Irrigated Row Crops - areas used for the production of row crops where a visible irrigation system is in place to supply water.

4.224 Cultivated grasses - areas of herbaceous vegetation, including perennial grasses, legumes, or grass-legume mixtures that are planted by humans and used for erosion control, for seed or hay crops, for grazing animals, or for landscaping purposes.

4.2241 Pasture/Hay - areas of cultivated perennial grasses and/or legumes (e.g., alfalfa) used for grazing livestock or for seed or hay crops. Pasturelands can have a wide range of cultivation levels. It can be managed by seeding, fertilizing, application of herbicides, plowing, mowing, or baling. Pastureland has often been cleared of trees and shrubs, is generally on steeper slopes than cropland, is intended to graze animals at a higher density than open rangeland, and is often fenced and divided into smaller parcels than rangeland or cropland. Hay fields may be more mottled than small grain fields as they are not plowed annually and may be harvested and baled two or three times a year in some locations.

4.22411 Irrigated Pasture/Hay - areas used as pasture or hay fields where a visible irrigation system is in place to supply water.

4.2242 Other planted grasses - areas of other cultivated grass such as turf and sod farms.

4.22421 Irrigated other grasses - areas of other cultivated grasses where a visible irrigation system is in place to supply water.

4.225 Irrigated Planted Herbaceous - land that is growing some indistinguishable crop or grass, but is obviously irrigated.

4.3 Vegetated Wetland - areas where the water table is at, near, or above the land surface for a significant part of most years and vegetation indicative of this covers more than 25% of the land surface. Wetlands can include marshes, swamps situated on the shallow margins of bays, lakes, ponds, streams, or reservoirs; wet meadows or perched bogs in high mountain valleys, or seasonally wet or flooded low spots or basins. Do not include agricultural land that is flooded for cultivation purposes.

4.31 Woody Wetland - areas dominated by woody vegetation. Includes seasonally flooded bottomland, mangrove swamps, shrub swamps, and wooded swamps including

those around bogs. Wooded swamps and southern flood plains contain primarily cypress, tupelo, oaks, and red maple. Central and northern flood plains are dominated by cottonwoods, ash, alder, and willow. Flood plains of the Southwest may be dominated by mesquite, saltcedar, seepwillow, and arrowweed. Northern bogs typically contain tamarack or larch, black spruce, and heath shrubs. Shrub swamp vegetation includes alder, willow, and buttonbush.

4.32 Emergent Herbaceous Wetlands - areas dominated by wetland herbaceous vegetation that is present for most of the growing season. Includes fresh-water, brackish-water, and salt-water marshes, tidal marshes, mountain meadows, wet prairies, and bogs.

Appendix I. Accuracy Assessment Analysis Results

Introduction

This appendix contains the results of the analysis of accuracy assessment (AA) field data. Each of the 762 AA field plots sampled at BLCA in 2004 was compared with the polygon in which it was located. If the field data matched the polygon label, the plot was deemed correct. If it did not, it was marked incorrect and underwent further analysis as to the type and pattern of error, and the best way to resolve the error.

We approached the error analysis with the idea that error can enter a map and into a data set from many sources, most of which are out of the photointerpreter's control. These sources of error include:

- Transcription error by the technician who created the digital mapping database
- Locational error in the field (e.g. canyons or dense forests where GPS doesn't work, OR small or narrow polygons, so sample is taken in a different polygon than was intended)
- Transcription error by persons entering AA data into the relational database
- Transcription error by persons creating the AA contingency table
- Field key is difficult to use (fault may lie with key or with classification)
- Field key does not include all plant associations present within the park
- Field crew error, either by mis-identifying diagnostic species in the field, or by not reading the key carefully, thus resulting in a bad call when the map is actually good
- Point falls within an ecotone, which is impossible to classify but which still has to get mapped as something
- The AA point falls in an inclusion of a different vegetation type that is too small to map as a separate polygon; the mapper had to choose the dominant type to label the polygon
- The photos were flown and/or the plot data collected in a year or season either much drier or much wetter than the year/season in which AA is done

These types of error may affect the accuracy of a map even when the map concepts are good. We therefore felt justified in making post-AA adjustments to the map class definitions, the association-map class crosswalk, field key, and in a few cases, the map polygon labels to account for what we considered to be "false" (i.e., not in control of the mapper) errors.

The initial (uncorrected) accuracy of the BLCA vegetation map was 29.3%. We therefore inspected the original AA plot data, plot photographs, and aerial imagery for approximately 540 plots of accuracy assessment field data to create the table that follows. We identified the patterns of error for every map class that failed to meet the program standard of 80% user's and producer's accuracy and suggested one or more potential solutions in each case. The final step in the process was to present the table in March, 2005 to BLCA natural resources staff and ask for their input for solutions we would apply to the final map. Park staff could choose from our suggestions or offer other solutions. In some cases, staff chose "none of the above" and opted instead to retain a map class with lower accuracy because it represented a vegetation type that was important to management.

Origin-al Map Class	Final Map Class	Original Map Class Name	Final Map Class Name	Map Class Concept	Problem	Proposed Solution	Final Decision
4	5	Box Elder / Gambel Oak Woodland	Canyon Bottom Mosaic	Unstable rocky river banks dominated by Box Elder and Gambel Oak	Confused with Gambel oak shrubland map classes (42 and 48)	Combine MU's 4, 5 and 16 into a Canyon Bottom Mosaic. This would acknowledge that separation was not practical, and that realistically we don't have a complete sampling of the canyon and it is probable that other communities are present.	Combine MUs 4, 5 and 16 into Canyon Bottom Mosaic (5)
5	5	Box Edler / Disturbed Understory Woodland	Canyon Bottom Mosaic	Box Elder riparian woodlands	In general in the highly mosaicked bottoms it is difficult to distinguish types and difficult or impossible to separate spatially. This type was not accuracy assessed along the Gunnison River, only along tributary draianges.	Combine MU's 4, 5 and 16 into a Canyon Bottom Mosaic. This would acknowledge that separation was not practical, and that realistically we don't have a complete sampling of the canyon and it is probable that other communities are present.	Combine MUs 4, 5 and 16 into Canyon Bottom Mosaic (5)
16	5	Reed Canary Grass Western Herbaceous Vegetation	Canyon Bottom Mosaic	Springs, seeps, and stream margins; also along river banks	In general in the highly mosaicked bottoms it is difficult to distinguish types and difficult or impossible to separate spatially. Most examples of this type are too small to be pulled out separately.	Combine MU's 4, 5 and 16 into a Canyon Bottom Mosaic. This would acknowledge that separation was not practical, and that realistically we don't have a complete sampling of the canyon and it is probable that other communities are present.	Combine MUs 5 and 16 into Canyon Bottom Mosaic (5)

Origin-al Map Class	Final Map Class	Original Map Class Name	Final Map Class Name	Map Class Concept	Problem	Proposed Solution	Final Decision
9	9	Blue Spruce Riparian Woodland Alliance	Blue Spruce Woodland Alliance	Mapped in deep ravines on N-facing, mesic slopes of the Gunnison River gorge	Confused with Douglas-fir stands in gullies/ravines. Rare type that is almost entirely inaccessible to field sampling, so was never documented by field crews in BLCA only in CURE.	N/A	Not Accuracy Assessed
14	20	Baltic Rush Herbaceous Vegetation	Mixed Upland Grasslands	Disturbed wet sites, such as old irrigated fields	Rare type in BLCA, more common in CURE	Merge with MU 20 in BLCA, but add a “M” modifier to denote more mesic conditions	See Solution
15	20	Kentucky Bluegrass - (Western Wheatgrass) Semi-natural Herbaceous Vegetation	Mixed Upland Grasslands	Rare type	Distinguishing herbaceous types was largely guess-work without direct field knowledge	Combine all grassland associations into one big grassland map class	Combine all types into MU 20
18	20	Smooth Brome Semi-natural Herbaceous Vegetation	Mixed Upland Grasslands	Rare type	Distinguishing herbaceous types was largely guess-work without direct field knowledge	Combine all grassland associations into one big grassland map class	Combine all types into MU 20
21	20	Muttongrass Herbaceous Vegetation	Mixed Upland Grasslands	Rare type	Distinguishing herbaceous types was largely guess-work without direct field knowledge	Combine all grassland associations into one big grassland map class	Combine all types into MU 20

Origin-al Map Class	Final Map Class	Original Map Class Name	Final Map Class Name	Map Class Concept	Problem	Proposed Solution	Final Decision
24	20	(Cheatgrass, Storksbill) Semi-natural Annual Herbaceous Vegetation	Mixed Upland Grasslands	Recorded in a recently burned site	Distinguishing herbaceous types was largely guess-work without direct field knowledge.	Use an "I" modifier in polys that are dominantly weedy	Combine all types into MU 20
84	20	Four-wing Saltbush - Big Sagebrush Shrubland	Mixed Upland Grasslands	Saltbush-sagebrush sparse shrubland with a grassy understory	Grasslands are often mosaicked with sagebrush shrublands and difficult to pull out separately. Photo signature is smooth and appears exactly like a grassland to the PI.	Combine with grassland associations into one big grassland map class	Combine all types into MU 20
85	20	Four-wing Saltbush / Indian Ricegrass Shrubland	Mixed Upland Grasslands	Sparse saltbush shrubland with a grassy understory	Photo signature is smooth and appears exactly like a grassland to the PI.	Combine with grassland associations into one big grassland map class	Combine all types into MU 20
28	28	Parry's Rabbitbrush Shrubland	Roadcut Sparse Shrubland	Road-fill, talus/scree. Often very weedy with sparse ERIPAR or ERINAU shrub cover	Positional errors common because polygons are often very small.	N/A	None needed
29	31	Gunnison's Prairie Dog Town	Wyoming Big Sagebrush Shrubland	Signs of prairie dog activity. Vegetation is usually dominated by rabbitbrush and weedy forbs.	The AA did not include information about prairie dog activity. Did not map well as a unique vegetation type.	Merge with MU 31, but label all polys formerly called MU 29 with a "P" modifier to denote prairie dog activity.	See Solution

Origin-al Map Class	Final Map Class	Original Map Class Name	Final Map Class Name	Map Class Concept	Problem	Proposed Solution	Final Decision
31	31	Wyoming Big Sagebrush Shrubland	Wyoming Big Sagebrush Shrubland	Mainly in buffer	Confused with Mountain Big Sagebrush and Black Sagebrush	Revise map class description to be for open sagebrush stands only with sparse understory and poor soils.	See solution
32	31	Black Sagebrush Shrub Herbaceous Vegetation	Wyoming Big Sagebrush Shrubland	It is there, but lacks a consistent signature and apparently is spotty and not common as and overstory or understory.	Very rare type, too difficult to pull out separately from Wyo. sage in the lowlands and lowslope basins.	Lumping with mixed montane type would improve accuracy	Combine with MU 31
86	31	Big Sagebrush / Galleta Grass Shrubland	Wyoming Big Sagebrush Shrubland	Based off of one plot near park boundary where active grazing was still occurring and galleta grass was the dominant understory.	Very rare type, too difficult to pull out separately. Not common enough to map as its own type.	Combine with MU 31	Combine with MU 31
94	31	Wyoming Big Sagebrush / Seeded Grasses Semi-natural Shrubland	Wyoming Big Sagebrush Shrubland	Disturbed Wyoming sagebrush shrublands with seeded grasses in the understory	Too difficult to pull out separately from the other Wyoming sagebrush shrublands	Merge with MU 31 and use an “I” modifier	See solution
35	31	Basin Big Sagebrush / Western Wheatgrass Shrubland	Wyoming Big Sagebrush Shrubland	Basin Big Sagebrush in altered, grazed sites with a western wheatgrass dominated understory	Big Sagebrush was not mapped separately in BLCA. Is there Basin Big Sage or is it just really tall Wyoming Big Sage???	Combine with MU 31	Combine with MU 31

Origin-al Map Class	Final Map Class	Original Map Class Name	Final Map Class Name	Map Class Concept	Problem	Proposed Solution	Final Decision
33	33	Mountain Big Sagebrush Shrub Herbaceous Vegetation	Mountain Big Sagebrush Shrubland	Mostly in SE corner of BLCA, high elevation sagebrush shrublands	Confused with Wyoming big sagebrush (probably hybrid stands)	N/A	N/A
36	33	Mountain Big Sagebrush / Muttongrass Shrubland	Mountain Big Sagebrush Shrubland	Higher elevation mountain big sagebrush shrublands with muttongrass in the understory	The Mtn. sagebrush associations targeted didn't have high accuracy of separation, but at alliance level accuracy is very acceptable	Combine all grassy understories together into one mountain big sagebrush alliance	Combine with MU 33
38	33	Mountain Big Sagebrush / Arrowleaf Balsamroot Shrubland	Mountain Big Sagebrush Shrubland	Higher elevation mountain big sagebrush shrublands with arrowleaf balsamroot in the understory	The Mtn. sagebrush associations targeted didn't have high accuracy of separation, but at alliance level accuracy is very acceptable	Combine all grassy understories together into one mountain big sagebrush alliance	Combine with MU 33
40	40	Gambel Oak / Big Sagebrush Shrubland Mosaic	Gambel Oak / Big Sagebrush Shrubland Mosaic	A matrix of oak mots and sagebrush, where oak mots grow too close together to be pulled out seperately from the sagebrush	Most of the confusion was with MU 42 (mapped as oak mixed with serviceberry or mahogany but found to be oak mixed with sagebrush). This type was undermapped and not properly accuracy assessed because the majority of polygons mapped fell in the SE corner of BLCA which was inaccessible to field crews because of private property constraints.	Some polygons that were confirmed to be this type were remapped as MU 40 when they were big enough stands to pull out as post-AA. So the accuracy of this map class may be a little higher than it is portrayed in the report and final contingency table.	See Solution

Origin-al Map Class	Final Map Class	Original Map Class Name	Final Map Class Name	Map Class Concept	Problem	Proposed Solution	Final Decision
42	42	Gambel Oak / Mixed Montane Shrubland Complex	Gambel Oak / Mixed Montane Shrubland Complex	Mixed montane shrublands with Gambel oak, serviceberry and mountain mahogany as co-dominants. Oak and serviceberry do look different in rather pure stands and do not really form a community as much as compete (oak will win eventually) in a mosaic.	None	N/A	N/A
45	42	Serviceberry - Mixed Shrub / Elk Sedge Shrubland	Gambel Oak / Mixed Montane Shrubland Complex	MU 45 was mapped by attempting to delineate areas with apparent matrix dominance of serviceberry.	Serviceberry typically mixed with oak and Mtn. mahogany such that boundaries were problematic.	Combine with Gambel oak – mixed montane shrubland complex to improve accuracy	Combine with MU 42
46	42	Mountain Mahogany Shale Shrubland	Gambel Oak / Mixed Montane Shrubland Complex	MU 46 was an attempt to separate CERMON dominated steep slopes. There are just a few polygons.	The AA sites all are in one polygon and indicate a mixed shrub community that includes CERMON but apparently not as the dominant shrub.	Combine with Gambel oak – mixed montane shrubland complex to improve accuracy	Combine with MU 42
43	43	Gambel Oak Woodlands	Gambel Oak Woodlands	MU 43 was separated from MU 42 largely to acknowledge tree form oak communities. These are more mesic sites and/or older stands.	This class seems to split understory/co-dominance floristics with MU 42.	QUEGAM / Carex geyeri association will be crosswalked to both map classes (42 and 43)	See Solution

Origin-al Map Class	Final Map Class	Original Map Class Name	Final Map Class Name	Map Class Concept	Problem	Proposed Solution	Final Decision
47	43	Oak- Saskatoon Serviceberry	Gambel Oak Woodlands	This MU was tentatively separated based on a fairly distinct pattern signature of large oak mots with serviceberry mosaicked in.	Difficult to tell Saskatoon from Utah serviceberry in oak stands, but stands of MU 43 should be much thicker.	Based on AA and potential usefulness it should be merged with 43 or to a broad oak-serviceberry complex.	Combine with MU 43
48	48	Gambel Oak / Rock Spirea Shrubland	Gambel Oak / Rock Spirea Scree Shrubland	The mapping model was steep, (scree and crag dominated) canyon slopes. The key agreement is steep slopes with scree, etc.	The HOLDUM component apparently was not the big thing but rather Mtn. mahogany and oak. One polygon sampled was Mtn. mahogany dominated, others were oak and some serviceberry. Overlapping associations in the key.	I would like to keep the unit but rename. Separate associations in the key based on unstable talus vs. stable uplands.	Add “Scree” to map class name and retain map clas
49	49	Mixed Montane Shrub / Big Sagebrush Mosaic	Mixed Montane Shrub / Big Sagebrush Mosaic	Catch-all map class for all the messy stuff of the mesa top: one big ecotone between sage, oak and serviceberry	None	N/A	N/A
52	52	Quaking Aspen / Tall Shrubs Forest	Quaking Aspen / Tall Shrubs Forest	Mapped in SE corner of BLCA only. MU 52 represents all of the aspen stands in BLCA.	None	N/A	N/A
54	52	Quaking Aspen / Gambel Oak Mesic Forest	Quaking Aspen / Tall Shrubs Forest	Quaking aspen stands mosaicked with Gambel oak	MU 54 aspen/oak should be regarded as a Park Special and could not be reliably interpreted by the PI	Merge with MU 52	Combine with MU 52

Origin-al Map Class	Final Map Class	Original Map Class Name	Final Map Class Name	Map Class Concept	Problem	Proposed Solution	Final Decision
60	60	Douglas-fir / Rock Spirea Scree Woodland	Douglas-fir Scree Woodland	Sparse Doug-fir canopy, P-J subcanopy and mixed shrub (incl. HOLDUM) understory on steep and/or scree slope canyonsides. Mapping includes a lot of outcrop and/or scree in some polygons.	Many of the AA sites are oak understory, (MU 62), suggesting that the PI did a poor job consistently pulling out oak in the understory.	Have PI relabel polygons with an oak understory (either visible on the imagery or documented from AA pts) to MU 62. This map class should not have an oak understory.	Retain map class even with low accuracy to pull out Doug-fir stands on steep and more xeric slopes with sparse mixed shrubs in the understory
62	62	Douglas-fir / Gambel Oak Forest	Douglas-fir Forest	Doug-fir stands generally not with P-J in the subcanopy (and generally of more stable and mesic sites) with mixed shrubs in the understory (usually incl. oak)	None	N/A	N/A
69	69	Pinyon Pine – Juniper / Greasebush Woodland	PJ / Sparse Mixed Shrubs Scree Woodland	MU 69 was based on two sites and a simple model: Very sparse P-J, little apparent understory, and Morrison formation south to west facing scarps. But it morphed into sparse P-J woodlands occupying the steep slopes of the inner Black Canyon.	Too many overlapping associations with MU 74 (especially P-J/CERMON and P-J/Sparse), but tends to occur on steep, rocky slopes with sparser vegetation cover. Habitat is unique, but associations are not.	If P-J/CERMON and P-J/Sparse associations are added to the crosswalk for this map class, accuracy is nearly 80%. Change the map class name to reflect these additional associations.	Add 2 new associations to the crosswalk and rename map class.
70	69	PJ / Rock Spirea Woodland	PJ / Sparse Mixed Shrubs Scree Woodland	PJ / Holodiscus based on two sites from CURE and the association may not be widespread in BLCA.	Like the other classes with HOLDUM in the name, the AA sampling turned up CERMON and some of the other understory species.	Fits well with the revised concept for MU 69.	Combine with MU 69

Origin-al Map Class	Final Map Class	Original Map Class Name	Final Map Class Name	Map Class Concept	Problem	Proposed Solution	Final Decision
77	69	Pinyon Pine – Juniper / Sparse Understory Woodland	PJ / Sparse Mixed Shrubs Scree Woodland	MU 77 was based on one training site (in BLCA) and a concept model based on signature (nearly closed canopy PJ)	This association was often used to describe low cover P-J woodlands with very little understory occurring on steep scree slopes	Crosswalk this association to MU 69 to improve accuracy	Combine with MU 69
71	71	PJ / Gambel Oak Woodland	PJ / Gambel Oak Woodland	Dense P-J woodlands or appearing so due to tall oak shrubs with high cover mixed in.	This is the strongest of the P-J associations with more errors of omission than commission; the rule seems to be that anything that looks like oak is oak and then some errors due to the fact that low cover of oak may not be apparent.	This map class may be more common in BLCA than it is currently mapped. PI will go through and relabel polygons documented to be P-J/oak as such (MU 71).	Relabel polys called P-J/oak by field crews to MU 71 since this map class was found to be more common than it was mapped.
72	72	PJ / Sagebrush Species Woodland	PJ / Sagebrush Species Woodland	Woodlands on drier sites with deep alluvial soils	This class had moderate signature recognition combined with flatter slopes, possibly deeper soils. The large block of error is with cheatgrass understory; I interpret this as a ground fire. Cheatgrass understory did not have an apparent signature, was low cover, and much of it may have been sagebrush before the fire.	Add JUNOST/BROTEC to crosswalk of associations. Still there is some confusion with MU 74 because photo signatures are not always distinct.	Retain this map class with lower accuracy because sagebrush is an ecologically significant understory species.

Origin-al Map Class	Final Map Class	Original Map Class Name	Final Map Class Name	Map Class Concept	Problem	Proposed Solution	Final Decision
74	74	PJ / Mixed Shrubs and Grasses Woodland	PJ / Mixed Shrubs and Grasses Woodland	Dry, open, generally steep-sloped woodlands	This class had more errors of omission and will benefit from merging with the most confused competing classes. While this is named mixed shrubs and grasses, by far the most prevalent association is PJ / CERMON. Other included communities may represent less than 25% of the total, based on AA sampling and would be both uncertain and spatially difficult to map.	Combine all P-J types with mixed shrubs or grasses in the understory that did not have high enough accuracy into this one large P-J type	See Solution
75	74	Pinyon Pine / Muttongrass Woodland	PJ / Mixed Shrubs and Grasses Woodland	Denser, more mesic woodlands with deeper soils. My theory was that POAFEN was more associated with harder rocks, Dakota or Pc and LEYSAL with Morrison. Nice theory not born out by AA.	The mapping model/signature that I tried to separate was not much different than classes 76, and 77. All represent fairly mature, nearly closed canopy woodlands/forests. There is considerable confusion between classes 74, 75, 76, and 77.	Combine all P-J types with mixed shrubs or grasses in the understory that did not have high enough accuracy into this one large P-J type	Combine with MU 74
76	74	Pinyon Pine – Juniper / Salina Wildrye Woodland	PJ / Mixed Shrubs and Grasses Woodland	MU 76 was based on two training sites and a concept model based on signature and Morrison formation. P-J woodland with Salina wildrye the dominant understory.	The AA sampling definitely proved that PJ / Leymus salinas is not extensive on the landscape but rather occurs in a complex with the CERMON “suite” and should be added to MU 74.	Combine all P-J types with mixed shrubs or grasses in the understory that did not have high enough accuracy into this one large P-J type	Combine with MU 74
77	74	Pinyon Pine – Juniper / Sparse Understory Woodland	PJ / Mixed Shrubs and Grasses Woodland	MU 77 was based on one training site (in BLCA) and a concept model based on signature (nearly closed canopy PJ)	Not reliably or consistently pulled out by the PI; accuracy would be improved by combining with the larger suite of P-J / mixed shrubs and grasses	Combine all P-J types with mixed shrubs or grasses in the understory that did not have high enough accuracy into this one large P-J type	Combine with MU 74

Origin-al Map Class	Final Map Class	Original Map Class Name	Final Map Class Name	Map Class Concept	Problem	Proposed Solution	Final Decision
88	74	Utah Juniper / Cheatgrass Semi-natural Woodland	PJ / Mixed Shrubs and Grasses Woodland	Open Utah juniper woodlands with a disturbed understory of cheatgrass	BROTEC is a common understory dominant in areas that were recently or somewhat recently burned	Crosswalk this association to MU 74 as well	Combine with MU 74
78	78	Utah Juniper / Big Sagebrush Woodland	Utah Juniper / Big Sagebrush Woodland	This class represents very sparse juniper with sagebrush understory, though herbaceous areas may get included in the patchy, disturbed landscapes that this is mapped in. While this class is mostly out of the park, it is a very real class.	MU 78 is of minor extent and didn't really get a fair shake in the AA. There were 3 sites sampled and while all were wrong, 2 were very near boundaries with correct classes. I would retain the class despite the apparent lack of accuracy. There was difficulty in separation with MU 87 and 76, but I hate to see this lost as I believe it is not as inaccurate as this 2 site sampled would indicate.	Rare type; retain map class even with low accuracy.	See Solution
80	80	Mancos Shale Badlands Vegetation	Mancos Shale Badlands Vegetation	Mat saltbush, shadscale and sparse grasses on low slopes of Mancos shale	None	N/A	N/A
81	80	Shale Barren Mixed Vegetation	Mancos Shale Badlands Vegetation	Rare types dominated by winterfat, Atriplex canescens, and ricegrass on gypsum badlands	Accuracy between the sparse Atriplex, spare Leymus salinas and other xeric grasses turned out to be poor. A merge up is reasonable and makes the accuracy reasonably good.	Separation of individual communities is not likely or significant to the NPS.	Combine with MU 80
82	80	Shadscale Shrub Herbaceous Complex	Mancos Shale Badlands Vegetation	Very sparse shadscale on shale badlands	Accuracy between the sparse Atriplex, spare Leymus salinas and other xeric grasses turned out to be poor. A merge up is reasonable and makes the accuracy reasonably good.	Separation of individual communities is not likely or significant to the NPS.	Combine with MU 80

Origin-al Map Class	Final Map Class	Original Map Class Name	Final Map Class Name	Map Class Concept	Problem	Proposed Solution	Final Decision
83	80	Gardner's Saltbush Shrubland	Mancos Shale Badlands Vegetation	Actively eroding slopes with extremely sparse cover by Gardner's saltbush	Accuracy between the sparse Atriplex, spare Leymus salinas and other xeric grasses turned out to be poor. A merge up is reasonable and makes the accuracy reasonably good.	Separation of individual communities is not likely or significant to the NPS.	Combine with MU 80
89	80	Leymus salinus Shale Sparse Vegetation	Mancos Shale Badlands Vegetation	Sparse Salina wildrye on shale slopes	Accuracy between the sparse Atriplex, spare Leymus salinas and other xeric grasses turned out to be poor. A merge up is reasonable and makes the accuracy reasonably good.	Separation of individual communities is not likely or significant to the NPS.	Combine with MU 80
96	80	Greasewood Shrubland	Mancos Shale Badlands Vegetation	Homogenous greasewood shrublands on alluvial flats	Greasewood was only pulled out separately in the buffer. In the park, greasewood also occurs as a co-dominant with Atriplex spp. on shale badlands	Keep MU 96 for buffer polygons only, otherwise combine all polys in the park with MU 80 "Shale Badlands"	See Solution
87	87	Utah Juniper / Salina Wildrye Woodland	Utah Juniper / Salina Wildrye Woodland	MU 87 is mapped on sparsely wooded slopes of Mancos, Morrison, Wanaka, and Entrada formations. The difference between MU 87 and MU 76 is whatever the difference is between a "woodland" and "wooded shrubland."	None	N/A	N/A
88	78	Utah Juniper / Cheatgrass Semi-natural Woodland	Utah Juniper / Big Sagebrush Woodland	Open Utah juniper woodlands with a disturbed understory of cheatgrass	BROTEC is a common understory dominant or co-dominant with Artemisia spp. in grazed or previously grazed areas near park boundary.	Combine with MU 78	Combine with MU 78

Origin-al Map Class	Final Map Class	Original Map Class Name	Final Map Class Name	Map Class Concept	Problem	Proposed Solution	Final Decision
92	93	Mountain Big Sagebrush - Rock Spirea Rock Outcrop Shrubland	Rock Spirea Sparsely Vegetated Rock Outcrop	This MU was based on one or two CURE sites, there is no training site sampling of these canyonside landscapes in BLCA.	Very rare type that was poorly mapped and does not merit the existence of its own map class.	Have PI dissolve map class into best fit of neighboring polygons MU 93 is the closest match and is most likely what the majority of polygons will be relabeled as.	See Solution
93	93	Rock Spirea Sparsely Vegetated Rock Outcrop	Rock Spirea Sparsely Vegetated Rock Outcrop	There is NO training site data in BLCA on the steep, unforested canyonsides. This MU was based on the CURE model (6 sites) which suggested that low cover of PJ was "normal" to the MU concept.	This type is poorly sampled because of accessibility issues on the very steep scree slopes it occupies.	Retain map class with lower accuracy because it represents the majority of the sparsely vegetated canyon slopes and vertical walls of Black Canyon.	Retain map class even with lower accuracy
96	96	Greasewood Shrubland	Greasewood Shrubland	This class was conceptualized without data and basically maps vegetation near an irrigation canal. Canal is in the buffer.	Greasewood was only pulled out separately in the buffer. In the park, it tends to occur in a mosaic with other Atriplex spp.	Keep MU 96 for buffer polygons only, otherwise combine all polys in the park with MU 80 “Shale Badlands”	No accuracy available for this type because it was merged with MU 80 in the park and mapped separately in the environs only (no AA pts.)
99	99	Hanging Garden Vegetation	Hanging Garden Vegetation	Hanging garden vegetation	None	N/A	Mapped as a point layer only. Not accuracy assessed.

Appendix J. Map Class Descriptions for Black Canyon of the Gunnison National Park

Introduction

This document provides a visual guide and description of the vegetation map classes for the Black Canyon National Park Vegetation Mapping Project. Twenty-four map classes are described in this guide. Eleven land use classes are not included.

Each of the map classes included in this guide is documented by:

- ground photographs (if available)
- a list of component NVC associations and ecological systems
- common plant species
- examples of each map class signature taken from the ortho imagery with delineated polygons
- descriptions of the photo signature
- a description of the ecology and distribution of the map class within the mapping area
- a graphic showing distribution of the map class throughout the mapping area
- polygon statistics report (polygon number, size, and area)
- accuracy assessment results for each map class

This guide does not attempt to show all variations within each vegetation map class; only the most common or significant representations are included. These should be sufficient to give the user an understanding of the relationships among the vegetation classification, the imagery, and mapping concepts.

VEGETATED MAP CLASSES OF BLACK CANYON NATIONAL PARK

Upland Forest and Woodland 487
Blue Spruce Woodland Alliance (W-PICE) 487
Quaking Aspen / Tall Shrubs Forest (F-POTR) 489
Douglas-fir / Rock Spirea Scree Woodlands (W-PSHO) 492
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Pinyon – Juniper / Sparse Mixed Shrubs Scree Woodland (W-PJSC) 496
Pinyon – Juniper / Gambel Oak Woodland (W-PJQU) 498
Pinyon – Juniper / Sagebrush Species Woodland (W-PJAR) 500
Pinyon – Juniper / Mixed Shrubs and Grasses Woodland (W-PJMX) 502
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Upland Shrublands 509
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Upland Forest and Woodland

Map Class 9
Blue Spruce Woodland Alliance (W-PICE)

No photos available

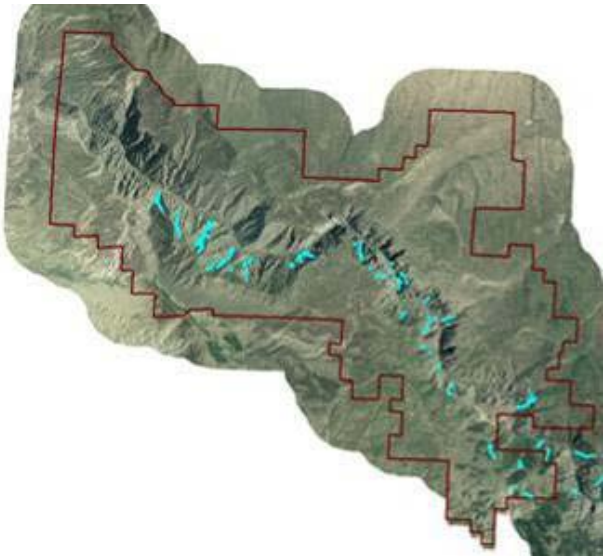
Associations
None documented

Common species
- *Picea pungens*
- *Mahonia repens*

W-PICE Map Class Statistics

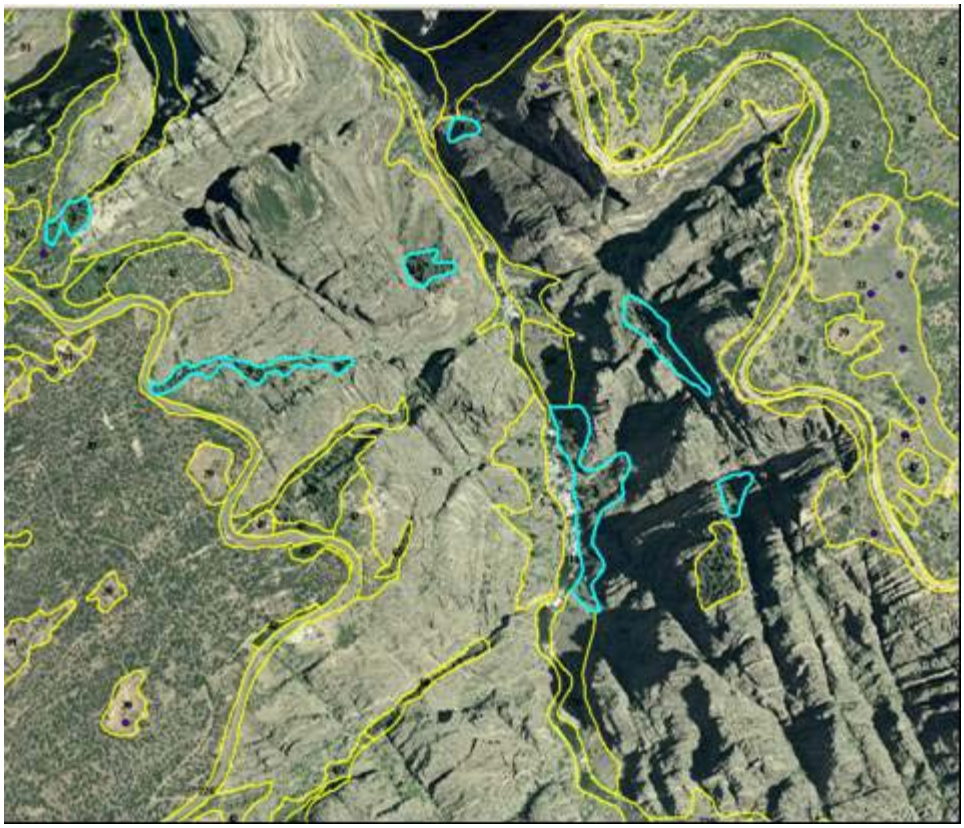
Type:	Association
Frequency:	41 total polygons 39 polygons in BLCA 2 polygons in the environs
Total project area:	48 hectares / 118 acres (< 0.2 %) 46 hectares / 115 acres in BLCA 1 hectares / 3 acres in the environs
Average Polygon Size:	1.2 hectares / 2.9 acres
Producer's accuracy:	N/A
User's accuracy:	N/A

Distribution in Mapping Area



Distribution/Ecology/Composition
Map class 9 occurs largely in the main canyon of the Black Canyon of the Gunnison. The environment is characterized by intermittent or ephemeral water flow, long shadows, and cold air drainage. Soils are rocky and coarse-textured and may have seasonal water tables at variable depths within the landscape. Tree canopy cover varies from sparse to nearly closed-canopy.

Interpretation
This uncommon map class occurs in cold, narrow canyon ravine or toe slope environments, both in the main canyon as well as in some steep side canyons. Polygons are mostly small. The tall, dark, narrow crowns of *Picea pungens* are evident in signature, as is the brighter green of the understory. Interpretation was based on the assumption that *Picea pungens* rather than *Pseudotsuga menziesii* would be expected in these canyon bottoms, though there are no plots or accuracy points to prove this assumption is correct. Adjacent polygons may include map classes 93 (Rock Spirea Sparsely Vegetated Rock Outcrop), 60 (Douglas-fir Scree Woodland), and 48 (Gambel Oak / Rock Spirea Scree Shrubland).



Example of photo signature for map class W-PICE (#9).

Map Class 52
Quaking Aspen / Tall Shrubs Forest (F-POTR)

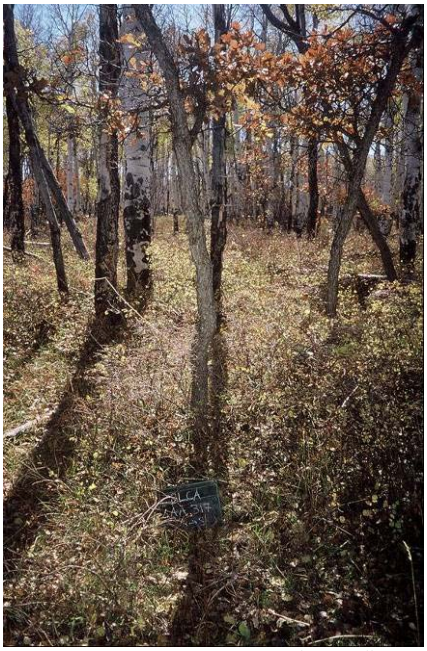



Photo credits: NPS

Associations

Populus tremuloides / *Amelanchier alnifolia* - *Symphoricarpos oreophilus* / *Calamagrostis rubescens* Forest
Populus tremuloides / *Symphoricarpos oreophilus* / *Thalictrum fendleri* Forest
Populus tremuloides / *Quercus gambelii* / *Symphoricarpos oreophilus* Forest

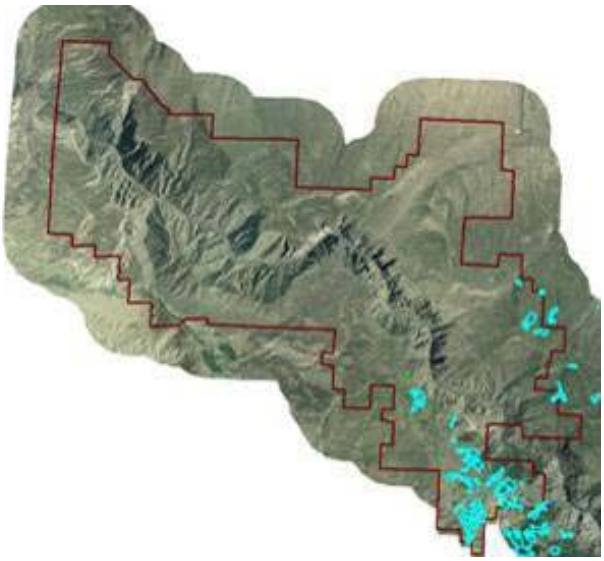
Common species

- *Populus tremuloides*
- *Amelanchier alnifolia*
- *Symphoricarpos oreophilus*
- *Quercus gambelii*
- *Calamagrostis rubescens*
- *Thalictrum fendleri*
- *Juniperus communis*

F-POTR Map Class Statistics

Type:	Complex of associations
Frequency:	64 total polygons 28 polygons in BLCA 36 polygons in the environs
Total project area:	154 hectares / 380 acres (0.7 %) 51 hectares / 127 acres in BLCA 103 hectares / 253 acres in the environs
Average Polygon Size:	2.4 hectares / 5.9 acres
Producer's accuracy:	100% ± 4 %
User's accuracy:	86% ± 19 %

Distribution in Mapping Area

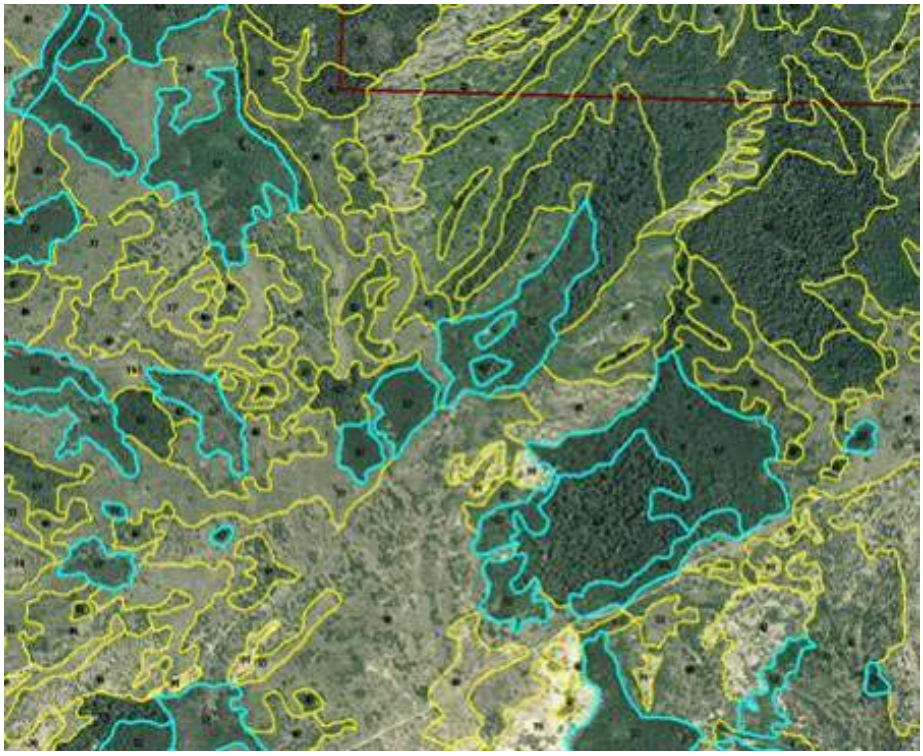


Distribution/Ecology/Composition

Persistent stands of *Populus tremuloides* occur on level to moderately steep slopes at higher elevations. Distribution on the landscape is limited by the need for relatively high soil moisture and fertility as well as cooler tempertatures. While aspect, elevation, and soil depth and texture all influence aspen presence or absence, no one factor can be singled out as independently critical. Soil fertility limits distribution but fire or avalanche history may also play a role in establishing *Populus tremuloides*. Within the survey area, the slumped landscapes at the interface of volcanic plateaus and Mancos or Morrison shale and the higher volcanic plateaus are two of the favored landscapes for aspen forests. The subcanopy layer is variable, but tall shrubs and *Symphoricarpos oreophilus* are prevalent. Drier stands may have high grass cover in the understory.

Interpretation

This map class occurs in small to medium, regular polygons at higher elevations on plateaus and in slumps, swales, and draws. Stands occur on all aspects. Most stands are nearly closed canopy and are recognizable with uniform canopy height, tall stature, round crowns, and a relatively bright green color. Short-stature stands have a similar appearance to *Quercus gambelii* stands and occur in similar landscapes. Adjacent polygons can include any of the montane woodland and shrubland map classes.



Example of photo signature for map class F-POTR (#52).

Map Class 60
Douglas-fir / Rock Spirea Scree Woodlands (W-PSHO)



Photo credits: NPS

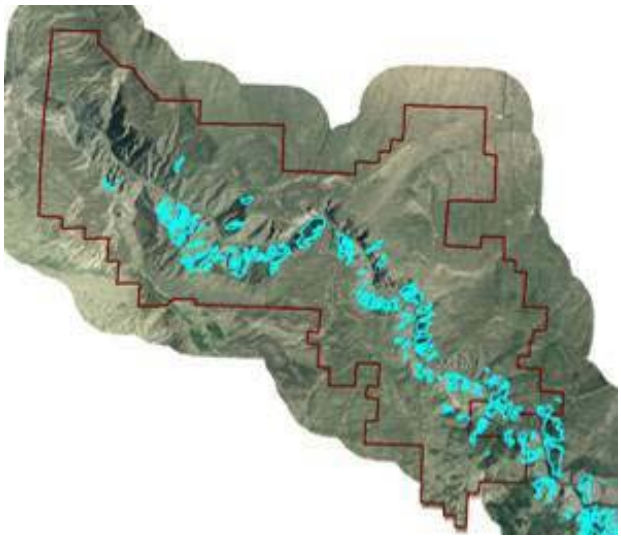
Associations
Pseudotsuga menziesii / *Holodiscus dumosus* Scree Woodland
Pseudotsuga menziesii Scree Woodland

Common species
- *Pseudotsuga menziesii*
- *Holodiscus dumosus*

W-PSHO Map Class Statistics

Type:	Complex of associations
Frequency:	72 total polygons 71 polygons in BLCA 1 polygons in the environs
Total project area:	273 hectares / 674 acres (1.2 %) 270 hectares / 667 acres in BLCA 3 hectares / 8 acres in the environs
Average Polygon Size:	3.8 hectares / 9.4 acres
Producer's accuracy:	67% ± 31 %
User's accuracy:	100% ± 8 %

Distribution in Mapping Area

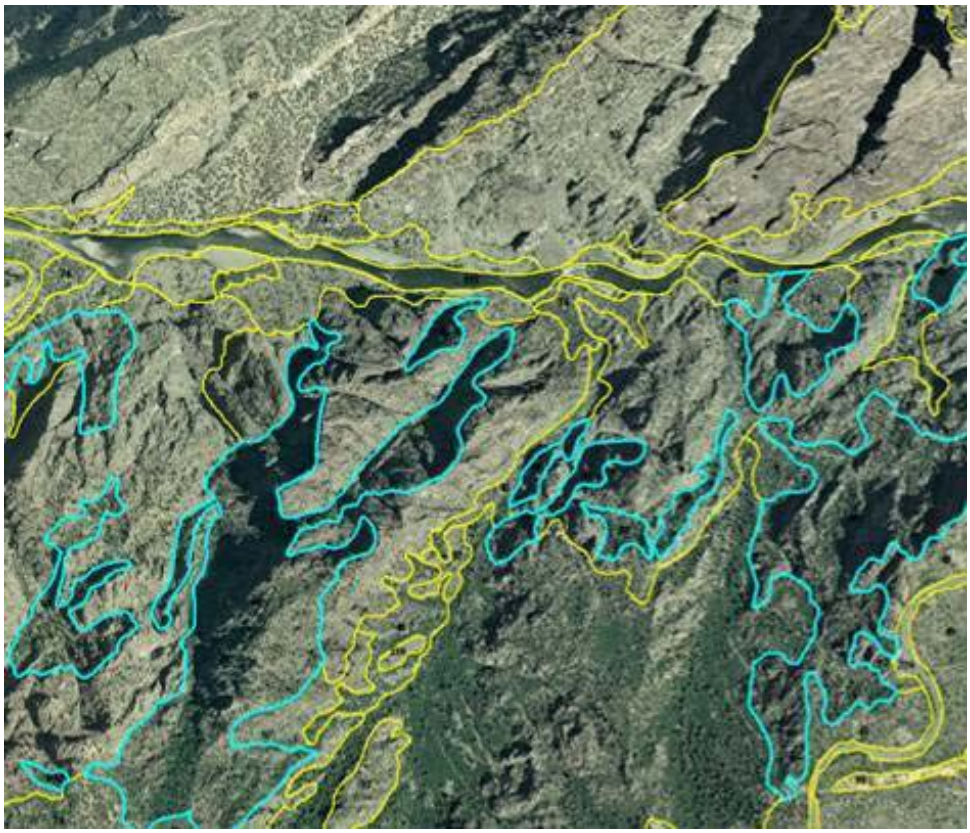


Distribution/Ecology/Composition

This map class occurs primarily on very steep slopes below the rims of the main Black Canyon often on the lower canyon walls. Canopy closure ranges from open to nearly closed in small areas. *Pseudotsuga menziesii* is generally dominant, although it should be noted that this class was rarely sampled due to the extreme steepness of the terrain.

Interpretation

This map class appears as small to large, regular polygons on very steep canyon sides and associated rugged talus slopes. North-facing aspects are most common, however, soil moisture and the presence of sheltered niches for trees, shadowing on the lower very steep slopes, and cold air drainage combine to override the influence of aspect, so both aspects in the canyon are represented. This class includes Precambrian gneiss outcrops, crags and the edges of scree slopes, and the Douglas-fir woodlands growing at the base of these outcrops. Photo identification of Douglas-fir is confirmed by tall stature, conical crowns. Typically these are very open stands on scree slopes or else limited to narrow openings between hard rock crags. Shadows often obscure steeper north and west facing slopes. Adjacent polygons include montane shrub, canyon wall, and riparian map classes.



Example of photo signature for map class W-PSHO (#60).

Map Class 62
Douglas-fir Forest (F-PSME)

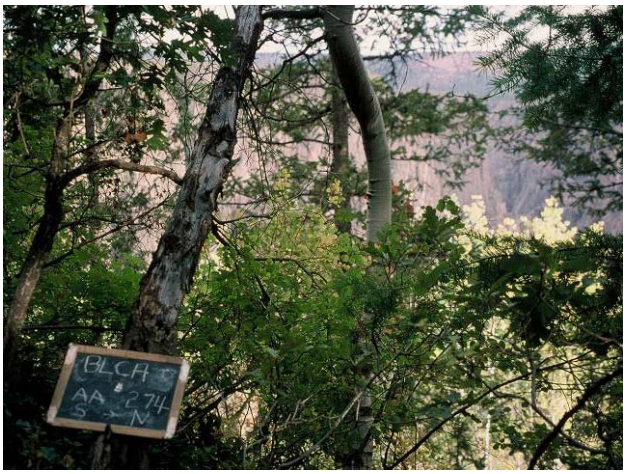




Photo credits: NPS

Associations

Pseudotsuga menziesii / *Carex geyeri* Forest
Pseudotsuga menziesii / *Mahonia repens* Forest
Pseudotsuga menziesii / *Quercus gambelii* Forest
Pseudotsuga menziesii / *Symphoricarpos oreophilus* Forest

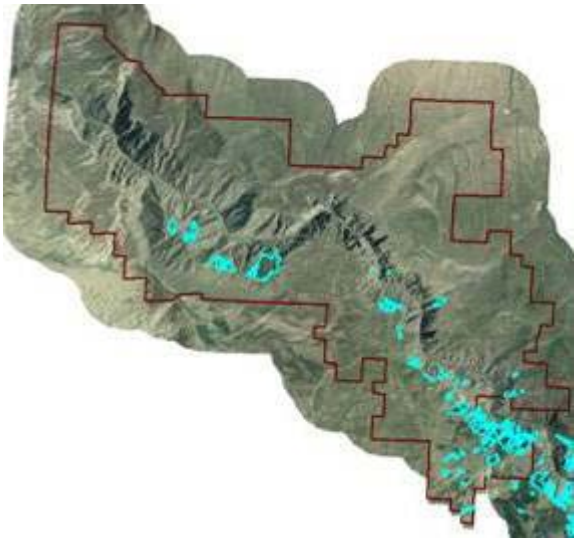
Common species

- *Pseudotsuga menziesii*
- *Symphoricarpos oreophilus*
- *Carex geyeri*
- *Poa fendleriana*
- *Quercus gambelii*
- *Mahonia repens*
- *Amelanchier* spp.
- *Achnatherum lettermanii*

F-PSME Map Class Statistics

Type:	Complex of associations
Frequency:	106 total polygons 88 polygons in BLCA 18 polygons in the environs
Total project area:	375 hectares / 926 acres (1.6 %) 345 hectares / 852 acres in BLCA 30 hectares / 75 acres in the environs
Average Polygon Size:	3.5 hectares / 8.7 acres
Producer's accuracy:	94% ± 8 %
User's accuracy:	94% ± 8 %

Distribution in Mapping Area

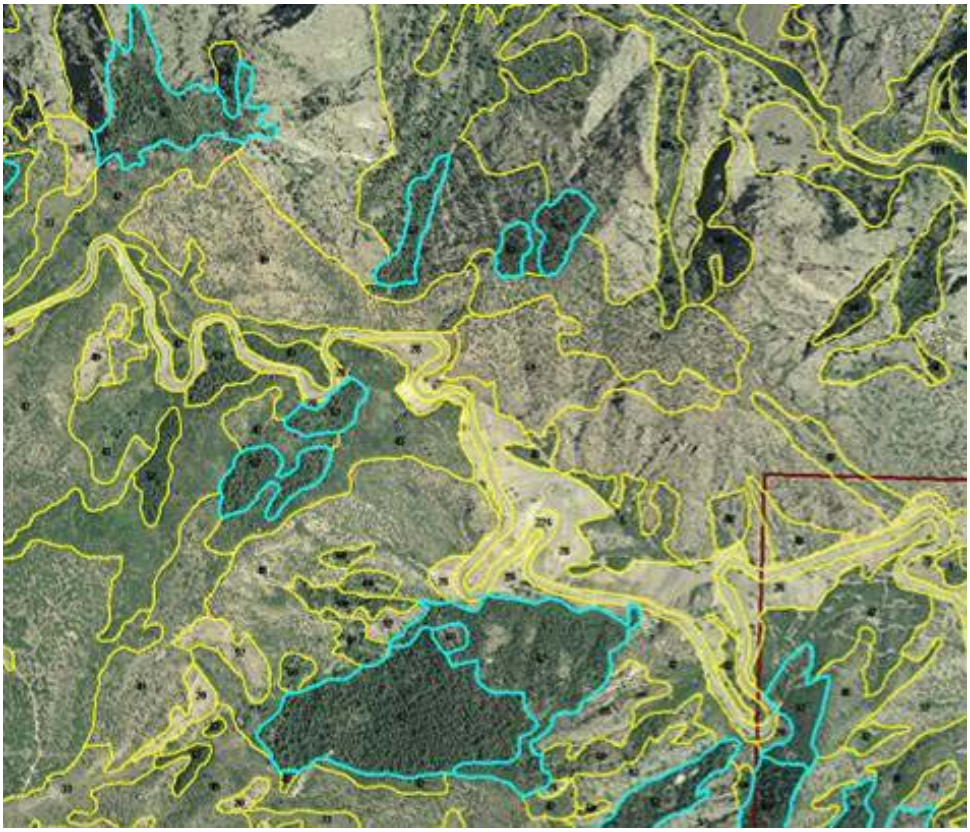


Distribution/Ecology/Composition

This map class occurs primarily on steep, mostly north facing slopes below the rims of the main Black Canyon or on north facing valley side slopes at higher elevations. Elevation range is substantial, with the higher elevations having a classic decreased temperature influence and the canyon sides having a cold air drainage influence and long shadows. Canopy closure ranges from open to nearly closed. A few areas at higher elevations have small, open woodland stands that occur on the north-facing aspects of small knolls. Drier, more open sites are typically on shoulder slopes or knolls and may have understories such as *Carex geyeri* or *Mahonia repens.* Low tree densities with high shrub cover on very steep canyon slopes may be reflecting avalanche history.

Interpretation

This map class appears as small to large, regular polygons on canyon sides or valley side slopes and foot slopes. Slopes are generally steep and rugged. North facing aspects are prevalent, however, soil moisture, shadowing, and cold air drainage may override the drying effects of south facing aspects. Photo identification is confirmed with magnification showing tall stature, conical crowns. Smaller dark forms may represent a reproductive layer of associated conifer species. Closed stands are a mottled dark green. Understories that have high cover of *Quercus gambelii* will have a brighter green matrix with darker trees. Adjacent polygons include montane shrub, canyon wall, and oak map classes.



Example of photo signature for map class F-PSME (#62).

Map Class 69
Pinyon – Juniper / Sparse Mixed Shrubs Scree Woodland (W-PJSC)





Photo credits: NPS

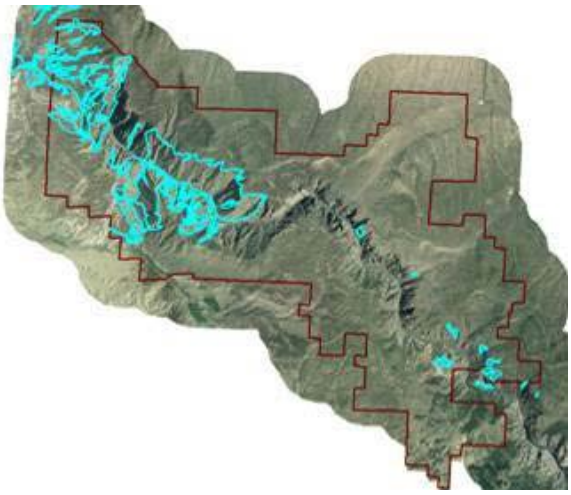
Associations
Pinus edulis - (*Juniperus monosperma, Juniperus osteosperma*) / *Hesperostipa comata* Woodland
Pinus edulis – (*Juniperus* spp.) / *Holodiscus dumosus* Woodland
Pinus edulis - *Juniperus* spp. / *Cercocarpus montanus* - Mixed Shrub Woodland
Pinus edulis - *Juniperus osteosperma* / Sparse Understory Woodland

Common species
- *Pinus edulis*
- *Cercocarpus montanus*
- *Holodiscus dumosus*
- *Hesperostipa comata*
- *Juniperus osteosperma*
- *Glossopetalon spinescens* var. *meionandrum*
- *Achnatherum hymenoides*

W-PJSC Map Class Statistics

Type:	Complex of associations
Frequency:	78 total polygons 59 polygons in BLCA 19 polygons in the environs
Total project area:	1,529 hectares / 3,778 acres (6.7 %) 1,357 hectares / 3,352 acres in BLCA 172 hectares / 426 acres in the environs
Average Polygon Size:	19.6 hectares / 48.4 acres
Producer's accuracy:	82% ± 10 %
User's accuracy:	100% ± 1 %

Distribution in Mapping Area

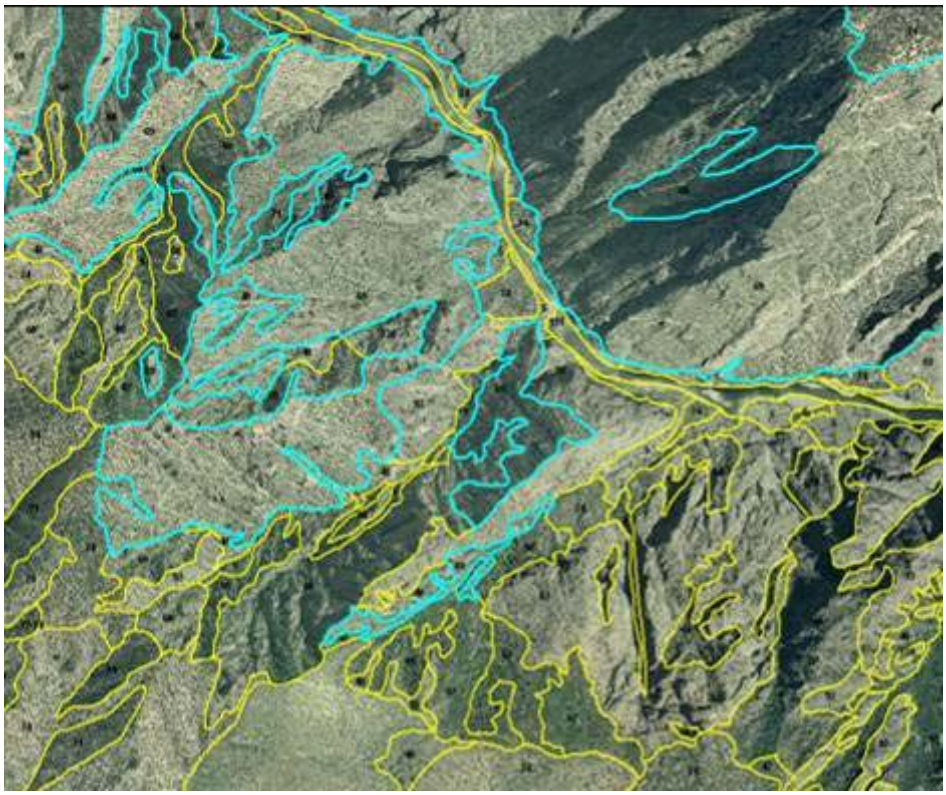


Distribution/Ecology/Composition

Map class 69 cocurs on various aspects of Precambrian rock substrate on canyon slopes. Soils are shallow and derived from hard granitic rocks. Tree cover is sparse, generally less than 10%. The understory is also sparse and includes *Cercocarpus montanus, Holodiscus dumosus* and/or *Glossopetalon spinescens* var. *meionandrum* with 3-10% cover and a sparse herbaceous layer that may include *Achnatherum hymenoides, Hesperostipa comata* and/or *Leymus salinus.*

Interpretation

Polygons are small to large, regular and occurring on southwest facing scarps of Precambrian rock substrate. Stands are very open on steep slopes. Trees are recognizable as small, dark green dots. Neighboring polygons are most commonly of map class 93 (Rock Spirea Sparsely Vegetated Rock Outcrop) and the geology class 330 (bedrock outcrops of gneiss).



Example of photo signature for map class W-PJSC (#69).

Map Class 71
Pinyon – Juniper / Gambel Oak Woodland (W-PJQU)





Photo credits: NPS

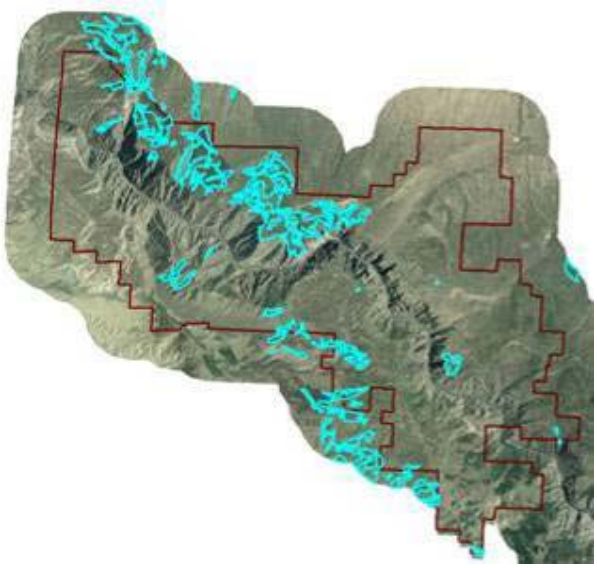
Associations
Pinus edulis - *Juniperus* spp. / *Quercus gambelii* Woodland

Common species
- *Pinus edulis*
- *Quercus gambelii*
- *Cercocarpus montanus*
- *Juniperus osteosperma*
- *Amelanchier utahensis*

C-TERR Map Class Statistics

Type:	Association
Frequency:	137 total polygons 77 polygons in BLCA 60 polygons in the environs
Total project area:	1,324 hectares / 3,273 acres (5.8 %) 881 hectares / 2,177 acres in BLCA 443 hectares / 1,096 acres in the environs
Average Polygon Size:	9.7 hectares / 23.9 acres
Producer's accuracy:	83% ± 7 %
User's accuracy:	91% ± 6 %

Distribution in Mapping Area

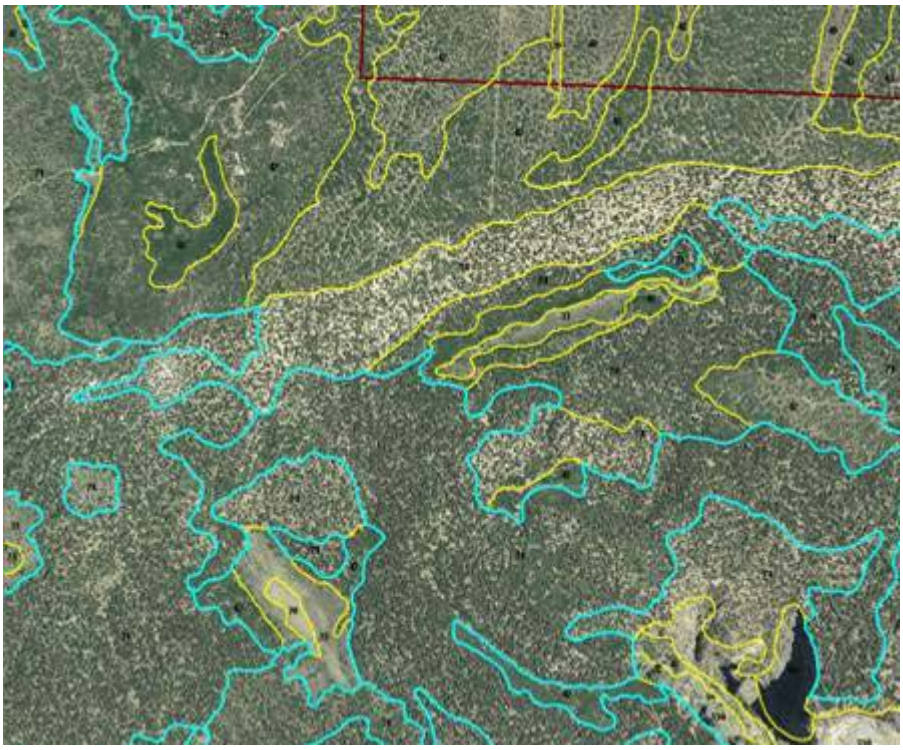


Distribution/Ecology/Composition

This map class is widely distributed, with much of it occurring on or near the main plateaus. In addition to the named species, any of the montane tall shrubs may be present. This map class suggests the influence of fire history and may be a mid or later fire seral stage.

Interpretation

Map class 71 typically has small to medium irregular polygons occurring on plateaus and slopes at mid to upper elevations. Slopes range from gentle to steep and aspect is variable throughout the range of elevation and steepness. Signature of P-J trees is dark green circular dots with a brighter green matrix of oak beneath. Separation of the low tree cover woodlands with high cover of Gambel oak from the deep green of pure Gambel oak shrublands was problematic. Polygons of map class 71 occur in a matrix with polygons of other pinyon-juniper map classes (69, 72, and 74) and montane shrublands (map class 42).



Example of photo signature for map class W-PJQU (#71).

Map Class 72
Pinyon – Juniper / Sagebrush Species Woodland (W-PJAR)





Photo credits: NPS

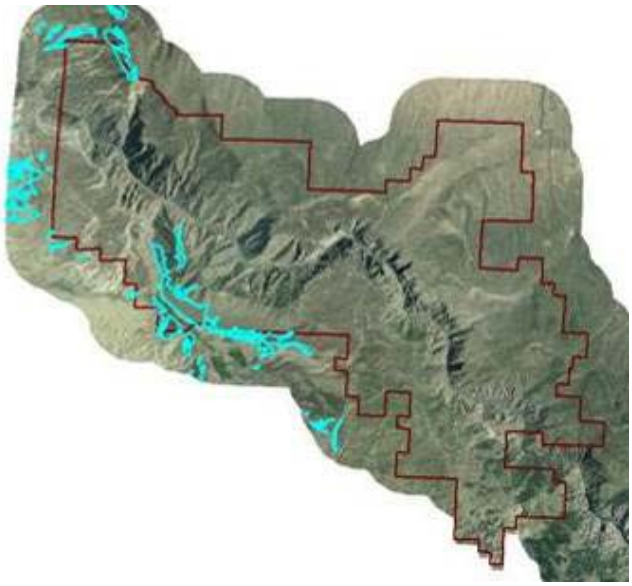
Associations
Pinus edulis - Juniperus osteosperma / *Artemisia nova* Woodland
Pinus edulis - Juniperus spp. / *Artemisia tridentata (*ssp. *wyomingensis,* ssp. *vaseyana)* Woodland
Juniperus osteosperma / *Artemisia nova* Woodland

Common species
- *Pinus edulis*
- *Artemisia tridentata* ssp. *wyomingensis*
- *Bromus tectorum*
- *Juniperus osteosperma*
- *Artemisia nova*
- *Ericameria nauseosa*

W-PJAR Map Class Statistics

Type:	Complex of associations
Frequency:	84 total polygons 30 polygons in BLCA 54 polygons in the environs
Total project area:	417 hectares / 1,032 acres (1.8 %) 117 hectares / 289 acres in BLCA 301 hectares / 743 acres in the environs
Average Polygon Size:	5 hectares / 12.3 acres
Producer's accuracy:	78% ± 16 %
User's accuracy:	75% ± 17 %

Distribution in Mapping Area

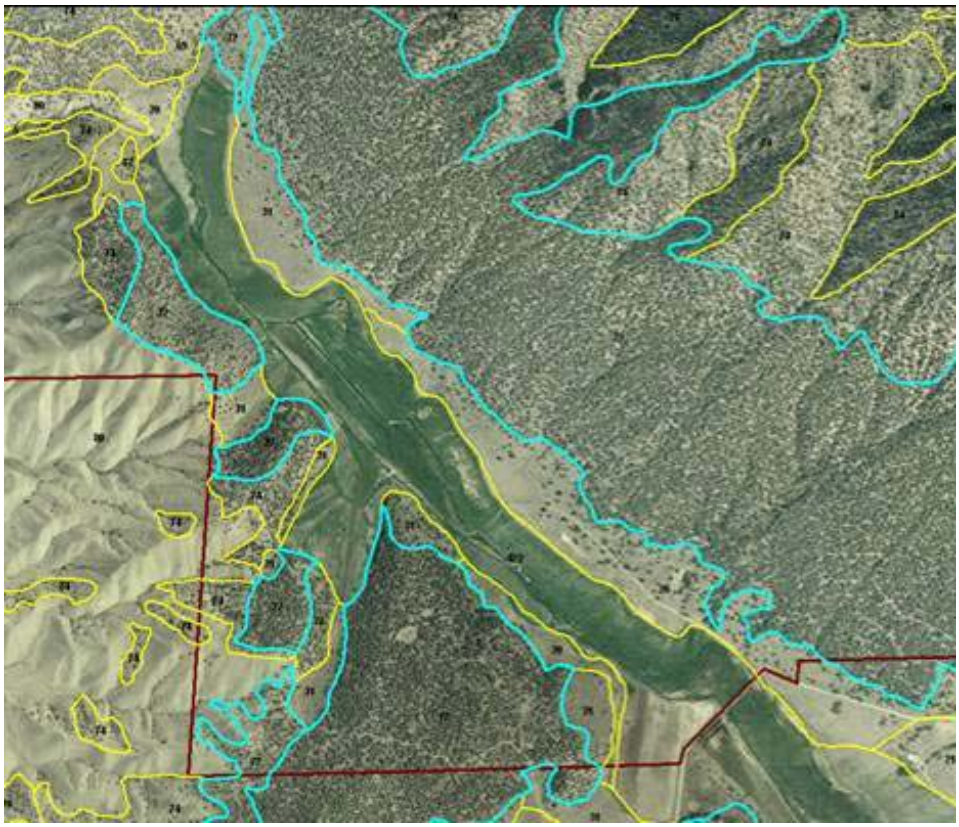


Distribution/Ecology/Composition

Map class 72 is uncommon in the Park and occurs on plateaus, benches, and fans with shallow to deep soils at the lower elevations. It can occur on gentle to moderately steep slopes. The understory is poorly developed and often contains exotic annual species such as *Bromus tectorum.* While soil type may play a role in the distribution of this map class, fire and other disturbance history is critical to the pattern of woodlands and shrublands. Outside the Park boundary, grazing and agricultural activities have altered the typical plant communities and their distribution on the landscape.

Interpretation

Most polygons of this map class are on substrates of Mancos or Morrison shale or older alluvium on fans and benches. Aspect is not independently controlling, but at the lower elevations this map class is on cooler and moister aspects. The canopy is open to nearly closed and an open understory of Wyoming big sagebrush and/or black sagebrush is visible as a textured, grayish green layer. Polygons are variable in shape and generally correspond to gently sloping landscapes. Separation of this map class from other pinyon-juniper woodlands was problematic and approximate rather than obvious. Adjacent polygons are most commonly other pinyon-juniper woodlands (map class 74), Wyoming sagebrush shrublands (map class 31), and grasslands (map class 20).



Example of photo signature for map class W-PJAR (#72).

Map Class 74
Pinyon – Juniper / Mixed Shrubs and Grasses Woodland (W-PJMX)



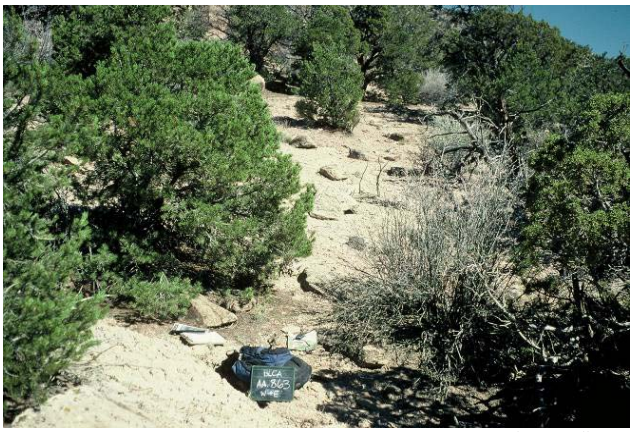


Photo credits: NPS

Associations

Juniperus osteosperma / *Bromus tectorum* Semi-natural Woodland
Pinus edulis - *Juniperus osteosperma* / *Bromus tectorum* Semi-natural Woodland
Pinus edulis - *Juniperus osteosperma* / Mixed Shrubs Talus Woodland
Pinus edulis - *Juniperus osteosperma* / Sparse Understory Woodland
Pinus edulis - *Juniperus* spp. / *Amelanchier utahensis* Woodland
Pinus edulis - *Juniperus* spp. / *Cercocarpus montanus* - Mixed Shrub Woodland
Pinus edulis - *Juniperus* spp. / *Leymus salinus* Woodland
Pinus edulis - *Juniperus* spp. / *Pseudoroegneria spicata* Woodland
Pinus edulis - *Juniperus* spp. / *Poa fendleriana* Woodland

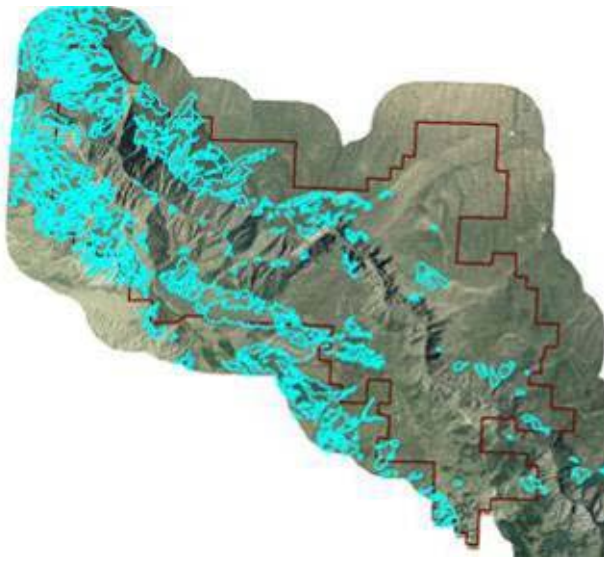
Common species

- *Pinus edulis*
- *Amelanchier utahensis*
- *Poa fendleriana*
- *Bromus tectorum*
- *Pseudoroegneria spicata*
- *Juniperus osteosperma*
- *Cercocarpus montanus*
- *Hesperostipa comata*
- *Leymus salinus*

W-PJMX Map Class Statistics

Type:	Complex of associations
Frequency:	548 total polygons 267 polygons in BLCA 281 polygons in the environs
Total project area:	3,678 hectares / 9,089 acres (16 %) 2,171 hectares / 5,364 acres in BLCA 1,507 hectares / 3,724 acres in the environs
Average Polygon Size:	6.7 hectares / 16.6 acres
Producer's accuracy:	95% ± 4 %
User's accuracy:	84% ± 6 %

Distribution in Mapping Area

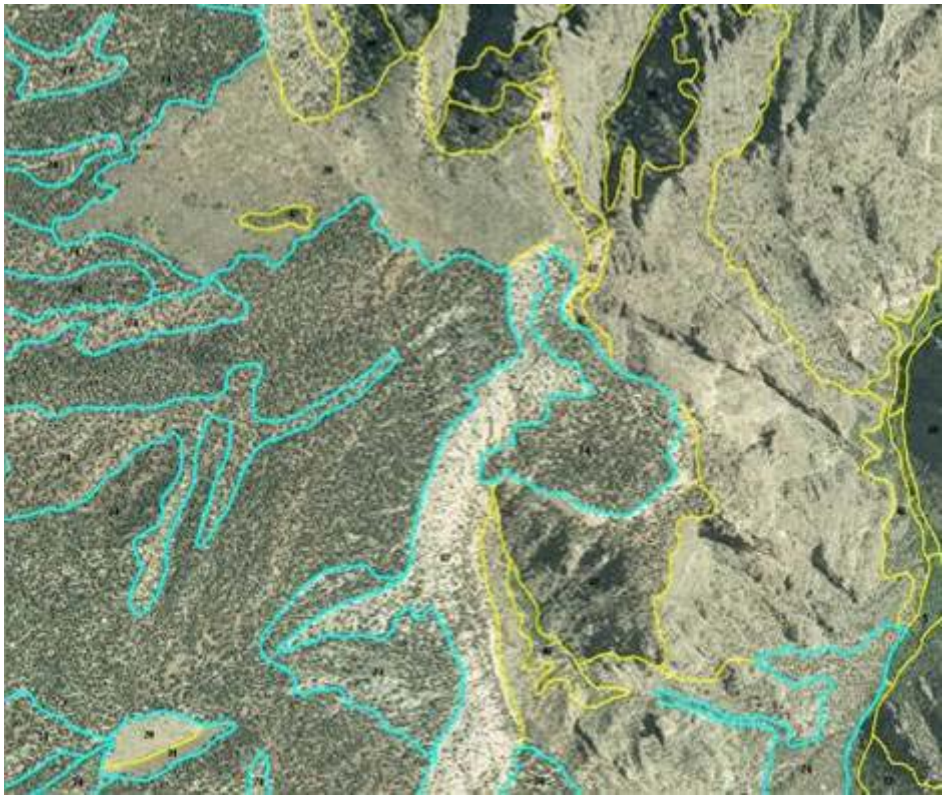


Distribution/Ecology/Composition

This extensive map class occurs on plateaus and valley and canyon slopes throughout the mapping area, at elevations ranging from the canyon bottom to the plateaus. Substrate is variable but is mostly derived from Precambrian hard rock. This map class represents several shrub and herbaceous understory associations that were not reliably distinguishable with photo interpretation. Pinyon-juniper with *Cercocarpus montanus* and mixed shrubs in the understory is the most extensive of the diverse associations and may represent the majority. Sparse and herbaceous understories are usually associated with the more closed tree canopies and are less extensive on the landscape. *Leymus salinus* understories are largely associated with Morrison shale substrates. These communities show some influence of fire history reflected in the lower tree densities of some stands or in an understory species mix including exotic annuals.

Interpretation

Polygons are small to frequently large, occurring on plateaus, valley side slopes, and canyon slopes. Slopes range from gentle to very steep. Stands are open to nearly closed. The trees are recognizable as dark green rounded crowns and the shrubs may appear as a gray to green textured color beneath. Shrub cover may be sparse (5%) to dense. Sparse stands require magnification to see the shrubs. This is one of the most extensive map classes in the Park. Adjacent map classes include the suite of montane shrub communities, grasslands, and other pinyon-juniper woodlands.



Example of photo signature for map class W-PJMX (#74).

Map Class 78
Utah Juniper / Big Sagebrush Woodland (W-JUAR)





Photo credits: NPS

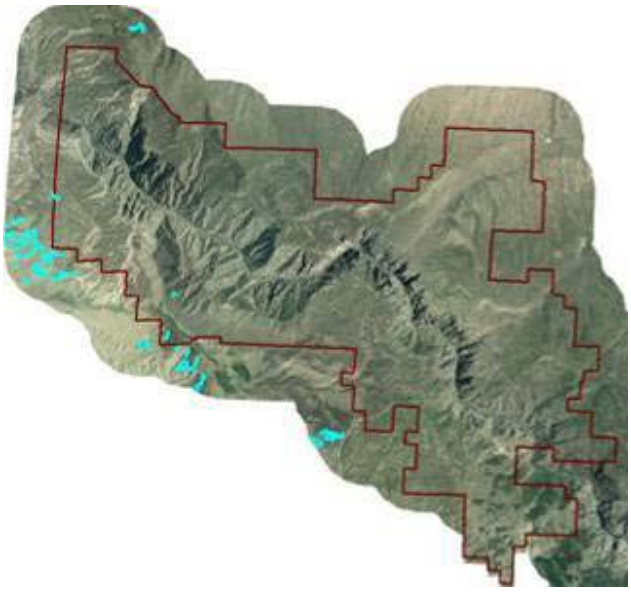
Associations
Juniperus osteosperma / Artemisia tridentata ssp. *wyominensis* Woodland
Pinus edulis - Juniperus osteosperma / *Bromus tectorum* Semi-natural Woodland

Common species
- *Juniperus osteosperma*
- *Artemisia tridentata* ssp. *wyomingensis*
- *Ericameria nauseosa*
- *Bromus tectorum*

W-JUAR Map Class Statistics

Type:	Complex of associations
Frequency:	37 total polygons 5 polygons in BLCA 32 polygons in the environs
Total project area:	116 hectares / 286 acres (0.5 %) 31 hectares / 78 acres in BLCA 84 hectares / 209 acres in the environs
Average Polygon Size:	3.1 hectares / 7.7 acres
Producer's accuracy:	100% ± 5 %
User's accuracy:	56% ± 22 %

Distribution in Mapping Area

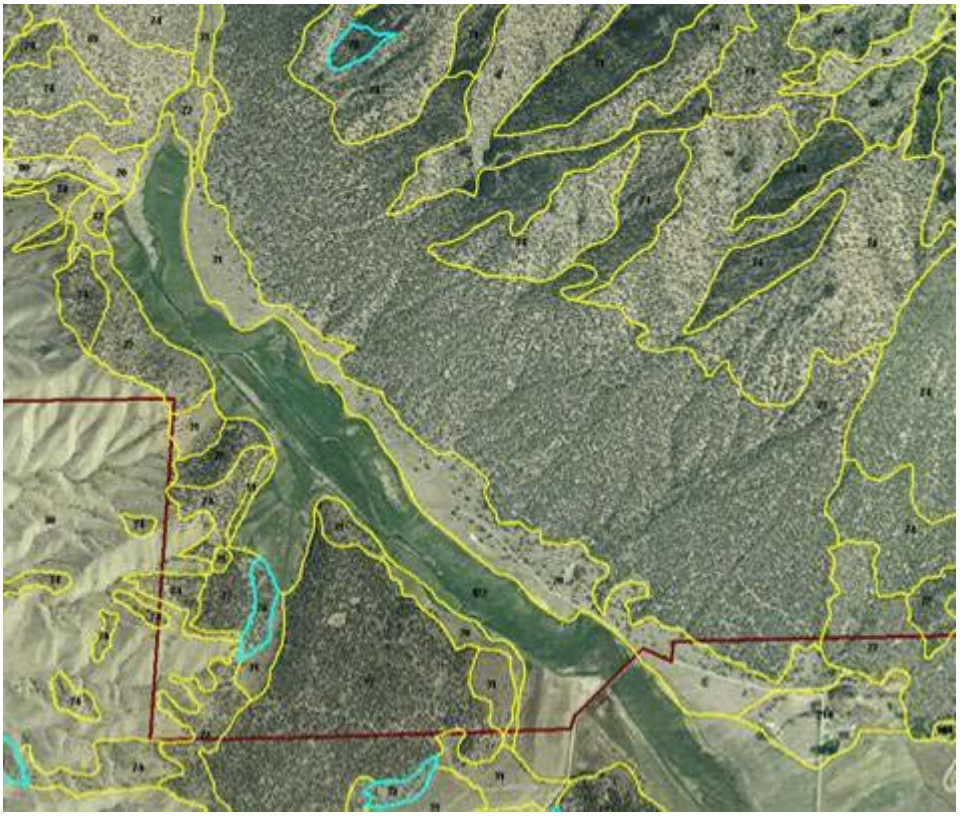


Distribution/Ecology/Composition

This very rare map class occurs on plateaus and benches with shallow to deep soils. Slopes are gentle to moderate. The juniper trees have sparse cover. The understory is poorly developed and often contains exotic annual species such as *Bromus tectorum.*

Interpretation

The open tree canopy is visible as dark green dots and an open sagebrush understory is visible as a textured, grayish green layer underneath. Polygons are variable in shape, but generally correspond to gentle landscapes. Adjacent polygons are those of other pinyon-juniper woodlands (map classes 72 and 73) and sagebrush shrublands (map classes 31 and 33).



Example of photo signature for map class W-JUAR (#78).

Map Class 87
Utah Juniper / Salina Wildrye Woodland (W-JULE)





Photo credits: NPS

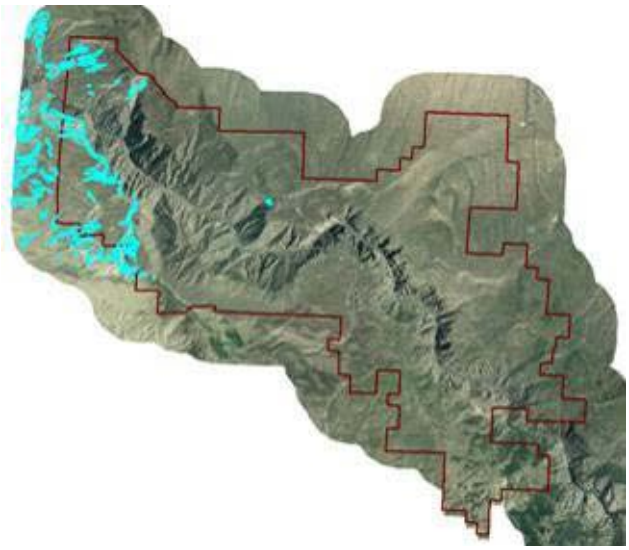
Associations
Juniperus osteosperma / *Leymus salinus* Woodland
Pinus edulis - *Juniperus osteosperma* / *Atriplex* spp. Woodland
Pinus edulis - *Juniperus* spp. / *Leymus salinus* Woodland

Common species
- *Juniperus osteosperma*
- *Atriplex canescens*
- *Leymus salinus*
- *Pinus edulis*
- *Atriplex confertifolia*

W-JULE Class Statistics

Type:	Complex of associations
Frequency:	93 total polygons
	34 polygons in BLCA
	59 polygons in the environs
Total project area:	445 hectares / 1,099 acres (1.9 %)
	181 hectares / 447 acres in BLCA
	264 hectares / 652 acres in the environs
Average Polygon Size:	4.8 hectares / 11.8 acres
Producer's accuracy:	67% ± 16 %
User's accuracy:	100% ± 3 %

Distribution in Mapping Area

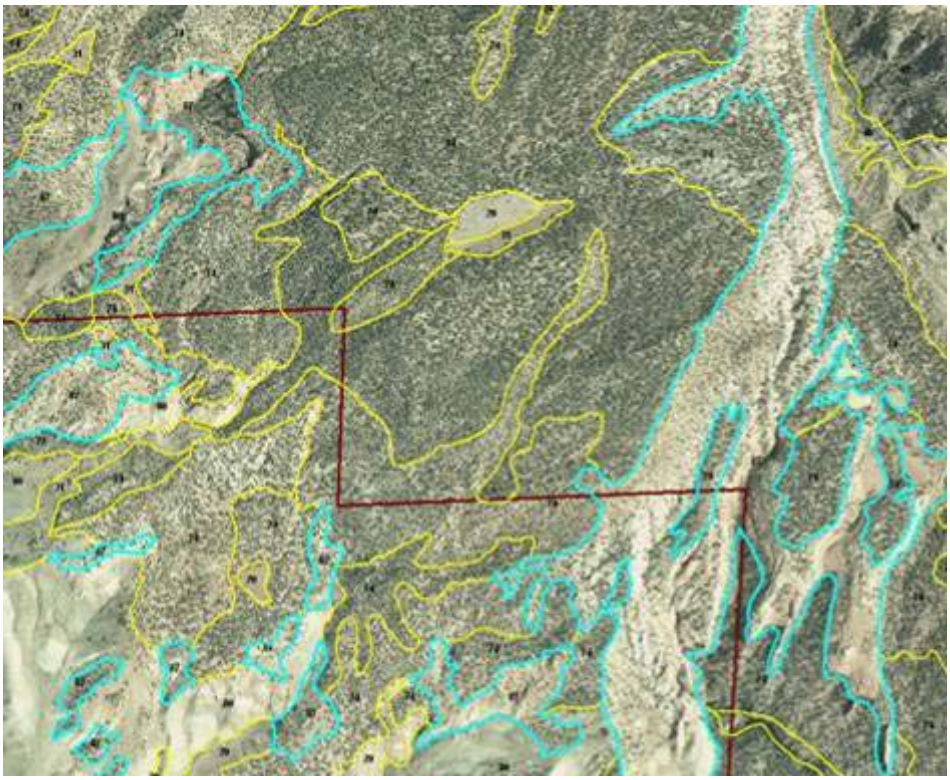


Distribution/Ecology/Composition
This uncommon map class occurs on predominantly east and north-facing slopes of Wanakah and Entrada formations, at moderately high elevations. Stands are open and occur on steep slopes. Soils are generally shallow and derived from hard sandstone substrates. Tree cover is sparse, as is the herbaceous understory,

which may include *Leymus salinus* and *Achnatherum hymenoides*, as well as shrubs of the *Atriplex* genera.

Interpretation

Polygons of map class 87 are small to medium, regular, and most are linear and occur on southwest facing scarps. Juniper, and sometimes pinyon, trees are recognizable as small, dark green dots; the shrub layer is sparse. A variety of map classes border polygons map class 87, but the most common neighbor is map class 74 (Pinyon - Juniper / Mixed Shrubs and Grasses Woodland).



Example of photo signature for map class W-JULE (#87).

Upland Shrublands

Map Class 28
Roadcut Sparse Shrubland (S-ROAD)




Photo credits: NPS

Associations

Ericameria nauseosa Shrubland
Ericameria parryi / *Achnatherum hymenoides* Shrubland

Common species

- *Ericameria parryi*
- *Ericameria nausesosa*
- *Achnatherum hymenoides*

S-ROAD Map Class Statistics

Type:	Complex of associations
Frequency:	11 total polygons
	11 polygons in BLCA
	polygons in the environs
Total project area:	13 hectares / 33 acres (0.1 %)
	13 hectares / 33 acres in BLCA
	hectares / acres in the environs
Average Polygon Size:	1.2 hectares / 3 acres
Producer's accuracy:	80% ± 39 %
User's accuracy:	100% ± 13 %
	11 total polygons

Distribution in Mapping Area

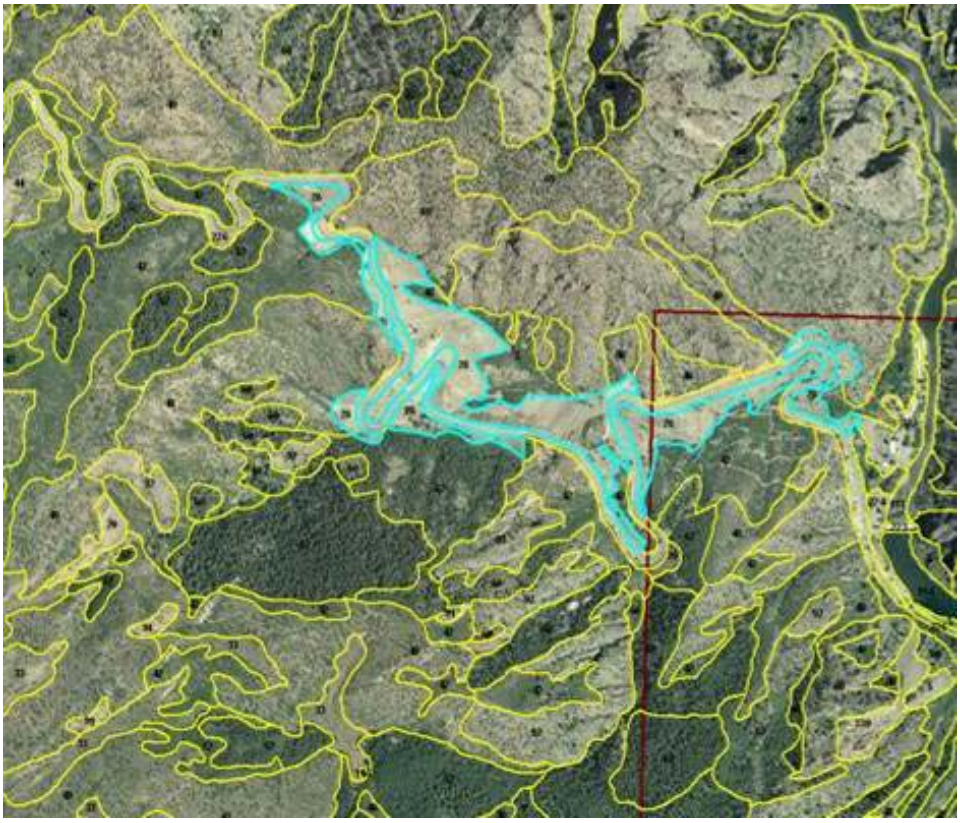


Distribution/Ecology/Composition

This extremely rare map class occurs on scree slopes alongs roads (road-fill) that are often weedy and sparsely vegetated. *Ericameria nauseosa* may be dominant to co-dominant in some stands.

Interpretation

The few polygons of this map class follow the main park road approaching Crystal Dam near the boundary with Curecanti NRA. The signature is steep, scree slopes of road fill that are a smooth, whitish-gray color.



Example of photo signature for map class S-ROAD (#28).

Map Class 31
Wyoming Big Sagebrush Shrubland (S-ARWY)




Photo credits: NPS

Associations

Artemisia nova / *Poa fendleriana* Shrubland
Artemisia nova / *Poa secunda* Shrubland
Artemisia tridentta / Pleuraphis jamesii Shrubland
Artemisia tridentata ssp. *wyomingensis* / *(Agropyron cristatum, Elymus junceus)* Seeded Grasses Semi-natural Shrubland
Artemisia tridentata ssp. *wyomingensis* / Disturbed Understory Shrubland
Artemisia tridentata ssp. *wyomingensis* / *Hesperostipa comata* Shrubland
Ericameria parryi / Achnatherum hymenoides Shrubland
Ericameria nauseosa Shrubland

Common species

- *Artemisia tridentata* ssp. *wyomingensis*
- *Ericameria nauseosa*
- *Elymus junceus*
- *Poa fendleriana*
- *Pleuraphis jamesii*
- *Artemisia nova*
- *Agropyron cristatum*
- *Hesperostipa comata*
- *Poa secunda*
- *Ericameria parryi*

S-ARWY Map Class Statistics

Type:	Complex of associations
Frequency:	44 total polygons
	19 polygons in BLCA
	25 polygons in the environs
Total project area:	245 hectares / 604 acres (1.1 %)
	134 hectares / 330 acres in BLCA
	111 hectares / 274 acres in the environs
Average Polygon Size:	5.6 hectares / 13.7 acres
Producer's accuracy:	90% ± 14 %
User's accuracy:	69% ± 17 %
	44 total polygons

Distribution in Mapping Area

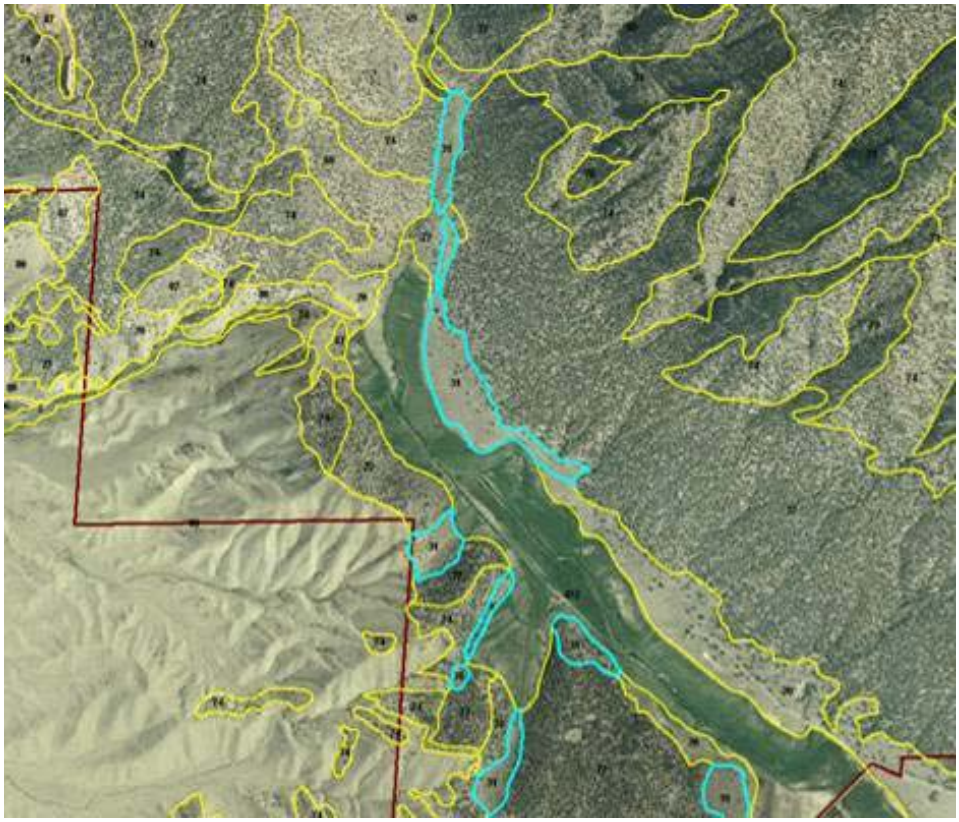


Distribution/Ecology/Composition

Map class 31 is extremely rare in the Park and occurs at lower elevations on level to moderate slopes with shallow to deep soils. At the lowest elevations, it may appear on north or east-facing aspects on the Mancos Formation, but at the highest elevations it can appear on south-facing slopes. Wyoming sagebrush communities are common in areas of disturbance, including fire, prairie dog activity, and grazing, and often have disturbed, weedy understories of non-native grass species. Separation of ssp. *vaseyana* vs. ssp. *wyomingensis* is problematic within a zone of change where annual precipitation is between 10 and 15 inches. Fires play a role in succession between grasses and sagebrush.

Interpretation

Polygons are generally medium to large and light to medium gray green in color. This map class was most common along the southern boundary of the Park and in the environs near pasture lands and in areas that are actively grazed. Adjacent polygons are generally map classes of pinyon-juniper woodlands (72, 74 and 78).



Example of photo signature for map class S-ARWY (#31).

Map Class 33
Mountain Big Sagebrush Shrubland (S-ARVA)




Photo credits: NPS

Associations

Artemisia tridentata ssp. *vaseyana / Achnatherum lettermanii* Shrubland
Artemisia tridentata ssp. *vaseyana / Achnatherum pinetorum* Shrubland
Artemisia tridentata ssp. *vaseyana / Balsamorhiza sagittata* Shrubland
Artemisia tridentata ssp. vaseyana / Hesperostipa comata Shrubland
Artemisia tridentata ssp. vaseyana / Pascopyrum smithii Shrubland
Artemisia tridentata ssp. vaseyana / Poa fendleriana Shrubland
Artemisia tridentata ssp. vaseyana / Poa (pratensis, compressa) Semi-natural Shrub Herbaceous

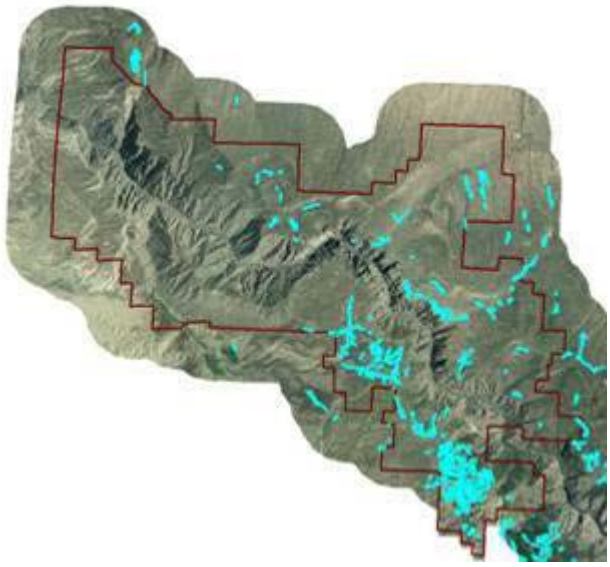
Common species

- *Artemisia tridentata* ssp. *vaseyana*
- *Achnatherum lettermanii*
- *Hesperostipa comata*
- *Poa fendleriana*
- *Balsamorhiza sagittata*
- *Achnatherum pinetorum*
- *Pascopyrum smithii*
- *Poa pratensis*

S-ARVA Map Class Statistics

Type:	Complex of associations
Frequency:	156 total polygons 101 polygons in BLCA 55 polygons in the environs
Total project area:	381 hectares / 942 acres (1.7 %) 194 hectares / 479 acres in BLCA 188 hectares / 463 acres in the environs
Average Polygon Size:	2.4 hectares / 6 acres
Producer's accuracy:	81% ± 10 %
User's accuracy:	90% ± 8 %

Distribution in Mapping Area



Distribution/Ecology/Composition

Map class 33 occurs at higher elevations on gentle to steep slopes with moderately deep or deep soils over variable substrates. There is an active relationship between this group of associations and fire; burned stands generally convert to grasslands, with most succeeding back to sagebrush within 30 years. *Symphoricarpos oreophilus* is often present as a sub-dominant shrub at higher elevations. The dominant bunchgrasses in the understory respond to substrate, elevation, and grazing history. The herbaceous layer may be a mix of species, often with high cover of *Balsamorhiza sagittata* where sagebrush cover is sporadic and patchy.

Interpretation

Polygons of map class 33 are small to large, regular, and light to medium gray green in color (depending on the density of the herbaceous layer) with an evenly speckled texture. A large number of map classes occur adjacent to map class 33, but communities of mixed mountain shrublands (42 and 49) and pinyon-juniper woodlands (71 and 74) are the most common neighbors.



Example of photo signature for map class S-ARVA (#33).

Map Class 40
Gambel Oak / Big Sagebrush Shrubland (S-QUAR)





Photo credits: NPS

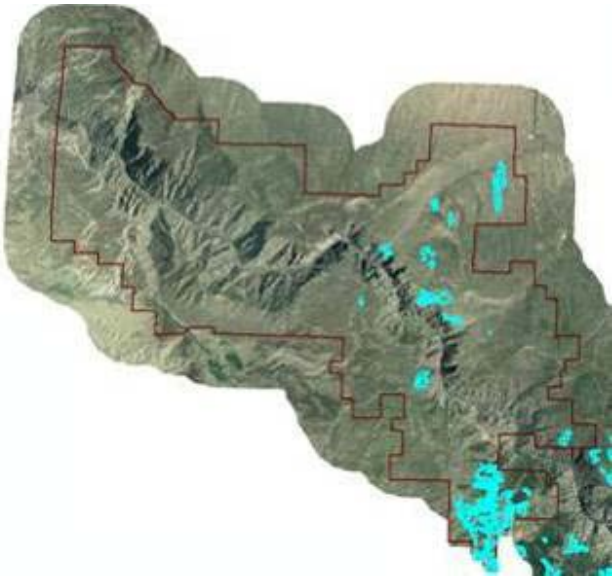
Associations
Quercus gambelii / *Artemisia tridentata* Shrubland

Common species
- *Quercus gambelii*
- *Artemisia tridentata*

S-QUAR Map Class Statistics

Type:	Association
Frequency:	60 total polygons
	29 polygons in BLCA
	31 polygons in the environs
Total project area:	275 hectares / 680 acres (1.2 %)
	107 hectares / 264 acres in BLCA
	168 hectares / 415 acres in the environs
Average Polygon Size:	4.6 hectares / 11.3 acres
Producer's accuracy:	100% ± 10 %
User's accuracy:	22% ± 16 %

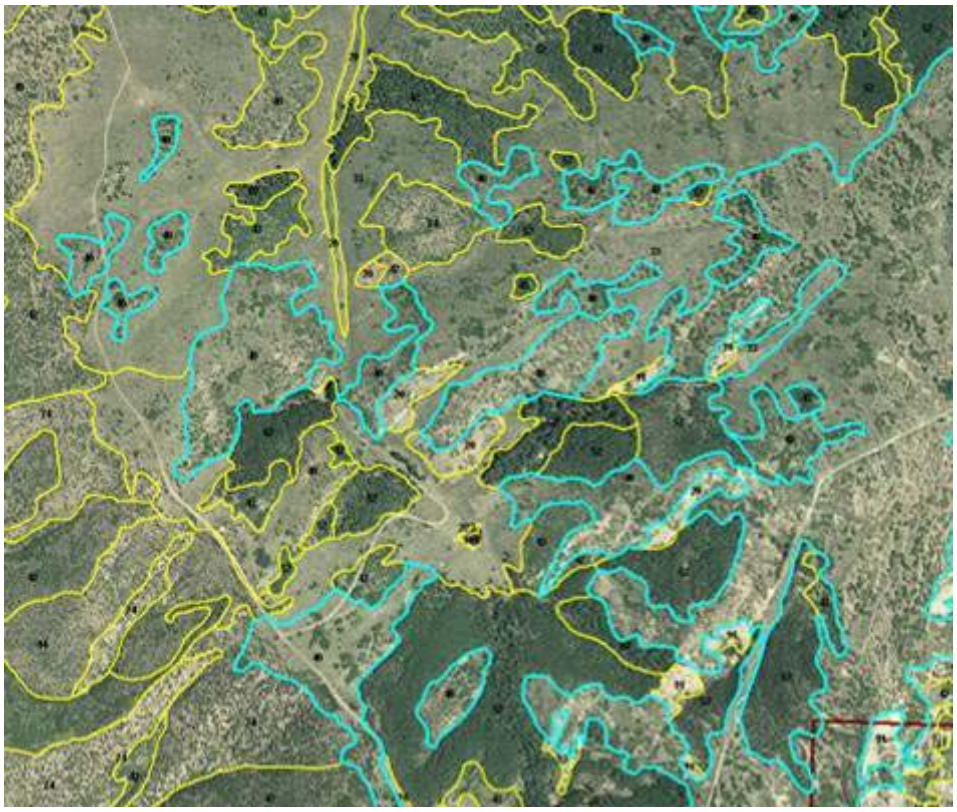
Distribution in Mapping Area



Distribution/Ecology/Composition
This uncommon map class represents the mosaic of big sagebrush and Gambel oak mots that are too interwoven to map separately. Prior to the accuracy assessment it was only mapped in the extreme southeastern corner of BLCA, but was remapped post-AA to include polygons elsewhere in Park after field crews found this type to be somewhat more widespread in its distribution.

Interpretation

The signature is a slightly textured, gray green background of sagebrush in a mosaic with small to large, rough-textured speckles of dark green (oak mots). A variety of map classes occur adjacent to polygons of map class 40.



Example of photo signature for map class S-QUAR (#40).

Map Class 42
Gambel Oak / Mixed Montane Shrubland (S-QUMX)





Photo credits: NPS

Associations

Amelanchier utahensis - Mixed Shrub / *Carex geyeri* Shrubland
Amelanchier (utahensis, alnifolia) - *Cercocarpus montanus* Shrubland
Cercocarpus montanus Shale Shrubland
Quercus gambelii / *Amelanchier utahensis* Shrubland
Quercus gambelii - *Cercocarpus montanus* / *(Carex geyeri)* Shrubland
Quercius gambelii / *Carex geyeri* Shrubland
Quercus gambelii / *Poa fendleriana* Shrubland

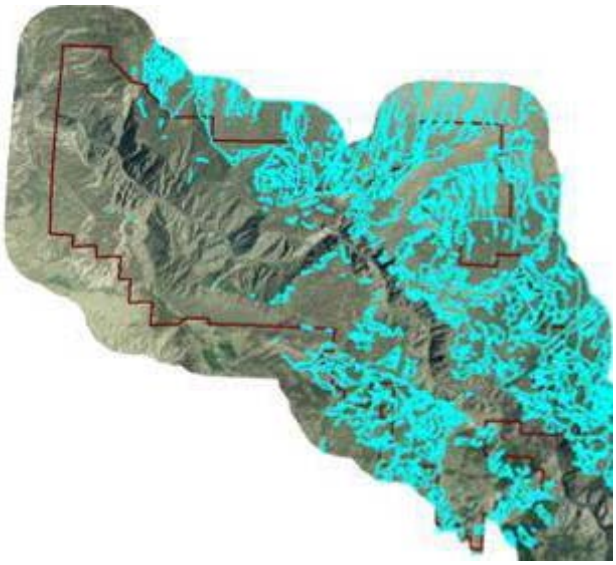
Common species

- *Quercus gambelii*
- *Cercocarpus montanus*
- *Poa fendleriana*
- *Amelanchier utahensis*
- *Carex geyeri*

S-QUMX Map Class Statistics

Type:	Complex of associations
Frequency:	554 total polygons 288 polygons in BLCA 266 polygons in the environs
Total project area:	6,581 hectares / 16,263 acres (28.6 %) 2,885 hectares / 7,130 acres in BLCA 3,696 hectares / 9,133 acres in the environs
Average Polygon Size:	11.9 hectares / 29.4 acres
Producer's accuracy:	82% ± 6 %
User's accuracy:	80% ± 6 %

Distribution in Mapping Area

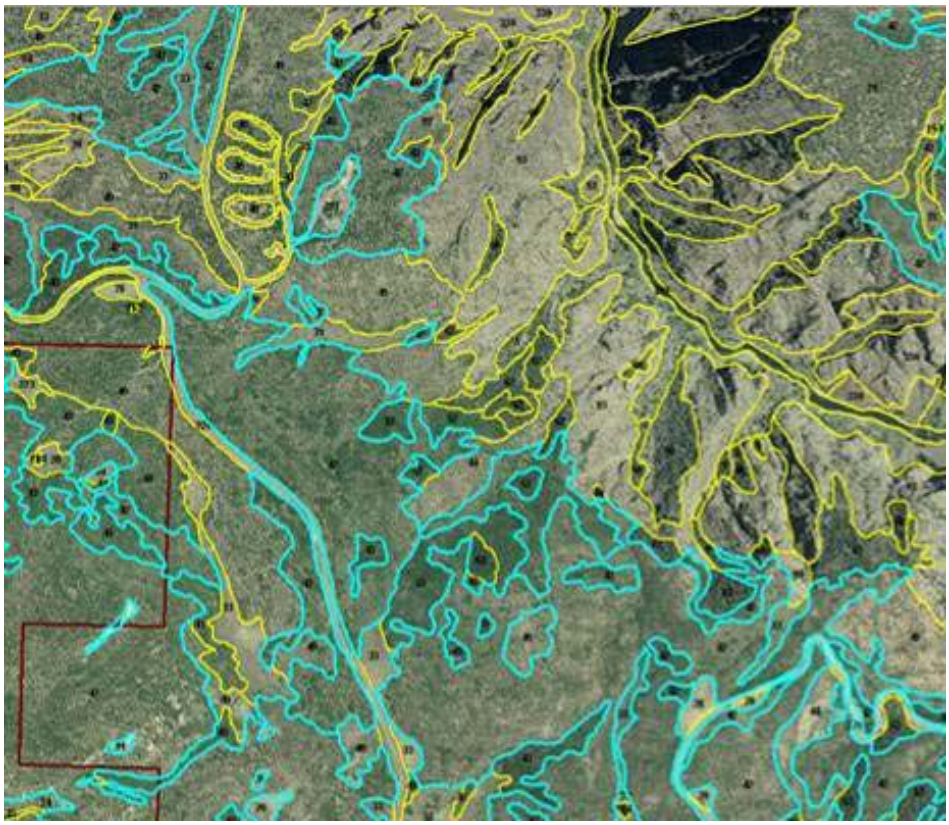


Distribution/Ecology/Composition

Dense thickets of *Quercus gambelii* and associated tall shrubs occur on plateaus, side slopes, and swales. Slopes may be gentle to steep and aspect is variable throughout the range of elevation and steepness. This map class is widely distributed and one of the most common in the Park. These mixed montane shrublands may be largely mid-seral communities that would succeed to conifer woodlands given a sufficient fire interval. While the distribution on the landscape is limited by soil moisture, fire is important to establishment.

Interpretation

This map class typically has small to medium, regular polygons with a rough-textured, bright to dark green color. Separation of this map class from the other montane shrublands was more approximate than precise in patchy landscapes. Greenness of the understory was the deciding factor in mapping. Separation of low tree cover pinyon-juniper woodlands with high cover Gambel oak was likewise problematic. The most common neighboring polygons are those of other mixed mountain shrublands (map class 49) and pinyon-juniper woodlands (map classes 71 and 74).



Example of photo signature for map class S-QUMX (#42).

Map Class 43
Gambel Oak Woodlands (S-QUSY)





Photo credits: NPS

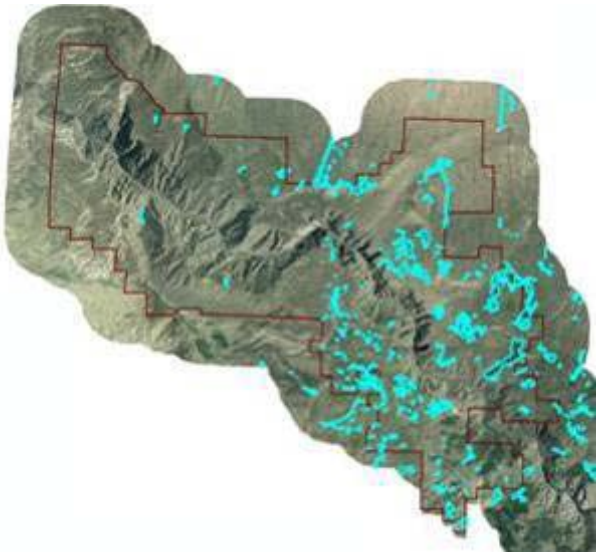
Associations
Quercus gambelii / *Amelanchier alnifolia* Shrubland
Quercius gambelii / *Carex geyeri* Shrubland
Quercus gambelii / *Symphoricarpos oreophilus* Shrubland

Common species
- *Quercus gambelii*
- *Carex geyeri*
- *Amelanchier alnifolia*
- *Symphoricarpos oreophilus*

S-QUSY Map Class Statistics

Type:	Complex of associations
Frequency:	275 total polygons
	152 polygons in BLCA
	123 polygons in the environs
Total project area:	609 hectares / 1,505 acres (2.6 %)
	411 hectares / 1015 acres in BLCA
	198 hectares / 490 acres in the environs
Average Polygon Size:	2.2 hectares / 5.5 acres
Producer's accuracy:	76% ± 10 %
User's accuracy:	80% ± 10 %

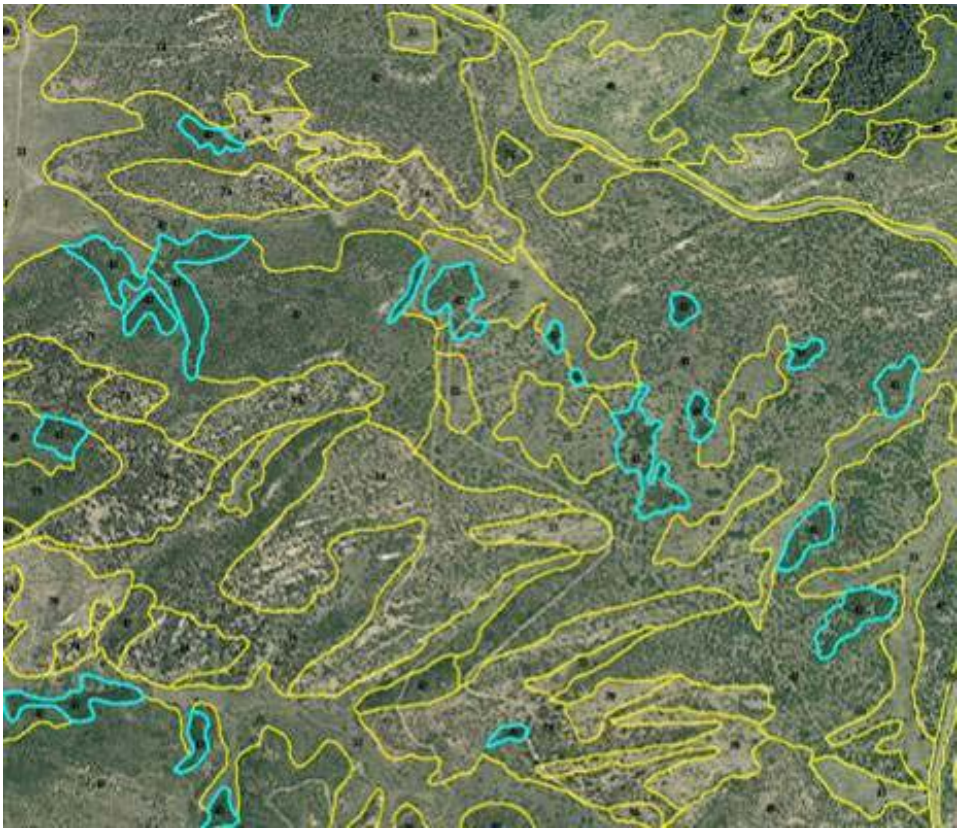
Distribution in Mapping Area



Distribution/Ecology/Composition
This map class was separated from map class 42 largely to acknowledge tree-form (older stands) oak communities of more mesic sites. Stands tend to have high oak shrub cover and sparse understory due to limited sunlight penetration through the stand.

Interpretation

Polygons of this map class tend to be small and narrow, generally occurring as dense mots within larger, more open oak stands. Smooth textured and dark green in color, they are easily distinguished from surrounding communities, which are most commonly the Gambel oak-mixed mountain shrub communities of map class 42.



Example of photo signature for map class S-QUSY (#43).

Map Class 48
Gambel Oak / Rock Spirea Scree Shrubland (S-QUHO)



Photo credits: NPS

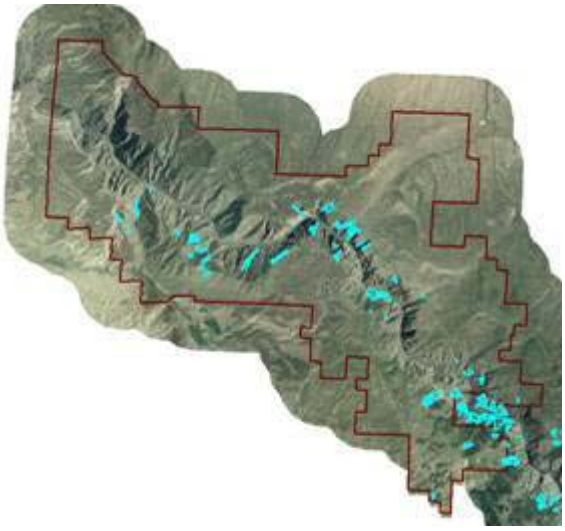
Associations
Quercus gambelii - *Holodiscus dumosus* Shrubland

Common species
- *Quercus gambelii*
- *Holodiscus dumosus*

S-QUHO Map Class Statistics

Type:	Association
Frequency:	54 total polygons
	50 polygons in BLCA
	4 polygons in the environs
Total project area:	96 hectares / 238 acres (0.4 %)
	95 hectares / 234 acres in BLCA
	2 hectares / 4 acres in the environs
Average Polygon Size:	1.8 hectares / 4.4 acres
Producer's accuracy:	67% ± 40 %
User's accuracy:	100% ± 13 %

Distribution in Mapping Area

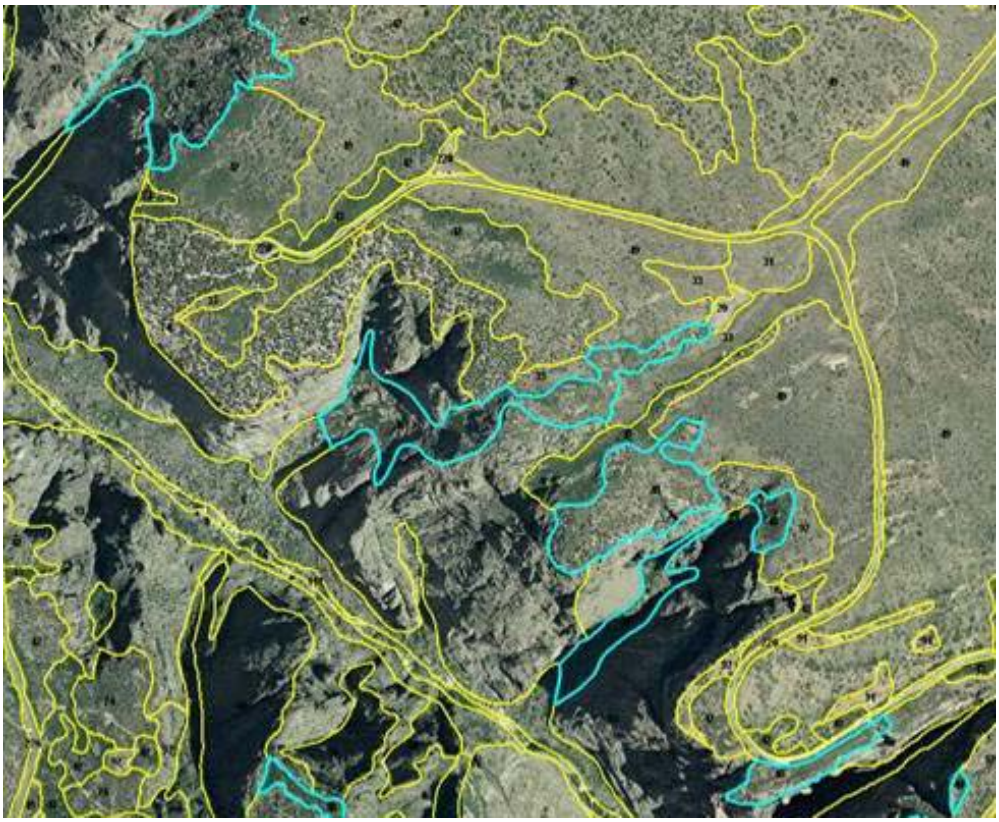


Distribution/Ecology/Composition

This map class occurs on steep (scree and crag dominated) canyon slopes of the main Black Canyon of the Gunnison and its tributaries. The *Holodiscus dumosus* component may or may not be the diagnostic species in the understory and *Cercocarpus montanus* may be present in its place.

Interpretation

Polygons of map class 48 tend be small and irregular in shape. The signature is similar to that of other oak map classes, but is differentiated by location and a rocky substrate. Neighboring polygons are most commonly rock spirea scree slopes (map class 93) and the geology map class 330 (bedrock outcrops of gneiss).



Example of photo signature for map class S-QUHO (#48).

Map Class 49
Mountain Big Sagebrush / Mixed Montane Shrubland (S-MXMO)




Photo credits: NPS

Associations

Amelanchier utahensis - Mixed Shrub / *Carex geyeri* Shrubland
Artemisia tridentata (ssp. *vaseyana,* spp. *wyomingensis*) - *Amelanchier utahensis* Shrubland
Artemisia tridentata ssp. *vaseyana* / *Hesperostipa comata* Shrubland
Artemisia tridentata ssp. *vaseyana* / *Poa (pratensis, compressa)* Semi-natural Shrub Herbaceous Vegetation

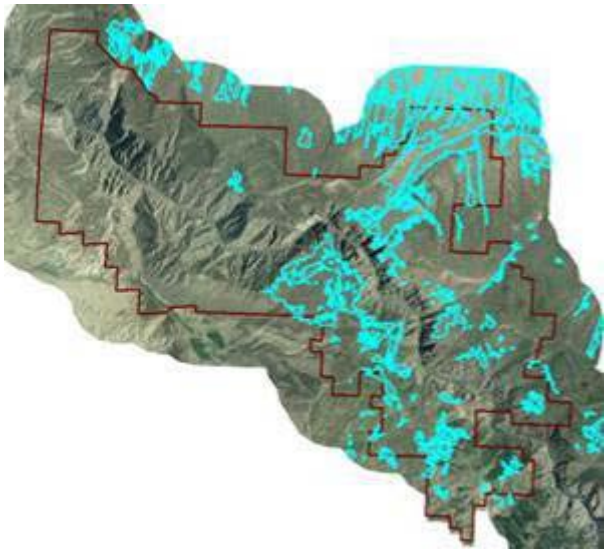
Common species

- *Amelanchier utahensis*
- *Cercocarpus montanus*
- *Hesperostipa comata*
- *Artemisia tridentata* ssp. *vaseyana*
- *Carex geyeri*
- *Poa pratensis*

S-MXMO Map Class Statistics

Type:	Complex of associations
Frequency:	210 total polygons 87 polygons in BLCA 123 polygons in the environs
Total project area:	2,629 hectares / 6,496 acres (11.4 %) 1404 hectares / 3468 acres in BLCA 1,225 hectares / 3,028 acres in the environs
Average Polygon Size:	12.5 hectares / 30.9 acres
Producer's accuracy:	66% ± 16 %
User's accuracy:	90% ± 13 %

Distribution in Mapping Area

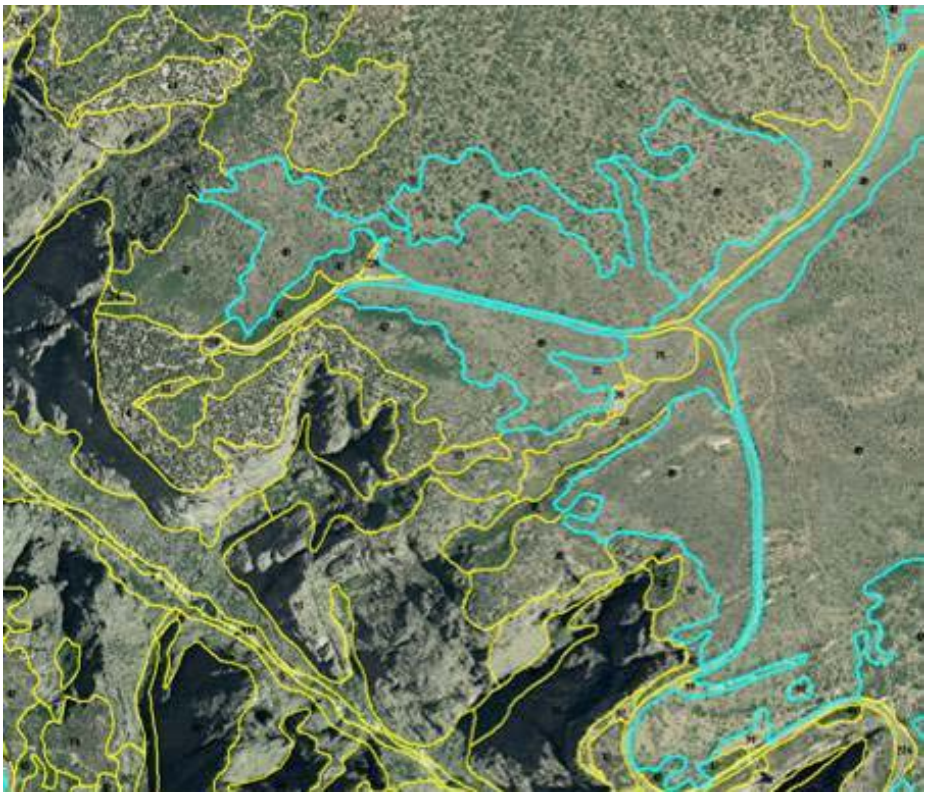


Distribution/Ecology/Composition

Map class 49 is widespread and common in the Park, largely represented on the plateaus. The sagebrush may be either ssp. *wyomingensis* or ssp. *vaseyana*, growing in a dense shrubland with emergent Utah or Saskatoon serviceberry, and lesser cover of mountain mahogany, sticky rabbitbrush, snowberry, or antelope bitterbrush. The herbaceous understory is diverse and generally has high cover. These areas generally do not have a history of recent fire.

Interpretation

This map class is represented by small to large polygons on gentle to moderate slopes at higher elevations on the large plateaus. The matrix color is the same as for map class 33, but there are scattered darker circles that correlate to individual *Amelanchier utahensis* shrubs. The shrubs may be scattered or clumped. Polygons often occur in a matrix with Gambel oak - mixed mountain shrublands (map class 42).



Example of photo signature for map class S-MXMO (#49).

Upland Herbaceous Communities

Map Class 20
Mixed Upland Grasslands (H-MXHE)




Photo credits: NPS

Associations

Achnatherum hymenoides Shale Barren Herbaceous Vegetation
Bromus inermis - (Pascopyrum smithii) Semi-natural Herbaceous Vegetation
Bromus tectorum Semi-natural Herbaceous Vegetation
Erodium cicutarium Semi-natural Annual Herbaceous Vegetation
Hesperostipa comata Great Basin Herbaceous Vegetation
Juncus balticus Herbaceous Vegetation
Pascopyrum smithii Herbaceous Vegetation
Pleuraphis jamesii Herbaceous Vegetation
Poa fendleriana Herbaceous Vegetation
Poa pratensis - (Pascopyrum smithii) Semi-natural Herbaceous Vegetation

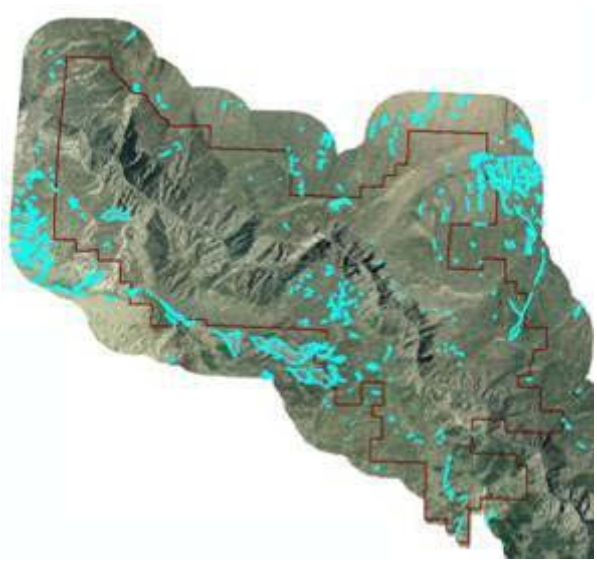
Common species

- *Achnatherum hymenoides*
- *Bromus tectorum*
- *Hesperostipa comata*
- *Pleuraphis jamesii*
- *Poa pratensis*
- *Bromus inermis*
- *Erodium cicutarium*
- *Pascopyrum smithii*
- *Poa fendleriana*
- *Juncus balticus*

H-MXHE Map Class Statistics

Type:	Complex of associations
Frequency:	299 total polygons 124 polygons in BLCA 175 polygons in the environs
Total project area:	739 hectares / 1,825 acres (3.2 %) 169 hectares / 418 acres in BLCA 570 hectares / 1,407 acres in the environs
Average Polygon Size:	2.5 hectares / 6.1 acres
Producer's accuracy:	77% ± 10 %
User's accuracy:	96% ± 6 %

Distribution in Mapping Area

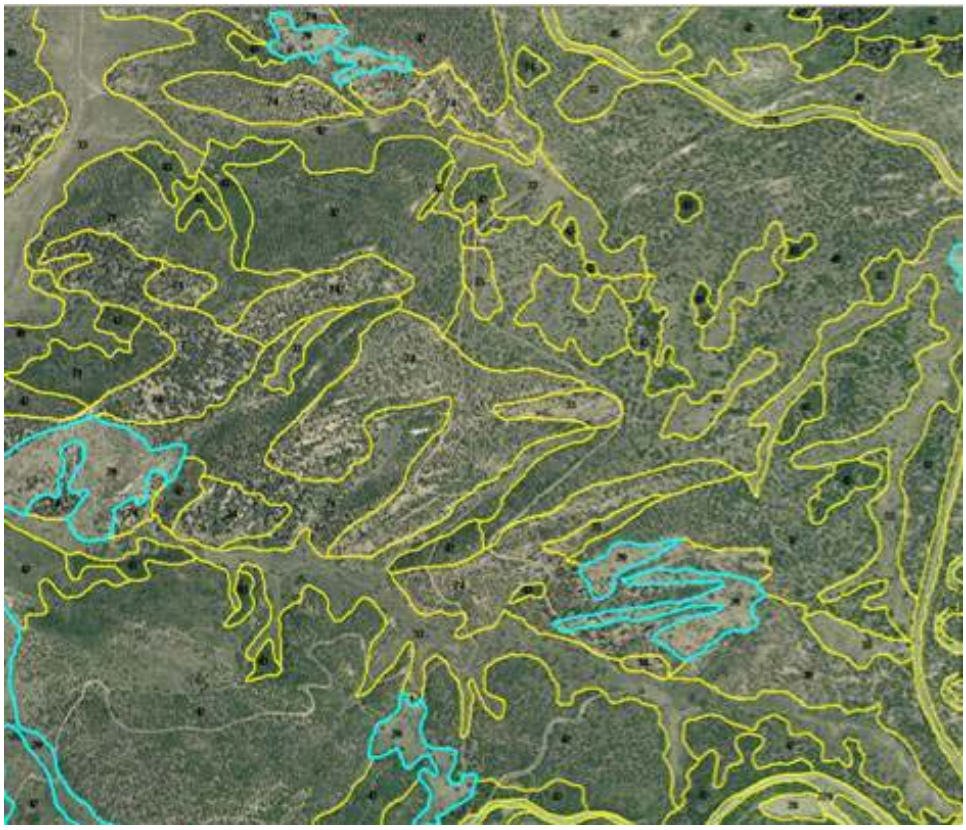


Distribution/Ecology/Composition

This widespread but fairly uncommon map class includes burned or disturbed areas dominated by exotic forb or graminoid species, and other areas dominated by native bunchgrasses. Some examples of this type are substrate-controlled, but most are the result of fire. Substrates and soils are variable, and this class occurs on level to moderately steep slopes and on diverse landforms. Some polygons capture recently burned pinyon-juniper woodlands or sagebrush shrublands, where the early-seral grasses (and forbs) are the first colonizers post-fire; many of these sites will transition back to shrublands or woodlands. The majority of polygons occur in the environs and most examples in the Park are small stands.

Interpretation

Polygons of this map class occur in all parts of the mapping area, in many different landscape positions and on many different geologic substrates. Polygons are small to medium, regularly shaped and characterized by a slightly textured grayish tan color. Larger polygons in burned areas may contain small inclusion of Wyoming big sagebrush shrublands (map class 31) or various pinyon-juniper woodlands, and conversely, large polygons of big sagebrush shrublands (map classes 31 and 33) likely have inclusions of map class 20 in pockets too small to pull out separately. Mixed mountain shrublands (map class 42) are another common neighbor of this map class.



Example of photo signature for map class H-MXHE (#20).

Sparse Vegetation & Talus Slope Communities

Map Class 80
Mancos Shale Badlands Complex (C-SHAL)




Photo credits: NPS

Associations

Atriplex canescens - *Artemisia tridentata* Shrubland
Atriplex confertifolia Wyoming Basins Shrubland
Atriplex corrugata Dwarf-shrubland
Atriplex gardneri Dwarf-shrubland
Glossopetalon spinescens var. *meionandrum* - *Atriplex confertifolia* Shrubland [Park Special]
Krascheninnikovia lanata / *Achnatherum hymenoides* Dwarf-shrubland
Leymus salinus Shale Sparse Vegetation
Sarcobatus vermiculatus Shrubland

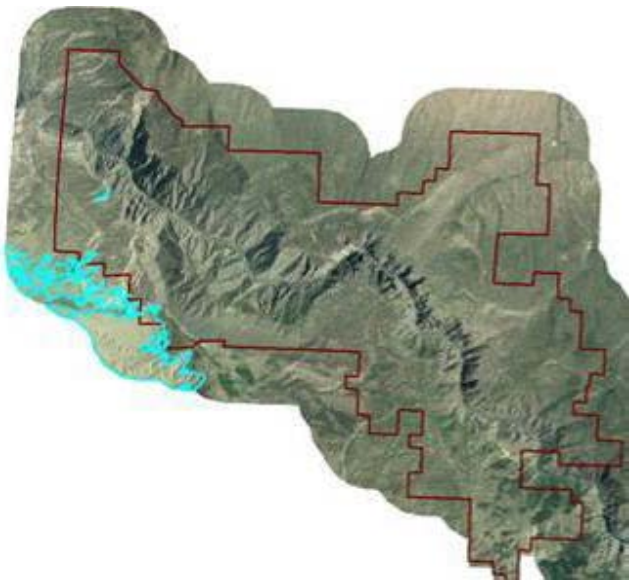
Common species

- *Atriplex canescens*
- *Atriplex confertifolia*
- *Atriplex gardneri*
- *Glossopetalon spinescens* var. *meionandrum*
- *Atriplex corrugata*
- *Krascheninnikovia lanata*
- *Artemisia tridentata*
- *Achnatherum hymenoides*
- *Leymus salinus*
- *Sarcobatus vermiculatus*

C-SHAL Map Class Statistics

Type:	Complex of associations
Frequency:	28 total polygons 9 polygons in BLCA 19 polygons in the environs
Total project area:	860 hectares / 2,126 acres (3.7 %) 41 hectares / 100 acres in BLCA 820 hectares / 2,026 acres in the environs
Average Polygon Size:	30.7 hectares / 75.9 acres
Producer's accuracy:	100% ± 3 %
User's accuracy:	81% ± 16 %

Distribution in Mapping Area

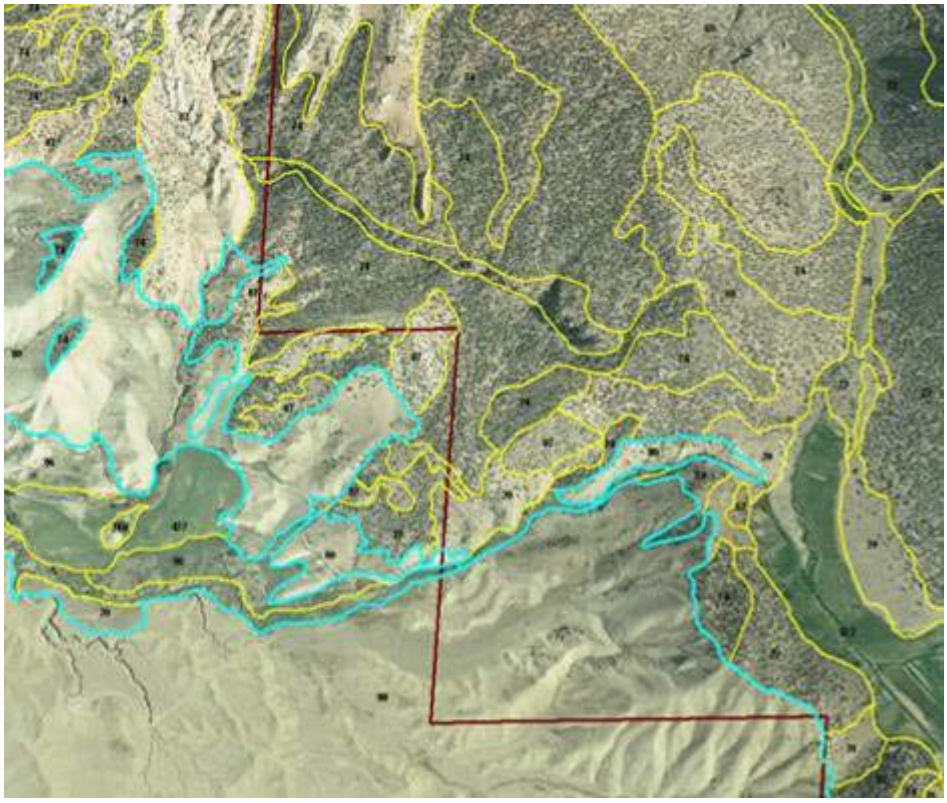


Distribution/Ecology/Composition

Map class 80 occurs almost entirely in the southwest environs of the Park on slopes of shallow, fine textured soils derived from the Mancos Formation or on alluvial benches of transported clay soils from the same source. *Leymus salinus* shale sparse vegetation is generally limited to north-facing steep slopes. Total vegetation cover is generally less than 15%.

Interpretation

This map class occurs in medium to large, regular polygons on slopes, benches and hogbacks at the lower elevations of the Mancos formation or on alluvial benches of transported clay soils in the Bostwick Park area. Because of the high reflectance of the shale substrate, the minute texture provided by the shrubs is rarely visible; polygons have the same smooth gray or yellowish gray signature as the unvegetated shale that the sparse shrubs are growing on. Most slopes of Mancos shale will support this community, except for the hottest and steepest south-facing aspects of just barren shale. Polygons adjacent to Mancos shale badlands are most commonly pinyon-juniper woodlands of map classes 74 and 78.



Example of photo signature for map class C-SHAL (#80).

Map Class 91
Sparsely Vegetated Bedrock (C-SPAR)

No photos available

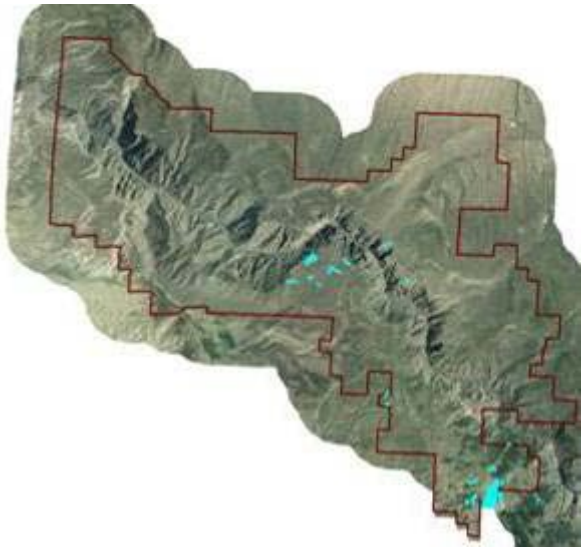
Associations
N/A

Common species
- *Cercocarpus montanus*
- *Amelanchier utahensis*

C-SPAR Map Class Statistics

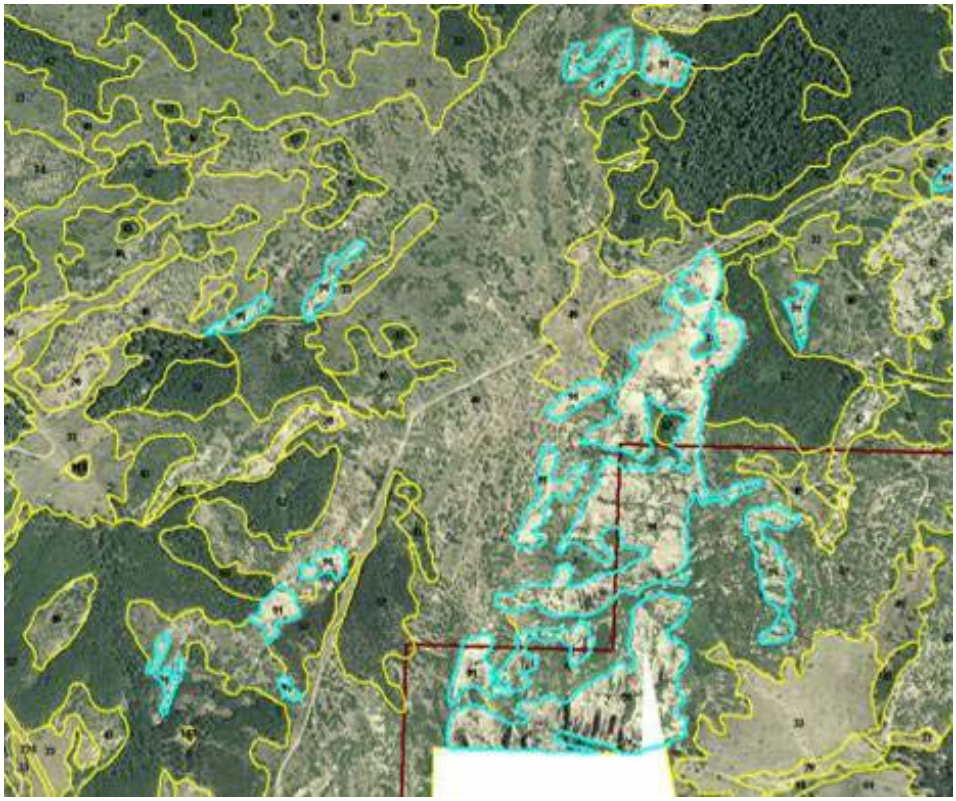
Type:	Geologic
Frequency:	31 total polygons
	13 polygons in BLCA
	18 polygons in the environs
Total project area:	26 hectares / 65 acres (0.1 %)
	9 hectares / 22 acres in BLCA
	18 hectares / 43 acres in the environs
Average Polygon Size:	0.9 hectares / 2.1 acres
Producer's accuracy:	100% ± 10 %
User's accuracy:	100% ± 10 %

Distribution in Mapping Area



Distribution/Ecology/Composition
Map class 91 occurs on plateaus and shoulder slopes of canyon rims of Black Canyon. Slopes are gentle to moderate. Most of the class is barren rock outcrops, with vegetation occurring in pockets or interstices between rock slabs. Shrubs including *Amelanchier utahensis* and *Cercocarpus montanus* are the dominant vegetation. Herbaceous cover includes *Pseudoroegneria spicata* and other grasses on shallow soils. Sampling was very limited in this map class, so there is not enough data to assign relevant associations to the map class description.

Interpretation
This map class occurs in small polygons and is extremely rare in the Park. It is restricted to small patches of bedrock that are large enough to pull out separately from the surrounding vegetation. The signature is mostly barren bedrock, with patches of sparse shrubs and trees sometimes visible. Common neighbors of map class 91 include Gambel oak-sagebrush-mixed montane shrublands (map classes 40 and 49) and aspen woodlands (map class 52).



Example of photo signature for map class C-SPAR (#91).

Map Class 93
Rock Spirea Sparsely Vegetated Rock Outcrop (S-HODU)

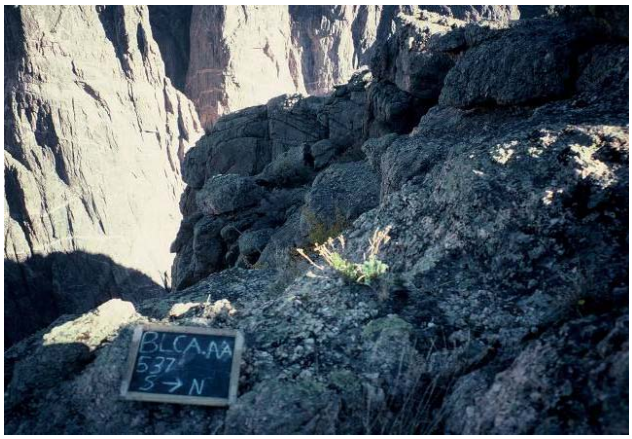




Photo credits: NPS

Associations

Holodiscus dumosus Rock Outcrop Sparse Vegetation
Cercocarpus montanus Shale Sparse Vegetation

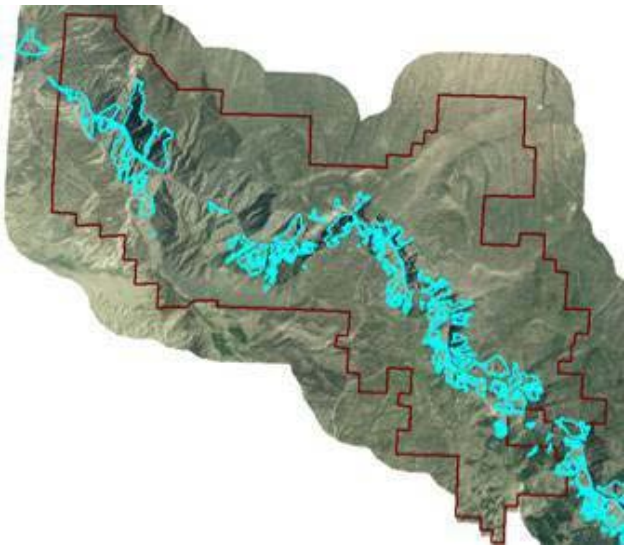
Common species

- *Cercocarpus montanus*
- *Artemisia tridentata* ssp. *vaseyana*
- *Holodiscus dumosus*

S-HODU Map Class Statistics

Type:	Complex of associations
Frequency:	67 total polygons
	64 polygons in BLCA
	3 polygons in the environs
Total project area:	1,193 hectares / 2,948 acres (5.2 %)
	1,153 hectares / 2,850 acres in BLCA
	39 hectares / 97 acres in the environs
Average Polygon Size:	17.8 hectares / 44 acres
Producer's accuracy:	100% ± 7 %
User's accuracy:	88% ± 25 %

Distribution in Mapping Area



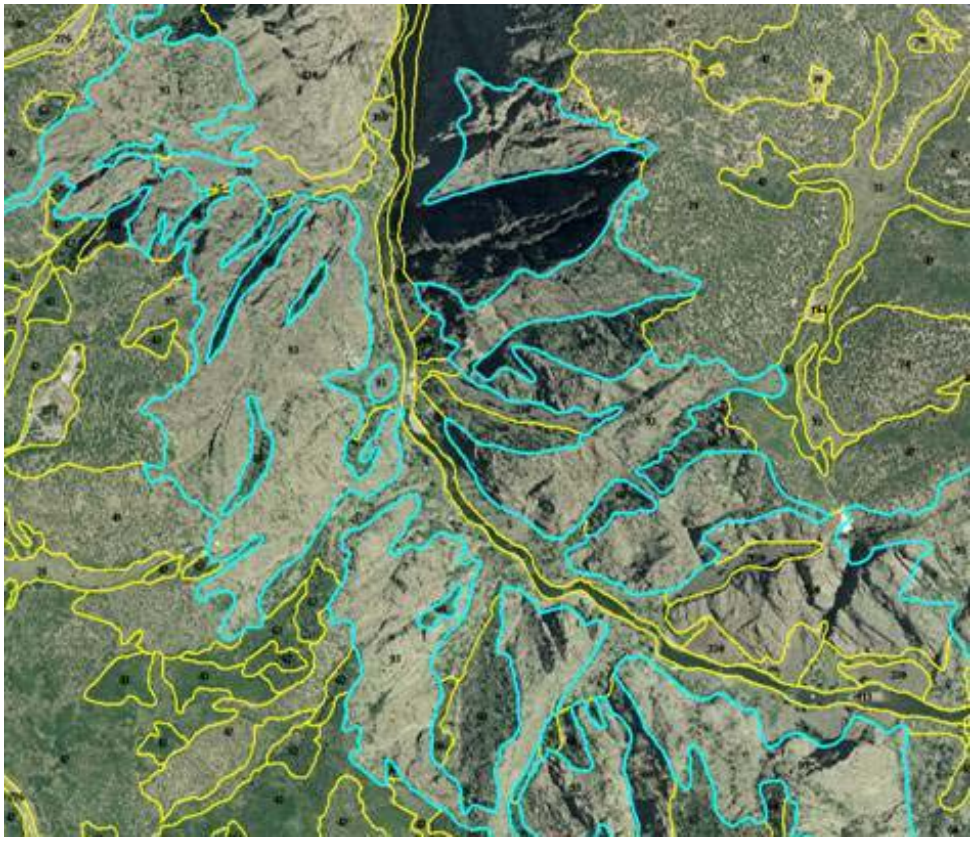
Distribution/Ecology/Composition

This map class occurs as cliff walls and talus slopes on the canyonsides of Black Canyon. Slopes are rugged and include near vertical cliffs. Most of the vegetation is sparse shrubs including *Artemisia tridentata*, *Cercocarpus montanus* and *Holodiscus dumosus*, but *Pinus edulis* and *Juniperus osteosperma*

may have very low cover in some polygons. Sampling was very limited in this map class due to difficult terrain and accessibility issues.

Interpretation

Map class 93 occurs in medium to large polygons and is restricted to the rugged canyon walls and talus slopes (all aspects) of Black Canyon. The signature is dominated by barren bedrock and talus, with patches of sparse shrubs visible. A variety of map classes border polygons map class 93, but the most common neighbors are riparian associations (map class 5), barren bedrock (map class 330) and pinyon-juniper sparse scree woodlands (map class 69).



Example of photo signature for map class S-HODU (#93).

Riparian / Wetland Woodlands and Shrublands

Map Class 5
Canyon Bottom Mosaic (C-CANY)




Photo credits: NPS

Associations

Acer negundo / *Quercus gambelii* Woodland
Acer negundo / Disturbed Understory Woodland
Phalaris arundinacea Western Herbaceous Vegetation

Common species

- *Acer negundo*
- *Phalaris arundinacea*
- *Prunus virginiana*
- *Quercus gambelii*
- *Artemisia tridentata*
- *Clematis ligusticifolia*

C-CANY Map Class Statistics

Type:	Complex of associations
Frequency:	86 total polygons 76 polygons in BLCA 10 polygons in the environs
Total project area:	193 hectares / 476 acres (0.8 %) 175 hectares / 432 acres in BLCA 18 hectares / 44 acres in the environs
Average Polygon Size:	2.2 hectares / 5.5 acres
Producer's accuracy:	100% ± 5 %
User's accuracy:	85% ± 20 %

Distribution in Mapping Area

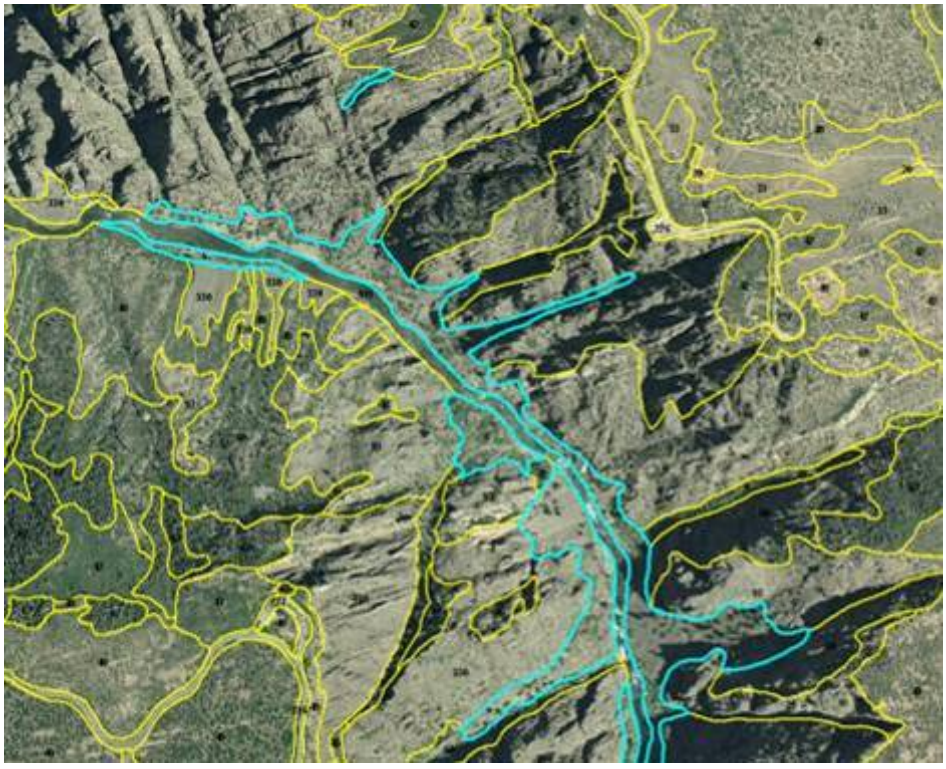


Distribution/Ecology/Composition

This map class is limited to the cold, narrow, main and tributary canyons of Black Canyon, often occurring on unstable, rocky, river banks. *Acer negundo* may form an open canopy with *Quercus gambelii*. Although these stands are generally not subject to flooding, the water table is high enough that the herbaceous layer includes a diversity of mesic species. Human activity (in the form of dam-building) has altered the stream bottom ecology both by controlling flood patterns, inundating some stream banks, and generally altering the periods and amount of flooding. Plant communities respond to moisture gradients both laterally across any part of the stream bottom (meaning narrow strips of different hydrologic regimes), while specific reaches of the stream also respond to changes in gradient, flooding frequency, soils, and other variables.

Interpretation

All polygons of map class 5 are linear and narrow and occur in the floodplain and on the toeslopes of Black Canyon and its short, high gradient tributaries. The signature is shades of bright green mottled with darker green and can include some patchesof scree-dominated openings. Separation of individual associations was not feasible due to the small scale of most occurrences, difficulty of distinguishing species on the photo, and limited data from undersampling in the canyon due to access difficulties/constraints. Shadows and the extreme topographic relief also tend to confound the use of magnification with stereoscopic lenses and make vegetation interpretation difficult in the narrow canyon bottoms. Neighboring polygons are the river (111) and most commonly map classes 330 (bare ground), 93 (rock spirea sparsely vegetated outcrops), and the scree woodland and shrublands 48 and 60.



Example of photo signature for map class C-CANY (#5).

Riparian / Wetland Herbaceous Communities

Map Class 99
Hanging Garden Vegetation (H-HANG)



Photo credit: NPS

Associations

Aquilegia micrantha - Calamagrostis scopulorum Herbaceous Vegetation

Common species

- *Aquilegia micrantha*
- *Calamagrostis scopulorum*

H-HANG Map Class Statistics

Type:	Association
Frequency:	N/A
Total project area:	N/A
Average Polygon Size:	N/A
Producer's accuracy:	N/A
User's accuracy:	N/A

Feature mapped as points, not polygons; data are incomplete and therefore not shown

Distribution/Ecology/Composition

Hanging gardens develop where groundwater moving through porous sandstone intercepts impermeable layers, forcing the water to emerge from canyon walls with a steady, year-round flow. Over time, alcoves form as water dissolves the calcareous cement holding the sandstone together. Well-developed hanging gardens are found in these alcoves and smaller gardens are sometimes found along seeping horizontal cracks on cliff faces at the junctions of geologic layers. The availability of water from a seep and the gradual building of soil caught and held by the moist rock surface are keys to the survival of hanging garden vegetation; these communities are vulnerable to changes and fluctuations in water availability due to drought.

Hanging gardens support a unique assemblage of plants within the alcove and in the saturated soils and talus downslope. Many species (such as alcove death camas) are endemic to the Colorado Plateau and are found rarely outside of hanging gardens. Although vegetation is dense within the gardens, examples are usually long and narrow; they may extend for more than 100m along a horizontal crack, but may be no more than 1 or 2m wide. Species that often surround the hanging gardens on moist, sheltered slopes below include poison ivy, Utah serviceberry, Gambel oak, chokecherry, and large pinyon or juniper trees.

Interpretation

This type was not interpreted because it occurs on near-vertical cliff faces or beneath cliff overhangs; occurrences are not visible on the aerial imagery. Instead, this type is documented by point data derived from the plots database; this mapping project located only a few of what is probably a much more extensive population of hanging garden communities.

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS 144/105270, August 2010

National Park Service
U.S. Department of the Interior

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