

VEGETATION MANAGEMENT PLAN

Bandelier National Monument

October 4, 2002

VEGETATION MANAGEMENT PLAN

BANDELIER NATIONAL MONUMENT

Submitted by:

Vegetation Management Specialist

Date

Recommended by:

Chief, Resources Management

Date

Reviewed by:

Facility Manager

Date

Approved by:

Superintendent

Date

DEDICATION TO CHESTER ARTHUR THOMAS

Chester Arthur Thomas, an early custodian of Bandelier National Monument, took an active interest in the natural history of the monument and helped begin the effort to document the vegetation of Bandelier. He understood that the lands managed by the National Park Service, could not be preserved unimpaired for future generations nor interpreted in a professional manner without the foundation of baseline natural history data. His eloquent memoranda (see Appendix F), scattered in various archival files, outlines a National Park Service philosophy so cognizant of the delicate balance between natural resource integrity and public access that one wonders why, nearly 50 years later, we still have only a fragmentary knowledge of the natural history of our parks and monuments. May the spirit of Chester Arthur Thomas prevail in the hearts and minds of those who manage our precious public lands.

TABLE OF CONTENTS

PART I: OVERVIEW

Introduction.....	2
Purpose and Need for Action.....	2
Compliance.....	3
Authorities.....	3
Relationship to other Guidance.....	4
Roles and Responsibilities.....	4
Contributors.....	5

PART II: ENVIRONMENT

Affected Environment.....	7
Geography.....	7
Geology.....	
Soils.....	7
Climate.....	8
Plant Life.....	8
Historic Landuse and Resource Impacts.....	10
Fire.....	11
Erosion.....	12
Ungulates.....	13
Vegetation Classification.....	14
Vegetation Types and Complexes.....	16
Management Zone Definitions and Standards.....	21

PART III: ISSUES AND STANDARD OPERATING PROCEDURES

Overview.....	25
Infrastructure Maintenance Guidelines.....	26
Miscellaneous Vegetation Management Techniques.....	26
Cultural Landscape Management (Historic and Pre-historic).....	28
Roads Operations.....	30
Trail Operations.....	32
Developed Landscapes (Non-Historic).....	33
Hazard Tree Management.....	33
Exotic Plant Management.....	34
Sensitive Plant Management.....	35
Integrated Pest Management.....	35
Issues Not Addressed in Detail.....	36

ILLUSTRATIONS

Figure 1a: Generalized Geology of the Pajarito Plateau.....	9
Figure 1b: Generalized Plant Communities of Jemez Mountains.....	9
Figure 2: Vegetation Map.....	15
Figure 3: Management Zones.....	23

PART IV: APPENDICIES

Appendix A: Bandelier National Monument Herbarium Status

Appendix B: Bandelier Vascular Plant Checklist

Appendix B-1: Exotic Species List

Appendix B-2: Sensitive Species List

Appendix C: New Mexico State Noxious Plant List

Appendix C-1: Santa Fe and Carson National Forests Invasive Plant List

Appendix D: Listing of Exotic Plants Not to be Cultivated at Bandelier

Appendix E: Suggested List of Native Species for Planting at Bandelier

Appendix F: Historic Memo from former Bandelier Custodian, Chester Thomas

Appendix G: Selected Vegetation Resources

Appendix H: Sensitive Plant Protocols

Appendix I: Disturbed Site Rehabilitation Guidelines

Appendix J: Hazard Tree Management

PART I

OVERVIEW

INTRODUCTION

Vegetation management is a component of many diverse activities planned or on-going at Bandelier National Monument. A variety of routine activities such as road and trail maintenance, hazard tree mitigation and developed landscape maintenance can be considered vegetation management actions. Prescribed fire, exotic plant control, rare plant management, ruins stabilization and disturbed site revegetation are other management actions which can affect vegetation. Since vegetative systems are dynamic, changes occur in the absence of management actions as well; no action or alternatively suppression of 'natural forces' such as wildfire can allow significant changes to occur. A vegetation management plan provides a context for these diverse activities, prescribes actions and assigns responsibilities. It also enables park managers to assess the cumulative effects of vegetation management actions parkwide. Vegetation is dynamic, changing whether or not it is actively managed. Through vegetation management planning, managers can understand the vegetation dynamics within their park and coordinate short-term actions to achieve long-term goals.

Controversial vegetation management issues at Bandelier result from either the affects of historic landuse practices (i.e. grazing, fire suppression) or simply lack of maintenance (i.e. historic landscape). The fire management, landscape restoration, and ungulate impact programs address legacies of overgrazing and fire suppression; historic landscape maintenance has been under-recognized and under-funded. The remaining vegetation management issues are mostly routine or programmatic in nature, required by law, policy, or management guidelines and include hazard tree, exotic plant, sensitive plant, wilderness, endangered species, and archeological site stabilization programs.

The complexity of any vegetation management program stems not only from the continually changing nature of the resource, but also from the diversity of management goals to be achieved. Natural resource management, cultural resources preservation, and infrastructural maintenance all influence vegetation. Actions taken in one vegetative setting often impact other settings. Coordination is best achieved through a comprehensive vegetation management plan which addresses relationships among all vegetation related activities in all areas of the park and its adjacent landscape.

PURPOSE OF AND NEED FOR ACTION

This vegetation management plan describes the vegetation, identifies issues, sets specific management goals and objectives, prescribes management techniques, and identifies research and monitoring needs. It proposes standards by which success can be measured and provides long-term program direction. Methodologies and standards proposed here are intended to be guidelines and can be modified for specific conditions or needs based on consultation with the vegetation management specialist.

This vegetation management plan attempts to reference a number of existing programs, plans and miscellaneous actions within a single coherent context. Since many of these programs, plans and actions are either already documented elsewhere or still under development, no attempt will be made to replicate these efforts. The vegetation management plan however, will supersede

existing documents in prescription of management techniques, rationales for treatment, and measures of success for routine operations.

This plan is intended to be an in-house reference manual for vegetation management and will provide a general context for vegetation management at Bandelier. It will define management zones as well as a framework for decision making. The scope of the current plan will include only those issues and actions deemed by the park to be routine or non-controversial. These include roads, trails, and other developed areas or infrastructure maintenance, sensitive and exotic plant management, hazard tree mitigation, and limited actions as necessary to mitigate imminent damage to historic or cultural resources. Additional information relevant to routine vegetation management actions is contained in the Appendices. In depth consideration of those issues and actions which are not routine and which may arouse public concern will be assigned to future plans and will be subject to higher level environmental and/or cultural analysis. These include restoration of degraded woodlands, ungulate management, fire management, and historic cultural landscape management.

COMPLIANCE

The subject vegetation management plan is a compilation and clarification of only non-controversial vegetation management actions (and is intended to be an internal reference manual for the use of Bandelier park managers) which by definition are consistent with existing NPS policy and guidelines and can be treated as categorical exclusions for the purposes of natural and cultural (i.e. NEPA, NHPP, and ESA among others) compliance. The vegetation management plan provides approval only to the compiled non-controversial actions and only under the stated conditions. The plan will propose preferred treatment options for on-going vegetation management actions (i.e. exotic plant control, hazard tree management, trail and road maintenance) authorized by existing agency mandates. References to controversial vegetation management actions in component programs (i.e. fire management, woodland restoration) have been or will be addressed separately for environmental, cultural and endangered species compliance. Additional management actions with potential impacts on vegetation are still under development by staff specialists (archeological site stabilization, historic landscape maintenance) and cannot be fully addressed in the current plan.

AUTHORITIES

Natural Resource Management Guidelines (NPS-77) and the 1995 Bandelier Resources Management Plan, provide a listing of authorities which are relevant to vegetation management activities in units of the National Park Service. In addition, the NPS Natural Resource Intranet Site provides a comprehensive source for applicable laws, regulations, management policies and guidelines. Cultural landscapes are afforded protection under the Historic Sites Act of 1935 and the National Historic Preservation Act of 1966. Collecting biological specimens (i.e. plants) for scientific purposes must be authorized by the park superintendent in accordance with requirements in 36 CFR 2.50. The mechanism for scientific sample collections is the Specimen Collection permit, covered in 36 CFR 2.5 and NPS-53, the Special Park Uses guideline (Chapter 5, Collections, NPS-77) which must be approved by the park superintendent. Additional

guidance for the collection of biological specimens is detailed in Bandelier's Research and Collecting Guidelines.

RELATIONSHIP TO OTHER GUIDANCE

Existing management plans for Bandelier National Monument, such as the Statement for Management and Resource Management Plan provide general guidance for all activities at Bandelier. In addition, many aspects of vegetation management have already been addressed in specific operational planning documents (see: 1997 Fire Management Plan, 1998 draft Wilderness Stewardship Plan, and Bandelier Trail Maintenance Guide).

Additional references to vegetation management are also contained in a number of NPS management and policy guidelines (including Directors Orders) the latest versions of which are available on the NPS Natural Resource Intranet Site.

ROLES AND RESPONSIBILITIES

The Superintendent and Chief of Resources Management are accountable for ensuring that the management of vegetation at Bandelier, as implemented through various programs and program managers, is consistent with the approved vegetation management plan. The Vegetation Management Specialist (VMS) serves as the principle contact and provides technical expertise in matters relating to the management of vegetation at Bandelier. The VMS currently manages the Restoration, Fire Monitoring, Exotic Plant, and Sensitive Plant Programs and currently serves as the Hazard Tree and Integrated Pest Management Coordinators.

Other programs which incorporate significant aspects of vegetation management, but which are managed by program managers other than the VMS include: Fire Management Program, Roads and Trails, Cultural Resources, and Wilderness. Natural and cultural resource and maintenance personnel should coordinate throughout all stages of project planning in order to incorporate vegetation issues with other objectives, develop strategies such as prevention and salvage that may be critical to achieve desired results, and monitor progress. This coordination is typically accomplished through quarterly planning meetings and the internal natural/ cultural compliance process. Even emergency operations, such as fire rehabilitation for watershed or cultural site stabilization, require timely staff consultation during the planning process to ensure parkwide consistency with established vegetation management standards and objectives.

CONTRIBUTORS

Brian Jacobs, Vegetation Management Specialist*
Charisse Sydoriak, former Chief Resources Management
Steve Fetting, Wildlife Biologist
Elizabeth Mozzillo, former Archeologist
Carlos Gonzales, Roads and Trails Foreman
Steve Gastellum, former Facility Manager
Charles Sellars, former Facility Manager
John Lissoway, former Fire Management Officer
Al King, former Fire Management Officer
Rory Gauthier, Archeologist
Vito Spinale, Facility Manager
Dixon Hayes, Curation Specialist
Jill Cowley, Cultural Resource Specialist, SSO

*lead author

PART II

ENVIRONMENT

AFFECTED ENVIRONMENT

Geography

Bandelier National Monument is located in north central New Mexico, approximately 10 miles southwest of Los Alamos and 50 miles northwest of Santa Fe. Within its boundaries are some 32,827 acres (15,308 hectares) of rugged canyons, mesas, and mountain slopes. Bandelier is located on the southern portion of the Pajarito Plateau in the Jemez Mountains at the southern edge of the Rocky Mountains in north-central New Mexico (see Figure 1). The area is composed of volcanic ash and lava flows that have been eroded into deep cañons separated by narrow mesas. The park spans an elevational gradient from the Rio Grande at 5,300 ft (1,590 meters) to the summit of Cerro Grande at 10,199 ft (3,109 meters) on the Valles Caldera rim, an altitudinal range of 4,899 ft (1,519 meters). Bandelier National Monument samples an elevational transect of the volcanic Jemez Mountains in north-central New Mexico. The vegetation along this transect has been influenced by a variety of historic disturbances, including periodic fire, pre-historic agriculture and overgrazing.

Geology

Cerro Grande, a volcanic dome of the Tschicoma formation, lies on the southeastern perimeter of the Valle Grande. This mountain, along with many in the Jemez Mountains, was formed prior to several major volcanic eruptions in the Jemez Mountains, although additional volcanic domes have formed subsequently. At least two of the eruptions formed calderas that appear today in the heart of the Jemez as broad green valleys and prompted their first discoverers to name these mountains the Sierras de los Valles. The younger, larger caldera, Valle Grande, truncates the older, smaller caldera, Valle Toledo. Below Cerro Grande, pyroclastic ash flow deposits of Bandelier Tuff spread out in a southeasterly direction toward the Rio Grande and are measured in thicknesses of up to ca. 1000 ft (ca. 300 meters). Near the Rio Grande, the Tuff overlies Cerros del Rio Basalts. The eastern fan of the Bandelier Tuff is referred to as the Pajarito Plateau.

Streams have formed deep erosional canyons in the Bandelier Tuff. These canyons from north to south are: Frijoles, Lummis, Alamo, Hondo, Capulin, Medio, and Sanchez. In the upper reaches of the first five canyons, erosion has exposed andesites of the Paliza Canyon Formation. These andesites are also exposed in the middle portions of Medio and Sanchez canyons. Cerros del Rio basalts are exposed in most of the canyons near the Rio Grande. In the lower part of Capulin Canyon, sediments of the Santa Fe Formation are exposed (figure 1a).

Soils

Most of the soils within Bandelier are derived from volcanic tuf and pumice deposits, although typically from parent materials which have been secondarily transported by alluvial action and/ or aeolian deposition. The soils are generally shallow, coarse textured, well drained and nutrient poor, but can be quite variable depending on substrate, elevation, rainfall, vegetation and historical land use patterns. While local soils supported dry land farming during pre-historic times and grazing during historic times, they may have been over-utilized and are now lacking in organic top soils, nutrients and water holding capacity.

Climate

Climate is very localized within the monument depending on elevation, topographic aspect and vegetation type. Precipitation averages 16 inches (40.64 centimeters) a year near park headquarters and generally increases with elevation, although considerable variation is introduced by the erratic nature of thunderstorms during the summer months. Spring (April-June) is normally dry and summers (July-August) wet, but the pattern is not always well defined. There appear to be wet and dry cycles lasting several years or more which may have far reaching consequences in terms of plant distribution and establishment. Normally a snow pack is formed during the winter months at the higher elevations, increasing stream flow considerably during the spring snow melt. Snow also falls at the lowest elevations, but typically does not persist. Temperatures range generally between 0.0 degrees F and 100.0 degrees F during the course of the year near park headquarters, although extremes above and below this are not uncommon. Diurnal temperature differences are usually in the range of 30 degrees F.

Plant Life

The diversity of habitats created by the great variety of elevations, topographic aspects, climates and soils are populated by an equally diverse assemblage of plant life. Thus, within a single days' march from the summit of Cerro Grande to the banks of the Rio Grande, one traverses mountain meadow, mixed conifer, pondersosa, piñon-juniper and juniper grassland communities, along with the floristic elements found primarily in moist canyon bottoms (figure 1). Bandelier National Monument contains over 750 taxa of vascular plants which are documented by a comprehensive herbarium collection (Appendix A, Status of the Bandelier Herbarium; Appendix B, Bandelier Vascular Plant Checklist). Appendix G, Selected Vegetation Resources, lists additional sources of information on plants and plants and plant ecology at Bandelier (figure 1b).

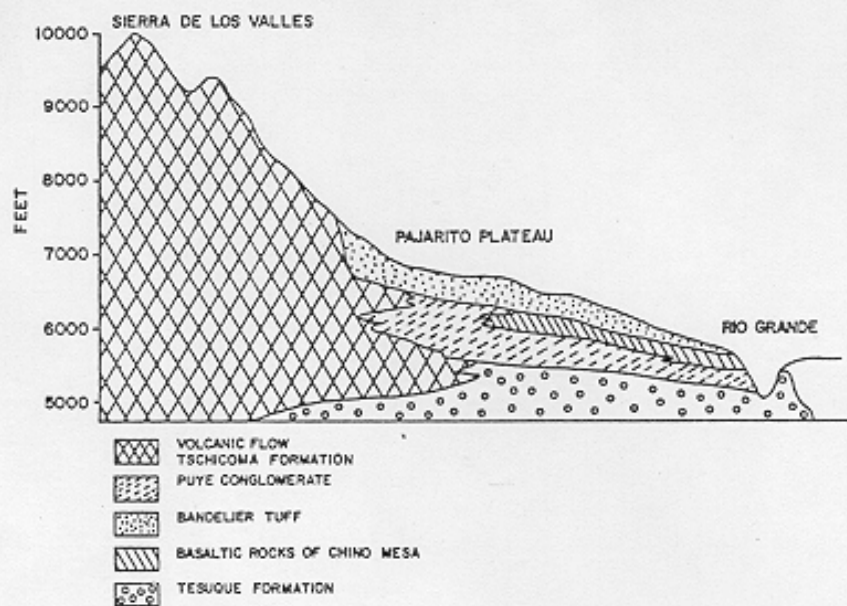


Figure 1a. Generalized geology of the Pajarito Plateau

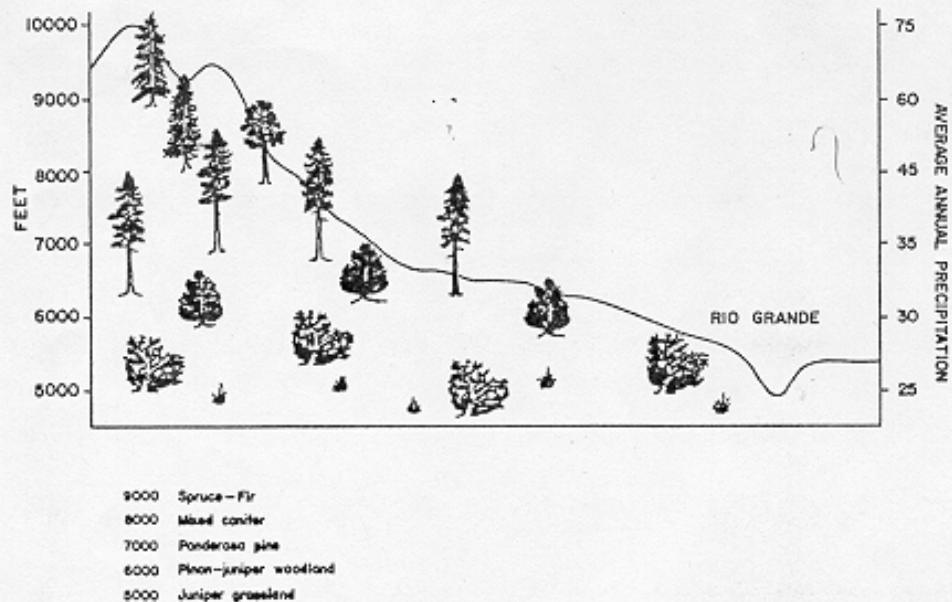


Figure 1b. Generalized plant communities of the Jemez Mountains

HISTORIC LANDUSE AND RESOURCE IMPACTS

The vegetation resources within Bandelier National Monument have been profoundly affected by historic landuse practices common throughout much of the western United States. Essentially all of the vegetation types in the park have been altered, to some degree, by the effects of historic grazing and active suppression of wildfires (Allen 1989). Some communities have undergone relatively minor structural changes which can be reversed through iterative mechanical and fire treatments, while others have experienced more permanent changes in both species composition and functionality.

About 17 percent of the park's documented vascular plant species are non-native; while some are naturalized and many more restricted to disturbed sites, a few of these exotics are aggressive invaders of native plant communities and thus merit active control. Fire suppression precipitated fundamental changes in plant community structure and composition: it indirectly provided the continuous ladder and crown fuels necessary to support large scale crown fire in ponderosa forests, supported increased densities of trees in piñon-juniper woodlands which has precipitated accelerated erosion, and allowed progressive encroachment of woody plants in former meadow and grassland systems.

Desired future conditions of Bandelier's plant communities are based on inferences about the nature and status of these plant communities prior to historical landuse patterns (beginning around 1880) and subsequent to pre-historic landuse activities (ending around 1600). While we are lacking precise information about what the vegetation within Bandelier looked like (i.e. structure and composition) between 1600 and 1880, historic accounts from oral, written and photographic records provide some general impressions. Age class information can provide a higher resolution record of pre-1880 forest structure, but only for the specific sites sampled. In addition, defining precise structural targets is complicated by spatial and temporal variability inherent in plant communities as mediated by site conditions, climate and their effects on individual species recruitment and mortality. Process oriented, functional definitions for target conditions (i.e. in terms of a historic fire frequency and fire behavior) may be more practical since they acknowledge the inherent variability in natural systems. In addition, functional definitions can provide a realistic measure of community stability, since processes like fire can be directly correlated with stand structure. Since desired future conditions cannot be precisely defined on the basis of existing information, only general recommendations will be made. Target conditions will be defined from both a structural and functional perspective. As additional information becomes available, we will continue to refine management objectives relative to desired future conditions.

The vegetation of Bandelier was still recovering from the effects of pre-historic human landuse when historic landuse activities began around 1800. Aboriginal occupation of the Bandelier area for nearly 500 years and ending around 1600 is thought to have yielded an 'unnatural' landscape shaped by the needs of a pre-industrial civilization. In particular, fire frequency, tree density, and ungulate populations could have been significantly affected by pre-historic landuse. After

abandonment in 1600, the system would have begun to adjust to the loss of the disturbance regime associated with a resident population. A pulse of woody plant establishment into former agricultural lands and a rebound of ungulate populations could have been a few of the changes resulting.

Around 1880, historic land use activities intensified (i.e. logging, fuel-wooding, grazing, hunting, and fire suppression) began to noticeably affect plant communities. Ponderosa and mixed coniferous forests were timbered, fence posts and fuel wood were extracted from accessible woodlands, animals were hunted (often to the point of local extirpation), fires were suppressed, and the entire landscape was intensively grazed by domestic livestock. Beginning around 1916, many of these consumptive activities ceased, although cattle grazing continued through 1940 and a population of feral burros was present until the mid-1980's. During the last five hundred years, local plant communities have been shaped by intermittent human land-use; extant plant communities at Bandelier are a product of this history of human use and disturbance, and disruption or alteration of communities and processes.

Increases in woody plant density across the landscape is the major legacy of historic grazing and fire suppression activities. More recently, the alteration of water regimes along the Rio Grande corridor resulting from irrigation, flood and sediment control activities has affected riparian habitat. Beginning in the early 1980's, park lands below 5460 feet (1664 meters) in White Rock Canyon along the Rio Grande have been seasonally inundated by Cochiti Reservoir in the context of flood and sediment control by the operation of Cochiti Dam. Extended periods of inundation during the mid-1980's killed all living vegetation within the flood zone and deposited many feet of silt. Native soils and natural habitats were altered; cottonwood bosques, springs and seeps and other riparian settings were displaced with sterile mudflats and subsequent dense growth of agricultural weeds.

A general discussion of three major resource management issues at Bandelier (fire, erosion, and ungulates) provides an overview of historical landuse patterns and their impacts on the Bandelier landscape and vegetation.

Fire

Most plant communities in Bandelier are fire-dependent. Prior to the 1880s, the average fire frequency in ponderosa pine forests was less than 10 years and extensive crown fire behavior was rare (Allen 1989). This regular, low intensity fire regime was interrupted during the last century with near cessation of fire as a result of grazing and fire suppression activities. Since 1976, over half of the area dominated by Ponderosa forests within Bandelier has burned under high intensity, crown fire conditions (1977 La Mesa and 1996 Dome Fires). In spring 2000 a large wildfire (Cerro Grande Fire) burned a significant portion of the Ponderosa community on the Pajarito Plateau from Bandelier north to Santa Clara Pueblo.

Fire has played a significant role in the evolution and maintenance of the park's plant communities. Prior to 1880, accumulations of dead and down plant material were regularly

consumed by periodic surface fire events. This cycle was interrupted with utilization of the area for livestock grazing, timber extraction, and settlement. After 1880, when livestock grazing and fire suppression activities became prevalent, widespread fire events were effectively eliminated. As a result of these historic land management practices, the structure and composition of the pre-1880 plant communities changed dramatically. Without culling effects of periodic fire, upland forests, pine savannas, woodland systems, and former grass/ shrub dominated communities have all sustained dramatic increases in tree stem densities during the last 150 years. Collectively, these conditions can support high-intensity wildfires in upland forests, such as the 1977 La Mesa and 1996 Dome wildfires, which cumulatively burnt nearly one-half of the monument. Post-fire flooding and erosion have resulted in long-term damage to soils, native plant communities, aquatic systems, and cultural resources. In lower elevation, woodland systems these same structural changes have resulted in accelerated erosion.

Erosion

Degraded piñon-juniper woodland communities occupy thousands of hectares within Bandelier National Monument. Grazing history, loss of a fire regime, and periodic drought during the last 120 years are thought to be the causative factors of the overstocked and degraded nature of many of the woodlands in our area. As increasing tree cover supplanted herbaceous cover, savanna like communities were gradually transformed into closed woodlands. Interspaces between trees are currently characterized by scant herbaceous cover and exposed, rapidly eroding soils.

Age class information from piñon-juniper study sites in our area suggest an exponential increase in piñon-juniper stem densities in former savanna areas beginning around 1880 (Allen, pers. comm.; Davenport and others, 1996; Gottfried and others, 1995;). Piñon and juniper also expanded their ranges, with both species invading upslope into ponderosa pine dominated forests and juniper invading downslope into former shrub and grassland communities (Gottfried and others, 1995).

Active soil erosion on degraded piñon-juniper sites during the last fifty years is clearly evidenced by exposed soils and bedrock, soil pedestals, lobes of active sediment and sediment accumulation behind fallen logs (Davenport, 1997). On the basis of both soil erosion bridge and sediment catchment data, soil loss within degraded piñon-juniper communities at Bandelier can be conservatively estimated at 1 cm per decade; an unsustainable rate given shallow soils with average depths of 1.0 to 12.0 dm (Davenport, 1997; Davenport and others, 1996; Wilcox and Breshears, 1995). Rapid soil loss in degraded piñon-juniper communities threatens the integrity of the thousands of pre-historic cultural sites located within Bandelier National Monument. Over 75% of the known pre-historic sites at Bandelier National Monument occur within piñon-juniper communities; of these cultural sites, nearly 80% percent have sustained erosional impacts (Mozzillo, 1999).

Overstocked with young trees and lacking an effective ground cover, degraded piñon-juniper systems are poorly equipped to manage limited soil and water resources. These degraded communities can yield significant amounts of runoff and sediment, at various scales, particularly

from bare ground interspaces during high intensity summer thunderstorms (Wilcox and others, 1996a,b). Freeze-thaw action on exposed soils is thought to facilitate erosional processes, both by inhibiting new plant establishment through root shear effects and by creating light textured crusts vulnerable to the forces of wind and rain. Harsh physical site conditions, characterized by exposed, nutrient poor soils, impose severe restrictions on the successful establishment of new herbaceous plants.

Ungulates

Elk numbers have increased dramatically during the last 30 years in and near Bandelier National Monument. Locally extirpated by the turn of the century, elk were reintroduced into the Jemez Mountains in the mid-1900's. Today, large numbers of elk and deer are causing visible damage to both cultural and natural resources in the park. Within the park, deer have been reported at habitat-damaging levels since at least the 1950's. Heavy grazing and browsing by elk and deer along with associated soil trampling appear to be changing forest and grassland structure, changing habitat compositions, contributing to losses of cultural resources, and magnifying high erosion rates in piñon-juniper habitats.

Elimination or reduction of local top carnivores (i.e. mexican gray wolves) combined with hunting restrictions in the park and adjoining national laboratory lands, has enabled reintroduced populations of elk to grow exponentially, with indeterminate effects on vegetation, soils, and cultural resources.

Elk can inflict considerable damage to plants, particularly to aspen by eating the bark in winter or by direct browsing of regenerating shoots (DeByle 1985). Aspen stands are now being de-barked by elk throughout most of the eastern half of the Jemez Mountains. Aspen stands that re-sprouted after the Dome and La Mesa Fires have been browsed by elk to an extent that the continued survival of the aspen clones appears questionable. Shattered rosettes of Yucca and shaping of favored browse shrubs clearly document elk browsing pressures in piñon-juniper woodlands. The stature of *Holodiscus*, a shrub in open grasslands on Cerro Grande, and *Ceanothus*, a shrub in the La Mesa burn areas have also been shaped by heavy browsing pressure.

Elk antler-rubs are slowing tree establishment in the La Mesa Fire burn area and a concern has developed that ungulate pressures have constrained recovery of herbaceous vegetative from historic overgrazing. Finally ungulate grazing pressures are of concern in mechanically restored woodlands where elk and deer greedily consume cool season grasses and shrubs reinvigorated by thinning and slash treatments.

VEGETATION CLASSIFICATION

The Vegetation Types classification presented below was developed for management purposes, to provide convenient and easily recognized groupings of major plant assemblages which occur at Bandelier. This classification is useful primarily at a landscape scale and field observers should expect considerable variability within the defined types.

Higher elevation communities, such as ponderosa and mixed coniferous types, extend down canyon systems in an attenuated pattern below their normal elevation range as a result of micro-climatic conditions. The sharp topographic, soil, and moisture boundaries typical of canyon systems support unique assemblages of vegetation which are classified here as canyon slope and canyon bottom complexes. An overview of the vegetation cover types at Bandelier and their relative distribution can be seen on the accompanying vegetation maps of Bandelier: Main Unit (figure 2a) and Tsankawi Unit (figure 2b).

Desired future conditions are included as a component of each vegetation type to reflect management objectives relative to existing conditions. However to the extent desired future conditions are based on our assessment of pre-European settlement conditions, our ability to quantify target community structure and composition is severely limited by a lack of historical data. Some general themes relating to historic overgrazing and loss of fire regime are presented.

As a direct result of historic overgrazing and associated loss of natural fire regimes, most extant plant communities at Bandelier are thought to have higher woody stem densities and fuel loading (and lower herbaceous cover and biomass) than at time of European contact (see previous section: HISTORIC LANDUSE AND RESOURCE IMPACTS for additional details). These trends have yielded accelerated erosion within the woodland and juniper savanna zones, increased fire hazard within the ponderosa and mixed coniferous zones. Desired future conditions from a whole park perspective would be reversal of these broad trends and restoration of native plant communities both relative to species composition and former range. Complicating simplistic restoration efforts based on reintroduction of fire are continued grazing pressures from native ungulate populations and inherent limitations of reducing tree density with prescribed fire alone. While not quantitative, these desired future conditions do provide management a relative target condition which can be realized incrementally through the re-introduction of fire and related attempts to restore natural conditions at Bandelier.

A general elevational sequence of the major vegetation cover types within Bandelier from the eastern boundary of the monument along the Rio Grande at 5,300 ft to the summit of Cerro Grande at 10,200 ft would proceed as follows: juniper-shrub-grasslands occur from 5,300 ft to approximately 6,200 ft; piñon-juniper woodlands from 6,200 to 7,000 ft; ponderosa pine forests 7,000 to 7,500 ft; and mixed conifer forests consisting of ponderosa pine, Douglas fir, white fir, Engelmann spruce, blue spruce, aspen, and limber pine from 7,500 to 10,200 ft. Grassland, shrub, and aspen types are found on southerly exposures within the mixed conifer zone. Detailed descriptions of vegetation communities follow (also see Appendix B for a plant species list).

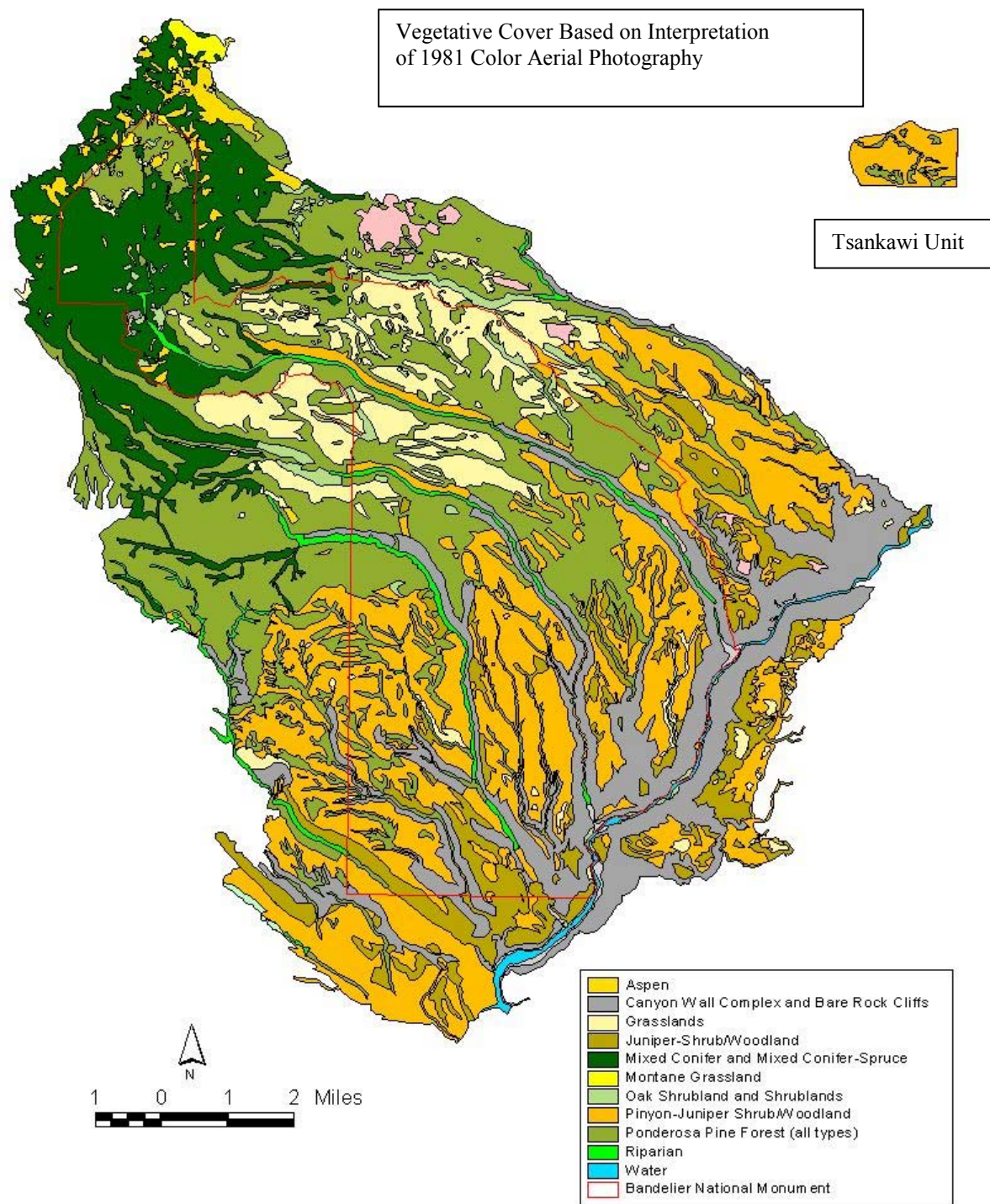


Figure 2. Vegetation Map of Banderlier National Mounument
Main Unit (boundary outlined in red) and detached Tsankawi Unit (upper right inset)

Vegetation Types and Complexes

Juniper-Shrub-Grasslands:

Characterized by the presence of a one-seed juniper overstory (not infrequently as a result of tree invasion since 1880) with an understory of various shrubs, grasses and forbs. Typical shrubs may include wavyleaf oak, mountain mahogany, skunk bush, apache plume, rabbit brush, and big sagebrush. This type is found on the lower mesas and canyon slopes and on elevated benches along the Rio Grande corridor. In addition to relict juniper savanna communities, this type incorporates former shrub and grassland communities recently invaded by juniper as a result of historic grazing and loss of fire regime.

Desired future conditions for this type include grass, forb, and shrub dominated communities with scattered mature trees (<5% cover) and herbaceous ground cover sufficient to stabilize soils and carry fire (at intervals of less than 5 years). Isolated patches of juniper dominated woodland (canopy cover >30%) may occur on shallow soil or rocky substrate sites.

Piñon-Juniper Savanna and Woodlands:

Generally characterized by overstory dominance of Colorado pinyon pine and/ or one-seed juniper overstory with a potentially diverse shrub, grass and forb understory. Dominant shrubs include wavyleaf oak and mountain mahogany. This community is located elevationally between the Juniper-Shrub-Grasslands and Ponderosa Pine types and is distinguished from the former by increased tree canopy cover and presence of pinyon pine. Embedded within this type are at least two distinct entities: older growth woodlands on rocky, shallow soil sites and recently invaded savanna communities on deeper, more productive soil sites; desired future conditions are described below. Piñon and juniper have expanded their ranges upslope into the ponderosa understory while juniper has invaded downslope into former grassland and shrub dominated communities; density of trees has increased dramatically throughout. These changes are thought to be a result of historic grazing and loss of fire regime since 1880. Alligator juniper becomes an important component of woodlands on steep rocky slopes in the southern portion of the monument.

PJ Savanna: Desired future conditions in this type envision a savanna-like community that maximizes a diverse shrub and grass-forb understory. Major tree species include both piñon and juniper in varying proportions depending on local site conditions. Mature tree canopy coverage averages less than 15%, with herbaceous and/ or shrub ground cover sufficient to stabilize soils and carry fire (at intervals of 10-15 years). These communities would typically be located on deeper and more productive soil sites where sufficient herbaceous cover can sustain frequent fires of intensity necessary to maintain open stand structure.

PJ Woodland: Desired future conditions in this type envision tree dominated woodland communities with canopy coverages generally exceeding 30%; herbaceous understories are sparse with fire return intervals in excess of 25 years. These communities would typically be located on rocky, shallow soil sites which limit herbaceous productivity, limit fire frequency and intensity, and promote woody plant dominance.

Ponderosa Pine Savannas and Forest:

Dominated by a mature ponderosa pine mature tree overstory (from open savanna structure to closed canopy) with a variety of grass-forb, shrub and tree understories depending elevation and aspect as well as recent fire history. Fire suppression and overgrazing in ponderosa pine forests have resulted in both increasing stand densities of ponderosa as well as recruitment of pinyon-juniper (upslope) and mixed conifer (downslope). Areas recently altered by catastrophic crown fire (i.e. La Mesa and Dome fire areas) are included under other grassland types since they are currently lacking the characteristic mature Ponderosa pine overstory.

Desired future conditions for this type are communities with ponderosa pine as the dominant tree overstory, but encompassing a both a wide range of cover values (from open savanna with ~5% mature tree cover to nearly closed canopy) and mixed age structure (i.e. seedlings, pole trees, overstory trees, dead snags and dead and down logs). Trees in excess of several hundred years would be scattered throughout with understories of grass-forb, shrub, and other tree species variable depending on aspect, elevation, and time since last fire. Overstory tree canopy cover and understory ladder fuels would generally be broken and patchy, effectively mitigating opportunities for continuous crown fire runs, while allowing limited torching of closed canopy patches. Accumulations of ground fuels (litter, duff, slash, logs, etc.) would be consumed periodically by low intensity, ground fire avoiding widespread damage to soils, mature canopy root systems, and perennial herbaceous cover.

Cottonwood Bosques:

A riparian vegetation type found along low gradient portions of the Rio Grande and tributary canyons (at or below 6000 ft. elevation) including canyon mouths. Narrowleaf cottonwood and boxelder maple are major overstory components in the tributary canyons, with Rio Grande cottonwood becoming along the Rio Grande. Dominant shrubs include New Mexico Olive. Some of our cottonwood bosque type, homogeneous in age structure, suggests rapid and uniform establishment following intensive landuse disturbance. We are currently experiencing high levels of mortality from tree fall and disease in these uniform stands. Former bosque areas along the Rio Grande and at the mouths of tributary canyons, recently extirpated by Cochiti reservoir water holding events, are included in this vegetation type since there is an expectation that the bosque will re-establish itself. Episodic loss and re-establishment of even aged bosque stands may be a natural disturbance pattern for this type, although perhaps not desirable from a management perspective.

Desired future conditions for this type are forests dominated by mature cottonwood with a secondary overstory of box elder. Overstory age structure represents a series of distinct cohorts structure and diverse assemblage of understory species indicate that dynamic disturbance conditions necessary for periodic recruitment are in place.

Rio Grande Springs and Seeps:

Springs and seeps, emitting from the base of canyon slopes at or just above river level along the

Rio Grande, are floristically diverse and support a variety of native riparian plant life. Unfortunately, nearly all the seeps and spring areas along the Rio Grande within Bandelier National Monument were impacted by Cochiti backwaters and thus this habitat type is essentially absent from the monument. Comparable examples of this type are still present immediately upstream of the monument.

Desired future conditions would maintain these communities intact without obvious impacts from cattle grazing, LANL activities, or reservoir holding events. The former habitat within Bandelier was essentially destroyed by siltation and capping of the perched aquifer as a result of reservoir operations beginning around 1980.

Mixed Conifer Forests:

These forests, occurring on mountain slopes and within upper canyon drainages, are characterized by a mixed overstory of mostly coniferous species (i.e. dominated by Engelman Spruce and Douglas Fir with subdominants being Ponderosa Pine, White Fir, Aspen, and Limber Pine. Blue spruce is common in mesic meadow situations where it may form nearly pure stands. . Engelman Spruce and Douglas Fir are common throughout with Ponderosa Pine becoming dominant on dry mountain slopes and ridges. In the absence of fire, aspen clones can become over topped by coniferous species; grazing pressures can accelerate this conversion of aspen to mixed conifer type through the combined effects of browsing on aspen saplings and consumption of fine fuels. At high elevations on northern exposures (primarily outside park boundaries) Corkbark Fir also becomes an important component of the mixed conifer type. Absence of fire from this type, as a result of fire suppression activities, has resulted in increased densities of the more shade tolerant trees in the understory, reduced herbaceous and shrub cover, and heavy fuel loading. Within this type are two sub-components distinguished by stand structure and species composition and a function of location and fire regime.

The common and widespread sub-component is distinguished by uneven stand structure with older growth, open stand structure, and an herbaceous/ shrub understory maintained by fire return intervals less than 15 years much like the lower elevation Ponderosa community. The second sub-component is more limited in extent; it is distinguished by a uniform, even-aged stand structure which is maintained by episodic crown fire return intervals (>100 years) and is often localized to steep, upper elevation or canyon system, north facing slopes. The cool, moist conditions in these settings and associated species composition that produces compact ground litter, precludes ground fire in most years. Even aged structure is reflective of episodic mortality and establishment following fire events.

Uneven Age Type: Desired future conditions for the common sub-component are mixed conifer forests with several species sharing dominance depending on local site conditions and with a full range of age classes (i.e. seedlings, pole trees, overstory trees, dead snags and dead and down logs. Trees in excess of several hundred years would be scattered throughout with understories of grass-forb, shrub, and other tree species variable depending on aspect, elevation, and time since last fire. Overstory tree canopy cover and understory ladder fuels would be broken and

patchy, effectively mitigating opportunities for continuous crown fire runs, while allowing limited torching of canopy patches. Accumulations of ground fuels (litter, duff, slash, logs, etc.) would be consumed periodically by low intensity, ground fire avoiding widespread damage to soils, mature canopy root systems, and perennial herbaceous cover. Fire disturbance would likely reveal former patches of montane meadow, aspen, and ponderosa types now embedded within the mixed conifer.

Uniform Age Type: Desired future conditions for the uniform mixed conifer type would be similar to current conditions with expectations that episodic crown fire will continue to impose mortality and recruitment cycles in excess of 100 years and maintain uniform stand structure. Park management may need to manage the perimeters of this type to minimize risk of crown fire escaping defined boundaries.

Aspen Groves:

These communities are dominated by an overstory of Aspen (often to the exclusion of other species in healthy clones) with an understory of grass/ forb; considered a potentially long-lived, but fire dependent seral stage which colonizes 'holes' created in mixed coniferous forests created by crown fire. These aspen clones will yield dominance to mixed conifer establishment in the absence of 'renewal' by periodic fire and/ or under sustained ungulate browsing pressures.

Desired future conditions for this type include maintenance and local expansion of existing clones through periodic fire disturbance and ungulate management. This is a dynamic community which is dependent on episodic fire mortality, sprouting and establishment to maintain itself. In addition, any loss of existing clones would be compensated by establishment of new clones in localized crown fire holes of the mixed coniferous type.

Montane Grasslands, Wet Meadows and other grassland types:

This assemblage includes several grass dominated communities currently distributed as localized patches and becoming embedded within the mixed coniferous type through progressive tree invasion. Montane grasslands are grass and forb dominated openings within mixed conifer or aspen forests on southerly exposures of upper mountain slopes. Occasionally intermingled with montane meadows are rock fields (felsenmeers) which can support patchy shrub and forb growth where soils have accumulated. Wet meadow areas are similarly situated grassy openings within mixed conifer forests, but located at the low gradient base of mountain slopes where snow runoff accumulates in late spring. Other montane grasslands includes those grassy areas of more recent origin which may exist as a result of recent crown fire or mechanical clearing and whose species mix has been influenced by seeding of non-native grasses such as timothy. All of these grasslands are interspersed with or bounded by stands of mixed conifer and aspen and can be considered a fire dependent seral stage since they will yield to mixed conifer establishment in the absence of fire. Patches of shrub (i.e. gambel oak and mountain spray) and scattered coniferous trees are often present in all types. In addition to active fire suppression, some of these grassland areas (i.e. wet meadows) have been subject to intensive overgrazing which has facilitated the establishment of exotic perennial grasses and forbs (i.e. white clover, dandelion, and blue grass).

Other grassland types include former Ponderosa forest converted to grass and shrub (gambel oak and New Mexico locust) dominated systems by recent catastrophic crown fire; recovery of these areas to forest is not anticipated for several hundred years.

Desired future conditions for these grassland types would expand existing acreage to reclaim areas recently colonized by mixed coniferous type during the last 100+ years. Native herbaceous (grass and forb) and shrub species should predominate (with <5% tree cover) and cover of naturalized exotic species should be steady to declining. Boundaries of grassland and forest type continue to be dynamic over the span of hundreds of years relative to fire disturbance regime and climatic patterns. Restoration actions (mechanical, chemical, and fire) will be necessary to initiate reclamation of former grassland areas.

Canyon slope complex:

This complex resembles the vegetation type on adjacent mesas and mountain slopes, but with additional floristic elements favoring steep, rocky or extreme north/south exposures as well. Reference should always be made to the dominant overstory vegetation (i.e. Pinyon-Juniper, Ponderosa, and Mixed Coniferous canyon slope complex). Within the upper elevation mixed coniferous type, the canyon slope community is not distinguishable from the adjacent mountain slope and mesatop communities. At lower elevations, the canyon slope complex becomes more distinct from the adjacent mesatop vegetation types (i.e. lower elevation Ponderosa and Pinyon-Juniper Woodlands) and relative to these has lower densities of trees, higher densities of shrubs, and a more robust grass cover. Typical shrubs on lower elevation canyon slopes may include Wavyleaf Oak, Mountain Mahogany, Mock Orange and Mountain Spray. Predominance of junipers less than several hundred years in age across many of the lower canyon slopes may suggest either grazing pressures interrupted fire regimes by consuming fire fuels or severe drought truncated age structure. The often rocky substrate of canyon slopes afford enhanced stability to plants established in favorable microsites and steep slopes have limited the potential for grazing. Intense fire runs have converted portions of formerly forested canyon slopes (at all elevations) into shrub communities. Fire regimes on canyon slopes have not been well documented but could be expected to be within the low end of ranges reported for adjacent communities given adequate continuity of fuels; with poor fuel continuity typical of rocky substrate areas, fire occurrence was undoubtedly much less frequent than in adjacent communities.

Desired future conditions for this complex are maintenance of existing conditions, since this is considered to be one of the most intact plant communities within the monument.

Canyon bottom complex:

This complex is a narrow riparian zone which includes dominant overstory elements from vegetation types immediately upslope and those additional floristic elements requiring enhanced moisture regimes. Reference should always be made to the dominant overstory vegetation (i.e. Pinyon-Juniper, Ponderosa, or Mixed conifer canyon bottom complex). Some common species associated with this riparian zone include: narrowleaf cottonwood, boxelder, mountain maple,

birch, alder, gambel oak, cherry and New Mexico Olive. Most of Bandelier's sensitive plants are associated with the perennial moisture found in the upper canyons areas. Periodic beaver dam activity within this zone has left notable impacts in the form of abandoned dams and associated pond terraces (upper canyon) and mortality through cutting of numerous large diameter cottonwoods (lower canyon). This is a fairly intact community in most areas where the historic use was limited to seasonal grazing; areas developed for more intensive uses such as Frijoles Canyons between Long House and the Stable (i.e. agriculture, housing, and visitor use) can be dominated by exotic perennial grasses or invasive native shrubs. Fire regimes for canyon bottom areas are comparable to the adjacent community.

Desired future conditions for this complex would include maintenance of dominant native overstory and understory species with associated reduction of exotic species. Maintenance of stable watershed conditions (i.e. through maintenance of effective vegetative cover) and high water quality are also desired features of this system. Discharge and water quality are measured quantitatively at the Frijoles Gauge and there is a nearly 25 year record as of 2000.

MANAGEMENT ZONE DEFINITIONS AND STANDARDS

Three general vegetation management zones are defined and standards presented for each: designated wilderness and undeveloped (ZONE I), national historic landscape district (ZONE II), and non-historic developed (ZONE III). Vegetation Management Zones (figure 3) depicts approximate boundaries for each vegetation management zone; itemized listings of all areas encompassed within each zone and applicable standards are detailed below.

Certain existing land uses (i.e. cultural resources, official trails, residential garden and lawns, historic gardens and lawns) and management activities may override or supplement general management zones. For example, pre-historic cultural resources are present within all three zones and any vegetation management which potentially affects these resources must be consistent with applicable cultural resource preservation standards. Likewise, many component vegetation management programs (i.e. prescribed fire, fire suppression, hazard tree removal, restoration and exotic plant control) transcend general management zones.

ZONE I (Designated Wilderness and Undeveloped Areas):

Included within this zone are the majority of park lands, including all land area which was officially designated as wilderness in 1976, as well as the upper portion of the Frijoles watershed (new acquisition), the buffer lands between the north rim of Frijoles Canyon and Hwy 4, and all of Tsankawi excluding the immediate vicinity of the visitor contact station.

No manipulation of the vegetation is permitted in this zone except as prescribed under existing land uses (i.e. maintenance of official trails), management actions affecting multiple zones (i.e. prescribed fire, woodland restoration, hazard tree mitigation and exotic plant control) and officially sanctioned traditional uses by native peoples. Desired future conditions are those necessary to support a naturally functioning ecosystem and as may have existed between 1600 and 1880. Also see: Wilderness Stewardship Plan.

ZONE II (National Historic Landmark District):

This zone encompasses most of the Frijoles Canyon developed area including: park headquarters, canyon residential area, visitor facilities, cottonwood picnic area, main parking area, stables proper (absent the stable road residential and storage areas), main loop trail system up to Ceremonial Cave, Abbott/ Frey orchard and irrigation system as well as the firetower, entrance station, scenic overlook, and entrance road corridor. Also included in this zone is the developed basecamp cabin vicinity.

A wide range of vegetation management activities may occur within this zone (i.e. display gardens, residential gardens, lawns, tree pruning and removal, etc.), but these activities must be consistent with any restrictions or guidelines imposed by the historic context. Desired future conditions are those which preserve and maintain the historic district consistent with its original design and purpose and in a manner compatible with NPS standards. Also see: Bandelier Historic Landscape Survey and Historic Structures Report.

ZONE III (Non-Historic Developed Areas):

This zone includes the mesa top residential area, mesa boneyard, Hwy 4 gravel yard, sewage treatment facilities, Juniper and Ponderosa campgrounds, amphitheater, stable road residential and storage areas, trail head parking areas and miscellaneous service roads, and immediate vicinity of the Tsankawi Visitor Contact Station.

Vegetation management actions within this zone are limited by the policies and guidelines of the National Park Service and the stated philosophy of park management (as detailed in approved plans and guidelines) at Bandelier. Non-invasive exotic plantings of a short lived nature (i.e. 1-3 years) are allowable in the context of flower and vegetable gardens. Existing lawns of non-native grass may continue to be maintained, but only locally native blue gramma seed may be used for reseeded. Existing exotic woody plants will be removed if considered a likely source of invasive propagules (i.e. targeted species including: Russian Olive, Siberian Elm, Tree of Heaven). Desired future vegetative conditions for these diverse non-historic developed areas are to mitigate impacts to native vegetation and plant communities.

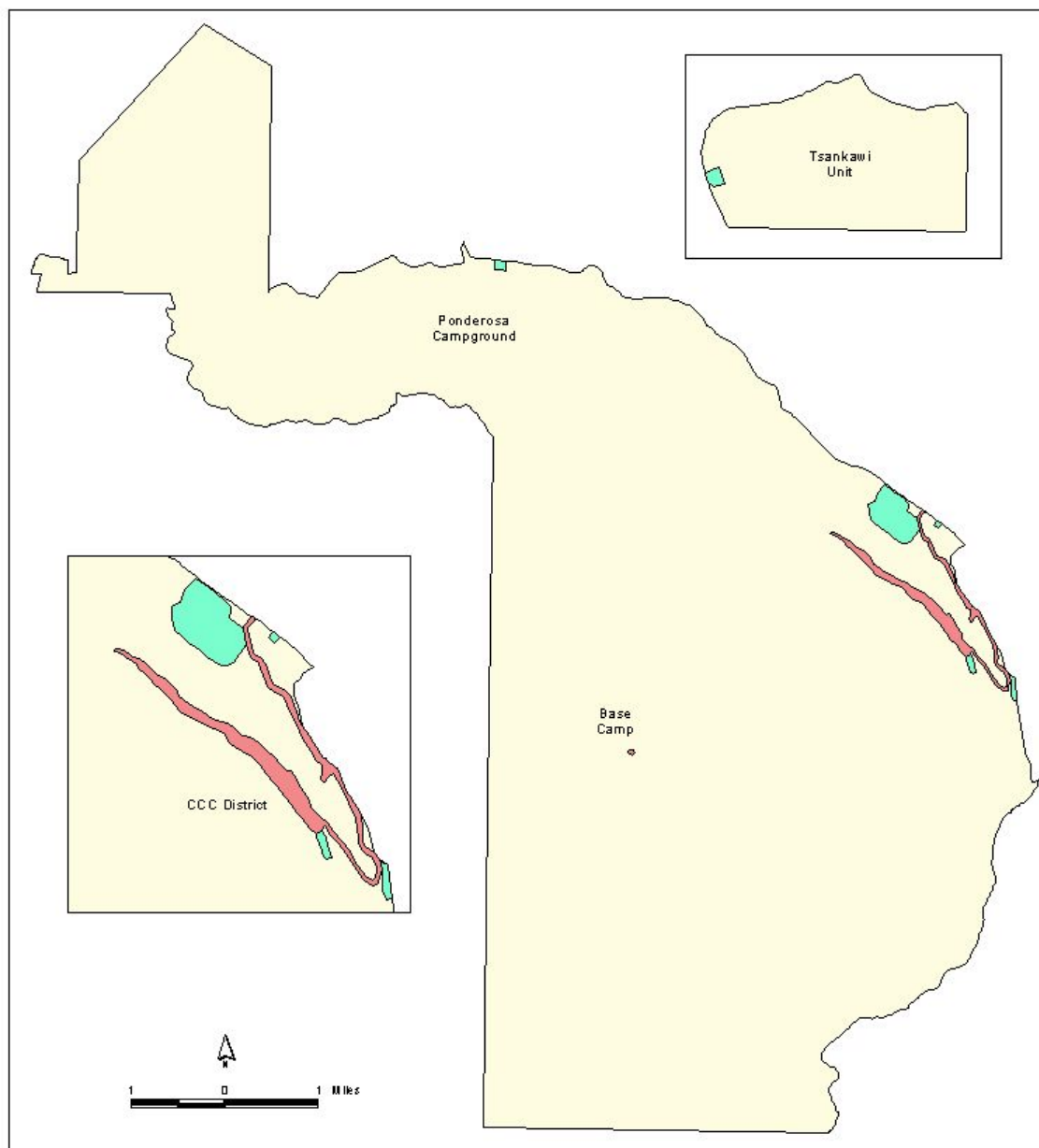
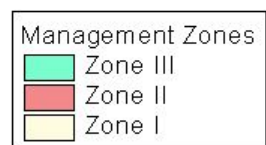


Figure 3. Management Zones



PART III

VEGETATION MANAGEMENT ISSUES

AND

STANDARD OPERATION PROCEDURES

Overview

This plan is intended to be an in-house reference manual for vegetation management and will provide a general context for vegetation management at Bandelier. The scope of the current plan will include only those issues and actions deemed by the park to be routine or non-controversial. These include roads, trails, and other developed areas or infrastructure maintenance, sensitive and exotic plant management, hazard tree mitigation, and limited actions as necessary to mitigate imminent damage to historic or cultural resources. Routine issues and associated standard operation procedures are organized as outlined below. The intent of the following section is to detail the range and scope of standard operating procedures for vegetation management which can generally be implemented without need for additional consultation with resource or compliance specialists. Additional consultation with a resource specialist is required prior to implementation of any actions either not described or when proposed actions would differ materially in purpose or scope. A separate listing of potentially controversial issues beyond the scope of this document are briefly discussed under **Vegetation Management Issues Not Addressed**.

Vegetation Management Issues:

Infrastructure Maintenance Guidelines

Miscellaneous Vegetation Management Techniques

Cultural Landscape Management (Historic and Pre-historic)

Roads Operations

Trail Operations

Developed Landscapes (Non-Historic)

Exotic Species Management

Hazard Tree Management

Sensitive Plant Management

Integrated Pest Management

Infrastructure Maintenance Guidelines

Infrastructure maintenance includes all routine activities necessary to properly maintain park infrastructure with regard to vegetation and references how park maintenance activities may affect vegetation resources. Infrastructure maintenance includes three major categories, Road Maintenance, Trail Maintenance and Developed Landscape Maintenance. Standard Operating Procedures follow identified sub-issues within each of these three categories. Miscellaneous vegetation management techniques are detailed below.

The park should strive for developed landscapes which present as natural a scene as practical, while also ensuring visitor and employee safety. For example, developed area plantings should generally be native (except as noted for historic areas) with selections and densities approximating adjacent plant communities. For aesthetic reasons, complete removal of individuals is preferred when extensive pruning would otherwise be required to meet objectives. To mitigate noise, raking of leaves, splitting of wood, clearing of snow and sand/cinders should be accomplished when feasible with non-motorized equipment.

Miscellaneous Vegetation Maintenance Techniques

Following are some Standard Operating Procedures which provide standard vegetation management techniques generally applicable throughout the park.

STANDARD OPERATING PROCEDURES:

Pruning:

Remove branches off of shrubs and trees by using a two step method: 1) cut off the main bulk of branch using an undercut/ top cut method and about 6-12 inches from trunk and, 2) make the final cut nearly flush with the main trunk leaving a ½ inch stub. Do not treat wounds with paint. Any individual which would require topping or severe pruning to meet objectives should be flush cut at base. Succulents like cacti and yucca's are not amenable to standard pruning techniques and should be severed at the root crown below grade.

Tree Removal:

Trees should be felled by only certified sawyers using approved methods. All stumps should be flush cut and concealed with dirt and litter. Trunk sections should be turned so flush cut is away from visibility or alternatively, roughened up with an axe. In the front country, trunk sections less than five feet length and all branches should be hauled to the gravel yard. Deciduous trees with the potential to re-sprout should be treated with approved herbicide immediately after cutting; either brush or spray the herbicide onto the fresh wound or drill one inch deep boreholes into stump face and fill.

Litter Removal:

It is only appropriate to collect and remove litter (i.e. fallen leaves and small branches) from developed areas and paved roads/trails. Along a corridor, small amounts of litter may be simply brushed onto the right of way. Large amounts of litter, such as may be collected from developed lawn areas, should be stockpiled for use in restoration efforts at the gravel yard area. Alternatively, residents with designated garden areas may use the material for mulch. Large amounts of litter (i.e. fall leaves) should not never be dumped into forest areas adjacent to

developed areas as has been the practice in the headquarters area.

Disposal and stockpiling of vegetative debris including raked leaves and wood ashes

Trunk sections less than 5 feet in length should normally should be hauled to the gravel yard for use as fuel wood since leaving them in developed areas poses both aesthetic and fire hazard concerns. Any cut logs remaining at a site should be turned so as to minimize exposure of cut surfaces. Branches of pinyon and juniper should be stockpiled as needed at the gravel yard for revegetation projects. Rootballs, stumps or other unusable logs or branches generated as result of treework, should hauled to the gravel yard and either burned or subsequently hauled to the county landfill. Raked leaves should likewise be hauled to the gravel yard and either burned or subsequently hauled to the county landfill. Wood ashes from fireplaces should only be disposed of in designated, non-flammable barrels; ash accumulation in these barrels should be periodically dumped at the county landfill.

Soil Salvage:

Top soil should be salvaged whenever possible in advance of a construction project. Since topsoil is alive with viable seed, soil fungi and microorganisms, it is important to store properly and minimize the storage period if possible. Soil should be stored in windrowed piles not to exceed six feet high by eight feet wide; they should be watered periodically to encourage plant growth and prevent drying out. Storage in partial shade or covered with a breathable mesh shade cloth is preferred. Subsoil and rock should also be salvaged even if not needed for the current project. These materials can be sorted and piled in the gravel yard area until needed.

Plant Materials Collection/ Salvage:

Collection of native seed material is generally not of any significant ecological consequence; the only restrictions apply to collection of seed material from sensitive plant species. Collection or salvage of native plant materials should only be done with prior clearance and approval of the vegetation management specialist. Collection and/ or salvage areas must be identified by the vegetation specialist; in many cases the individual to be collected or salvaged will also be identified. Only smaller individuals will typically be collected or salvaged since larger wild grown individuals will often have developed sprawling root systems which cannot be successfully transplanted without the use of mechanized tree spades. Hand tools (spade and garden cart) will be used for all plant materials collection outside of construction sites, to allow access to a variety of collection areas without the associated damage typically resulting from use of heavy machinery. Salvage materials will be stored in the vicinity of the park greenhouse.

Cultural Landscape Management

Cultural resources management may require manipulation of vegetation in order to accomplish stabilization or preservation objectives (i.e. mitigate heat effects from fire, limit physical damage from trees, or stabilize soils). The basic approaches to vegetation management presented elsewhere apply, but the cultural context may necessitate application of modified techniques to accommodate special concerns.

Historic Landscapes

These areas are located within the historic district and were originally constructed and planted by the CCC between 1934 and 1940. In addition, the historic landscape includes persisting remnants of the pre-CCC historic landscape (i.e. orchard and other miscellaneous plantings) created during the homesteading era. No precise planting information short of historical photos, oral history and the general intent of the CCC plantsmen is available to detail exactly what was growing in each of the historic landscape areas. No actual plant lists or planting plans for the developed area were located during preparation of the 1988 Bandelier Historic Structures Report. Most of the planting is thought to have been done in a more casual manner, with only verbal direction from the planners. Also unclear is what happened in the intervening years in terms of supplemental plantings (particularly ornamentals), plantings which died or were removed, and shading/ water competition effects of the maturing overstory. Some combination of park staff, park residents and the Frijoles Canyon Concession staff provided care and maintenance for these landscape areas in the years after the CCC left Bandelier. Regular care of many of the canyon garden and lawn areas probably lapsed when the Frijoles Lodge Concession closed in 1979. Regular care of the orchard probably lapsed many years earlier with availability of produce from outside markets. During the last ten years the current concession operation has provided intermittent attention to gardens in the gift shop/ snack bar courtyard areas. Intermittent attention to garden areas by interested staff and residents remains undocumented. Mrs. Frey, who ran the Frijoles Lodge concession operation until 1977, maintained several private residential garden areas immediately adjacent to her former residence until her death in 1988. Park maintenance of lawn areas during the last 25 years has included periodic watering, seeding, fertilization, and mowing.

The 1988 Historic Structures Report indicates that...

'The underlying intent for the vegetative plantings at the site was based in the rustic design ethic. Landscape architects concentrated on using native plant materials in a fashion that made the development -both buildings and the vegetation - seem as natural as possible in the setting. Native grasses were transplanted from the mesa top to provide a ground cover around the visitor center and in the cabin courtyard. Originally, indigeneous grasses and vegetation were planted and gave a much stronger regionalism to the developed area. In addition, these grassed areas were top dressed with forest duff and strategically placed boulders.

A concerted effort was established in May 1939 to eradicate exotic plants such as silverleaf popular, Lombardy popular, and peach trees. This task indicates that an underlying philosophy existed, defining both acceptable and unacceptable plants for Bandelier.'

and proposes...

‘altering the current management practice of fertilizing, mowing and watering the lawn areas around the visitor center to allow the lawns to return to a more natural, semiarid state.

However conversion of lawn areas by simply ceasing regular maintenance would not result in a native turf, since these lawns are currently dominated by exotic turf species. Further, lawns which receive regular use by visitors, employees or residents require considerable maintenance whether native or not. Selected historic lawn areas could potentially be converted to native turf, but this would require a separate planning process and is beyond the scope of the current plan.

In terms of the woody component, the Historic Structures Report presents photographic evidence that the developed area is overgrown by the mature shrubs and trees planted some sixty years ago as seedlings. A systematic program of thinning, pruning, and removal is proposed to lower the density of woody vegetation in order to 'restore the character of the historic landscape' as well as protect historic fabric, expose building facades and open vistas to the cliffs. While the park concurs that the historic district is overgrown relative to photos taken immediately after construction in the 1930's, it is not clear what the desired future condition should be for the mature landscape. A number of the larger box elder trees, damaging historic structures or fabric, were removed during the last twenty years in response to the 1988 Historic Structures Report, but many more remain and many of those treated in the past subsequently re-sprouted.

STANDARD OPERATING PROCEDURES:

The park is currently targeting removal of trees in the historic district when justification can be made in the context of the hazard tree program for protection of property (i.e. park infrastructure or historic fabric) or to ensure visitor/employee safety. Use of an approved herbicidal stump treatment (i.e. Pathfinder II) is necessary on box elders to prevent resprouting.

Routine maintenance of historic landscape areas requires periodic watering, fertilization (using weed-free organic fertilizer), weeding (using mechanical means), pruning, and replanting (using locally native plant materials/ seed or historically accurate ornamentals). In addition, these areas are subject to limitations imposed by both their historical context and restrictions on use of weedy, invasive species (see Appendix D, Listing of Exotic Species Not to be Cultivated at Bandelier).

Pre-historic Archeological Sites

Routine vegetation manipulation on and immediately around archeological sites requires prior concurrence by cultural resource staff, thus no recommended routine vegetation actions are presented here. Some past actions consistent with cultural resource management objectives include removal of dead trees and heavy (1000+) fuels (to mitigate heat effects prior to prescribed fire) and removal of living trees (to prevent potential structural damage from root growth and eventual tree failure).

Road Operations

Bandelier's road system includes paved entrances roads, associated parking areas and campground loops as well as dirt and graveled service and fire roads (see map 1). Also included under this category are the maintenance service areas (i.e. bone yard, gravel yard, and sewage lagoons). Roads and parking areas include the road surface, road shoulder, and road corridor. Most of the existing road and parking infrastructure will be kept and maintained as is except as necessary to implement the 1995 Development Concept Plan. One notable exception are the existing fire roads which are targeted for closure and rehabilitation as funds become available.

STANDARD OPERATING PROCEDURES:

General considerations for vegetative maintenance of gravel/ dirt road corridors with little or no public access are little different than those for the paved entrance road and associated paved parking areas and campground loops. The latter however, require much more attention to *aesthetics* and *safety* than road sections with little or no public access. In this sense, the same standards apply to all park roads, but the priorities and intensity of effort are focused on areas of high visitor use.

Pruning and removal of woody vegetation along the right of way for clearance, visibility, hazard or aesthetics reasons

Routine removal of woody vegetation, particularly young trees, from the road corridor (i.e. six to twelve feet from the road edge) is recommended to prevent loss of clearance and visibility, and to prevent root damage to the road and associated structures (i.e. gutters and walls). For pinon and juniper, complete removal by flush cutting at the base is recommended when ever extensive pruning would be required to meet objectives. Selected shrubs and trees (i.e. box elder) may require either removal of the root crown or chemical stump treatment (with an approved herbicide) to prevent resprouting.

Trees located outside of the six-twelve foot corridor or specimen trees located within the corridor may be selectively pruned. Use standard pruning methods to prevent tears in the main trunks bark (i.e. cut off main bulk of branch using undercut/ top cut method about a foot from trunk, finish off with a flush cut at main trunk; do not treat wounds with tree paint). Again, it is preferable to flush cut trees (i.e. pinon and juniper) which would require severe pruning to meet objectives. This reduces tree density along the road corridor (increasing potential for scenic vistas and providing a more effective fire break) while minimizing the tunnel effect and the number of roadside trees with obvious pruning scars.

Mowing of herbaceous vegetation along the right of way for clearance, visibility, hazard, shoulder maintenance or aesthetic reasons.

Mowing of the road shoulders is generally not permitted for routine maintenance, since mowing promotes establishment and growth of weedy plant species, while creating an artificial trimmed appearance on the road edge. However, in wet years when tall herbaceous growth poses safety concerns mowing may be necessary for proper maintenance of the road corridor; in this instance consultation with a resource specialist is required before implementation. In addition, mowing may be an appropriate technique to impact the seed crop of an undesirable exotic plant as directed by a resource specialist.

Removal of vegetation from roadside gutters, retaining walls, curbs and other structures

Routine mechanical removal of vegetation from cracks in roadside gutters, retaining walls and curbs (i.e. using hand tools) followed by cleaning and sealing of cracks is the current method of choice but requires considerable time and effort. The use of heat treatment to remove these unwanted plants, either by direct flame or steam, is also an option that needs to be evaluated. In addition, use of an approved water fast herbicide (i.e. Rodeo) may be warranted for control of unwanted vegetation on historic structures (i.e. roadside gutters and retaining walls) when mechanical or heat methods are not meeting objectives or pose unacceptable risk to historic fabric. Techniques described here are also relevant to the removal of vegetation from cracks in building, walkways and paved trails. These techniques may also be applicable to the maintenance of stabilized archeological ruins along the main loop trail where it is desirable to keep stabilized room blocks and joints free of vegetation.

Soil disturbance, removal and salvage from road or shoulder after storms or as part of routine road maintenance

Routine soil removal activities should never exceed the constructed road shoulder. In addition, excess soil should never be bladed off the road corridor since this practice widens the road scar, buries vegetation downslope and may exasperate drainage problems. Native soil removed from roads and shoulders should always be salvaged by stockpiling in the gravel yard. Non-native soils such as shoulder gravel and basecourse should be stockpiled separately or taken to the landfill.

Drainage problems

Drainage problems are best addressed through re-design and re-construction of the affected area otherwise frequent maintenance is required. Excess soil cleaned out of drainage ditches or culverts should be salvaged and stockpiled in the gravel yard. Frequent need to replace road materials or to cleanout roadside ditches/ culverts should signal the need for re-design/ re-construction efforts. Focused runoff as a result of roadway water diversion structures may create erosional problems below a road and require mitigation efforts which disperse runoff downslope.

Mowing of herbaceous vegetation around the sewage lagoons for maintenance of good air flow across the evaporative cells

Mowing and/or weed whipping of the areas within the fenced sewage lagoon enclosures is necessary to maintain adequate air flow across the cells to ensure evaporation of water from the cells. The main constraints to this activity are T&E species time frame limitations addressed in the Peregrine Site Management Plan.

Winter operations

Timely snow removal and the use of cinders and sand (i.e. no salt) have proven adequate to maintain safe road conditions in most instances. When road conditions deteriorate below acceptable levels (as recommended by the chief ranger or facility manager to the superintendent), the entrance road will be closed to all non-essential incoming traffic and visitors and commuting employees sent home. No salt or other deicing compounds are to be used at Bandelier. These chemicals have been shown to injure native vegetation, pollute surface waters and cause damage to roads and associated infrastructure.

Winter snow in excess of what can be bladed to the roadside or plowed into piles in the backpackers parking area may be hauled to the stables road parking area. Excess snow from the main parking area should never be pushed into the Frijoles drainage, since it will frequently contain cinders and petroleum products.

Excess cinders and sand left over from winter snow operations should be cleaned up in early spring, particularly from parking areas. Excess cinders/ sand along the main roadway may be swept onto the shoulder, but should never be intentionally bladed or swept beyond the road corridor unless incidentally with the plowed snow. Excess soil mixed with significant quantities cinders/sand should be hauled to the landfill (i.e. do not save as salvaged soil).

Trail Maintenance Operations

Bandelier maintains a trail infrastructure of over 70 miles, with many more miles of unofficial or abandoned trails. Only routine maintenance of official visitor or administrative trails and obliteration of unofficial or abandoned trails is permitted without additional consultation and compliance. In addition, trails may only be maintained to the standards allowed for the type of usage designated. Relative to vegetation, trails are maintained to keep the designated corridor width open by removing fallen trees or limbs and cutting back encroaching shrubs.

STANDARD OPERATING PROCEDURES:

The Bandelier Trail Maintenance Manual references a number of routine trail vegetation maintenance practices which are consistent with the current vegetation management plan, except as noted. Consistent practices excerpt from the trail maintenance manual are presented below with minor modifications. A reference to Root Outcrop Removal has been modified to emphasis retention of roots whenever possible, since these often act to stabilize the trail and removal may only exasperate erosion. A reference to Obliteration has been supplemented to encourage use of techniques presented under Disturbed Site Rehabilitation. Finally a reference to Poison Ivy, which addressed routine removal of poison ivy along trails, is rescinded by the current plan and is no longer permitted.

Windfall Removal recommends that bucked up logs or limbs not be piled alongside trail or thrown into streams, open areas, or talus slopes. Where possible, remove cut sections to low side of trail and hide or obliterate sawed ends.

Brush Trimming recommends to cut (using appropriate methods detailed under **Miscellaneous Vegetation Maintenance Techniques**) only what is necessary to allow for hiker and/or equestrian use depending on the designation of a particular trail segment. Branches trimmed from trees should be cut back as close as possible to the main trunk or fork. Limbs shall not be piled alongside the trail or thrown into streams, open areas or talus slopes. Remove cut sections to low side of trail and hide.

Root Outcrop Removal recommends root systems causing trip hazards, severe surface unevenness, and preventing a normal flow of water from a drainage course will be removed.

Exposed root systems, which are outside both the treadway and drainage, may not be removed. In addition, roots should be left whenever possible since exposed roots are symptomatic of degrading trail conditions and removal may only exasperate erosion problems.

Trail Dimensions suggest hiker trails should be brushed to a maximum width of 4 ft. and a height of 8 ft. Horse trails are not addressed specifically, but a trim width of 5 ft. and a height of 12 feet is proposed. Acceptable log and tree limb removal practices are illustrated on pages 73-74 (Figure 1A) of the trail maintenance manual.

Obliteration prescribes rehabilitation of social trails, switchback cuts, borrow pits, illegal fire circles and illegal campsites. These areas are to be reclaimed to promote natural revegetation and prevent both continued use and mitigate aesthetic impacts. Also see: Appendix I (Disturbed Site Rehabilitation Guidelines) to supplement basic trail obliteration techniques.

Developed Landscapes (Non-Historic)

Developed landscapes at Bandelier include both historic and non-historic areas. General landscape maintenance techniques are comparable for both areas, however actions within historic areas are subject to cultural resource protection mandates regarding historical context and preservation of historic fabric. Historic landscapes are treated under **Cultural Landscapes**.

These landscape areas were established in conjunction with development of the non-historic mesa residential area, Juniper and Ponderosa campgrounds, and miscellaneous maintenance facilities (i.e. sewage lagoons, bone yard, gravel yard). The park has more discretion to alter non-historic landscapes on the basis of broad resource management goals such as elimination of exotic plants, promotion of water conservation, and enhancement of the natural scene.

STANDARD OPERATING PROCEDURES:

Maintenance of non-historic landscapes are supported by the park only so far as necessary to meet the basic needs of park residents or to protect park infrastructure. Given these limitations, non-historic landscapes are similar in their routine maintenance needs to historic landscapes (see above) requiring periodic watering, mowing, pruning, fertilization (using weed-free organic fertilizer), weeding (using mechanical means), replanting of the woody component (using locally native plant materials) and reseeding of the grass component (using blue grama seed with local origins if available). These areas are also subject to restrictions in the use of weedy, invasive plantings (see Appendix D: Listing of Exotic Species Not to be Cultivated at Bandelier and Appendix E: Suggested List of Native Species for Planting in Canyon and Developed Areas). Trees can be removed as appropriate in the context of the Hazardous Tree program. Garden sites are either attached to individual residences or are 'common garden areas' for multiple residential use. These garden sites, once approved by management and cleared through cultural/ natural compliance are available to the park resident for normal gardening activities subject to the same limitations as detailed above.

Hazard Tree Management

Where ever park developed areas with accompanying visitor activities are intermixed with forested areas, a risk of damage to property and injury to visitors from tree failure exists.

Although every tree presents some degree of risk to visitors, employees, or property, only trees determined to possess both structural defects and potential targets are identified as hazardous under the standard definition. In addition to this standard concept of hazard trees (i.e. failure probability and a target), trees which might impact historic structures or fabric (i.e. walls and foundations) or park infrastructure (i.e. roads, paved pathways, and utility corridors), or which pose seasonal safety hazards (i.e. obstructing visibility or clearance due to snow weight) are also considered hazardous for the purposes of this plan.

STANDARD OPERATING PROCEDURES:

Bandelier has a hazard tree program (also see Appendix J, Bandelier Hazardous Tree SOP) in place; hazard tree inspections and recommended treatments are implemented on an annual basis.

Exotic Plant Management

Exotic plants (i.e. non-native, introduced or alien species), constitute approximately 17% of the vascular plant species occurring within Bandelier. Disturbances associated with homesteading, historic overgrazing and loss of fire regime, and post-wildfire rehabilitation facilitated the widespread establishment of weedy species in Bandelier. Losses of soil and herbaceous vegetation along with continued grazing pressures from feral and native ungulates have hampered recovery of native flora. Good management practices including restoration actions and the reintroduction of fire may provide long-term benefits to native plant communities. Despite our best efforts however, many of the introduced species already established within the park are likely to become naturalized components of the local flora.

STANDARD OPERATING PROCEDURES:

Park management seeks to minimize the impacts of these immigrants and contain their spread, but complete eradication is in most instances impractical. At Bandelier, primary efforts will be focused on those ‘targeted’ species which can be effectively controlled or contained using mechanical and/or limited chemical methods.

Targeted exotic plants at Bandelier are limited to woody species which have the potential to become more widely established in the absence of any control efforts; they also must be susceptible to containment through mechanical and/or limited chemical treatment. Targeted species include: Salt Cedar, (Tamarix pentandra); Siberian Elm, (Ulmus siberica); Russian Olive, (Elaeagnus angustifolia); and Tree of Heaven, (Ailanthus altissimus). Mitigation efforts for these targeted species are currently conducted on an opportunistic basis (i.e. as identified and when resources are available to treat). The standard approach for all targeted species is mechanical removal (i.e. cut at base) followed immediately by herbicidal treatment (using an approved herbicide) of the exposed stump wound.

Other exotic species of concern at Bandelier are primarily herbaceous with more extensive distributions and thus difficult to control. Those limited to disturbed habitats (such as occur in the vicinity of the Headquarters horse corral, gravel yard, bone yard, sewage lagoons, and along the disturbed Rio Grande corridor) include: Kochia (Kochia scoparia), Russian Thistle (Salsola kali), Whitetop (Cardaria draba), Canada thistle (Cirsium arvense), Musk Thistle (Carduus nutans), Yellow Toadflax (Linaria vulgaris), Perennial Pepperweed (Lepidium latifolium) and

Burdock (*Xanthium strumarium*). Other species of more widespread distribution include: Mullein (*Verbascum thaspus*), Cheat Grass (*Bromus tectorum*), and Dandelion (*Taraxacum officinalis*). Mechanical and/or chemical control options are generally considered impractical control methods for these species and current emphasis is being placed on landscape level habitat restoration approaches. In addition, the use of biological control agents may be considered for control of selected exotic species, if there is sufficient information to conclude that native species would not be put at risk (also see Appendix B-1, for a complete listing of exotic plants at Bandelier and Appendix C for a listing of New Mexico State invasive species).

Sensitive Plant Management

Sensitive species at Bandelier (Appendix B-2) were selected on the basis of state or federal status or lacking official status, because the park has made a determination that the species warrants monitoring to verify status and potential impacts on the populations and habitat. Sensitive plants currently monitored at Bandelier include three riparian canyon bottom species (Yellow Ladyslipper, *Cypripedium pubescens*; Grape Fern, *Botrychium virginicum*; Wood Lily, *Lilium umbellatum*) and one arid mesa top species (Gramma Grass Cactus, *Pediocactus papyracanthus*). None of the sensitive species at Bandelier are federally listed, but all except the grape fern are state listed.

STANDARD OPERATING PROCEDURES:

Identified sensitive plant populations are monitored periodically to assess any significant change in health or numbers of individuals and to identify any potential threats to known populations. There is currently no program in place relative to re-introduction of extirpated plant species or enhancement of existing sensitive plant populations and habitat (also see Appendix H, Sensitive Plant Monitoring Protocols).

Integrated Pest Management

The Integrated Pest Management (IPM) program, as detailed in the 1994 IPM plan, has relevance to vegetation management either when specific plants are considered pests and require treatment or when a proposed IPM action may impact native plants or their habitat.

STANDARD OPERATING PROCEDURES:

In the 1994 IPM Plan the only 'pest' plant referenced is poison ivy and the park currently prescribes no action to control this presumably native species. Hazard trees are managed per protocols detailed under **Hazard Tree Management**. Complete removal of Box Elder, a native tree in the historic district whose roots can damage historic fabric, entails use of a herbicidal stump treatment to prevent re-sprouting. Targeted exotic species are managed per protocols detailed under **Exotic Plant Management**. All of the targeted exotic species, Tree of Heaven, Siberian Elm, Tamarisk, and Russian Olive require herbicidal stump treatment (i.e. Pathfinder II) immediately following cutting to prevent re-sprouting.

Vegetation Management Issues Not Addressed In Detail

Fire Management

Research, Inventory and Monitoring Activities

Wilderness Management

Watershed Management

Threatened and Endangered Species Management

New Mexico State Highway Winter Road De-icing

Rio Grande/ Cochiti Reservoir water management

Ferral cattle

Ferral burros

Elk management

Traditional Uses By Native Peoples

Fire Management

Bandelier views fire in the context of a natural disturbance regime and as an integral process necessary for proper maintenance of forest structure and ecosystem dynamics. Fire is reintroduced where and when necessary to restore forest structure, reduce hazard fuels and recycle nutrients among other management objectives. Wildfires are variously suppressed, contained or managed as prescribed natural fires depending on the particular circumstances. Some plant communities (i.e. Montane Meadows and Pinyon-Juniper) require mechanical pre-treatment prior to the reintroduction of fire because of unsuitable fuel conditions and/or stand structure. See the 1997 Fire Management Plan and associated 1994 Environmental Assessment for a more complete description of this program.

Research, Inventory and Monitoring Activities

Bandelier conducts, supports and facilitates ongoing research, inventory and monitoring activities to increase baseline information, defend proposed management actions and support expanded understanding of natural systems and how best to manage them. See the Bandelier Research and Collecting Guidelines and Annual Investigator Reports for additional information on this topic.

Wilderness Management

Seventy percent of Bandelier is designated wilderness and over ninety percent is zoned backcountry and managed as de-facto wilderness. See the 1995 Draft Wilderness Plan and 1973 Revised Draft Proposed Wilderness EA for a complete description proposed management actions and use restrictions to be undertaken in fulfillment of the Wilderness Act.

Watershed Management

Historic landuse practices have created a host of watershed issues ranging from accelerated erosion in woodlands to increased potential for catastrophic fire in forested areas with associated post-fire risks to watershed values. Relevant sources of information include the 1999 Water Resources Management Plan, 1996 Watershed Restoration EA and Biological Assessment and recent reports by the USGS-WRD detailing hydrologic response of Bandelier watersheds to wildfire.

Threatened and Endangered Species Management

Bandelier will identify and promote the conservation of all state and federally listed threatened, endangered, or former candidate plant species within park boundaries and their critical habitats. Management actions at Bandelier with the potential to affect listed species will either be in accordance with existing recovery, conservation, and habitat management plans; consultation with USFWS as documented in a biological assessment may also be necessary. The 1994 Peregrine Habitat Management Plan and 1998 Fire Management Plan Biological Assessment provide additional information on this topic.

New Mexico State Highway Winter Road De-icing

The park is bounded and traversed by New Mexico State Highway 4, which is maintained by the State of New Mexico, Department of Transportation (NMDOT) using New Mexico Highway standards. Some park input has been incorporated into how the state maintains this section of Hwy 4, but communication with NMDOT is intermittent and they are generally not very responsive to park needs. A letter sent by the park to NMDOT in 1994 proposed the use of alternatives to salt along the Bandelier section of Highway 4 but never received a response. Recent informal contacts however, suggest that NMDOT is evaluating alternative deicing products. NMDOT periodically contacts the park regarding thinning trees along the road right-of-way to increase sight distance along the portion of Hwy 4 above the county line; the park has supported this action by NMDOT both for safety reasons and to increase the effectiveness of Hwy 4 as a fuel break.

Rio Grande/ Cochiti Reservoir water management

(see: Cochiti Reregulation Interagency Biological Report)

Ferral cattle

(see: 1995 Ferral Cattle EA)

Ferral burros

(see: 1979 Revised Ferral Burro Management EA)

Elk management

(see: 1997 Evaluation of Ungulate Impacts to Park Resources EA)

Traditional Uses By Native Peoples

Traditional hunting, gathering and ceremonial uses of the park by local tribes have been compiled in a 1997 ethnographic study of Bandelier National Monument (Ethnographic Literature Search and Consultation by Frances Levine and Thomas Merlan) on file at Bandelier. These activities are restricted by law and to the terms of any agreements made between the park and local pueblos.

PART IV

APPENDICIES

APPENDIX A

STATUS OF THE BANDELIER NATIONAL MONUMENT HERBARIUM

ADDRESS/PHONE: Bandelier National Monument, Los Alamos, NM 87544;
(505) 672-3861

AFFILIATION: National Park Service

DATE FOUNDED: (Earliest collection in 1938)

NUMBER OF SPECIMENS: 1600+

COMPUTERIZED RECORDS: YES,
see: flora.dbf and finalst.dbf in DBASE III+ format
also see: nhdata.dbf in ANCS museum cataloging software

AVAILABILITY OF COLLECTION: Open to qualified researchers,
by advance appointment only, M-F: 8:30 A.M.-4:30 P.M.,
materials are not available for loan, facilities are minimal.

SPECIAL CONCENTRATION OF COLLECTION: Serves as reference
collection and vouchers to document the vascular plant life of
Bandelier.

HISTORY OF COLLECTIONS AND COLLECTORS: see: Jacobs, B.F., 1989, A Flora of
Bandelier National Monument and supplemental Guide to the Bandelier Herbarium (1938-1988).

RESEARCH: Plant inventory (1986-1989), see: Jacobs, B.F., 1989,
A Flora of Bandelier National Monument.

CURATOR: Gary Roybal

BOTANICAL LIBRARY: Yes, but very limited.

HERBARIUM CODE: BAND

APPENDIX B

VASCULAR PLANT CHECKLIST, BANDELIER NATIONAL MONUMENT

NAME	GENUS	SPECIES	VARIETY	FAMILY
Rocky Mountain	Acer	glabrum Torr.	neomexicanum (Greene) K. & P.	Aceraceae
Western Box Elder	Acer	negundo L.	interius (Britt.) Sarg.	Aceraceae
White Amaranth	Amaranthus	albus L.		Amaranthaceae
Prostrate Pigweed	Amaranthus	graecizans L.		Amaranthaceae
Hybrid Pigweed	Amaranthus	hybridus L.		Amaranthaceae
Love-lies-bleeding	Amaranthus	leucocarpus Wats.		Amaranthaceae
Carelessweed	Amaranthus	palmeri Wats.		Amaranthaceae
Green Amaranth	Amaranthus	powellii Wats.		Amaranthaceae
Smooth Sumac	Rhus	glabra L.		Anacardiaceae
Poison Ivy	Rhus	radicans L.		Anacardiaceae
Skunkbush	Rhus	trilobata Nutt.		Anacardiaceae
Spreading Dogbane	Apocynum	androsaemifolium	androsaemifolium	Apocynaceae
Indian Hemp	Apocynum	medium Greene	floribundum (Greene) Woodson	Apocynaceae
Dogbane	Apocynum	sibericum Jacq.	salignum (Greene) Fern.	Apocynaceae
American Spikenard	Aralia	racemosa L.		Araliaceae
Antelope Horns	Asclepias	asperula (Dene)	asperula	Asclepiadaceae
Engelmann's Milkweed	Asclepias	engelmanniana		Asclepiadaceae
Rock Milkweed	Asclepias	macrotis Torr.		Asclepiadaceae
Poison Milkweed	Asclepias	subverticillata		Asclepiadaceae
Butterflyweed	Asclepias	tuberosa L.	terminalis Woodson	Asclepiadaceae
Green Milkweed	Asclepias	viridiflora Raf.		Asclepiadaceae
Colorado Barberry	Berberis	fendleri Gray		Berberidaceae
Oregon Grape	Berberis	repens Lindl.		Berberidaceae
New Mexican Alder	Alnus	oblongifolia Torr.		Betulaceae
Mountain Alder	Alnus	tenuifolia Nutt.		Betulaceae
Western Water-birch	Betula	occidentalis Hook.		Betulaceae
James Hiddenflower	Cryptantha	jamesii (Torr.)	jamesii	Boraginaceae
James Hiddenflower	Cryptantha	jamesii (Torr.)	pustulosa (Rydb.) Harrington	Boraginaceae
Hiddenflower	Cryptantha	minima Rydb.		Boraginaceae
Beggarlice	Hackelia	floribunda (Lehm.)		Boraginaceae
Beggarlice	Hackelia	grisea (Woot. &		Boraginaceae
Beggarlice	Hackelia	hirsuta (Woot. &		Boraginaceae
Stickseed	Lappula	redowskii	redowskii	Boraginaceae
Stickseed	Lappula	texana (Scheele)		Boraginaceae
Fringed Puccoon	Lithospermum	incisum Lehm.		Boraginaceae
Many-flowered	Lithospermum	multiflorum Torr.		Boraginaceae
Franciscan Bluebells	Mertensia	franciscana Heller		Boraginaceae
Bluebells	Mertensia	lanceolata (Pursh)	fendleri Gray	Boraginaceae
Pincushion Cactus	Coryphantha	vivipara (Nutt.)		Cactaceae
Fendler Hedgehog	Echinocereus	fendleri Engelm.		Cactaceae
Claret-cup Hedgehog	Echinocereus	triglochidiatus N	gonacanthus (Engelm. & Bigel.)	Cactaceae
Claret-cup Hedgehog	Echinocereus	triglochidiatus	melanacanthus (Engelm.) L.	Cactaceae

NAME	GENUS	SPECIES	VARIETY	FAMILY
Claret-cup Hedgehog	Echinocereus	triglochidiatus	triglochidiatus	Cactaceae
Green-flowered	Echinocereus	viridiflorus		Cactaceae
Utah Prickly Pear	Opuntia	erinacea Engelm. &	utahensis (Engelm.) L. Benson	Cactaceae
Cane Cholla	Opuntia	imbricata (Haw.)		Cactaceae
Prickly Pear	Opuntia	phaeacantha	major Engelm.	Cactaceae
Plains Prickly Pear	Opuntia	polyacantha Haw.	trichophora (Engelm. & Bigel.)	Cactaceae
Grama Grass Cactus	Pediocactus	papyracanthus		Cactaceae
Harebell	Campanula	rotundifolia L.		Campanulaceae
Western Cardinal	Lobelia	cardinalis L.	graminea (Lam.) McVaugh	Campanulaceae
American Hops	Humulus	americanus Nutt.		Cannabinaceae
Rocky Mountain Bee-	Cleome	serrulata Pursh		Capparidaceae
Clammyweed	Polanisia	trachysperma Torr.		Capparidaceae
Rocky Mountain Red	Sambucus	microbotrys Rydb.		Caprifoliaceae
Mountain Snowberry	Symphoricarpos	oreophilus Gray		Caprifoliaceae
Sandwort	Arenaria	confusa Rydb.		Caryophyllaceae
Fendler's Sandwort	Arenaria	fendleri Gray		Caryophyllaceae
Big-leaved Sandwort	Arenaria	macrophylla Hook.		Caryophyllaceae
Meadow Chickweed	Cerastium	arvense L.		Caryophyllaceae
Common Mousies Ears	Cerastium	vulgatum L.		Caryophyllaceae
Soapwort	Saponaria	officinalis L.		Caryophyllaceae
Sleepy Catchfly	Silene	antirrhina L.		Caryophyllaceae
Scours Catchfly	Silene	scouleri Hook.	pringlei (Wats.) Hitchc. &	Caryophyllaceae
Sand Spurry	Spergularia	marina (L.) Griseb.		Caryophyllaceae
Mountain-lover	Pachystima	myrsinites (Pursh)		Celastraceae
Fourwing Saltbush	Atriplex	canescens (Pursh)		Chenopodiaceae
Mexican Tea	Chenopodium	ambrosioides L.		Chenopodiaceae
Goosefoot	Chenopodium	desiccatum A.		Chenopodiaceae
Fremont's Goosefoot	Chenopodium	fremontii Wats.		Chenopodiaceae
Oak-leaved Goosefoot	Chenopodium	glaucum L.	glaucum	Chenopodiaceae
Ragleaf Goosefoot	Chenopodium	graveolens Willd.	neomexicanum (Aellen) Aellen	Chenopodiaceae
Slimleaf Goosefoot	Chenopodium	leptophyllum Nutt.		Chenopodiaceae
Red Goosefoot	Chenopodium	rubrum L.		Chenopodiaceae
Goosefoot	Chenopodium	sp.		Chenopodiaceae
Winter Fat	Eurotia	lanata (Pursh) Moq.		Chenopodiaceae
Summer Cypress	Kochia	scoparia (L.) Roth.		Chenopodiaceae
Russian Thistle	Salsola	kali L.	tenuifolia Tausch	Chenopodiaceae
Dayflower	Commelina	dianthifolia Delile		Commelinaceae
Western Yarrow	Achillea	lanulosa Nutt.		Compositae
Arizona Mountain	Agoseris	arizonica Greene		Compositae
Orange Mountain	Agoseris	aurantiaca (Hook.)		Compositae
Smooth Mountain	Agoseris	glauca (Pursh) D.		Compositae
Pearly Everlasting	Anaphalis	margaritacea (L.)		Compositae
Pussytoes	Antennaria	marginata Greene		Compositae
Pussytoes	Antennaria	parvifolia Nutt.		Compositae
Pussytoes	Antennaria	rosea (D.C. Eaton)		Compositae
Aphanostephus	Aphanostephus	arizonicus Gray		Compositae
Bigelow Sagebrush	Artemisia	bigelovii Gray		Compositae
Sagebrush	Artemisia	campestris L.	caudata (Michx.) H. & C.	Compositae

NAME	GENUS	SPECIES	VARIETY	FAMILY
Wormwood	Artemisia	carruthii Wood		Compositae
False Tarragon	Artemisia	dracunculus L.		Compositae
Sand Sagebrush	Artemisia	filifolia Torr.		Compositae
Ragweed Sagebrush	Artemisia	franserioides		Compositae
Fringed Sagebrush	Artemisia	frigida Willd.		Compositae
Wormwood	Artemisia	ludoviciana Nutt.	albula (Woot.) Keck.	Compositae
Wormwood	Artemisia	ludoviciana Nutt.	ludoviciana	Compositae
Wormwood	Artemisia	ludoviciana Nutt.	mexicana (Willd.) Keck	Compositae
Wormwood	Artemisia	ludoviciana Nutt.	redolens (Gray) Keck	Compositae
Wormwood	Artemisia	ludoviciana Nutt.	sulcata (Rydb.) Keck	Compositae
Big Sagebrush	Artemisia	tridentata Nutt.		Compositae
Aster	Aster	ericoides L.		Compositae
Leafy-bracted Aster	Aster	foliaceus Lindl.		Compositae
Marsh Aster	Aster	hesperius Gray		Compositae
Smooth Aster	Aster	laevis L.	laevis	Compositae
Yellow Ragweed	Bahia	dissecta (Gray)		Compositae
New Mexico Bahia	Bahia	neomexicana Gray		Compositae
Desert Marigold	Baileya	multiradiata Harv.		Compositae
Lyre Leaf	Berlandiera	lyrata Benth.		Compositae
Nodding Beggarticks	Bidens	cernua L.		Compositae
Tufted Beggarticks	Bidens	cosmosa (Gray)		Compositae
Sticktight	Bidens	frondosa L.		Compositae
Bract-leaved	Brickellia	brachyphylla Gray		Compositae
California Bricklebush	Brickellia	californica (Torr. &		Compositae
Fendler's Bricklebush	Brickellia	fendleri Gray		Compositae
Tassel Bricklebush	Brickellia	grandiflora (Hook.)		Compositae
Musk-thistle	Carduus	nutans L.		Compositae
Golden Aster	Chrysopsis	villosa (Pursh)		Compositae
Rabbitbrush	Chrysothamnus	nauseosus (Pall.)	latisquameus (Gray) H. & C.	Compositae
Rabbitbrush	Chrysothamnus	nauseosus (Pall.)	pinifolius (Greene) H. & C.	Compositae
Parry's Rabbitbrush	Chrysothamnus	parryi (Gray)	attenuatus (M.E. Jones) H. & C.	Compositae
Parry's Rabbitbrush	Chrysothamnus	parryi (Gray)	howardii (Parry) H. & C.	Compositae
New Mexican Thistle	Cirsium	neomexicanum		Compositae
Yellow Thistle	Cirsium	pallidum Woot. &		Compositae
Wavyleaf Thistle	Cirsium	undulatum (Nutt.)		Compositae
Bull Thistle	Cirsium	vulgare (Savi) Ten.		Compositae
Horseweed	Conyza	canadensis (L.)		Compositae
Cosmos	Cosmos	parviflorus (Jacq.)		Compositae
Dogweed	Dyossodia	papposa (Vent.)		Compositae
Hoary Fleabane	Erigeron	canus Gray		Compositae
Spreading Fleabane	Erigeron	divergens Torr. &		Compositae
Elated Fleabane	Erigeron	elator (Gray)		Compositae
Trailing Fleabane	Erigeron	flagellaris Gray		Compositae
Itchy Fleabane	Erigeron	formosissimus	viscidus (Rydb.) Cronq.	Compositae
Sprawling Fleabane	Erigeron	nudiflorus Buckl.		Compositae
Philadelphia Fleabane	Erigeron	philadelphicus L.		Compositae
Low Fleabane	Erigeron	pumilus Nutt.	concinoides Cronq.	Compositae
Ciliate Fleabane	Erigeron	rhizomatus Cronq.		Compositae

NAME	GENUS	SPECIES	VARIETY	FAMILY
Oregon Fleabane	Erigeron	speciosus (Lindl.)		Compositae
3-nerved Fleabane	Erigeron	subtrinervis Rydb.		Compositae
Superb Fleabane	Erigeron	superbus Greene ex		Compositae
Desert Thoroughwort	Eupatorium	herbaceum (Gray)		Compositae
Bursage	Franseria	acanthicarpa		Compositae
Indian Blanket Flower	Gaillardia	pinnatifida Torr.		Compositae
Firewheel	Gaillardia	pulchella Foug.		Compositae
Broad-leaved Cottony	Gnaphalium	chilense Spreng.		Compositae
Narrow-leaved Cottony	Gnaphalium	grayi Nels. &		Compositae
Winged Cudweed	Gnaphalium	macounii Greene		Compositae
Marsh Cudweed	Gnaphalium	palustre Nutt.		Compositae
Wright's Cudweed	Gnaphalium	wrightii Gray		Compositae
Gumweed	Grindelia	aphanactis Rydb.		Compositae
Snakeweed	Gutierrezia	sarothrae (Pursh)	microcephala (DC.) L. Benson	Compositae
Snakeweed	Gutierrezia	sarothrae (Pursh)	sarothrae	Compositae
Showy Goldenweed	Haplopappus	croceus Gray		Compositae
Annual Goldenweed	Haplopappus	gracilis (Nutt.)		Compositae
Parry Goldenweed	Haplopappus	parryi Gray		Compositae
Spiny Goldenweed	Haplopappus	spinulosus (Pursh)		Compositae
Winged Sneezeweed	Helenium	autumnale L.	montanum (Nutt.) Fern.	Compositae
Orange Sneezeweed	Helenium	hoopesii Gray		Compositae
Annual Sunflower	Helianthus	annuus L.		Compositae
Prairie Sunflower	Helianthus	petiolaris Nutt.		Compositae
Mesa Sunflower	Helianthus	rigidus (Cass.)	subrhomboideus (Rydb.) Heiser	Compositae
Hawkweed	Hieracium	carneum Greene		Compositae
Fendler Hawkweed	Hieracium	fendleri Sch. Bip.		Compositae
White Ragweed	Hymenopappus	filifolius Hook.	arenosus Heller	Compositae
White Ragweed	Hymenopappus	filifolius Hook.	cinereus (Rydb.) I.M. Johnst.	Compositae
Yellow Ragweed	Hymenopappus	filifolius Hook.	lugens (Greene) Jeps.	Compositae
Yellow Ragweed	Hymenopappus	flavescens Gray	cano-tomentosus Gray	Compositae
Perky Sue	Hymenoxys	argentea (Gray)		Compositae
Pinque	Hymenoxys	richardsonii	floribunda (Gray) Parker	Compositae
Marsh-elder	Iva	xanthifolia Nutt.		Compositae
Dwarf-dandelion	Krigia	biflora (Walt.)		Compositae
Plumed Boneset	Kuhnia	chlorolepis Woot.		Compositae
Canadian Lettuce	Lactuca	canadensis L.		Compositae
Prickly Lettuce	Lactuca	ludoviciana (Nutt.)		Compositae
Chicory Lettuce	Lactuca	pulchella (Pursh)		Compositae
Prickly Lettuce	Lactuca	serriola L.	integrata Gran. & Godr.	Compositae
Prickly Lettuce	Lactuca	serriola L.	serriola	Compositae
Spike Lettuce	Lactuca	spicata (Lam.)		Compositae
Sand Aster	Leucelene	ericoides (Torr.)		Compositae
Dotted Gayfeather	Liatris	punctata Hook.		Compositae
Bigelow Aster	Machaeranthera	bigelovii (Gray)		Compositae
Aster	Machaeranthera	canescens (Pursh)		Compositae
Tansy-leaved Aster	Machaeranthera	tanacetifolia		Compositae
Aster	Machaeranthera	tephrodes (Gray)		Compositae
Desert Dandelion	Malacothrix	fendleri Gray		Compositae

NAME	GENUS	SPECIES	VARIETY	FAMILY
Plains Blackfoot	Melampodium	leucanthum Torr. &		Compositae
Mariola	Parthenium	incanum H.B.K.		Compositae
Fetid Marigold	Pectis	angustifolia Torr.		Compositae
Taperleaf	Pericome	caudata Gray		Compositae
Wooly Paperflower	Psilostrophe	tagetina (Nutt.)		Compositae
False Dandelion	Pyrrhopappus	multicaulis DC.		Compositae
Prairie Coneflower	Ratibida	columnifera (Nutt.)		Compositae
Canyon Coneflower	Ratibida	tagetes (James)		Compositae
Black-eyed Susan	Rudbeckia	hirta L.		Compositae
Cutleaf Coneflower	Rudbeckia	laciniata L.		Compositae
Butterweed	Senecio	atratus Greene		Compositae
Bigelow Butterweed	Senecio	bigelovii Gray		Compositae
Butterweed	Senecio	cymbalarioides		Compositae
Threadleaf Groundsel	Senecio	douglasii DC.	longilobus (Benth.) L. Benson	Compositae
MacDougal's	Senecio	eremophilus	macdougalii (Heller) Cronq.	Compositae
Groundsel	Senecio	eurypterus Greenm.		Compositae
Notchleaf Groundsel	Senecio	fendleri Gray		Compositae
Groundsel	Senecio	integerrimus Nutt.		Compositae
Many-headed	Senecio	multicapitatus		Compositae
Lobed-leaf Groundsel	Senecio	multilobatus Torr.		Compositae
New Mexico	Senecio	neomexicanus Gray		Compositae
Butterweed	Senecio	pauperculus Michx.		Compositae
Wooton Butterweed	Senecio	wootonii Greene		Compositae
Tall Goldenrod	Solidago	altissima L.		Compositae
Canadian Goldenrod	Solidago	canadensis L.	gilvocanescens Rydb.	Compositae
Missouri Goldenrod	Solidago	missouriensis Nutt.		Compositae
Goldenrod	Solidago	mollis Bartl.		Compositae
Pale Goldenrod	Solidago	pallida (Porter)		Compositae
Few-flowered	Solidago	sparsiflora Gray		Compositae
Alpine Goldenrod	Solidago	spathulata DC.	neomexicana (Gray) Cronq.	Compositae
Wright's Goldenrod	Solidago	wrightii Gray		Compositae
Prickly Sow-thistle	Sonchus	asper (L.) Hill		Compositae
Skeletonweed	Stephanomeria	pauciflora (Torr.)		Compositae
Common Dandelion	Taraxacum	officinale Weber		Compositae
Yellow-flowered	Tetradymia	canescens DC.	inermis (Nutt.) Gray	Compositae
Greenthread	Thelesperma	filifolium Gray	intermedium (Rydb.) Shinnars	Compositae
Indian Tea	Thelesperma	megapotamicum		Compositae
Townsend's Aster	Townsendia	eximia Gray		Compositae
Easter Daisy	Townsendia	exscapa (Richards.)		Compositae
Yellow Salsify	Tragopogon	dubius Scop.		Compositae
Meadow Salsify	Tragopogon	pratensis L.		Compositae
Golden Crownbeard	Verbesina	encelioides (Cav.)		Compositae
Goldeneye	Viguiera	multiflora (Nutt.)		Compositae
Cocklebur	Xanthium	strumarium L.		Compositae
Rocky Mountain	Zinnia	grandiflora Nutt.		Compositae
Hedge Bindweed	Convolvulus	sepium L.		Convolvulaceae
Dodder	Cuscuta	campestris Yuncker		Convolvulaceae
Dodder	Cuscuta	sp.		Convolvulaceae

NAME	GENUS	SPECIES	VARIETY	FAMILY
Morning Bouquet	Evolvulus	pilosus Nutt.		Convolvulaceae
Star-glory	Ipomoea	coccinea L.	hederifolia (L.) Gray	Convolvulaceae
Red-osier Dogwood	Cornus	stolonifera Michx.		Cornaceae
Stone Crop	Sedum	wrightii Gray		Crassulaceae
Rockcress	Arabis	divaricarpa A.		Cruciferae
Drummond Rockcress	Arabis	drummondii Gray		Cruciferae
Fendler Rockcress	Arabis	fendleri (Wats.)	fendleri	Cruciferae
Fendler Rockcress	Arabis	fendleri (Wats.)	spatifolia (Rydb.) Rollins	Cruciferae
Tower Mustard	Arabis	glabra (L.) Bernh.		Cruciferae
Hairy Rockcress	Arabis	hirsuta (L.) Scop.	pyncocarpa (Hopkins) Rollins	Cruciferae
Shepherd's Purse	Capsella	bursa-pastoris (L.)		Cruciferae
Heartleaf Bittercress	Cardamine	cordifolia Gray		Cruciferae
Hoary Cress	Cardaria	draba (L.) Desv.		Cruciferae
Pinnate Tansy Mustard	Descurainia	pinnata (Walt.)		Cruciferae
Western Tansy	Descurainia	richardsonii	incisa (Engelm.) Detling	Cruciferae
Western Tansy	Descurainia	richardsonii	procera (Greene) Detling	Cruciferae
Western Tansy	Descurainia	richardsonii	richardsonii	Cruciferae
Western Tansy	Descurainia	richardsonii	viscosa (Rydb.) Detling	Cruciferae
Flaxweed Tansy	Descurainia	sophia (L.) Webb		Cruciferae
Spectacle Pod	Dithyrea	wislizenii Engelm.		Cruciferae
Whitlow Grass	Draba	helleriana Greene		Cruciferae
Whitlow Grass	Draba	reptans (Lam.)		Cruciferae
Western Wallflower	Erysimum	capitatum (Dougl.)		Cruciferae
Peppergrass	Lepidium	medium Greene		Cruciferae
Bladderpod	Lesquerella	fendleri (Gray)		Cruciferae
Bladderpod	Lesquerella	rectipes Woot. &		Cruciferae
Watercress	Rorippa	nasturtium-		Cruciferae
Yellow Cress	Rorippa	palustris (L.) Bess.	glabra (O.E. Schulz) Stuckey	Cruciferae
Yellow Cress	Rorippa	palustris (L.) Bess.	hispida (Desv.) Jonsell	Cruciferae
Sinuate-leaved Cress	Rorippa	sinuata (Nutt.)		Cruciferae
Field Cress	Rorippa	truncata (Jeps.)		Cruciferae
Tumble Mustard	Sisymbrium	altissimum L.		Cruciferae
Yellow Rocket	Sisymbrium	irio L.		Cruciferae
Purple Wallflower	Sisymbrium	linearifolium		Cruciferae
Canyon Royalty	Streptanthus	cordatus Nutt.		Cruciferae
Wright's Thelypody	Thelypodium	wrightii Gray		Cruciferae
Wild Candytuff	Thlaspi	alpestre L.		Cruciferae
Coyote Gourd	Cucurbita	foetidissima H.B.K.		Cucurbitaceae
Dwarf Juniper	Juniperus	communis L.	saxatilis Pall.	Cupressaceae
Alligator-bark Juniper	Juniperus	depeana Steud.		Cupressaceae
One-seed Juniper	Juniperus	monosperma		Cupressaceae
Rocky Mountain	Juniperus	scopulorum Sarg.		Cupressaceae
Bolander Sedge	Carex	bolanderi Olney		Cyperaceae
Brevior Sedge	Carex	brevior (Dewey)		Cyperaceae
Douglas Sedge	Carex	douglasii Boott.		Cyperaceae
Meadow Sedge	Carex	festivella Mack.		Cyperaceae
Rock Sedge	Carex	geophila Mack.		Cyperaceae
Bottlebrush Sedge	Carex	hystricina Muhl.		Cyperaceae

NAME	GENUS	SPECIES	VARIETY	FAMILY
Marsh Sedge	Carex	lanuginosa Michx.		Cyperaceae
Rocky Mountain Sedge	Carex	occidentalis Bailey		Cyperaceae
Silver Sedge	Carex	praegracilis W.		Cyperaceae
Sedge	Carex	sp.		Cyperaceae
Stipate Sedge	Carex	stipata Muhl. ex		Cyperaceae
Sedge	Cyperus	aristatus Rottb.		Cyperaceae
Fendler Flatsedge	Cyperus	fendlerianus		Cyperaceae
River Nutgrass	Cyperus	rivularis Kunth.		Cyperaceae
Pale Spikerush	Eleocharis	macrostachya Britt.		Cyperaceae
Russian Olive	Elaeagnus	angustifolia L.		Elaeagnaceae
Torrey Joint-fir	Ephedra	torreyana Wats.		Ephedraceae
Mormon Tea	Ephedra	viridis Cov.	viscida (Culter) L. Benson	Ephedraceae
Field Horsetail	Equisetum	arvense L.		Equisetaceae
Scouring-Rush	Equisetum	hiemale L.	affine A.A. Eaton	Equisetaceae
Smooth Horsetail	Equisetum	laevigatum A. Br.		Equisetaceae
Kinnikinnik	Arctostaphylos	uva-ursi (L.)		Ericaceae
Pinesap	Monotropa	latisquama (Rydb.)		Ericaceae
Pinedrops	Pterospora	andromedeae Nutt.		Ericaceae
Gingerleaf Wintergreen	Pyrola	asarifolia Michx.		Ericaceae
Wintergreen Pyrola	Pyrola	chlorantha Sw.		Ericaceae
Variegated	Pyrola	picta J.E. Smith		Ericaceae
Sidebells	Ramischia	secunda (L.)		Ericaceae
Doveweed	Croton	texensis (Klotzsch)		Euphorbiaceae
Poinsettia	Euphorbia	dentata Michx.	cuphosperma Engelm.	Euphorbiaceae
Poinsettia	Euphorbia	dentata Michx.	dentata	Euphorbiaceae
Fendler Spurge	Euphorbia	fendleri Torr. &		Euphorbiaceae
Spurge	Euphorbia	geyeri Engelm.		Euphorbiaceae
Spurge	Euphorbia	revoluta Engelm.		Euphorbiaceae
Spurge	Euphorbia	robusta (Engelm.)		Euphorbiaceae
Thymeleaf Spurge	Euphorbia	serpyllifolia Pers.		Euphorbiaceae
Noseburn	Tragia	nepetaefolia Cav.		Euphorbiaceae
Gambel Oak Hybrid	Quercus	X gambelii Nutt. 'a		Fagaceae
Gambel Oak	Quercus	gambelii Nutt.		Fagaceae
Gray Oak	Quercus	grisea Liebm.		Fagaceae
Live Oak	Quercus	turbinella Greene		Fagaceae
Wavyleaf Oak	Quercus	undulata Torr.		Fagaceae
Golden Smoke	Corydalis	aurea Willd.		Fumariaceae
Bigelow Closed	Gentiana	bigelovii Gray		Gentianaceae
Gentian	Gentiana	plebeia Cham.		Gentianaceae
Gentian	Gentiana	sp.		Gentianaceae
Deer's Ears	Swertia	radiata (Kell.)		Gentianaceae
Heron's Bill	Erodium	cicutarium (L.)		Geraniaceae
James Geranium	Geranium	caespitosum James		Geraniaceae
Richardson Geranium	Geranium	richardsonii Fisch.		Geraniaceae
Jointed Goatgrass	Aegilops	cylindrica Host		Gramineae
Crested Wheatgrass	Agropyron	cristatum (L.)		Gramineae
Downy Wheatgrass	Agropyron	dasystachyum		Gramineae
Quackgrass	Agropyron	repens (L.) Beauv.		Gramineae

NAME	GENUS	SPECIES	VARIETY	FAMILY
Western Wheatgrass	Agropyron	smithii Rydb.		Gramineae
Slender Wheatgrass	Agropyron	trachycaulum		Gramineae
Spike Bent	Agrostis	exarata Trin.		Gramineae
Autumn Bent	Agrostis	perennans (Walt.)		Gramineae
Rough Bent	Agrostis	scabra Willd.		Gramineae
Water Bent	Agrostis	semiverticillata		Gramineae
Red Top	Agrostis	stolonifera L.		Gramineae
Short-awn Foxtail	Alopecurus	aequalis Sobol.		Gramineae
Cane Beardgrass	Andropogon	barbinodis Lag.		Gramineae
Big Bluestem	Andropogon	gerardii Vitman		Gramineae
Sand Bluestem	Andropogon	hallii Hack.		Gramineae
Little Bluestem	Andropogon	scoparius Michx.		Gramineae
Springfield Bluestem	Andropogon	springfieldii Gould		Gramineae
Six-weeks Three-awn	Aristida	adscensionis L.		Gramineae
Arizona Three-awn	Aristida	arizonica Vasey		Gramineae
Poverty Three-awn	Aristida	divaricata Humb. &		Gramineae
Reverchon Three-awn	Aristida	purpurea Nutt.	glaucia (Nees.) A. Holm. & N.	Gramineae
Purple Three-awn	Aristida	purpurea Nutt.	longiseta (Steud.) Vasey	Gramineae
Purple Three-awn	Aristida	purpurea Nutt.	robusta (Merr.) A. Holm. & N.	Gramineae
Sloughgrass	Beckmannia	syzigachne (Steud.)		Gramineae
Pine Dropseed	Blepharoneuron	tricholepis (Torr.)		Gramineae
Six-weeks Grama	Bouteloua	barbata Lag.		Gramineae
Side-oats Grama	Bouteloua	curtipendula		Gramineae
Black Grama	Bouteloua	eriopoda (Torr.)		Gramineae
Blue Grama	Bouteloua	gracilis (H.B.K.)		Gramineae
Hairy Grama	Bouteloua	hirsuta Lag.		Gramineae
Nodding Brome	Bromus	anomalus Rupr.		Gramineae
California Brome	Bromus	carinatus Hook. &		Gramineae
Fringed Brome	Bromus	ciliatus L.		Gramineae
Weeping Brome	Bromus	frondosus (Shear)		Gramineae
Smooth Brome	Bromus	inermis Leyss.		Gramineae
Japanese Brome	Bromus	japonicus Thunb.		Gramineae
Canada Brome	Bromus	purgans L.		Gramineae
Cheat Grass	Bromus	tectorum L.		Gramineae
Sandbur	Cenchrus	pauciflorus Benth.		Gramineae
Awned Dogtail	Cynosurus	echinatus L.		Gramineae
Orchard Grass	Dactylis	glomerata L.		Gramineae
Parry Danthonia	Danthonia	parryi Scribn.		Gramineae
Poverty Oatgrass	Danthonia	spicata (L.) Beauv.		Gramineae
Desert Saltgrass	Distichlis	stricta (Torr.)		Gramineae
Barnyard Grass	Echinochloa	crusgalli (L.)		Gramineae
Canada Wild Rye	Elymus	canadensis L.		Gramineae
Blue Wild Rye	Elymus	glaucus Buckl.		Gramineae
Stinking Lovegrass	Eragrostis	cilianensis (All.)		Gramineae
Weeping Lovegrass	Eragrostis	curvula (Schrud.)		Gramineae
Creeping Lovegrass	Eragrostis	hypnoides (Lam.)		Gramineae
Carolina Lovegrass	Eragrostis	pectinacea (Michx.)		Gramineae
Sand Lovegrass	Eragrostis	trichodes (Nutt.)		Gramineae

NAME	GENUS	SPECIES	VARIETY	FAMILY
Arizona Fescue	Festuca	arizonica Vasey		Gramineae
Six-weeks Fescue	Festuca	octoflora Walt.		Gramineae
Sheep Fescue	Festuca	ovina L.		Gramineae
Meadow Fescue	Festuca	pratensis Huds.		Gramineae
Thurber Fescue	Festuca	thurberi Vasey		Gramineae
Northern Manna Grass	Glyceria	borealis (Nash)		Gramineae
Manna Grass	Glyceria	grandis Wats.		Gramineae
Fowl Manna Grass	Glyceria	striata (Lam.)		Gramineae
Galleta	Hilaria	jamesii (Torr.)		Gramineae
Meadow Barley	Hordeum	brachyantherum		Gramineae
Foxtail Barley	Hordeum	jubatum L.		Gramineae
Junegrass	Koeleria	cristata (L.) Pers.		Gramineae
Cutgrass	Leersia	oryzoides (L.)		Gramineae
Ryegrass	Lolium	perenne L.		Gramineae
Wolftail	Lycurus	phleoides H.B.K.		Gramineae
Porter Melic	Melica	porteri Scribn.		Gramineae
Cliff Muhly	Muhlenbergia	arsenei Hitchc.		Gramineae
Mexican Muhly	Muhlenbergia	mexicana (L.) Trin.		Gramineae
Mountain Muhly	Muhlenbergia	montana (Nutt.)		Gramineae
New Mexican Muhly	Muhlenbergia	pauciflora Buckl.		Gramineae
Bush Muhly	Muhlenbergia	porteri Scribn.		Gramineae
Deergrass	Muhlenbergia	rigens (Benth.)		Gramineae
Ring Muhly	Muhlenbergia	torreyi (Kunth)		Gramineae
Red Muhly	Muhlenbergia	wolfii (Vasey)		Gramineae
Spike Muhly	Muhlenbergia	wrightii Vasey		Gramineae
False Buffalo-grass	Munroa	squarrosa (Nutt.)		Gramineae
Mountain Ricegrass	Oryzopsis	asperifolia Michx.		Gramineae
Indian Ricegrass	Oryzopsis	hymenoides (R. &		Gramineae
Littleseed Ricegrass	Oryzopsis	micrantha (Trin. &		Gramineae
Bulbed Panic Grass	Panicum	bulbosum H.B.K.		Gramineae
Witchgrass	Panicum	capillare L.		Gramineae
Halls Panic Grass	Panicum	hallii Vasey		Gramineae
Vine Mesquite	Panicum	obtusum H.B.K.		Gramineae
Canyon Panic Grass	Panicum	scribnerianum		Gramineae
Switchgrass	Panicum	virgatum L.		Gramineae
Alpine Timothy	Phleum	alpinum L.		Gramineae
Common Timothy	Phleum	pratense L.		Gramineae
Common Reed	Phragmites	communis Trin.		Gramineae
Annual Bluegrass	Poa	annua L.		Gramineae
Canada Bluegrass	Poa	compressa L.		Gramineae
Muttongrass	Poa	fendleriana (Steud.)		Gramineae
Long-liguled	Poa	longiligula Scribn.		Gramineae
Fowl Bluegrass	Poa	palustris L.		Gramineae
Kentucky Bluegrass	Poa	pratensis L.		Gramineae
Rabbitfoot Grass	Polypogon	monspeliensis (L.)		Gramineae
Wiregrass	Schedonnardus	paniculatus (Nutt.)		Gramineae
False Melic	Schizachne	purpurascens		Gramineae
Grisebach Bristlegrass	Setaria	grisebachii Fourn.		Gramineae

NAME	GENUS	SPECIES	VARIETY	FAMILY
Yellow Bristlegrass	Setaria	lutescens (Weigel)		Gramineae
Plains Bristlegrass	Setaria	macrostachya		Gramineae
Green Bristlegrass	Setaria	viridis (L.) Beauv.		Gramineae
Bottlebrush Squirreltail	Sitanion	hystrix (Nutt.) J.G.		Gramineae
Indian Grass	Sorghastrum	nutans (L.) Nash		Gramineae
Alkali Sacaton	Sporobolus	airoides (Torr.)		Gramineae
Tall Dropseed	Sporobolus	asper (Michx.)		Gramineae
Spike Dropseed	Sporobolus	contractus Hitchc.		Gramineae
Sand Dropseed	Sporobolus	cryptandrus (Torr.)		Gramineae
Needle-and-thread	Stipa	comata Trin. &		Gramineae
Letterman Needlegrass	Stipa	lettermanii Vasey		Gramineae
New Mexico Porcupine	Stipa	neomexicana		Gramineae
Manna Grass	Torreyochloa	pauciflora (Presl)		Gramineae
Western St. John's-	Hypericum	formosum H.B.K.		Guttiferae
Western Waterleaf	Hydrophyllum	fendleri (Gray)		Hydrophyllaceae
Nama	Nama	hispidum Gray	hispidum	Hydrophyllaceae
Blue Scorpionweed	Phacelia	coerulea Greene		Hydrophyllaceae
Scorpionweed	Phacelia	corrugata A. Nels.		Hydrophyllaceae
Virgate Scorpionweed	Phacelia	heterophylla Pursh		Hydrophyllaceae
Scorpionweed	Phacelia	integrifolia Torr.		Hydrophyllaceae
Blue Flag	Iris	missouriensis Nutt.		Iridaceae
Blue-eyed Grass	Sisyrinchium	demissum Greene		Iridaceae
Blue-eyed Grass	Sisyrinchium	montanum Greene		Iridaceae
Wire Rush	Juncus	balticus Willd.	montanus Engelm.	Juncaceae
Toad Rush	Juncus	bufonius L.		Juncaceae
Rush	Juncus	confusus Cov.		Juncaceae
Rush	Juncus	longistylis Torr.		Juncaceae
Soft Rush	Juncus	tenuis Willd.		Juncaceae
Rush	Juncus	xiphioides E. Mey.		Juncaceae
Wild Basil	Clinopodium	vulgare L.		Labiatae
False Pennyroyal	Hedeoma	drummondii Benth.		Labiatae
False Pennyroyal	Hedeoma	nana (Torr.) Briq.		Labiatae
False Pennyroyal	Hedeoma	pulcherrima Woot.		Labiatae
American Bugleweed	Lycopus	americanus Muhl.		Labiatae
Common Horehound	Marrubium	vulgare L.		Labiatae
Common Mint	Mentha	arvensis L.		Labiatae
Spearmint	Mentha	spicata L.		Labiatae
Small-flowered	Moldavica	parviflora (Nutt.)		Labiatae
Horsemint	Monarda	menthaefolia		Labiatae
Ponymint	Monarda	pectinata Nutt.		Labiatae
Healall	Prunella	vulgaris L.		Labiatae
Sage	Salvia	pratensis L.		Labiatae
Rocky Mountain Sage	Salvia	reflexa Hornem.		Labiatae
Sage	Salvia	subincisa Benth.		Labiatae
Leadplant Amorpha	Amorpha	canescens Pursh		Leguminosae
False Indigobush	Amorpha	fruticosa L.	occidentalis (Abrams) K. & P.	Leguminosae
Two-grooved	Astragalus	bisulcatus (Hook.)		Leguminosae
Flexile Milkvetch	Astragalus	flexuosus Dougl.		Leguminosae

NAME	GENUS	SPECIES	VARIETY	FAMILY
Bladderpod Locoweed	Astragalus	lentiginosus Dougl.	diphysus (Gray) M.E. Jones	Leguminosae
Rush Milkvetch	Astragalus	lonchocarpus Torr.		Leguminosae
Missouri Milkvetch	Astragalus	missouriensis Nutt.		Leguminosae
Nuttall's Milkvetch	Astragalus	nuttallianus Nutt.		Leguminosae
Feather Indigobush	Dalea	formosa Torr.		Leguminosae
Indigobush	Dalea	leporina (Ait.) K. &		Leguminosae
Dwarf Indigobush	Dalea	nana Torr.		Leguminosae
Six-weeks Indigobush	Dalea	polygonoides Gray		Leguminosae
Spreading Indigobush	Dalea	terminalis M.E.		Leguminosae
Wild Licorice	Glycyrrhiza	lepidota (Nutt.)		Leguminosae
Arizona Peavine	Lathyrus	arizonicus Britt.		Leguminosae
Deervetch	Lotus	wrightii (Gray)		Leguminosae
Silvery Lupine	Lupinus	argenteus Pursh		Leguminosae
Short-stemmed Lupine	Lupinus	brevicaulis Wats.		Leguminosae
Blue Lupine	Lupinus	caudatus Kell.	argophyllus (Gray) Phillips	Leguminosae
King's Lupine	Lupinus	kingii Wats.		Leguminosae
Black Medic	Medicago	lupulina L.		Leguminosae
Alfalfa	Medicago	sativa L.		Leguminosae
White Sweet Clover	Melilotus	albus Desr.		Leguminosae
Sweet Yellow Clover	Melilotus	officinalis (L.)		Leguminosae
Lambert Locoweed	Oxytropis	lambertii Pursh		Leguminosae
White Prairie Clover	Petalostemum	candidum (Willd.)		Leguminosae
Rat-tail Prairie Clover	Petalostemum	compactum		Leguminosae
Purple Prairie Clover	Petalostemum	purpureum (Vent.)		Leguminosae
Narrowleaf Bean	Phaseolus	angustissimus Gray	angustissimus	Leguminosae
Little Scurfpea	Psoralea	hypogaea Nutt.		Leguminosae
Lemon Scurfpea	Psoralea	lanceolata Pursh		Leguminosae
Slender Scurfpea	Psoralea	tenuiflora Pursh	bigelovii (Rydb.) Macbr.	Leguminosae
New Mexico Locust	Robinia	neomexicana Gray		Leguminosae
Goldenbanner	Thermopsis	pinetorum Greene		Leguminosae
Alsike Clover	Trifolium	hybridum L.		Leguminosae
Red Clover	Trifolium	pratense L.		Leguminosae
White Clover	Trifolium	repens L.		Leguminosae
American Vetch	Vicia	americana Muhl.	americana	Leguminosae
Narrow-leaved Vetch	Vicia	americana Muhl.	linearis (Nutt.) Wats.	Leguminosae
Slim Vetch	Vicia	exigua Nutt.		Leguminosae
Duckweed	Lemna	sp.		Lemnaceae
Rocky Mountain	Allium	cernuum Roth.		Liliaceae
Geyer Onion	Allium	geyeri Wats.		Liliaceae
Mesa Onion	Allium	macropetalum		Liliaceae
Asparagus	Asparagus	officinalis L.		Liliaceae
Gunnison Mariposa	Calochortus	gunnisonii Wats		Liliaceae
Sego Lily	Calochortus	nuttallii Torr. &		Liliaceae
Wood Lily	Lilium	umbellatum Pursh		Liliaceae
Beargrass	Nolina	microcarpa Wats.		Liliaceae
False Solomon's Seal	Smilacina	racemosa (L.) Desf.		Liliaceae
Star Flower	Smilacina	stellata (L.) Desf.		Liliaceae
Narrowleaf Yucca	Yucca	angustissima		Liliaceae

NAME	GENUS	SPECIES	VARIETY	FAMILY
Banana Yucca	Yucca	baccata Torr.		Liliaceae
Death Camas	Zygadenus	elegans Pursh		Liliaceae
New Mexican Yellow	Linum	neomexicanum		Linaceae
Yellow Flax	Linum	rigidum Pursh		Linaceae
White-stemmed	Mentzelia	albicaulis Dougl.		Loasaceae
Golden Blazing Star	Mentzelia	pumila (Nutt.) Torr.	multicaulis (Osterh.) Nelson	Loasaceae
Golden Blazing Star	Mentzelia	pumila (Nutt.) Torr.	multiflora (Nutt.) Urb. & Gilg.	Loasaceae
Golden Blazing Star	Mentzelia	pumila (Nutt.) Torr.	pumila	Loasaceae
Dwarf Mistletoe	Arceuthobium	vaginatum (Willd.)	cryptopodum (Engelm.) H. &	Loranthaceae
Juniper Mistletoe	Phoradendron	juniperinum		Loranthaceae
Hollyhock Mallow	Althaea	rosea Cav.		Malvaceae
Common Mallow	Malva	neglecta Wallr.		Malvaceae
White Prairie Mallow	Sidalcea	candida Gray		Malvaceae
Red Globe Mallow	Sphaeralcea	coccinea (Pursh)		Malvaceae
Fendler Globe Mallow	Sphaeralcea	fendleri Gray		Malvaceae
Showy Four-o'clock	Mirabilis	multiflora (Torr.)		Nyctaginaceae
Trailing Four-o'clock	Mirabilis	oxybaphoides Gray		Nyctaginaceae
Desert Four-o'clock	Oxybaphus	linearis (Pursh)		Nyctaginaceae
New Mexico Olive	Forestiera	neomexicana Gray		Oleaceae
Rough Bull Cods	Menodora	scabra Gray		Oleaceae
Sundrops	Calylophus	hartwegii (Benth.)		Onagraceae
Fireweed	Epilobium	angustifolium L.	cimcumvagus Mosquin	Onagraceae
Canyon Willowweed	Epilobium	ciliatum Raf.		Onagraceae
Fall Ann Willowweed	Epilobium	paniculatum Nutt.		Onagraceae
Scarlet Gaura	Gaura	coccinea Nutt.		Onagraceae
Tall Gaura	Gaura	parviflora Dougl.		Onagraceae
Prairie Evening-	Oenothera	albicaulis Pursh		Onagraceae
Tufted Evening-	Oenothera	caespitosa Nutt.		Onagraceae
Hairy-throat Evening-	Oenothera	coronopifolia Torr.		Onagraceae
Stemless Evening-	Oenothera	flava (A. Nels.)		Onagraceae
Hooker's Evening-	Oenothera	hookeri Torr. &		Onagraceae
Pale Evening-primrose	Oenothera	pallida Lindl.		Onagraceae
Grape Fern	Botrychium	multifidum (S.G.)	coulteri (Underw.) Clausen	Ophioglossaceae
Fairy Slipper	Calypso	bulbosa(L.) Oakes		Orchidaceae
Spotted Coralroot	Corallorhiza	maculata Raf.		Orchidaceae
Striped Coralroot	Corallorhiza	striata Lindl.		Orchidaceae
Yellow Lady's Slipper	Cypripedium	calceolus L.	pubescens (Willd.) Correll	Orchidaceae
Helleborine	Epipactis	gigantea Dougl.		Orchidaceae
Giant Rattlesnake	Goodyera	oblongifolia Raf.		Orchidaceae
Bog Orchid	Habenaria	hyperborea (L.) R.		Orchidaceae
Few-flowered Bog	Habenaria	sparsiflora Wats.		Orchidaceae
Adder's Mouth	Malaxis	soulei L.O. Wms.		Orchidaceae
Mexican Squawroot	Conopholis	mexicana Gray		Orobanchaceae
Cancer Root	Orobanche	fasciculata Nutt.		Orobanchaceae
Broomrape	Orobanche	ludoviciana Nutt.		Orobanchaceae
Many-flowered	Orobanche	multiflora Nutt.		Orobanchaceae
Violet Woodsorrel	Oxalis	violacea L.		Oxalidaceae
White Fir	Abies	concolor (Gord. &		Pinaceae

NAME	GENUS	SPECIES	VARIETY	FAMILY
Engelmann Spruce	Picea	engelmannii Parry		Pinaceae
Blue Spruce	Picea	pungens Engelm.		Pinaceae
Colorado Pinyon Pine	Pinus	edulis Engelm.		Pinaceae
Limber Pine	Pinus	flexilis James		Pinaceae
Ponderosa Pine	Pinus	ponderosa Laws	scopulorum Engelm.	Pinaceae
Douglas Fir	Pseudotsuga	menziesii (Mirbel)	glauca (Beissner) Franco	Pinaceae
Plantain	Plantago	major L.		Plantaginaceae
Wooly Indian-wheat	Plantago	purshii R. & S.		Plantaginaceae
Gilia	Gilia	flavocincta A. Nels.	australis (A. & V. Grant) Day &	Polemoniaceae
Gilia	Gilia	pinnatifida Nutt.		Polemoniaceae
Skyrocket Gilia	Ipomopsis	aggregata (Pursh)	texana (Greene) Martin &	Polemoniaceae
Blue Trumpet Gilia	Ipomopsis	longiflora (Torr.)		Polemoniaceae
Microsteris	Microsteris	gracilis (Hook.)		Polemoniaceae
Jacob's Ladder	Polemonium	foliosissimum Gray		Polemoniaceae
Albert's Wild	Eriogonum	abertianum Torr.		Polygonaceae
Winged Wild	Eriogonum	alatum Torr.		Polygonaceae
Annual Wild	Eriogonum	annuum Nutt.		Polygonaceae
Nodding Wild	Eriogonum	cernuum Nutt.		Polygonaceae
Green-stemmed Wild	Eriogonum	effusum Nutt.		Polygonaceae
Antelope-sage	Eriogonum	jamesii Benth.		Polygonaceae
Sorrel Wild Buckwheat	Eriogonum	polycladon Benth.		Polygonaceae
Redroot Wild	Eriogonum	racemosum Nutt.		Polygonaceae
Water Smartweed	Polygonum	amphibium L.	stipulaceum (Coleman) Fern.	Polygonaceae
Smartweed	Polygonum	aviculare L.		Polygonaceae
Bistort	Polygonum	bistortoides Pursh		Polygonaceae
Cornbind	Polygonum	convolvulus L.		Polygonaceae
Rocky Mountain	Polygonum	montanum (Small)		Polygonaceae
Heart's Ease	Polygonum	persicaria L.		Polygonaceae
Sawatche Knotweed	Polygonum	sawatchense Small		Polygonaceae
Sheep Sorrel	Rumex	acetosella L.		Polygonaceae
Curlyleaf Dock	Rumex	crispus L.		Polygonaceae
Mexican Dock	Rumex	mexicanus Meisn.		Polygonaceae
Patient Dock	Rumex	patientia L.		Polygonaceae
Triangle-valved Dock	Rumex	triangulivalis		Polygonaceae
Female-fern	Athyrium	filis-femina (L.)	californicum Butters	Polypodiaceae
Fee's Lip-fern	Cheilanthes	feei Moore		Polypodiaceae
Fendler's Lip-fern	Cheilanthes	fendleri Hook.		Polypodiaceae
Tomentose Lip-fern	Cheilanthes	tomentosa Link		Polypodiaceae
Fragile Fern	Cystopteris	fragilis (L.) Bernh.		Polypodiaceae
Male-fern	Dryopteris	filix-mas (L.)		Polypodiaceae
Cloak-fern	Notholaena	standleyi Maxon		Polypodiaceae
Fendler Cliffbrake	Pellaea	fendleri (Kunze)		Polypodiaceae
Mucronate Cliffbrake	Pellaea	longimucronata		Polypodiaceae
Bracken Fern	Pteridium	aquilinum (L.)	pubescens Underw.	Polypodiaceae
Mexican Woodsia	Woodsia	mexicana Fee		Polypodiaceae
Oregon Woodsia	Woodsia	oregana D.C. Eaton		Polypodiaceae
Common Purslane	Portulaca	oleracea L.		Portulacaceae
Western Rock-jasmine	Androsace	septentrionalis L.		Primulaceae

NAME	GENUS	SPECIES	VARIETY	FAMILY
Shooting Star	Dodecatheon	pulchellum (Raf.)		Primulaceae
Western Baneberry	Actaea	arguta Nutt.		Ranunculaceae
Candle Anemone	Anemone	cylindrica Gray		Ranunculaceae
Rocky Mountain	Aquilegia	caerulea James		Ranunculaceae
Red Columbine	Aquilegia	elegantula Greene		Ranunculaceae
Western Virgin's	Clematis	ligusticifolia Nutt.		Ranunculaceae
Rocky Mountain	Clematis	pseudoalpina		Ranunculaceae
Kidneyleaf Buttercup	Ranunculus	abortivus L.		Ranunculaceae
White Water-crowfoot	Ranunculus	aquatilis L.	capillaceus (Thuill.) DC.	Ranunculaceae
Heart-leaved Buttercup	Ranunculus	cardiophyllus		Ranunculaceae
Desert Crowfoot	Ranunculus	cymbalaria Pursh	saximontanus Fern.	Ranunculaceae
Homely Buttercup	Ranunculus	inamoenus Greene		Ranunculaceae
Macoun's Buttercup	Ranunculus	macounii Britt.		Ranunculaceae
Cursed Crowfoot	Ranunculus	scleratus L.	multifidus Nutt.	Ranunculaceae
Fendler Meadowrue	Thalictrum	fendleri Engelm.		Ranunculaceae
Buckbrush	Ceanothus	fendleri Gray		Rhamnaceae
Agrimony	Agrimonia	striata Michx.		Rosaceae
Serviceberry	Amelanchier	bakeri Greene		Rosaceae
Alder-leaf Mountain	Cercocarpus	montanus Raf.		Rosaceae
Hawthorn	Crataegus	erythropoda Ashe		Rosaceae
Apache Plume	Fallugia	paradoxa (D. Don)		Rosaceae
Wild Strawberry	Fragaria	americana (Porter)		Rosaceae
Wild Strawberry	Fragaria	ovalis (Lehm.)		Rosaceae
Cutleaf Avens	Geum	macrophyllum	perincisum (Rydb.) Raup.	Rosaceae
Old-man's Whiskers	Geum	triflorum Pursh	ciliatum (Pursh) Fawcett	Rosaceae
Mountain-spray	Holodiscus	dumosus (Nutt.)		Rosaceae
Ninebark	Physocarpus	monogynous		Rosaceae
Silverweed	Potentilla	anserina L.		Rosaceae
Cinquefoil	Potentilla	crinita Gray		Rosaceae
Shrubby Cinquefoil	Potentilla	fruticosa L.		Rosaceae
Glandular Cinquefoil	Potentilla	glandulosa Lindl.		Rosaceae
Cinquefoil	Potentilla	hippiana Lehm.		Rosaceae
Norway Cinquefoil	Potentilla	norvejica L.		Rosaceae
Bushy Cinquefoil	Potentilla	paradoxa Nutt.		Rosaceae
Cinquefoil	Potentilla	pulcherrima Lehm.		Rosaceae
Brook Cinquefoil	Potentilla	rivalis Nutt.	millegrana (Engelm.) Wats.	Rosaceae
Brook Cinquefoil	Potentilla	rivalis Nutt.	rivalis	Rosaceae
Chickasaw Plum	Prunus	americana Marsh.		Rosaceae
Western Black	Prunus	virginiana L.	melanocarpa (A. Nels.) Sarg.	Rosaceae
Wild Rose	Rosa	woodsii Lindl.		Rosaceae
Western Thimbleberry	Rubus	parviflorus Nutt.		Rosaceae
Red Raspberry	Rubus	strigosus Michx.	arizonicus (Greene) K. & P.	Rosaceae
Goosegrass Bedstraw	Galium	aparine L.		Rubiaceae
Northern Bedstraw	Galium	boreale L.		Rubiaceae
Fendler Bedstraw	Galium	fendleri Gray		Rubiaceae
Sweet-scented	Galium	triflorum Michx.		Rubiaceae
Narrowleaf Hoptree	Ptelea	trifoliata L.		Rutaceae
Plains Cottonwood	Populus	X sargentii Dole		Salicaceae

NAME	GENUS	SPECIES	VARIETY	FAMILY
Narrowleaf	Populus	angustifolia James		Salicaceae
Rio Grande	Populus	fremontii Wats.		Salicaceae
Quaking Aspen	Populus	tremuloides Michx.	aurea (Tides.) Daniels	Salicaceae
Bebb's Willow	Salix	bebbiana Sarg.	perrostrata (Rydb.) Schneid.	Salicaceae
Coyote Willow	Salix	exigua Nutt.		Salicaceae
Blue-stem Willow	Salix	irrorata Anderss.		Salicaceae
Yew-leaf Willow	Salix	taxifolia H.B.K.		Salicaceae
Bastard Toad-flax	Comandra	pallida A. DC.		Santalaceae
Yerba-mansa	Anemopsis	californica (Nutt.)		Saururaceae
Alumroot	Heuchera	parvifolia Nutt.		Saxifragaceae
Cliffbush	Jamesia	americana Torr. &		Saxifragaceae
Mock-orange	Philadelphus	microphyllus Gray		Saxifragaceae
Wax Currant	Ribes	cereum Dougl.		Saxifragaceae
Whitestem Gooseberry	Ribes	inermis Rydb.		Saxifragaceae
Trumpet Gooseberry	Ribes	leptanthum Gray		Saxifragaceae
Rothrock Currant	Ribes	wolfii Rothr.		Saxifragaceae
Saxifrage	Saxifraga	rhomboidea Greene		Saxifragaceae
Kittentails	Besseyia	plantaginea (James)		Scrophulariaceae
Indian Paintbrush	Castilleja	confusa Greene		Scrophulariaceae
Wholeleaf Indian	Castilleja	integra Gray		Scrophulariaceae
Wyoming Indian	Castilleja	linariaefolia Benth.		Scrophulariaceae
Yellow Indian	Castilleja	lineata Greene		Scrophulariaceae
Painted Cup	Castilleja	minor Gray		Scrophulariaceae
Wright Clubflower	Cordylanthus	wrightii Gray		Scrophulariaceae
Northern Mudwort	Limosella	aquatica L.		Scrophulariaceae
Butter & Eggs	Linaria	vulgaris Mill.		Scrophulariaceae
False Pimpernel	Lindernia	anagallidea		Scrophulariaceae
Smooth Monkeyflower	Mimulus	glabratus H.B.K.	fremontii (Benth.) Grant	Scrophulariaceae
Spotted Monkeyflower	Mimulus	guttatus DC.		Scrophulariaceae
Yellow Owl-clover	Orthocarpus	luteus Nutt.		Scrophulariaceae
Purple-white Owl-	Orthocarpus	purpureo-albus		Scrophulariaceae
Wood Betony	Pedicularis	grayi A. Nels.		Scrophulariaceae
Gilia Beardtonque	Penstemon	ambiguus Torr.		Scrophulariaceae
Beardlip	Penstemon	barbatus (Cav.)	torreyi (Benth.) Keck.	Scrophulariaceae
James Penstemon	Penstemon	jamesii Benth.	jamesii	Scrophulariaceae
Spring Penstemon	Penstemon	lentus Pennell		Scrophulariaceae
Rydberg's Penstemon	Penstemon	rydbergii A. Nels.		Scrophulariaceae
Candy Cane	Penstemon	virgatus Gray		Scrophulariaceae
Mullein	Verbascum	thapsus L.		Scrophulariaceae
American Speedwell	Veronica	americana		Scrophulariaceae
Water Speedwell	Veronica	anagallis-aquatica		Scrophulariaceae
Purslane Speedwell	Veronica	peregrina L.	xalapensis (H.B.K.) Pennell	Scrophulariaceae
Thyme-leaved	Veronica	serpyllifolia L.	borealis Laestad.	Scrophulariaceae
Spikemoss	Selaginella	mutica D.C. Eaton		Selaginellaceae
Tree-of-Heaven	Ailanthus	altissimus (Mill.)		Simaroubaceae
Chamaesaracha	Chamaesaracha	coronopus (Dunal)		Solanaceae
Sacred Datura	Datura	meteloides DC.		Solanaceae
Pale Wolfberry	Lycium	pallidum Miers		Solanaceae

NAME	GENUS	SPECIES	VARIETY	FAMILY
Clammy Groundcherry	Physalis	foetens Poir.	neomexicana (Rydb.) Waterfall	Solanaceae
Groundcherry	Physalis	hederaefolia Gray	cordifolia (Gray) Waterfall	Solanaceae
Virginia Groundcherry	Physalis	virginiana Mill.	sonorae (Torr.) Waterfall	Solanaceae
Amercian Black	Solanum	americanum Mill.		Solanaceae
White Horse-nettle	Solanum	elaeagnifolium		Solanaceae
Wildpotato	Solanum	jamesii Torr.		Solanaceae
Sweet Nightshade	Solanum	sarachoides Sendt.		Solanaceae
Cutleaf Nightshade	Solanum	triflorum Nutt.		Solanaceae
Salt Cedar	Tamarix	pentandra Pall.		Tamaricaceae
Narrow-leaved Cattail	Typha	latifolia L.		Typhaceae
Netleaf Hackberry	Celtis	reticulata Torr.		Ulmaceae
Canyon Caraway	Aletes	acaulis (Torr.)		Umbelliferae
Water Parsnip	Berula	erecta (Huds.) Cov.		Umbelliferae
Western Water-	Cicuta	douglasii (DC.)		Umbelliferae
Mountain Wafer-	Cymopterus	montanus (Nutt.)		Umbelliferae
Cow-parsonip	Heracleum	lanatum Michx.		Umbelliferae
Lovage	Conioselinum	scopulorum (Gray)		Umbelliferae
Bluntseed Sweet	Osmorhiza	obtusa (Coult. &		Umbelliferae
Fendler Cowbane	Oxypolis	fendleri (Gray)		Umbelliferae
Yellow Mountain		montanus (Gray)		Umbelliferae
Snakeroot	Sanicula	marilandica L.		Umbelliferae
Stinging Nettle	Urtica	gracilis Ait.		Urticaceae
Arizona Valerian	Valeriana	arizonica Gray		Valerianaceae
Prostrate Vervain	Verbena	bracteata Lag. &		Verbenaceae
New Mexico Vervain	Verbena	macdougalii Heller		Verbenaceae
Wright's Vervain	Verbena	wrightii Gray		Verbenaceae
Western Dog Violet	Viola	adunca J.E. Smith		Violaceae
Canadian Violet	Viola	canadensis L.		Violaceae
Northern Bog Violet	Viola	nephrophylla	arizonica (Greene) K. & P.	Violaceae
Western Virginia	Parthenocissus	inserta (Kerner) K.		Vitaceae
Arizona Canyon Grape	Vitis	arizonica Engelm.		Vitaceae
Puncture Vine	Tribulus	terrestris L.		Zygophyllaceae

APPENDIX B-1

EXOTIC PLANT LIST, BANDELIER NATIONAL MONUMENT

NAME	GENUS	SPECIES	VARIETY	FAMILY	STATUS
Jointed Goatgrass	Aegilops	cylindrica Host		Gramineae	E
Crested Wheatgrass	Agropyron	cristatum (L.)		Gramineae	E
Quackgrass	Agropyron	repens (L.) Beauv.		Gramineae	E
Rough Bent	Agrostis	scabra Willd.		Gramineae	E?
Water Bent	Agrostis	semiverticillata		Gramineae	E
Tree-of-Heaven	Ailanthus	altissimus (Mill.)		Simaroubaceae	E
Short-awn Foxtail	Alopecurus	aequalis Sobol.		Gramineae	E?
Hollyhock Mallow	Althaea	rosea Cav.		Malvaceae	E
White Amaranth	Amaranthus	albus L.		Amaranthaceae	E?
Prostrate Pigweed	Amaranthus	graecizans L.		Amaranthaceae	E?
Hybrid Pigweed	Amaranthus	hybridus L.		Amaranthaceae	E?
Love-lies-bleeding	Amaranthus	leucocarpus Wats.		Amaranthaceae	E
Carelessweed	Amaranthus	palmeri Wats.		Amaranthaceae	E?
Indian Hemp	Apocynum	medium Greene	floribundum (Greene) Woodson	Apocynaceae	E?
Six-weeks Three-awn	Aristida	adscensionis L.		Gramineae	E?
Poison Milkweed	Asclepias	subverticillata		Asclepiadaceae	E?
Butterflyweed	Asclepias	tuberosa L.	terminalis Woodson	Asclepiadaceae	E?
Asparagus	Asparagus	officinalis L.		Liliaceae	E
Sloughgrass	Beckmannia	syzigachne (Steud.)		Gramineae	E?
Nodding Beggarticks	Bidens	cernua L.		Compositae	E?
Tufted Beggarticks	Bidens	cosmosa (Gray)		Compositae	E?
Sticktight	Bidens	frondosa L.		Compositae	E?
Smooth Brome	Bromus	inermis Leyss.		Gramineae	E
Japanese Brome	Bromus	japonicus Thunb.		Gramineae	E
Cheat Grass	Bromus	tectorum L.		Gramineae	E
Shepherd's Purse	Capsella	bursa-pastoris (L.)		Cruciferae	E
Hoary Cress	Cardaria	draba (L.) Desv.		Cruciferae	E
Musk-thistle	Carduus	nutans L.		Compositae	E
Sandbur	Cenchrus	pauciflorus Benth.		Gramineae	E?
Meadow Chickweed	Cerastium	arvense L.		Caryophyllaceae	E?
Common Mousies Ears	Cerastium	vulgatum L.		Caryophyllaceae	E
Mexican Tea	Chenopodium	ambrosioides L.		Chenopodiaceae	E
Goosefoot	Chenopodium	desiccatum A.		Chenopodiaceae	E?
Oak-leaved Goosefoot	Chenopodium	glaucum L.	glaucum	Chenopodiaceae	E
Red Goosefoot	Chenopodium	rubrum L.		Chenopodiaceae	E
Goosefoot	Chenopodium	sp.		Chenopodiaceae	E?
Bull Thistle	Cirsium	vulgare (Savi) Ten.		Compositae	E
Hedge Bindweed	Convolvulus	sepium L.		Convolvulaceae	E?
Horseweed	Conyza	canadensis (L.)		Compositae	E
Doveweed	Croton	texensis (Klotzsch)		Euphorbiaceae	E?
Awned Dogtail	Cynosurus	echinatus L.		Gramineae	E
Orchard Grass	Dactylis	glomerata L.		Gramineae	E

NAME	GENUS	SPECIES	VARIETY	FAMILY	STATUS
Indigobush	Dalea	leporina (Ait.) K. &		Leguminosae	E?
Flaxweed Tansy	Descurainia	sophia (L.) Webb		Cruciferae	E
Barnyard Grass	Echinochloa	crusgalli (L.)		Gramineae	E?
Russian Olive	Elaeagnus	angustifolia L.		Elaeagnaceae	E
Stinking Lovegrass	Eragrostis	cilianensis (All.)		Gramineae	E
Weeping Lovegrass	Eragrostis	curvula (Schrاد.)		Gramineae	E?
Creeping Lovegrass	Eragrostis	hypnoides (Lam.)		Gramineae	E?
Carolina Lovegrass	Eragrostis	pectinacea (Michx.)		Gramineae	E
Philadelphia Fleabane	Erigeron	philadelphicus L.		Compositae	E?
Heron's Bill	Erodium	cicutarium (L.)		Geraniaceae	E
Six-weeks Fescue	Festuca	octoflora Walt.		Gramineae	E?
Meadow Fescue	Festuca	pratensis Huds.		Gramineae	E
Goosegrass Bedstraw	Galium	aparine L.		Rubiaceae	E
Annual Sunflower	Helianthus	annuus L.		Compositae	E?
Prairie Sunflower	Helianthus	petiolaris Nutt.		Compositae	E?
Foxtail Barley	Hordeum	jubatum L.		Gramineae	E?
Marsh-elder	Iva	xanthifolia Nutt.		Compositae	E?
Summer Cypress	Kochia	scoparia (L.) Roth.		Chenopodiaceae	E
Dwarf-dandelion	Krigia	biflora (Walt.)		Compositae	E?
Canadian Lettuce	Lactuca	canadensis L.		Compositae	E?
Chicory Lettuce	Lactuca	pulchella (Pursh)		Compositae	E?
Prickly Lettuce	Lactuca	serriola L.	integrata Gran. & Godr.	Compositae	E
Prickly Lettuce	Lactuca	serriola L.	serriola	Compositae	E
Stickseed	Lappula	redowskii	redowskii	Boraginaceae	E?
Cutgrass	Leersia	oryzoides (L.)		Gramineae	E?
Duckweed	Lemna	sp.		Lemnaceae	E?
Butter & Eggs	Linaria	vulgaris Mill.		Scrophulariaceae	E
Ryegrass	Lolium	perenne L.		Gramineae	E
Common Mallow	Malva	neglecta Wallr.		Malvaceae	E
Common Horehound	Marrubium	vulgare L.		Labiatae	E
Black Medic	Medicago	lupulina L.		Leguminosae	E
Alfalfa	Medicago	sativa L.		Leguminosae	E
White Sweet Clover	Melilotus	albus Desr.		Leguminosae	E
Sweet Yellow Clover	Melilotus	officinalis (L.)		Leguminosae	E
Common Mint	Mentha	arvensis L.		Labiatae	E?
Spearmint	Mentha	spicata L.		Labiatae	E
Deergrass	Muhlenbergia	rigens (Benth.)		Gramineae	E?
False Buffalo-grass	Munroa	squarrosa (Nutt.)		Gramineae	E
Lambert Locoweed	Oxytropis	lambertii Pursh		Leguminosae	E
Witchgrass	Panicum	capillare L.		Gramineae	E?
Vine Mesquite	Panicum	obtusum H.B.K.		Gramineae	E
Canyon Panic Grass	Panicum	scribnerianum		Gramineae	E?
Common Timothy	Phleum	pratense L.		Gramineae	E?
Common Reed	Phragmites	communis Trin.		Gramineae	E?
Plantain	Plantago	major L.		Plantaginaceae	E
Annual Bluegrass	Poa	annua L.		Gramineae	E
Canada Bluegrass	Poa	compressa L.		Gramineae	E
Fowl Bluegrass	Poa	palustris L.		Gramineae	E?

NAME	GENUS	SPECIES	VARIETY	FAMILY	STATUS
Kentucky Bluegrass	Poa	pratensis L.		Gramineae	E
Smartweed	Polygonum	aviculare L.		Polygonaceae	E
Cornbind	Polygonum	convolvulus L.		Polygonaceae	E
Heart's Ease	Polygonum	persicaria L.		Polygonaceae	E
Rabbitfoot Grass	Polypogon	monspeliensis (L.)		Gramineae	E
Common Purslane	Portulaca	oleracea L.		Portulacaceae	E
Healall	Prunella	vulgaris L.		Labiatae	E
Watercress	Rorippa	nasturtium-		Cruciferae	E
Curlyleaf Dock	Rumex	crispus L.		Polygonaceae	E
Patient Dock	Rumex	patientia L.		Polygonaceae	E
Russian Thistle	Salsola	kali L.	tenuifolia Tausch	Chenopodiaceae	E
Sage	Salvia	pratensis L.		Labiatae	E
Soapwort	Saponaria	officinalis L.		Caryophyllaceae	E
Yellow Bristlegrass	Setaria	lutescens (Weigel)		Gramineae	E
Green Bristlegrass	Setaria	viridis (L.) Beauv.		Gramineae	E
Sleepy Catchfly	Silene	antirrhina L.		Caryophyllaceae	E?
Tumble Mustard	Sisymbrium	altissimum L.		Cruciferae	E
Yellow Rocket	Sisymbrium	irio L.		Cruciferae	E
Sweet Nightshade	Solanum	sarachoides Sendt.		Solanaceae	E
Prickly Sow-thistle	Sonchus	asper (L.) Hill		Compositae	E
Tall Dropseed	Sporobolus	asper (Michx.)		Gramineae	E?
Salt Cedar	Tamarix	pentandra Pall.		Tamaricaceae	E
Common Dandelion	Taraxacum	officinale Weber		Compositae	E
Yellow Salsify	Tragopogon	dubius Scop.		Compositae	E
Meadow Salsify	Tragopogon	pratensis L.		Compositae	E
Puncture Vine	Tribulus	terrestris L.		Zygophyllaceae	E
Alsike Clover	Trifolium	hybridum L.		Leguminosae	E
Red Clover	Trifolium	pratense L.		Leguminosae	E
White Clover	Trifolium	repens L.		Leguminosae	E
Mullein	Verbascum	thapsus L.		Scrophulariaceae	E
Golden Crownbeard	Verbesina	encelioides (Cav.)		Compositae	E?
Water Speedwell	Veronica	anagallis-aquatica		Scrophulariaceae	E?
Thyme-leaved	Veronica	serpyllifolia L.	borealis Laestad.	Scrophulariaceae	E
Cocklebur	Xanthium	strumarium L.		Compositae	E?

APPENDIX B-2

SENSITIVE PLANT LIST, BANDELIER NATIONAL MONUMENT

NAME	GENUS	SPECIES	VARIETY	FAMILY
Grama Grass Cactus	Pediocactus	papyracanthus		Cactaceae
Western Cardinal	Lobelia	cardinalis L.	graminea (Lam.) McVaugh	Campanulaceae
Hawthorn	Crataegus	erythropoda Ashe		Rosaceae
Sego Lily	Calochortus	nuttallii Torr. &		Liliaceae
Wood Lily	Lilium	umbellatum Pursh		Liliaceae
Grape Fern	Botrychium	multifidum (S.G.	coulteri (Underw.) Clausen	Ophioglossaceae
Yellow Lady's Slipper	Cypripedium	calceolus L.	pubescens (Willd.) Correll	Orchidaceae
Few-flowered Bog	Habenaria	sparsiflora Wats.		Orchidaceae
Adder's Mouth	Malaxis	soulei L.O. Wms.		Orchidaceae
Bistort	Polygonum	bistortoides Pursh		Polygonaceae
Canyon Caraway	Aletes	acaulis (Torr.)		Umbelliferae
Mountain Wafer	Cymopterus	montanus (Nutt.)		Umbelliferae

APPENDIX C

NEW MEXICO STATE NOXIOUS WEED LIST

See attached memo from New Mexico State Department of Agriculture.

Also reference handbook on New Mexico's Invasive Weeds by Richard Lee (Lee, Richard D. New Mexico's Invasive Weeds, 1999, College of Agriculture, NMSU, Las Cruces, NM).

NEW MEXICO DEPARTMENT OF AGRICULTURE

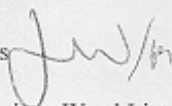
OFFICE OF THE DIRECTOR/SECRETARY
BOX 30005 MSC 3189
Las Cruces, New Mexico 88003-8005
Telephone: (505) 646-3007



September 20, 1999

MEMORANDUM

TO: General Public

FROM: Frank A. DuBois 

SUBJECT: New Mexico Noxious Weed List

The New Mexico Department of Agriculture has selected the following plant species to be targeted as noxious weeds for control or eradication pursuant to the Noxious Weed Management Act of 1998.

New Mexico's noxious weed list is classified into three divisions: Class A, Class B, and Class C weeds, all of which are non-native to New Mexico. Class A weeds are species that currently are not present in New Mexico or have limited distribution; preventing new infestations of these species and eradicating existing infestations is the highest priority.

Class B weeds are species that are limited to portions of the state. In areas that are not infested, these species should be treated as class A weeds. In areas with severe infestations, management plans should be designed to contain the infestation and stop any further spread.

Class C weeds are species that are wide-spread in the state. Management decisions for these species should be determined at the local level based on feasibility of control and level of infestation.

This list does not include every plant species with a potential to negatively impact the state's environment and economy. Vegetation managers are also encouraged to recognize plant species listed on the federal noxious weed list or other western states' noxious weed lists as potentially having negative impacts and to manage them accordingly.

New Mexico Noxious Weed List

Class A Weeds

	Latin name	Origin
Alfombrilla	<i>Drymaria arenarioides</i>	Mexico
Black Henbane	<i>Hyoscyamus niger</i>	Europe
Camelthorn	<i>Alhagi pseudalhagi</i>	Asia
Canada Thistle	<i>Cirsium arvense</i>	Eurasia
Dalmatian Toadflax	<i>Linaria genisitifolia</i> ssp. <i>dalmatica</i>	Europe
Diffuse Knapweed	<i>Centaurea diffusa</i>	Mediterranean
Dyer's Woad	<i>Isatis tinctoria</i>	Europe
Eurasian Watermilfoil	<i>Myriophyllum spicatum</i>	Eurasia
Hoary Cress	<i>Cardaria draba</i>	Europe
Hydrilla	<i>Hydrilla verticillata</i>	South Africa
Leafy Spurge	<i>Euphorbia esula</i>	Eurasia
Onionweed	<i>Asphodelus fistulosus</i>	Mediterranean
Perennial Pepperweed	<i>Lepidium latifolium</i>	South Europe
Purple Loosestrife	<i>Lythrum salicaria</i>	Europe
Purple Starthistle	<i>Centaurea calcitrapa</i>	Europe
Scotch Thistle	<i>Onopordum acanthium</i>	Europe
Spotted Knapweed	<i>Centaurea maculosa</i>	Eurasia
Yellow Starthistle	<i>Centaurea solstitialis</i>	Europe
Yellow Toadflax	<i>Linaria vulgaris</i>	Eurasia

Class B Weeds

	Latin name	Origin
African Rue	<i>Peganum harmala</i>	North Africa
Bull Thistle	<i>Cirsium vulgare</i>	Eurasia
Halogeton	<i>Halogeton glomeratus</i>	Asia
Malta Starthistle	<i>Centaurea melitensis</i>	Europe
Musk Thistle	<i>Carduus nutans</i>	South Europe
Russian Knapweed	<i>Acroptilon repens</i>	Eurasia
Poison Hemlock	<i>Conium maculatum</i> L.	Europe
Teasel	<i>Dipsacus fullonum</i>	Europe

Class C Weeds

	Latin name	Origin
Field Bindweed	<i>Convolvulus arvensis</i> L.	Europe
Jointed Goatgrass	<i>Aegilops cylindrica</i>	South Europe
Russian Olive	<i>Elaeagnus angustifolia</i> L.	Europe
Saltcedar	<i>Tamarix</i> sp.	Europe
Siberian Elm	<i>Ulmus pumila</i>	Europe

APPENDIX C-1

SANTA FE and CARSON NATIONAL FORESTS INVASIVE PLANT LIST

See attached checklist

Carson and Santa Fe National Forest
INVASIVE PLANT SPECIES LIST
REGION 3, USDA-FS

SCIENTIFIC NAME	COMMON NAME	ORIGIN	LIFE CYCLE	CLASSIF.
Alhagi pseudalhagi	Camelthorn	Asia	P	A
Cardaria draba	Hoary Cress	Eurasia	P	A
Carduus nutans	Musk Thistle	So. Europe	B	B
Centaurea diffusa	Diffuse Knapweed	Eurasia	P	A
Centaurea maculosa	Spotted Knapweed	Eurasia	P	A
Centaurea repens	Russian Knapweed	Eurasia	P	B
Centaurea solstitialis	Yellow Starthistle	Europe	A	A
Cirsium arvense	Canada Thistle	Eurasia	P	A
Cirsium vulgare	Bull Thistle	Eurasia	B	B
Dipsacus fullonum	Teasel	Eurasia	B	B??????????????????
Drymaria arenariodes	Alfombria	Mexico	P	A??????????????????
Elaeagnus angustifolia	Russian Olive	Eurasia		
Euphorbia esula	Leafy Spurge	Eurasia	P	A
Halogeton glomeratus	Halogeton	Asia	A	B
Hydrilla verticillata	Hydrilla	So. Africa	P	A??????????????????
Hyoscyamus niger	Black Henbane	Europe	B	A
Isatis tinctoria	Dyer's Woad	Europe	B	A
Linaria dalmatica	Dalmation Toadflax	Europe	P	A
Linaria vulgaris	Yellow Toadflax	Eurasia	P	A
Onopordum acanthium	Scotch Thistle	Europe	B	A
Peganum harmala	African Rue	No. Africa	P	B
Tamarix ramosissima	Saltcedar	Eurasia	P	C
Ulmus pumila	Siberian Elm	Eurasia		

LEGEND

LIFE CYCLE: A = Annual B = Biennial P = Perennial

CLASSIFICATION: A,B,C Classification refers to Region 3's weed class system for assigning management priorities (Ref: Project Risk Assessment).

Date 8/17/00 Daniel Rael/Charlie Jankiewicz

APPENDIX D

LISTING OF EXOTIC PLANTS NOT TO BE CULTIVATED AT BANDELIER

NOTE: In addition to the following list of exotic species, DO NOT CULTIVATE PLANTS NATIVE TO BANDELIER WHICH WERE OBTAINED FROM COMMERCIAL NURSERIES since these have a very high potential to escape or contaminate local populations/genepools. Only native plants obtained locally (i.e. growing in or around Bandelier) are suitable. Bandelier hopes to develop a small native plant nursery to store salvaged plant materials and grow small quantities of native plants for landscaping purposes in order to meet these objectives.

Forbs:

Mullein, Verbascum thaspus

Flax, Linum sp.

Chicory, Cichorium intybus

Oxeye daisy, Chrysanthemum sp.

Hollyhock Mallow, Althaea rosea

Dandelion, Taraxacum vulgare

Amaranth, Amaranthus sp.

Mint, Mentha sp.

Sage, Salvia sp.

Grasses:

Kentucky Bluegrass, Poa pratensis

Smooth Brome, Bromus inermis

Japanese Brome, Bromus japonicus

Orchard Grass, Dactylis glomerata

Timothy, Phleum pratensis

Red Top, Agrostis stolonifera

Western Wheat Grass, Agropyron smithii

Shrubs and Trees:

Salt Cedar, Tamarix pentandra

Russian Olive, Elaeagnus angustifolia

Tree of Heaven, Ailanthus altissimus

Siberian Elm, Ulmus siberica

APPENDIX E

SUGGESTED LIST OF NATIVE SPECIES FOR PLANTING IN CANYON AND MESA DEVELOPED AREAS

Trees

Ponderosa Pine, Pinus ponderosa
Pinyon Pine, Pinus edulis
Rocky Mountain Juniper, Juniperus scopulorum
Dwarf Juniper, Juniperus communis
Gambel Oak, Quercus gambelli

Shrubs

Rabbitbrush, Chrysothamnus nauseosus
Sumac, Rhus trilobata
Barberry, Berberis fendleri
Narrow-leaf Yucca, Yucca glauca
New Mexico Olive, Forestiera neomexicana
Wavy-leaf Oak, Quercus undulata
Apache Plume, Fallugia paradoxa
Buckbrush, Ceanothus fendleri
Mountain Mahogany, Cercocarpus montanus
Mock Orange, Philadelphus microphyllus

Forbs

Skyrocket Gilia, Ipomopsis aggregata
Blazing Star, Liatris punctata
Indian Paint Brush, Castilleja integra
Penstemon species, Penstemon sp.
Fire Wheel, Gaillardia sp.
Desert 4-oclock, Mirabilis multiflora
Golden Aster, Chrysopsis villosa
Sage species, Artemisia sp.

Grasses

Little Blue-stem, Andropogon scoparius
Blue Gramma, Bouteloua gracilis
Mountain Muhly, Muhlenbergia montana
Side Oats, Bouteloua curtipendula

APPENDIX F

EXCERPTED HISTORIC MEMO FROM FORMER CUSTODIAN CHESTER THOMAS

See attached historic memo from park files

N-18

UNITED STATES
DEPARTMENT OF THE INTERIOR
NATIONAL PARK SERVICE
BANDELIER NATIONAL MONUMENT
SANTA FE, NEW MEXICO



701

June 4, 1941.

MEMORANDUM for the Superintendent,
Southwestern National Monuments.

Reference is made to your letter of May 15, 1941, regarding the policy of excluding exotic plants in National Park Service areas. Exotic plants at Bandelier National Monument are confined largely to the areas on which the operator holds special use permit. Two acres of land lying on the floor of Frijoles Canyon are devoted to the operator's garden. About 50 trees of different varieties of fruit are present in this area. The remainder of the area is devoted to garden vegetables, such as: corn, beans, squash, and other varieties. The only justification for their retention is the agreement with the operator, Mrs. Evelyn Frey, that she might retain her orchard and garden for some time. As the trees are in about the most conspicuous portion of the monument used by visitors, their removal would be highly desirable. Other exotics exist in the patios of the operator's residence. These areas consist of two small plots about 40' x 40' and are filled with numerous varieties of exotic flowering species. Some exotic trees are also present in the patios.

Exotic weeds are present in the canyon to a considerable extent. Sunflowers, Russian thistles, white and yellow sweet clover grow in great profusion around the areas which have been disturbed in constructing the lodge, destroying the old lodge utility area, and the old plots of land which formerly were farmed. As I recall, there was some talk at one time of attempting to eradicate these exotics. Personally, I feel that as time goes on, native vegetation will tend to reestablish itself in the disturbed areas and crowd out the exotics eventually.

Chester A. Thomas,
Custodian.

cc: Thomas.

CAT:hl

APPENDIX G

SELECTED VEGETATION RESOURCES

SYSTEMATICS OF VASCULAR PLANTS:

The 1986-89 floristic survey of Bandelier compiled existing floristic information with significant additional collections.

Jacobs; B.F., 1989, A Flora of Bandelier National Monument,

including:

- 1) annotated checklist,
- 2) vascular plant herbarium collection housed at Bandelier,
- 3) floristic databases (on NPS/NBS computers at BAND)

SYSTEMATICS OF NON-VASCULAR PLANTS:

Lichen collection (housed at BAND herbarium)

Fungi collection (housed at Nelson Jarmie residence, Los Alamos, NM)

Fungi database (on NPS/ NBS computers at BAND)

LANDSCAPE ECOLOGY:

The following references provide some of the best available information on the ecology of the Bandelier landscape:

Allen, C.D., 1984, Montane grasslands in the landscape of the Jemez Mountains, New Mexico.

Allen, C.D., 1989, Changes in the landscape of the Jemez Mountains, New Mexico.

Allen, C.D., 1990, Fire history across a landscape gradient in the Frijoles Canyon watershed, New Mexico, Bull. Ecol. Soc. America, 71:2.

Also see: 1995 Bandelier Resources Management Plan

APPENDIX H

SENSITIVE PLANT PROTOCOLS

See attached copy

Sensitive Plants at Bandelier

Standard Operating Procedures

Population Identification

1) For the purposes of recording information on sensitive plants in Bandelier National Monument, a "population" of plants is defined as a single individual, a group of individuals or a number of groups (distributed in patches) within the same general area. When groups of plants occur each case must be considered individually to decide if the group represents one population or may be subdivided into multiple populations. Possible factors to use in this decision may be:

- a. number and spacing of individuals
- b. changes in habitat between groups of individuals

2) Each population will be assigned a distinct number and have an associated GPS coordinates, location description, and maps (both topographic and a small scale grid map).

NOTE: AS MUCH AS POSSIBLE ONE SHOULD **AVOID** THE USE OF TREES AS GENERAL LANDMARKS FOR GUIDING SOMEONE TO THE AREA OF THE POPULATION. LARGE CLIFFS, STREAM CROSSINGS, ETC... ARE MUCH BETTER FOR THIS PURPOSE. (The author does realize however, that not using trees is often difficult especially for those plant populations not near a significant landmark). Trees may be used **within** the population with the site specific map since the compass and meter tape measurements should be specific enough to guide one to the landmark trees and plants as needed.

3) Data that is unchanging or varies little over time will be entered on the Permanent Data Sheet. Please note the following in regards to the yearly recording of information on individually labeled plants:

FLW = flowering, FR = fruiting.

CODES TO FILL IN THE BLANKS:

1). "INDIVIDUAL" should be assigned a letter A - Z **which corresponds** to the individual plants as marked on a site specific map.

2). yes = plant is flowering or fruiting (fill in the appropriated column). Use "yes" ONLY if you can visually see the plant is or will shortly fruit or flower. Do not assume a flower = a fruit at a later stage.

3). no = plant is NOT flowering or fruiting. Use "no" ONLY when you are certain the plant is not or will not flower or fruit.

4). ? = unknown if the plant is or will fruit or flower. This may be due to you visiting the population at an inappropriate time or other factors.

4) Data that varies from year to year is entered on the Annual Survey Information and Update form. Note that information on individual plants should be entered on the permanent data form after every annual survey. Finally, do not throw away the annual survey form. It should be stapled to the previous year's Annual Survey.

**Bandelier National Monument
Sensitive Plant Information Form**

Part I: Permanent Plant Population Data

Taxon:

Population ID Number:

Creation Date of this data sheet:

Recommended Observation dates for flowering/fruiting:

Population Location (also see attached map):

a) Topographic map information

- 1) Topographic Quad name:
- 2) Range:
- 3) Township:
- 4) Section:
- 5) Quarter:

b) GPS/UTM Coordinates:

- 1) Easting:
- 2) Northing:
- 3) Elevation (very approx.):

c) Directions to population (include a major landmark):

Habitat:

a) For habitat determination purposes please state an area (square or rectangular area in square meters) containing the sensitive plants. Minimum area is 5 by 5 meters):

b) Plant Community type (circle or check one or more):

NON-VEGETATED

- ☐ Bare rock, cliffs
- ☐ Sand bars, mud flats
- ☐ Water
- ☐ Roads, structures

NON-FOREST VEGETATION

- ☐ Oak shrubland
- ☐ Shrubland (other)
- ☐ Grass/shrub (mixed)
- ☐ Montane grassland
- ☐ Grassland (other)
- ☐ Moist meadow
- ☐ Wetland
- ☐ Juniper savanna
- ☐ Ponderosa pine savanna/burn
- ☐ Inundated by Cochiti Res.
- ☐ Dry wash/arroyo

OTHER

Please describe...

WOODLANDS

- ☐ Juniper woodland
- ☐ Piñon-juniper woodland

FOREST

- ☐ Ponderosa pine/piñon-juniper
- ☐ Ponderosa pine
- ☐ Ponderosa pine/mixed conifer
- ☐ Mixed conifer
- ☐ Aspen
- ☐ Engelmann spruce/Corkbark

RIPARIAN FOREST

- ☐ Riparian conifer
- ☐ Riparian deciduous
- ☐ Broadleaf, spring/seep sites
- ☐ Riparian piñon-juniper

c) Slope (%):

d) Aspect:

e) Elevation (estimated from topo map):

f) Soils:

g) Drainage:

h) Associated plants (within area defined above in "a"):

1) % Tree Overstory:

2) % non-vegetation (plus) % vegetation (=100%)

_____ % soil

_____ % rock

_____ % fallen trees

_____ % litter

_____ % Tree (basal interc)

_____ % Shrubs

_____ % Forbs

_____ % Gramin.

3) Associated species:

TREES & SHRUBS

FORBS

GRASSES

i) General comments (including disturbances, fire, threats, etc...):

[illegible]

Bandelier National Monument Sensitive Plant Information Form

Part II: Annual Survey Data

Taxon:

Population ID Number:

Date:Observer(s):

Population Data:

a) Total Population:

b) Number of plants in flower (or with buds):

c) Number of plants with fruit:

d) General Comments on plant vigor:

Please see the comments on the permanent data sheet and in the sensitive plant "Standard Operating Plan" (SOP) for information on the use of appropriate codes in the following table.

[illegible]

Recommended Changes for the Permanent Data Form:

a) Changes in recommended observation dates?

b) Changes or additions to habitat observations?

Other Information:

a) Potential or Actual Impacts:

b) Other comments or notes:

APPENDIX I

DISTURBED SITE REHABILITATION GUIDELINES

Disturbed sites by definition are in a developed or formerly developed area and require active site rehabilitation. Two levels of rehabilitation intensity are described to reflect the general approach of using the least invasive methods to accomplish revegetation objectives.

LEVEL I

In many instances minimal techniques, such as installation of erosion control devices, use of dead and down materials for mulching and exclusion of foot and animal traffic, will produce an acceptable vegetative response from existing native plants and native seed already present in the soil. This is the basic approach currently favored for restoration of degraded pinyon-juniper woodland areas.

LEVEL II

If a good response cannot be obtained with minimal physical techniques alone (i.e. Level I), then additions of locally native plant materials may be used to supplement Level I methods. The only acceptable plant materials for use in Bandelier are those with local origins (i.e. seed, cuttings, or transplants with local genetic origins)

Seeding is more efficient than transplanting if suitable seed and site conditions exist and adequate seeding techniques can be employed. Seedbed preparation is an essential part of planting and requires some sort of superficial ground disturbance. Seed should be well incorporated into the soil surface and the seeded sites mulched (i.e. with litter/slash, sterile hay, burlap, or erosion control fabric) to enhance germination conditions.

In some instances, it may be desirable to transplant materials salvaged locally or raised from locally native seed or cuttings in addition to seeding. This may also be an appropriate technique for general landscaping of new developments (see Appendix J for a list of acceptable native species). Outplanting salvaged or greenhouse/ nursery grown plant materials should generally be restricted to early spring (March-April) or late fall (October-November) to take advantage of dormancy and favorable weather patterns.

APPENDIX J

BANDELIER HAZARD TREE SOP

See attached copy

HAZARD TREE MANAGEMENT

Standard Operating Procedures

Introduction:

Bandelier National Monument encompasses forested landscapes with numerous developed sites and recreational opportunities. The intermingling of large trees, park facilities, visitors and personal property poses significant opportunities for hazard tree incidents. The National Park Service (NPS) and Bandelier have a legal responsibility to provide for visitor safety and this includes the systematic inspection, monitoring and mitigation of potential hazard tree damage to people and property.

Impetus for the hazardous tree program derives from aspects of liability. The Federal Tort Claims Act-1 46 (28 USC 2671-80 and 1346 (b)) provides the basis for the Service to be held liable for failure or negligence with respect to visitor protection. Most interpretations of tort law make the landowner responsible for taking reasonable care to avert harm to visitors. Reasonable care may take the form of action and/or warnings. The government as a landowner is required to have superior knowledge of dangers which would not be obvious to the invitee if such dangers are discoverable in the exercise of due care.

The NPS recognizes however, that visitors, park staff and residents are continuously exposed to hazards inherent in a natural environment. Bandelier will exercise reasonable care to protect people and property from harm by hazard trees through implementation of a hazard tree management program. The basis of this program is 1) systematic inspection of trees in developed portions of the park for potential to be a hazard, 2) ranking of potentially hazardous trees, 3) removal of identified hazard trees, which exceed the established threshold, in a timely manner and 4) followup monitoring of trees which were below established thresholds, for changes in status, and of felled trees/limbs for validation of inspection criteria. In addition, since even healthy trees can fail under extreme weather conditions, the park will attempt to issue visitor warnings when deemed appropriate.

The purpose of a hazard tree program at Bandelier helps to provide a safer environment for people and property while also protecting the National Park Service from potential liability in the event of a tree failure.

The National Park Service however, recognizes that park visitors and staff will be continuously exposed to a variety of hazards inherent to a natural environment and which include hazard trees. Visitors and park staff should be aware of these inherent dangers and hold the National Park Service harmless for 'Acts of God'.

The monument will attempt to assess and treat only those hazard trees which are both in developed frontcountry areas and which also pose immediate and obvious threat to life and property. The removal of every tree parkwide, which could potentially be deemed hazardous by some standard, would violate the intent and integrity of designated natural areas.

Hazard Tree Management Zones:

Hazard tree management efforts at Bandelier will involve annual assessments of individual trees in all developed frontcountry areas (public\ employee use and residential) within the monument which are accessible by automobile, or within a short walking distance (1/4 mile) of parking areas on paved trails. These areas include: Frijoles Canyon Picnic Area, Frijoles Canyon Administrative and Residential Areas, Frijoles Canyon Parking areas (both sides of the creek), Frijoles Canyon Main Ruins Trail (not to include the 1/2 mile unpaved trail to Ceremonial Cave), Frijoles Mesa Residential Area, Juniper Campground and Amphitheater Parking, Firetower and Heliport Vicinity, Entrance Gate Vicinity and Entrance Road Corridor including Overlook Pulloff, Ponderosa Campground and Trailhead, Tsankawi Parking Area and Contact Station Vicinity, and Dome Winter Activities Parking Areas/ Rest Stops (see figure 1).

Areas specifically excluded from routine hazard tree inspections include: backcountry trails and undeveloped trail head parking outside of Frijoles Canyon such as Burnt Mesa, Apache Springs, and County Line (see figure 1).

Areas wholly within the Pinyon-Juniper woodland may be excluded from annual inspections once it is established that the probability for hazard trees is low.

Program:**INSPECTION**

On an annual basis, the Hazardous Tree Coordinator (resource management specialist) and the Roads and Trails foreman will conduct a joint inspection of trees within developed areas in order to identify and rank potentially hazardous trees.

The inventory and rating system are detailed in: Detection and Correction of Hazard Trees in Southwestern Recreational Areas, 1992, A How-to Guide for Recreational Site Managers by Terrence J. Rogers, of the U.S.D.A., Forest Service.

Hazard tree rating is based on the probability of a tree failure within a certain time frame combined with the presence/ absence of potential targets should the tree fail. A potentially hazardous tree without a target is a low priority and likewise, a target surrounded by healthy trees is also of little concern. When a hazardous tree is associated with a definitive target, then treatment or at least continued monitoring is indicated. The preferred time frame for the annual inspection is in the spring after the leaves have fully expanded; this allows better distinction between living and dead wood.

TREATMENT:

Hazardous trees which rank at or above the established threshold value will be treated. Treatment will typically consist of removal of the identified hazardous limb or tree; alternatively temporary closure of the target area can be prescribed.

Prompt treatment (i.e. within sixty days) following the annual spring inventory is essential to a successful hazardous tree program. Significant delay may expose the National Park Service to potential litigation if damage or injury results from inaction on an identified hazard. Annual spring inventories will be scheduled and conducted on the understanding that funds, staff or other resources exist to promptly implement prescribed treatments; lacking adequate resources to implement treatments will automatically result in temporary closure of the target area.

Prescribed treatments will be implemented, under the supervision of the Roads and Trails foreman, by a combination of Roads and Trail personnel, Fire Crew personnel or through contract to a local tree removal company. Temporary closure of target areas will be implemented by Protection under the direction of the Hazardous Trees Coordinator with prior approval of the Superintendent.

DATA MANAGEMENT: *The Hazardous Tree Coordinator will schedule annual inventories in consultation with the Roads and Trails Foreman and provide supplies for recording data. In addition the Hazardous Trees Coordinator will manage the annual hazardous tree data set and provide the Roads and Trails foreman with a summarized printout listing hazardous trees targeted for treatment with location and prescribed treatment.*