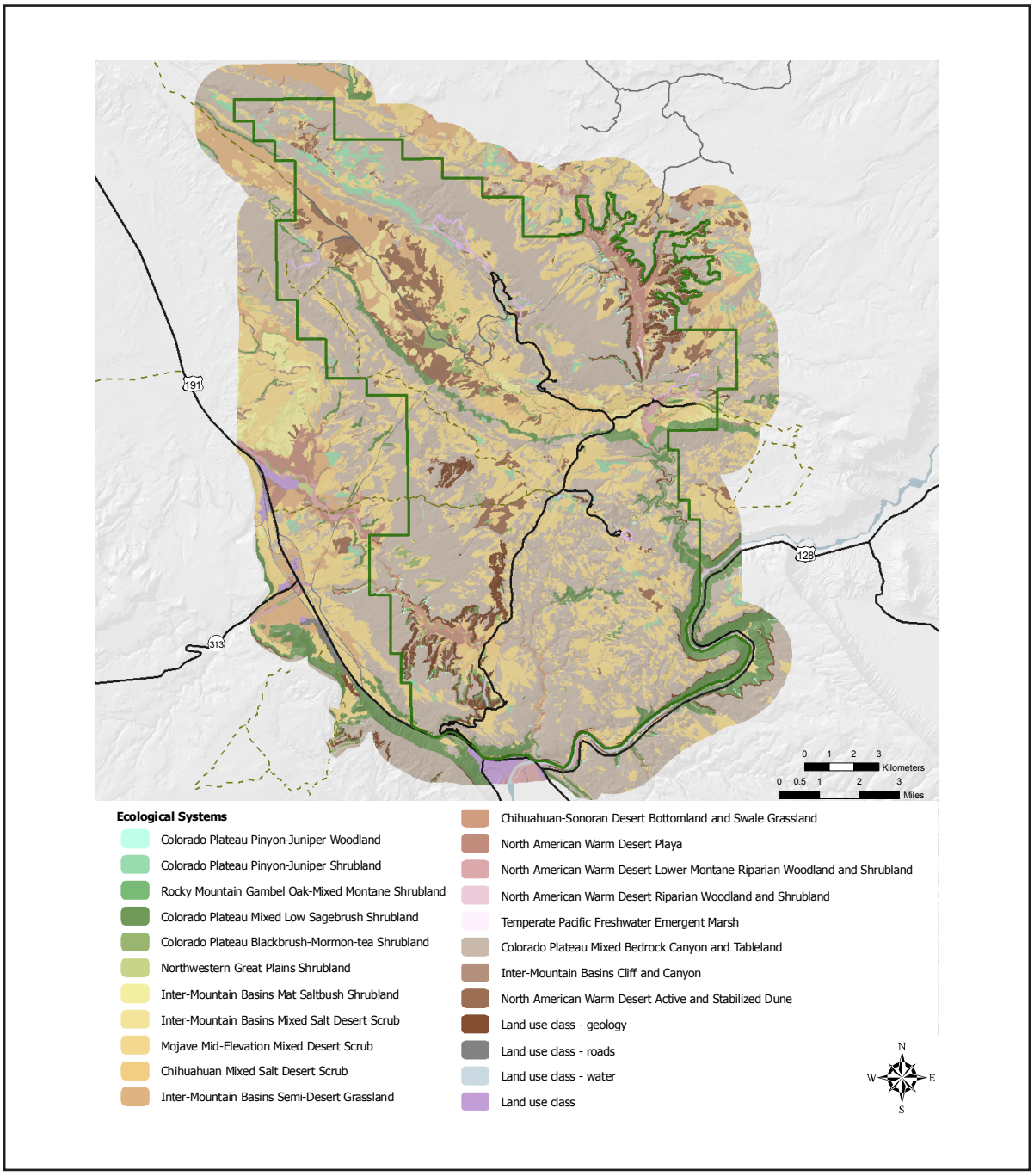
National Park Service
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Natural Resource Program Center

Vegetation Inventory Applications for Park Management

Natural Resource Report NPS/NRPC/BRMD/NRR—2011/342



ON THE COVER
Vegetation Inventory map for Arches National Park

Vegetation Inventory Applications for Park Management

Natural Resource Report NPS/NRPC/BRMD/NRR—2011/342

National Park Service
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March 2011

U.S. Department of the Interior
National Park Service
Natural Resource Program Center
Fort Collins, Colorado

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This report received informal peer review by subject-matter experts who were not directly involved in the collection, analysis, or reporting of the data.

Views, statements, findings, conclusions, recommendations, and data in this report do not necessarily reflect views and policies of the National Park Service, U.S. Department of the Interior. Mention of trade names or commercial products does not constitute endorsement or recommendation for use by the U.S. Government.

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Please cite this publication as:

National Park Service. 2011. Vegetation inventory applications for park management. Natural Resource Report NPS/NRPC/BRMD/NRR—2011/342. National Park Service, Fort Collins, Colorado.

NPS 909/107245, March 2011

Contents

Abstract vii
Foreword viii
Acknowledgements ix
Introduction 1
Appalachian Highlands Network 4
GREAT SMOKEY MOUNTAINS NATIONAL PARK 4
Chihuahuan Desert Network 6
CARLSBAD CAVERNS NATIONAL PARK 6
Eastern Rivers and Mountains Network 8
ALLEGHENY PORTAGE RAILROAD NATIONAL HISTORIC SITE 8
BLUESTONE NATIONAL SCENIC RIVER 10
DELAWARE WATER GAP NATIONAL RECREATION AREA 12
FORT NECESSITY NATIONAL BATTLEFIELD 14
FRIENDSHIP HILL NATIONAL HISTORIC SITE 16
JOHNSTOWN FLOOD NATIONAL MEMORIAL 18
NEW RIVER GORGE NATIONAL RIVER 20
UPPER DELAWARE SCENIC AND RECREATIONAL RIVER 22
Great Lakes Network 24
ISLE ROYALE NATIONAL PARK 24
VOYAGEURS NATIONAL PARK 26
Greater Yellowstone Network 28
GRAND TETON NATIONAL PARK 28
Gulf Coast Network 30
PADRE ISLAND NATIONAL SEASHORE 30
PALO ALTO BATTLEFIELD NATIONAL HISTORIC PARK 32
SAN ANTONIO MISSIONS NATIONAL HISTORIC PARK 34
Heartland Network 36
EFFIGY MOUNDS NATIONAL MONUMENT 36
Klamath Network 38

WHISKEYTOWN NATIONAL RECREATION AREA....38
Mid-Atlantic Network....40
APPOMATTOX COURT HOUSE NATIONAL HISTORICAL PARK....40
BOOKER T. WASHINGTON NATIONAL MONUMENT....42
EISENHOWER NATIONAL HISTORIC SITE....44
FREDERICKSBURG AND SPOTSYLVANIA NATIONAL MILITARY PARK....46
GETTYSBURG NATIONAL MILITARY PARK....48
HOPEWELL FURNACE NATIONAL HISTORIC SITE....50
PETERSBURG NATIONAL BATTLEFIELD....52
RICHMOND NATIONAL BATTLEFIELD PARK....54
SHENANDOAH NATIONAL PARK....56
VALLEY FORGE NATIONAL HISTORIC PARK....58
National Capitol Network....60
ROCK CREEK PARK....60
Northeast Coastal and Barrier Network....62
ASSATEAGUE ISLAND NATIONAL SEASHORE....62
COLONIAL NATIONAL HISTORICAL PARK....64
FIRE ISLAND NATIONAL SEASHORE....66
GATEWAY NATIONAL RECREATION AREA....68
GEORGE WASHINGTON BIRTHPLACE NATIONAL MONUMENT....70
SAGAMORE HILL NATIONAL HISTORIC SITE....72
Northeast Temperate Network....74
ACADIA NATIONAL PARK....74
SAUGUS IRON WORKS NATIONAL HISTORIC SITE....76
WEIR FARM NATIONAL HISTORIC SITE....78
Northern Colorado Plateau Network....80
ARCHES NATIONAL PARK....80
CAPITOL REEF NATIONAL PARK....82
COLORADO NATIONAL MONUMENT....84
DINOSAUR NATIONAL MONUMENT....86

HOVENWEEP NATIONAL MONUMENT 88
NATURAL BRIDGES NATIONAL MONUMENT 90
PIPE SPRINGS NATIONAL MONUMENT 92
TIMPANOGAS CAVE NATIONAL MONUMENT 94
ZION NATIONAL PARK 96
Northern Great Plains Network 98
AGATE FOSSIL BEDS NATIONAL MONUMENT 98
BADLANDS NATIONAL PARK 100
DEVILS TOWER NATIONAL MONUMENT 102
FORT LARAMIE NATIONAL HISTORIC SITE 104
FORT UNION TRADING POST NATIONAL HISTORIC SITE 106
JEWEL CAVE NATIONAL MONUMENT 108
KNIFE RIVER INDIAN VILLAGES NATIONAL HISTORIC SITE 110
MOUNT RUSHMORE NATIONAL MEMORIAL 112
SCOTTS BLUFF NATIONAL MONUMENT 114
THEODORE ROOSEVELT NATIONAL PARK 116
WIND CAVE NATIONAL PARK 118
Rocky Mountain Network 120
FLORISSANT FOSSIL BEDS NATIONAL MONUMENT 120
GLACIER NATIONAL PARK 122
GREAT SAND DUNES NATIONAL PARK AND PRESERVE 124
ROCKY MOUNTAIN NATIONAL PARK 126
San Francisco Bay Network 128
GOLDEN GATE NATIONAL RECREATION AREA 128
JOHN MUIR NATIONAL HISTORIC SITE 130
POINT REYES NATIONAL SEASHORE 132
Sierra Nevada Network 134
YOSEMITE NATIONAL PARK 134
Sonoran Desert Network 136
TUZIGOOT NATIONAL MONUMENT 136

Southeast Coast Network....138
CONGAREE NATIONAL PARK....138
Southern Colorado Plateau Network....140
AZTEC RUINS NATIONAL MONUMENT....140
MESA VERDE NATIONAL PARK....142
SUNSET CRATER VOLCANO NATIONAL MONUMENT....144
WALNUT CANYON NATIONAL MONUMENT....146
WUPATKI NATIONAL MONUMENT....148
Southern Plains Network....150
ALIBATES FLINT QUARRIES NATIONAL MONUMENT....150
BENT'S OLD FORT NATIONAL HISTORIC SITE....152
FORT LARNED NATIONAL HISTORIC SITE....154
FORT UNION NATIONAL MONUMENT....156
LAKE MEREDITH NATIONAL RECREATION AREA....158
LYNDON B. JOHNSON NATIONAL HISTORICAL PARK....160
SAND CREEK MASSACRE NATIONAL HISTORIC SITE....162
WASHITA BATTLEFIELD NATIONAL HISTORIC SITE....164
Upper Columbia Basin Network....166
CRATERS OF THE MOON NATIONAL MONUMENT AND PRESERVE....166
HAGERMAN FOSSIL BEDS NATIONAL MONUMENT....168

Abstract

The NPS Vegetation Inventory (http://science.nature.nps.gov/im/inventory/veg/index.cfm) is one of the twelve national inventories being completed by the NPS Inventory and Monitoring (I&M) Program. The vegetation inventory is a long-term effort to develop baseline vegetation data for all National Park units that have a natural resource component. The Vegetation Inventory Program has been a collaborative arrangement between the USGS Center for Biological Informatics and the NPS since 1992. Over the years, the National Park Service has assumed the role as primary funding agency through the NPS Inventory and Monitoring base funds. The USGS collaborators have continued to host the data posting for completed vegetation inventory projects and coordination for imagery archiving and standards development. The joint-website for data products is through the USGS Vegetation Characterization Program (http://biology.usgs.gov/npsveg/status.html). The NPS Natural Resource Information Portal is also updated to include a hyperlink to the final products for each NPS Park Unit (http://science.nature.nps.gov/nrdata).

The NPS plans to complete an inventory of vegetation in more than 270 park units service-wide. Approximately 94 park inventories have been completed since the Program's inception in 1994, and there are concurrently about 150 projects underway, with additional projects being planned annually.

This document provides an overview of many of the completed vegetation inventory projects, and some of the valuable applications that have been made of the data produced from them. This document is a compilation of text, images, and data from the reports, GIS data, and other products developed as part of those vegetation inventories. It contains a 2-page abstract for each of the 83 NPS units that had a vegetation inventory complete, or nearing completion, as of December, 2009. It is our hope that the information contained on the following pages will provide additional insight and inspiration for the important uses the vegetation inventory products can support.

March 31, 2011

Foreword

This compilation of park applications illustrates the breadth and depth of interest and support that results from the valuable vegetation inventory products provided to park managers. Evidenced by the vital signs that have been selected, many of the NPS Inventory and Monitoring Networks clearly see the vegetation as a composite indicator for many of the NPS cultural and natural resource values that parks need to maintain. To that end, the Vegetation Inventory staff will work with Park and Network staff to utilize the field keys and classification products to design and enable a work flow to use the best available imagery and field data to represent the existing vegetation at the most current state.

Geographic Information Systems (GIS) and Global Positioning Systems (GPS) allow the Park and Network staffs to collect, manage, and monitor the status of the vegetation at the Parks. There is a thread of interest that shows consistently through these applications, and that involves the update or refresh of the datasets as the park vegetation evolves. Conceptually, the updating, versioning, archiving, and data management needs are well understood. The effort and support to upgrade or retire polygon features, attributes, or other geospatial features, and to package and verify the new datasets are a continuous challenge and opportunity. New inventory funding and realigned inventory priorities are already indicating that a suite of parks will need this effort and support.

Land exchanges and disturbances such as fire, hurricanes, forest insect and pathogens outbreaks, climate change and a variety of other “change agents” are active on the Park lands. Fire effects data, new fire intensity polygons, and post burn assessments are active examples of “place based” data that can and should facilitate vegetation updates. In the near future, the Vegetation Inventory plans to develop several case studies of park change and vegetation map updates that can illustrate this process and provide some examples of how to proceed with a dataset update. For the remaining parks, these applications provide a broad sampling of the use and benefits of the vegetation inventory products. The Vegetation Inventory program looks forward to the completion of the more than 270 baseline datasets with a full expectation that updates and refresh tasks will become a common need and desire to provide the best available data to park managers.

Dr. Karl E. Brown, Vegetation Inventory Program Manager
Natural Resources Stewardship and Science, 2011

Acknowledgements

All of the information and photos in this document were gathered from the following sources:
- Vegetation Inventory products available by NPS unit on the USGS Vegetation Characterization Program website (http://science.nature.nps.gov/im/inventory/veg/products.cfm),
- Individual NPS unit websites (e.g., http://www.nps.gov/arch/index.htm), and
- Phone conversations and e-mail correspondence with I&M Network Coordinators and/or individuals at the NPS units (see table below for list of contributors).

Sincere thanks is extended to those individuals at the various NPS Networks (see Figure 1 in the Introduction) and Parks who provided content information on applications of the vegetation inventory, and took time to review the draft abstracts. Special appreciation is extended to Karl Brown and Tammy Cook for their guidance and asssistance in compiling this information!

NPS Network	Park Code	Park Name	Network Contributors	Park Contributors
Appalachian Highlands	GRSM	Great Smoky Mountains National Park	Robert Emmott	Tom Ramaley
Chihuahuan Desert	CAVE	Carlsbad Caverns National Park	Kristen Gallo Hildy Reiser	
Eastern Rivers and Mountains	ALPO	Allegheny Portage Railroad NHS	Matt Marshall Stephanie Perles	
	BLUE	Bluestone National Scenic River	Matt Marshall Stephanie Perles	
	DEWA	Delaware Water Gap NRA	Matt Marshall Stephanie Perles	
	FONE	Fort Necessity National Battlefield	Matt Marshall Stephanie Perles	
	FRHI	Friendship Hill National Historic Site	Matt Marshall Stephanie Perles	
	JOFL	Johnstown Flood National Memorial	Matt Marshall Stephanie Perles	
	NERI	New River Gorge National River	Matt Marshall Stephanie Perles	
	UPDE	Upper Delaware Scenic & RR	Matt Marshall Stephanie Perles	
Great Lakes	ISRO	Isle Royale National Park	Bill Route Ulf Gafvert	Mark Romanski Ted Gostomski
	VOYA	Voyageurs National Park	Bill Route Ulf Gafvert	Mark Romanski Ted Gostomski Steve Windels Jim Schaberl Sam Lammie
Greater Yellowstone	GRTE	Grand Teton National Park	Cathie Jean	Kelly McCloski
Gulf Coast	PAIS	Padre Island National Seashore	Martha Segura	James Lindsay
	PAAL	Palo Alto Battlefield NHP	Martha Segura Jeff Bracewell	Rolando Garza
	SAAN	San Antonio Missions National Historic Site	Martha Segura	Greg Mitchell

NPS Network	Park Code	Park Name	Network Contributors	Park Contributors
Heartland	EFMO	Effigy Mounds National Monument	Mike DeBacker	Rodney Rovang Kevin James
Klamath	WHIS	Whiskeytown National Recreation Area	Dan Sarr	Jennifer Gibson
Mid-Atlantic	APCO	Appomattox Court House NHP	Jim Comiskey	
	BOWA	Booker T. Washington National Monument	Jim Comiskey	Timbo Simms
	EISE	Eisenhower National Historic Site	Jim Comiskey	
	FRSP	Fredericksburg Battlefield and Spotsylvania NMP	Jim Comiskey	
	GETT	Gettysburg National Military Park	Jim Comiskey	
	HOFU	Hopewell Furnace National Historic Site	Jim Comiskey	
	PETE	Petersburg National Battlefield	Jim Comiskey	
	RICH	Richmond National Battlefield Park	Jim Comiskey	Kristen Allen
	VAFO	Valley Forge National Historic Park	Jim Comiskey	
	SHEN	Shenandoah National Park	Jim Comiskey	Wendy Cass
National Capital	ROCR	Rock Creek Park	Patrick Campbell	Ken Ferebee
Northeast Coastal and Barrier	ASIS	Assateague Island National Seashore	Sara Stevens	Chris Lea
	COLO	Colonial National Historical Park	Sara Stevens	Dorothy Geyer
	FIIS	Fire Island National Seashore	Sara Stevens	Mike Bilecki
	GATE	Gateway National Recreation Area	Sara Stevens	Mark Christiano
	GEWA	George Washington Birthplace NM	Sara Stevens	Rijk Morawe
	SAHI	Sagamore Hill National Historic Site	Sara Stevens	Scott Gurney
Northeast Temperate	ACAD	Acadia National Park	Brian Mitchell	Kate Miller
	SAIR	Saugus Iron Works National Historic Site	Brian Mitchell	Marc Albert
	WEFA	Weir Farm National Historic Site	Brian Mitchell	Greg Waters

NPS Network	Park Code	Park Name	Network Contributors	Park Contributors
Northern Colorado Plateau	ARCH	Arches National Park	Dusty Perkins Amy Tendick Aneth Wight	Jeff Troutman
	CARE	Capitol Reef National Park	Dusty Perkins Amy Tendick Aneth Wight	Sandy Borthwick
	COLM	Colorado National Monument	Dusty Perkins Amy Tendick Aneth Wight	Pam Koenig Kimberly Hartwig
	DINO	Dinosaur National Monument	Dusty Perkins Amy Tendick Aneth Wight	Tamara Naumann
	HOVE	Hovenweep National Monument	Dusty Perkins Amy Tendick Aneth Wight	Jeff Troutman
	NABR	Natural Bridges National Monument	Dusty Perkins Amy Tendick Aneth Wight	Jeff Troutman
	PISP	Pipe Spring National Monument	Dusty Perkins Amy Tendick Aneth Wight	Kristin Legg Andrea Bornemeier
	TICA	Timpanogas Cave National Monument	Dusty Perkins Amy Tendick Aneth Wight	Cami Pulham
	ZION	Zion National Park	Dusty Perkins Amy Tendick Aneth Wight	Kristin Legg, Matt Betenson & Dan Cohan
Northern Great Plains	AGFO	Agate Fossil Beds National Monument	Kara Paintner Amy Symstad	James Hill Robert Manasek
	BADL	Badlands National Park	Kara Paintner Amy Symstad	Brian Kenner
	DETO	Devils Tower National Monument	Kara Paintner Amy Symstad	Mark Biel
	FOLA	Fort Laramie National Historic Site	Kara Paintner Amy Symstad	Mitzi Frank
	FOUS	Fort Union Trading Post NHS	Kara Paintner Amy Symstad	Audrey Barnhart
	JECA	Jewel Cave National Monument	Kara Paintner Amy Symstad	Mike Wiles
	KNRI	Knife River Indian Villages NHS	Kara Paintner Amy Symstad	John Moeyken
	MORU	Mount Rushmore National Memorial	Kara Paintner Amy Symstad	Bruce Weisman
	SCBL	Scotts Bluff National Monument	Kara Paintner Amy Symstad	Robert Manasek
	THRO	Theodore Roosevelt National Park	Kara Paintner Amy Symstad	Bill Whitworth
	WICA	Wind Cave National Park	Kara Paintner Amy Symstad	Beth Burkhart Ken Hyde
Rocky Mountain	FLFO	Florissant Fossil Beds NM	Mike Britten Billy Schweiger	Rick Wilson
	GLAC	Glacier National Park	Mike Britten Billy Schweiger	Richard Menicke Tara Carolin

NPS Network	Park Code	Park Name	Network Contributors	Park Contributors
	GRSA	Great Sand Dunes National Park	Billy Schweiger	
	ROMO	Rocky Mountain National Park	Mike Britten Billy Schweiger	Jeff Connor
San Francisco Bay	GOGA	Golden Gate National Recreation Area	Marcus Koenen	Alison Forrestel
	JOMU	John Muir National Historic Site	Marcus Koenen	
	PORE	Point Reyes National Seashore	Marcus Koenen	Alison Forrestel
Sierra Nevada	YOSE	Yosemite National Park	Linda Mutch	Peggy Moore
Sonoran Desert	TUZI	Tuzigoot National Monument		Andy Hubbard
Southeast Coast	CONG	Congaree National Park	Joe DeVivo	Bill Hulslander
Southern Colorado Plateau	AZRU	Aztec Ruins National Monument	Lisa Thomas Anne Cully	Paul Whitelfield
	MEVE	Mesa Verde National Park	Lisa Thomas Anne Cully	George SanMiquel Allan Loy
	SUCR	Sunset Crater National Monument	Lisa Thomas Anne Cully	Paul Whitelfield
	WACA	Walnut Canyon National Monument	Lisa Thomas Anne Cully	Paul Whitelfield
	WUPA	Wupatki National Monument	Lisa Thomas Anne Cully	Paul Whitelfield
Southern Plains	ALFL	Alibates Flint Quarries NM	Robert Bennetts Tomye Folts-Zettner	
	BEOL	Bent's Old Fort National Historic Site	Robert Bennetts Tomye Folts-Zettner	
	FOLS	Fort Larned National Historic Site	Robert Bennetts Tomye Folts-Zettner	
	FOUN	Fort Union National Monument	Robert Bennetts Tomye Folts-Zettner	
	LAMR	Lake Meredith NRA	Robert Bennetts Tomye Folts-Zettner	
	LYJO	Lyndon B. Johnson NHP	Robert Bennetts Tomye Folts-Zettner	
	SAND	Sand Creek Massacre National Historic Site	Robert Bennetts Tomye Folts-Zettner	
	WABA	Washita Battlefield National Historic Site	Robert Bennetts Tomye Folts-Zettner	
Upper Columbia Basin	CRMO	Craters of the Moon	Lisa Garrett Tom Rodhouse	John Apel Steve Bekedam Gordon Dicus
	HAFO	Hagerman Fossil Beds National Monument	Lisa Garrett Tom Rodhouse	

Introduction

As part of the National Park Service's (NPS) effort to "improve park management through greater reliance on scientific knowledge," the Inventory and Monitoring (I&M) Program was created to accumulate natural resource information through data collection, analyses, synthesis, and modeling. Inventories are being completed at NPS units across the country to create baseline information for 12 basic natural resource components, including air quality, climate, soils, water, vegetation, and others (visit http://science.nature.nps.gov/im/inventory/index.cfm for details).

The Vegetation Inventory

The NPS Vegetation Inventory (http://science.nature.nps.gov/im/inventory/veg/index.cfm) is one of the twelve national inventories being completed by the NPS Inventory and Monitoring (I&M) Program in an effort to classify, describe, and map vegetation communities in more than 270 National Park units across the United States. The Vegetation Inventory is a long-term effort to develop baseline vegetation data for all National Park units that have a natural resource component. As such, program activities are based on a set of standardized procedures and produce peer-reviewed, objective data and reports. The program standards and quality control procedures are used to ensure that products are accurate and consistent for initial inventory purposes and are suitable for long-term monitoring and management purposes.

The products generated by the vegetation inventory meet Federal Geographic Data Committee (FGDC) standards for vegetation classification, metadata, and national standards for spatial accuracy and data transfer. The standards used include a minimum mapping unit of 0.5 hectares and classification accuracy of 80% for each map class. The US National Vegetation Classification System (USNVC) is used by the program to classify the vegetation communities (http://usnvc.org). Digital products produced by the vegetation inventory are available for download from the NPS on the World Wide Web data portal (http://biology.usgs.gov/npsveg/).

The USNVC standard was first developed in 1997 and is an FGDC standard through the upper five levels, which focus primarily on physiognomic (or plant shape) characteristics. The lower levels of the hierarchy focus on vegetative characteristics (floristics) and are not yet fully adopted as the FGDC standard. In 2008, the FGDC formally adopted the revised classification standard (version 2) which includes changes at the mid-levels of the hierarchy, primarily in the interest of increased ease of mapping.

The eight levels of the USNVC hierarchy are organized into three upper levels, three middle levels, and two lower levels (Table 2.2). All levels of the classification are defined using floristic and physiognomic characteristics of the vegetation. The "alliance" and the "association" comprise the lower levels of the classification and are the finest classification units used in the NPS vegetation inventories.

The structure of the Revised USNVC hierarchy includes the following levels (*from* National Vegetation Classification Standard Version 2.0, Vegetation Subcommittee, Federal Geographic Data Committee, FGDC Document number: FGDC-STD-005-2008. U.S.Geological Survey, Reston, Virginia. February, 2008).

Revised Hierarchy for Natural Vegetation (Version 2.0):

Upper Levels
- Level 1 – Formation Class
- Level 2 – Formation Subclass
- Level 3 – Formation

Mid Levels
- Level 4 – Division
- Level 5 – Macrogroup
- Level 6 – Group

Lower Levels
- Level 7 – Alliance
- Level 8 – Association

The units reported in the NPS vegetation inventories (alliance and association) are defined in the USNVC as:

Alliance: A vegetation classification unit of low rank (7th level) containing one or more associations, and defined by a characteristic range of species composition, habitat conditions, physiognomy, and diagnostic species, typically at least one of which is found in the uppermost or dominant stratum of the vegetation. Alliances reflect regional to sub-regional climate, substrates, hydrology, moisture/nutrient factors, and disturbance regimes.

Association: A vegetation classification unit of low rank (8th level) defined on the basis of a characteristic range of species composition, diagnostic species occurrence, habitat conditions and physiognomy. Associations reflect the influence of topo-edaphic, climatic, hydrologic, and substrate features, and local disturbance regimes.

The Vegetation Inventory plans to complete inventory of vegetation in more than 270 units service-wide. The program has completed approximately 94 park inventories since its inception in 1994. There are concurrently about 150 projects underway, with additional projects being planned annually (visit http://biology.usgs.gov/npsveg/status.html for up-to-date status information). The products of the inventories reflect the conditions of the vegetation of a park at a single point in time. Park units are encouraged to keep the product relevant over time by maintaining and updating the inventory data as new data become available, and as changes to the vegetation from human and natural causes occur.

This document provides an overview of many of the completed vegetation inventory projects and some of the valuable applications that have been made of the data produced from them. The applications range from routine park management to scientific research and ecological modeling. The data and products from the inventories are widely used to inform education and interpretive programs, facilitate natural and cultural resource planning, and support fire management activities within many parks. It is our hope that the information contained on the following pages will provide additional insight and inspiration for the value and important uses the vegetation inventory products can support.

Organization of this Document

This document is a compilation of text, images, and data from completed products of Vegetation Inventory projects across the country. It contains a 2-page abstract for 83 of the NPS units that had a Vegetation Inventory complete, or nearing completion, as of December, 2009. Abstracts are ordered alphabetically by Inventory and Monitoring Network (Figure 1), and then by unit. The abstracts are designed to serve a dual purpose: 1) to summarize the inventory project and how park staff have

Figure 1. Inventory and Monitoring Program Networks of the National Park Service, coterminous U.S.



applied the data; and 2) to provide a nearly camera ready fact sheet that can be easily adapted by the park for printed or web-based interpretation materials. In order to accommodate the desire to utilize individual abstracts as stand-alone materials, several departures have been made from the NPS report standards. These include labeling of photographs and tables, sizing and coloring of heading fonts, and other stylistic adaptations made for aesthetic purposes.

Each abstract contains the following information:

- Unit name;
- Dates of Vegetation Inventory (year project was begun through year of final report publication);
- State(s) in which the unit occurs;
- Descriptive summary of the park;
- Brief summary of the classification and mapping results;
- Table highlighting the type, acreage, and percent cover of the top 10 map classes within the park boundaries;
- Summary of the various ways that park and Network staff have used the data; and
- Illustrative photos (photos are from the Vegetation Inventory products, or from the NPS park websites, unless credited otherwise).

The descriptions of the applications for the Vegetation Inventory data in this document are considered a minimum. Responses from many park units remain outstanding, and we are confident that the actual usage of Vegetation Inventory data completed to date exceeds the information provided here, both in type of application, as well as in number.

One theme that was constant across park staff who provided input for this effort was the desire for additional future funds to keep the maps updated. Other common themes include the desire for support to conduct advanced ecological analyses using the vegetation data, and to update the imagery upon which data updates are based.

GREAT SMOKEY MOUNTAINS NATIONAL PARK

1995 – 1999 Tennessee, North Carolina

Park Character

Great Smokey Mountains National Park (GRSM) covers over 800 square miles (more than 500,000 acres) of forested land straddling the crest of the Appalacian Trail along the Tennessee/North Carolina border. Elevations range from approximately 875' to 6,600'. Vegetation is generally characterized by high elevation spruce-fir forests, high elevation hardwood forests, and pine-oak and mountain cove forests. Roughly 80% of the park is comprised of deciduous forests.



The Great Smokey Mountains.

Classification and Mapping

This classification and mapping project was a pilot that focused on two quadrangles: Cades Cove and Mount Le Conte. The classification for GRSM describes natural and semi-natural vegetation in 42 alliances and 68 associations, including 48 hardwood forests, two woodlands, and six shrublands, as well as 10 herbaceous and two sparsely vegetated types.

Fifty-two of the 68 associations are documented on the pilot quads. The final map was created using 40 classes (31 vegetated, 9 non-vegetated), with an overall accuracy of 80.4%.

Applications of the Vegetation Inventory

Planning and Park Management — Staff at GRSM have used their map to:The vegetation map and other products will soon be available at http://nrinfo.nps.gov/Reference.mvc/Profile?Code=2097270.

- Create a geospatial map of imperiled communities by cross-walking the vegetation map with a database of at-risk communities identified by NatureServe, to graphically display these communities on a park wide map;
- Create fuel models for prescribed fires; and
- Analyze understory vegetation to plan safe and efficient backcountry travel for resource management projects.

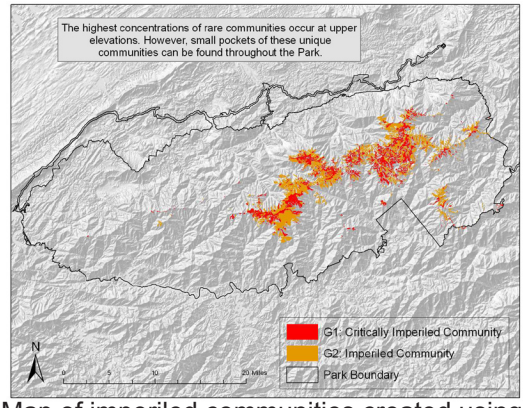
Invasive Species Management — The vegetation map is GRSM's primary planning and reconnaissance tool to identify areas to release biocontrol agents and establish conservation areas to manage hemlock woolly adelgid (HWA). HWA is a non-native insect that infests eastern hemlocks and causes tree mortality in three to ten years. GRSM has the largest areal extent of old growth hemlock in the NPS, so management of this significant resource is a primary concern for GRSM.

Education and Interpretive Programs — Vegetation data were used to create a web-based resource education tool that combines videos and interactive games, as well as downloadable lessons and activities, to teach grade school children about biodiversity. Visit the site at http://www.smokymountainseft.org/10modules.html.

Representative Vegetation Types at GRSM*		
Map Class	**Acres**	**% of Park**
Northern Hardwood / Acid Hardwood Forest	87,726	16%
Chestnut Oak Forest	76,697	14%
Oak-Hickory Forest (Red Oak type)	60,802	11%
Cove Forest (typic type)	49,162	9%
Oak-Hickory Forest (typic acidic type)	43,102	8%
Yellow Pine Forest	38,320	7%
Northern Hardwood / Boulderfield Forest	22,204	4%
Acid Cove Forest (typic type)	21,120	4%
Successional Hardwood Forest	19,815	4%
Spruce-Fir Forest	13,987	3%

**The top 10 of 40 mapped classes, representing 80% of the park.*

In addition, vegetation maps and data are routinely used for a variety of natural resource based presentations. For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?code=2165636.



Map of imperiled communities created using Vegetation Inventory map.



Cades Cove.



Autumn colors at GRSM.



Over 2,100 miles of streams and rivers flow through Great Smoky Mountains National Park. *John Heidecker*

CARLSBAD CAVERNS NATIONAL PARK

1999 - 2003 New Mexico

Park Character

President Calvin Coolidge established Carlsbad Caverns National Monument (CAVE) on October 15, 1923, in order to protect scenic Carlsbad Cave. Congress established CAVE as a National Park in 1930, and in 1978 Congress designated 71% of the park's surface area as Wilderness. CAVE was designated as a World Heritage Site in 1995, for protection of "physical and biological formations and groups, which are of universal world-wide value and interest." Including additions made to the park over the years, CAVE is currently 46,766 acres, 33,125 acres of which are wilderness backcountry with little water.



CAVE landscape. *Missy Powell*

CAVE not only harbors world-renowned caves, it also supports one of the more complex and unique ecosystems in the arid Southwest. The same unusual Permian limestone reefs that house the caverns give rise to diverse vegetation communities that provide habitat and forage for a plethora of wildlife.

Classification and Mapping

To classify the vegetation, 400 representative plots located in CAVE were collected in 1999-2002. Analysis of the plot data identified 85 plant associations ranging from desert shrublands and semi-grasslands of the lowland basins and foothills up through montane grasslands, shrublands and woodlands of the highest elevations. Of these, 20 were considered well established associations described elsewhere in the Southwest; 37 were considered provisional types with more limited documentation (three or four plots), and the remaining 28 are new associations that had not previously been described (represented by one or two plots).

Using the vegetation classification as a foundation, a total of 33 vegetation mapping classes (out of 34 total mapping units) were defined for the entire project area. The vegetation map documents that more than half the park is montane and desert shrubland, and about a third of the park is covered in various grassland associations. Both Level 1 and Level 2 map units meet accuracy requirements (91.1% and 80.5%, respectively) and are sufficient for most natural resource planning and management applications.

Applications of the Vegetation Inventory

CAVE is the only unit in the Chihuahuan Desert Network (CHDN) to have completed a vegetation inventory.

Research Applications — Mapping data have been used to model habitat for Mexican Spotted Owl, conduct targeted surveys for

Representative Vegetation Types at CAVE*		
Map Class	**Acres**	**% of Park**
Moderate Oak - Mountain Mahogany Shrubland	7,766	17%
Curlyleaf Muhly Grassland	6,249	13%
Dense Oak - Mountain Mahogany Shrubland	4,001	9%
Curlyleaf Muhly Grassland with Oak and Mountain Mahogany	3,356	7%
Mariola - Goldeneye Desert Shrubland	3,261	7%
Pinchot Juniper - Oak Shrubland	2,750	6%
Viscid Acacia Desert Shrubland	2,497	5%
Sparse Oak - Mountain Mahogany Shrubland	2,497	5%
Curlyleaf Muhly Grassland with Pinchot Juniper	2,338	5%
Cactus - Ocotillo Desert Succulent Shrubland	2,118	5%

**Top 10 of 34 total mapped classes, representing 79% of CAVE.*

the owl based on the habitat models, as well as for federally listed cactus species.

Interpretation — Mapping data have been used in interpretative talks to illustrate the diversity of the landscape, particularly to increase interest in the back country.

Future Applications

Park Management — Vegetation data will be used to assist in the preparation of Natural Resource Condition Assessments, Resource Stewardship Strategies, and delineation of nesting habitat for Bell's Vireo.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?code=2165621.



Shrubland vegetation at CAVE. *Missy Powell*



Shrubland vegetation at CAVE. *Missy Powell*

ALLEGHENY PORTAGE RAILROAD NATIONAL HISTORIC SITE

2004 - 2006 Pennsylvania

Park Character

The Allegheny Portage Railroad National Historic Site (ALPO) covers approximately 1,280 acres in two Units. The Main Unit lies on a dividing ridge of the Allegheny Mountains that separates two major drainage basins - the Chesapeake Bay Watershed and the Ohio River basin. At the Staple Bend Tunnel Unit in the Ohio River Basin, seeps and intermittent streams are found along the historic railroad trace, which is now a hiking and biking trail.



Allegheny Hardwood Forest.

The Allegheny Portage Railroad was built in 1831 to traverse the Allegheny Mountains which stand between the eastern seaboard and the country's interior. Many environmental factors, such as geology, topography, soils, and hydrology, influenced the construction of the inclined planes. These environmental attributes and land use history also influence the types and distribution of vegetation within ALPO.

Classification and Mapping

The vegetation classification identified 16 associations. Allegheny Hardwood Forest and Northern Hardwood Forest, both part of the Sugar Maple - Yellow Birch - (American Beech) Forest Alliance, are the two most abundant vegetation associations within ALPO. Several other forest associations occur scattered throughout ALPO within these two common forest types. Three hemlock- hardwood types are differentiated from each other by their environmental setting and the species of co-dominant hardwoods. The forest types in the Staple Bend Unit are generally of lower quality compared with the forests at higher elevations in the Main Unit, and contain dense infestations of two invasive species. Vegetation types were mapped to the alliance level, with an overall accuracy of 72.4%.

Applications of the Vegetation Inventory

Insect and Disease Mitigation, Management, and Monitoring — The vegetation classification is being used to predict which areas of ALPO are susceptible to damage from impending insect and disease infestations, specifically hemlock wooly adelgid and emerald ash borer. This information can then be used to prioritize stands for control by looking at land ownership, cultural and natural resource value, topography, potential for hazard trees, and difficulty of hazard tree removal.

Research and Monitoring — The vegetation map has been used in the production of a report which identifies the distribution and abundance of non-native plant species.

NatureServe has developed ecological systems maps based on the vegetation association maps (Technical Report NPS/

Representative Vegetation Types at ALPO*		
Map Class	**Acres**	**% of Park**
Sugar Maple - Yellow Birch - (American Beech) Forest Alliance	941	51%
Northern Red Oak - (Sugar Maple) Forest Alliance	162	9%
Orchard Grass - Common Sheep Sorrel Herbaceous Alliance	104	6%
Eastern Hemlock - Yellow Birch Forest Alliance	97	5%
Black Cherry - Red Maple - Canada Serviceberry - Oak species Forest Alliance	90	5%
American Beech - Sugar Maple - (Tuliptree) Forest Alliance	86	5%
Black Cherry - Red Maple - Canada Serviceberry - Oak species Forest Alliance / Orchard Grass - Common Sheep Sorrel Herbaceous Alliance	36	2%
Sugar Maple - Bitternut Hickory Temporarily Flooded Forest Alliance	28	1%
Eastern Hemlock - Tuliptree Forest Alliance	26	1%
Eastern Hemlock - Tuliptree Forest Alliance / Sugar Maple - Bitternut Hickory Temporarily Flooded Forest Alliance	25	1%

**Top 10 of 28 total mapped classes, representing 86% of mapped area.*

NER/NRTR-2009/136, authored by E.F. Largay and L. A. Sneddon).

Future Applications

Invasive Species Management — Non-native species are a major threat to the native vegetation at ALPO, particularly in disturbed areas and along the historic trace. The historic trace may facilitate the movement of invasive species into ALPO's relatively high quality hardwood and mixed hemlock-hardwood forests. Thus, future management will likely include significant invasive species control along the length of the trace.

Park Management — Three vegetation types at ALPO tend to contain significant cover of non-native invasive species. A management plan could be developed to specify appropriate activities and times for mowing and use of herbicide. Restoration plans could then focus on controlling non-native plant species as the primary goal. While eradication of all non-native plants is not feasible in former agricultural areas, the most problematic non-natives could be targeted for removal, and facilitate the transition to closed canopy forests, dominated by native trees and shrubs.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?code=1047695.



Eastern Hemlock - Northern Hardwood Forest.

BLUESTONE NATIONAL SCENIC RIVER

2003 - 2008 West Virginia

Park Character

Bluestone National Scenic River (BLUE) encompasses approximately 4,337 acres of a 10.5 mile stretch of the Bluestone River, which flows through a relatively unspoiled section of southern West Virginia. The Bluestone River, named for the deep blue limestone streambed of its upper reaches in Virginia, has created a gorge 1,000 feet deep. BLUE includes the Bluestone River and its tributaries and shores, and extends upslope to include small areas of alluvial floodplains, large areas of moderate to steep gorge slopes, and a few narrow ridge tops. Elevations in BLUE range from 1,429 feet to 2,389 feet above sea level. The vegetation is characterized by hardwood forests.



Sugar Maple - Yellow Buckeye - American Basswood Forest.

Classification and Mapping

Vegetation of BLUE was classified in 22 associations, including 12 upland types and 10 riparian types. Prevailing physiognomic expressions include 17 forest associations, four woodland associations, and one herbaceous association. The vegetation map was produced using 24 map classes. Upland forests and woodlands comprise about 85% of BLUE and are represented by 12 map classes. Three major forest associations (Oak - Hickory - Sugar Maple Forest, Oak - Eastern White Pine / Ericad Forest, and Sugar Maple - Yellow Buckeye - American Basswood Forest) comprise about 70% of BLUE. Riparian vegetation, which includes two upland forest and woodland associations, comprises about eight percent of BLUE. Four percent of BLUE is mapped as natural waterways, and the remaining three percent is mapped as disturbed areas and cultural and transportation features. Vegetation types were mapped to the association level, with an overall accuracy of 92.2%.

Applications of the Vegetation Inventory

Insect and Disease Mitigation, Management, and Monitoring — The vegetation classification is being used to predict which areas of BLUE are susceptible to damage from impending insect and disease infestations, specifically hemlock wooly adelgid and emerald ash borer. This information can then be used to prioritize stands for control by analyzing land ownership, cultural and natural resource value, topography, potential for hazard trees, and difficulty of hazard tree removal.

Fire Management — Data were used to develop canopy cover and fire fuel models, which were then incorporated into FARSITE, a fire growth simulation model. Analysis of vegetation along with elevation, slope, and aspect allow managers to model fire behavior and burn likelihood in different locations of BLUE. FARSITE incorporates spatial information on fuels, fire behavior,

Representative Vegetation Types at BLUE*		
Map Class	**Acres**	**% of Park**
Oak - Hickory - Sugar Maple Forest	1,538	35%
Oak - Eastern White Pine / Ericad Forest	981	23%
Sugar Maple - Yellow Buckeye - American Basswood Forest	524	12%
Modified Successional Floodplain Forest and Woodland	201	5%
Successional Eastern White Pine - Tuliptree Forest	178	4%
Eastern Hemlock - American Basswood Forest	172	4%
Floodplain Forest and Woodland	141	3%
Eastern Hemlock - Chestnut Oak Forest	106	2%
Virginia Pine - Oak Shale Woodland	64	1%
Successional Tuliptree / Northern Spicebush Forest	50	1%

**The top 10 (natural or semi-natural vegetation) of 24 mapped classes,representing 90% of BLUE.*

topography, weather, and wind to predict fire spread under various scenarios.

Research and Monitoring —
Data were used to create maps showing the location of hemlock stands and ash forests. These maps are consulted in planning for the control of disease and insect outbreaks, protection of endangered species, and location of important wildlife foraging habitat.

Oak-hickory stands and other hard mast species have been mapped to predict potential habitat for small mammals. Maps of the location of protected species allow staff to monitor areas where poachers could be working.

NatureServe has mapped ecological systems based on the vegetation association maps, and developed global ranks for state-rare communities identified in the vegetation map.

For the full vegetation classification, map, report, and other products, visit: http://nrinfo.nps.gov/Reference.mvc/Profile?code=1048521.



Oak - Hickory - Sugar Maple Forest.



Successional Eastern White Pine - Tuliptree Forest.

DELAWARE WATER GAP NATIONALRECREATION AREA

2001 - 2007 New Jersey, Pennsylvania

Park Character

Delaware Water Gap National Recreation Area (DEWA) encompasses 67,000 acres of mountain ridge, forest, and floodplain on both sides of the Delaware River in the states of New Jersey and Pennsylvania. It stretches from its southern terminus at the Delaware Water Gap to the town of Milford, Pennsylvania, at the northern terminus. For 40 miles, the Middle Delaware River passes between low forested mountains



Hickory - Eastern Red-cedar Rocky Woodland.
Gregory Podniesinski

of rural countryside. Then the river cuts through the mountain ridge to form the famed "Water Gap." Many environmental factors, such as geology, topography, soils, hydrology, land use history, and fire, affect the types and distribution of vegetation within DEWA . The vegetation of the region is generally classified as Appalachian Oak Forest. Ecosystems include hemlock ravines with bountiful rhodendron and ridgetops with prickly pear cactus. DEWA contains trout streams, lakes, ponds, and some of the highest waterfalls of either state.

Classification and Mapping

This project resulted in 27 vegetation associations from a total of 92 map classes. Eight associations are considered DEWA's xeric terrestrial forests. Interspersed with the xeric terrestrial forests are nine additional associations that are strongly influenced by exposed bedrock, xeric conditions, thin soils, and fire. Different forest associations were identified in the more mesic, mid- to lower-elevation settings. DEWA contains a diversity of palustrine associations, ranging from forest to sparse vegetation and from very common to globally rare. Overall accuracy was 56.1%.

Applications of the Vegetation Inventory

Insect and Disease Mitigation, Management, and Monitoring — The vegetation classification is being used to predict which areas of DEWA are susceptible to damage from insects and diseases, specifically hemlock wooly adelgid and emerald ash borer. This information can then be used to prioritize stands for control by looking at land ownership, cultural and natural resource value, topography, potential for hazard trees, and difficulty of hazard tree removal.

Fire Management — Data were used to develop canopy cover and fire fuel models, which were then incorporated into FARSITE, a fire growth simulation model. Analysis of vegetation along with elevation, slope, and aspect allow managers to model fire behavior and burn likelihood in different locations of DEWA. FARSITE incorporates spatial information on fuels, fire behavior,

Representative Vegetation Types at DEWA*		
Map Class	**Acres**	**% of Park**
Chestnut Oak - (Scarlet Oak, Black Oak) Forest Alliance	10,925	16%
Black Cherry - Red Maple - Canada Serviceberry - Oak species Forest Alliance	9,251	13%
White Oak - (Northern Red Oak, Hickory species) Forest Alliance	7,205	10%
Eastern White Pine - (White Oak, Northern Red Oak, Black Oak) Forest Alliance	5,813	8%
Sugar Maple - Yellow Birch - (American Beech) Forest Alliance	4,217	6%
Eastern White Pine - Eastern Hemlock Forest Alliance	3,270	5%
Eastern Hemlock - Yellow Birch Forest Alliance	2,725	4%
Northern Red Oak - (Sugar Maple) Forest Alliance	2,660	4%
Eastern Hemlock - Tuliptree Forest Alliance	2,657	4%
Roughleaf Dogwood Shrubland Alliance	2,122	3%

**Top 10 (natural or semi-natural vegetation) of 92 total mapped classes, representing 73% of DEWA.*

topography, weather, and wind to predict fire spread under various scenarios.

The locations of specific fire dependent communities identified in the vegetation mapping report are used to guide prescribed burns.

Research and Monitoring — Data were used to located suitable or potential habitat for an endangered species.

NatureServe has mapped ecological systems based on the vegetation association maps (Technical Report NPS/NER/NRTR-2009/136, authored by E.F. Largay and L. A. Sneddon), and developed global ranks for state-rare communities identified in the vegetation map (Natural Resource Technical Report NPS/NER/ERMN/NRTR—2010/151, authored by L.A. Sneddon).

Invasive Species Management — Data were used to determine the status and trends of key invasive plant species in DEWA. This information was used as a component of invasive plant modeling efforts to determine the probability of occurrence for invasive species throughout DEWA. Results will help guide prioritization of invasive species management actions.

Park Management — Data were used to advise Natural Resource staff on the likelihood that power line right-of-way improvements would impact an area of sensitive vegetation.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?code=1047702.



Dry Oak - Heath Forest.

FORT NECESSITY NATIONAL BATTLEFIELD

2003 - 2006 Pennsylvania

Park Character

Set in the Allegheny Mountains of southwestern Pennsylvania, Fort Necessity National Battlefield (FONE) is located along U.S. Route 40, the historic National Road, in Fayette County between the Youghiogheny and the Monongahela Rivers. FONE is situated on a plateau, so there are no drastic changes in elevation within FONE's boundaries.



Fort Necessity and battlefield.

The prominent features of the region surrounding FONE are two anticlines, Laurel Hill and Chestnut Ridge. The Main Unit and the Braddock's Grave Unit are situated in the shallow upland valley between Laurel Hill and Chestnut Ridge which support large contiguous blocks of forest. These forests have suffered from the widespread loss of oak due to gypsy moth infestations in the late 1980s and early 1990s. These forests have also experienced several rounds of logging in the last two centuries. On the middle and lower slopes of the Allegheny Mountains, higher moisture levels and deeper soils create increased diversity of vegetation.

Classification and Mapping

This project resulted in 10 map classes, eight of which are known within FONE boundaries. These eight alliances reflect the land use history, ongoing management, and varied environmental settings. FONE supports three common deciduous hardwood forest associations. The Successional Old Field and Wet Meadow associations in the Main Unit of Fort Necessity National Battlefield are important natural and cultural resources. These vegetation types provide visitors with the landscape context for the historic battles, and also provide habitat to numerous birds, moths, butterflies, and dragonflies. Overall accuracy was 69.8%.

Applications of the Vegetation Inventory

Invasive Species Management — The vegetation map has been used to identify the distribution and abundance of non-native plant species. Morrow's honeysuckle, an invasive exotic shrub, is of particular concern due to its capacity to produce large numbers of seeds that are easily dispersed by birds. Management and monitoring for this and several other invasive species is critical to maintain the diverse native species composition of the fields, and to retain their historical open nature.

Research and Monitoring —NatureServe has mapped ecological systems based on the vegetation association maps (Technical Report NPS/NER/NRTR-2009/136, authored by E.F. Largay and L. A. Sneddon).

Representative Vegetation Types at FONE*		
Map Class	**Acres**	**% of Park**
Northern Red Oak - (Sugar Maple) Forest Alliance	180	20%
Orchard Grass - Sheep-sorrel Herbaceous Alliance	159	17%
Eastern White Pine Planted Forest Alliance	131	14%
Tuliptree Forest Alliance	130	14%
Black Cherry - Red Maple - Canada Serviceberry - Oak species Forest Alliance	124	13%
White Oak - (Northern Red Oak, Hickory species) Forest Alliance	114	12%
Tussock Sedge Seasonally Flooded Herbaceous Alliance	41	4%
Sugar Maple - White Ash - American Basswood Forest Alliance	1	0.1%

**The top 8 of 10 mapped classes, representing ~95% of FONE. These are all of the natural or semi-natural vegetation types that occur in the park.*

Park Management — Vegetation data have assisted managers in:

- Evaluating the potential for construction activities to impact an area of sensitive vegetation;
- Controlling weedy species in open fields;
- Establishing oak regeneration currently suppressed by an abundance of white-tailed deer, as well as the absence of catastrophic disturbances that originally facilitated the establishment of oak-dominated forests; and.
- Restoring Great Meadow Run, which provides visitors with a landscape context for historic battles.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?code=1047709.



Successional Old Field at the Main Unit.



Northern Red Oak – Mixed Hardwood Forest at the Main Unit.

FRIENDSHIP HILL NATIONAL HISTORIC SITE

2003 - 2006 Pennsylvania

Park Character

Friendship Hill National Historic Site (FRHI) is situated in Fayette County on the banks of the Monongahela River in southwestern Pennsylvania, and encompasses the 693 acre country estate of Albert Gallatin. Gallatin served as a U.S. Senator and a U.S. Congressman before being appointed Secretary of the Treasury under Presidents Thomas Jefferson and James Madison. FRHI occurs within



The Stone House section of the Gallatin House (completed in 1823).

the Pittsburgh Low Plateau section of the Appalachian Plateau physiographic province, a mature plateau where many steep-sided stream valleys cut down from the uplands to the large rivers that flow through this section. Since the time Albert Gallatin acquired the Friendship Hill estate over 200 years ago, the forest has been timbered and replanted numerous times, and the land has been mined for coal and cultivated for row crops, hay, orchards, tree nurseries, and Christmas trees. The effects of these uses can be seen on the land today.

Classification and Mapping

The mapping effort at FRHI focused on identifying forest types. Out of a total of 13 map classes, eight vegetation associations were identified, all of which were described in detail except Grassland. The most abundant vegetation type in FRHI is American Beech – Sugar Maple – (Tuliptree) Forest. This vegetation type is similar to the natural vegetation of the region (Mixed Mesophytic Forest). However, the predominance of tuliptree, a common pioneer species, reflects that much of the park was cleared or maintained in an open condition relatively recently. The Sycamore Floodplain Forest is the prominent vegetation type on the floodplain terraces adjacent to the Monongahela River. The Conifer Plantation association (Eastern White Pine Planted Forest) is found in small patches of conifers that are remnants of the pine plantations that once covered the Friendship Hill estate. This is the least abundant association. The overall accuracy of the classification was 83.0%.

Applications of the Vegetation Inventory

Research and Monitoring —NatureServe has mapped ecological systems based on the vegetation association maps (Technical Report NPS/NER/NRTR-2009/136, authored by E.F. Largay and L. A. Sneddon).

Future Applications

Invasive Species Management — Invasive exotic plant species are the main threat to the native vegetation at FRHI, particularly in the abandoned agricultural fields, on forest edges, and along trails and

Representative Vegetation Types at FRHI*		
Map Class	**Acres**	**% of Park**
American Beech - Sugar Maple - (Tuliptree) Forest Alliance	280	36%
Black Cherry - Red Maple - Canada Serviceberry - Oak species Forest Alliance / Orchard Grass - Sheep-sorrel Herbaceous Alliance	112	15%
Sycamore - (Green Ash, Sugarberry, Silver Maple) Temporarily Flooded Forest Alliance	83	11%
Grassland	78	10%
Black Cherry - Red Maple - Canada Serviceberry - Oak species Forest Alliance	54	7%
Northern Red Oak - (Sugar Maple) Forest Alliance	42	5%
Orchard Grass - Sheep-sorrel Herbaceous Alliance	16	2%
Smartweed species Seasonally Flooded Herbaceous Alliance	6	1%
Eastern White Pine Planted Forest Alliance	1	0%

**All 9 vegetation classes out of 13 total mapped classes, representing 87% of surveyed area.*

roads. These species may threaten and impede the succession to a native forest type without proper management. FRHI plans to develop a management plan specifically tailored to these areas that addresses the control of invasive species, designates desired target vegetation structure and composition, and outlines management actions to achieve the desired target conditions. The development and implementation of such a plan would facilitate the control of these invasive species and the restoration of natural vegetation associations.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?code=1047710.



Tuliptree – Beech – Maple Forest.



Early Successional Hardwood Forest.

JOHNSTOWN FLOOD NATIONAL MEMORIAL

2004 - 2006 Pennsylvania

Park Character

Set in the Allegheny Mountains of southwestern Pennsylvania, Johnstown Flood National Memorial (JOFL) encompasses 182 acres of the former lakebed of Lake Conemaugh, a two-mile-long reservoir on the South Fork of the Little Conemaugh River. On May 31, 1889, the 72 foot high earthen dam that created the 450-acre reservoir breeched, causing a devastating flood in the towns downstream, including



Old Lake Conemaugh.

Johnstown, Pennsylvania. JOFL is now an empty lakebed bordered by rolling hills, woodlands, wet meadows, managed fields, and the South Fork of the Little Conemaugh River.

Classification and Mapping

As a result of this project, 13 map classes were identified; seven of these were vegetation associations that were described in detail. These vegetation types reflect the land use history, ongoing management, and varied environmental settings of the park. Land uses and management include creation and removal of plantations, lakebed hydroseeding, management of woody plants and exotic plant species, and natural succession.

The vegetation association that covers the largest area of JOFL encompasses three subtypes of Old Field, represented in different sections of JOFL. Red Maple – Black Cherry Forest Alliance is the most common forest type in the park, although its vegetation structure and composition varies. Two small remnants of Eastern Hemlock – Northern Hardwood Forest occur on shallow north-facing slopes in the park. The Conifer Plantation (Eastern White Pine Planted Forest) areas are remnants from the pine stands planted in the lakebed in the middle of last century. The Cattail Marsh and Silky Willow Shrub Swamp are maintained by the railroad berm that influences the hydrology in the immediate area. The Cobble/Gravel Shore (or Riverine Scour Vegetation) is located on bars, islands, and spits in the South Fork of the Little Conemaugh River and is influenced by water and ice scour from the river. Overall map accuracy was 84.8%.

Applications of the Vegetation Inventory

Insect and Disease Mitigation, Management, and Monitoring — Vegetation data are being used to predict which areas of JOFL are susceptible to damage from impending insect and disease infestations, specifically hemlock wooly adelgid and emerald ash borer. This information can then be used to prioritize stands for control by analyzing land ownership, cultural and natural resource

Representative Vegetation Types at JOFL*		
Map Class	**Acres**	**% of Park**
Black Cherry - Red Maple - Canada Serviceberry - Oak species Forest Alliance	67	25%
Orchard Grass - Sheep-sorrel Herbaceous Alliance	51	19%
Steeplebush - Blackberry species Seasonally Flooded Shrubland Alliance / Orchard Grass - Sheep-sorrel Herbaceous Alliance	34	13%
Orchard Grass - Sheep-sorrel Herbaceous Alliance / Black Cherry - Red Maple - Canada Serviceberry - Oak species Forest Alliance	15	6%
Eastern Hemlock - Yellow Birch Forest Alliance	7	2%
Silky Willow Seasonally Flooded Shrubland Alliance	3	1%
Eastern White Pine Planted Forest Alliance	3	1%
(Narrowleaf Cattail, Broadleaf Cattail) - (Clubrush species) Semipermanently Flooded Herbaceous Alliance	2	1%
Cobble/Gravel Shore Sparsely Vegetated Alliance	1	0.5%

**All 9 natural/semi-natural vegetation types out of 13 total mapped classes, representing ~69% of the surveyed area.*

value, topography, potential for hazard trees, and difficulty of hazard tree removal.

Research and Monitoring — NatureServe has developed ecological systems maps based on the vegetation association maps.



Red Maple – Black Cherry Successional Forest/ Woodland.

Future Applications

Invasive Species Management — Invasive exotic plant species are the main threat to the native vegetation at JOFL. Continued inventory, monitoring, and management of invasive species will be a priority for the park's resource managers. The results of a 2005 study conducted by the Western Pennsylvania Conservancy on the status of invasive species in JOFL can provide crucial information towards this end. The development and implementation of a management/restoration plan would facilitate the control of these invasive species and the restoration of natural vegetation associations.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?code=1047720.



Herbaceous subtype of Old Field vegetation.

NEW RIVER GORGE NATIONAL RIVER

1998 - 2007 West Virginia

Park Character

New River Gorge National River (NERI) encompasses about 72,161 acres along approximately 53 miles of the New River in southern West Virginia. NERI includes the river and numerous tributaries and their shores and floodplains, and extends upslope to include large areas of gorge slopes, rim rock cliffs, rolling plateaus, and mountains. Elevations range from 835 feet along the New River to 3,281 feet on Swell Mountain.



New River Gorge National River.

In the two centuries before NREI was established, vegetation in almost all areas of the park was subject to direct impacts from human activities, including coal mining, logging, burning, farming, transportation, and residence. Many of the forests in the park have been logged multiple times, but currently there are large areas of maturing second-growth and possibly some small old-growth stands. Vegetation has also been impacted by the introduction of exotic species.

Classification and Mapping

The vegetation map consists of 47 map classes, including 15 upland forest and woodland vegetation types, one lichen and sparse vegetation type, 15 riparian vegetation types, two headwater wetland vegetation types, three aquatic feature types, eight cultural and disturbed types, and three transportation feature types. Approximately 83% of the park is occupied by upland deciduous forests. A large proportion of these forests are occupied by three major intergrading, upland deciduous forest community types. Distribution of forest types is probably best explained by soil moisture and fertility gradients, which are affected by topographic position, aspect, and geology. Overall map accuracy was 96.2%.

Applications of the Vegetation Inventory

Insect and Disease Mitigation, Management, and Monitoring — The vegetation classification is being used to predict which areas of NERI are susceptible to damage from insects and diseases, specifically hemlock wooly adelgid and emerald ash borer. Decline of eastern hemlock and all ash species may represent the greatest changes to vegetation in NERI in the near future. Because canopies with eastern hemlock can usually be distinguished remotely, the vegetation map and aerial imagery developed for this project may be used as a baseline to monitor these changes and to identify stands which have not yet been assessed for adelgid infestation.

Research and Monitoring — NatureServe has mapped ecological systems based on the vegetation association maps (Technical Report NPS/NER/NRTR-2009/136, authored by E.F. Largay and L. A. Sneddon), and developed global ranks for state-rare communities identified in the vegetation

Representative Vegetation Types at NERI*		
Map Class	**Acres**	**% of Park**
Sugar Maple - Yellow Buckeye - American Basswood Forest	18,306	25%
Oak - Hickory Forest	16,974	24%
Oak - Hickory - Sugar Maple Forest	14,346	20%
Oak / Ericad Forest	2,778	4%
Eastern Hemlock - Sweet Birch - Tuliptree / Great Laurel Forest	2,689	4%
Successional Tuliptree Forest	1,797	2%
Deciduous Tree / Great Laurel Forest	1,204	2%
Steep Riparian Edge	689	1%
Eastern Hemlock - Chestnut Oak / Catawba Rhododendron Forest	621	1%
Sycamore - Ash Floodplain Forest	519	1%

**The top 10 (natural or semi-natural vegetation) of 47 total mapped classes,representing 84% of NERI.*

map (Natural Resource Technical Report NPS/NER/ERMN/NRTR—2010/151, authored by L.A. Sneddon).

Vegetation data were used to create maps showing the location of hemlock stands and ash forests. These maps are consulted in planning for control of disease and insect outbreaks, protection of endangered species, and location of important wildlife foraging habitat.

Oak-hickory stands and other hard mast species have been mapped to predict potential habitat for small mammals. Maps of protected species locations allow staff to monitor areas where poachers could be working.

Fire Management — Data were used to develop canopy cover and fire fuel models, which were then incorporated into FARSITE, a fire growth simulation model. FARSITE uses vegetation, along with elevation, slope, and aspect, to model fire behavior and burn likelihood in different locations. FARSITE also incorporates spatial information on fuels, fire behavior, topography, weather, and wind to predict fire spread.

Park Management — Data are being used to identify areas in greatest danger of degradation from high human use, and to determine the most appropriate locations for recreational use. For example, inappropriately sited river access and boating lunch stops may adversely impact rare riparian communities.

Future Applications

Invasive Species Management —Some imminent threats to natural vegetation in the park can be identified and some of these present opportunities for intervention. Priorities can be set based on the occurrence of rare community types and species, as well as the likelihood that control measures will be successful. Although eradication of invasive exotic plant species throughout NERI is an unrealistic goal, some high priority areas can be identified where eradication may be practical and effective.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?code=1048526.

UPPER DELAWARE SCENIC AND RECREATIONAL RIVER

2003 - 2008 New York, Pennsylvania

Park Character

The Upper Delaware Scenic and Recreational River (UPDE) was designated as part of the National Wild and Scenic Rivers System in 1978 to acknowledge the outstanding natural and cultural resources of the valley. The Delaware River is the longest free-flowing river in the eastern United States; its watershed provides water for over 17 million people. The park stretches along 73.4 miles of the river and encompasses the watershed lands immediately adjacent to the river, up to the first ridgetops. UPDE also includes portions of the historic Delaware and Hudson Canal and the Delaware Aqueduct, the nation's oldest existing wire suspension bridge. The predominant natural vegetation in the environs of UPDE is Appalachian Oak Forest and Northern Hardwood Forest. The Upper Delaware valley is noted for its northern hardwood forests, which have supported a thriving lumber industry, producing thousands of cubic feet of veneer logs, sawlogs, millwood, and pulpwood each year.



Riverside Rock Outcrop at Skinner's Falls.

Classification and Mapping

This project identified 48 vegetated map classes out of a total of 54 map classes. Forested vegetation dominates the UPDE landscape. The most abundant type in UPDE is Hemlock - Beech - Oak Forest (part of the Eastern Hemlock – Yellow Birch Forest Alliance). Several oak-dominated types are also high in abundance. Another major class of forested vegetation types in UPDE contains several associations dominated by northern hardwoods. For a variety of reasons, the overall map accuracy was 42.0%, well below the desired overall accuracy of 80%.

Applications of the Vegetation Inventory

Research and Monitoring — Vegetation data, along with other factors such as topography, slope, and exposure, will be used to model wildlife habitat use. This will allow managers to better understand critical habitats, including possible winter communal roosting locations and future nest locations, and to prioritize areas for future protection.

Data were used to locate suitable or potential habitat for the bald eagle.

NatureServe has mapped ecological systems based on the vegetation association maps (Technical Report NPS/NER/NRTR-2009/136, authored by E.F. Largay and L. A. Sneddon), and developed global ranks for state-rare communities identified in the vegetation map (Natural Resource Technical Report NPS/NER/ERMN/NRTR—2010/151, authored by L.A. Sneddon).

Representative Vegetation Types at UPDE*		
Map Class	**Acres**	**% of Park**
Eastern Hemlock - Yellow Birch Forest Alliance	13,617	25%
White Oak - (Northern Red Oak, Hickory species) Forest Alliance	6,869	12%
Chestnut Oak - (Scarlet Oak, Black Oak) Forest Alliance	6,844	12%
Sugar Maple - Yellow Birch - (American Beech) Forest Alliance	2,791	5%
Sugar Maple - White Ash - American Basswood Forest Alliance	2,677	5%
(Pignut Hickory, Shagbark Hickory) - White Ash - (White Oak, Northern Red Oak) Forest Alliance	2,519	5%
Northern Red Oak - (Sugar Maple) Forest Alliance	1,905	3%
Black Cherry - Red Maple - Canada Serviceberry - Oak species Forest Alliance	1,822	3%
Eastern White Pine - (White Oak, Northern Red Oak, Black Oak) Forest Alliance	777	1%
Reed Canarygrass Seasonally Flooded Herbaceous Alliance	552	1%

**The top 10 (natural and semi-natural vegetation) out of 54 total mapped classes representing 72%% of UPDE.*

Invasive Species Management — Data were used to determine the status and trends of key invasive plant species in UPDE as a component of invasive plant modeling efforts. These models show the probability of occurrence for invasive species



Hemlock - Beech - Oak Forest.

throughout UPDE. This information can be used to guide prioritization of invasive species management actions.

Future Applications

Park Management — Data can be used to identify some imminent threats to natural vegetation in UPDE. Some of these present opportunities for intervention. Priorities can be set based on the occurrence of rare community types and species, as well as the likelihood that management actions will be successful. Effective means of controlling invasive species at the landscape-scale have yet to be developed, but will be considered in future management efforts.

For the full vegetation classification, map, report, and other http://nrinfo.nps.gov/Reference.mvc/Profile?code=1048531.



Northeastern Dry Oak - Hickory Forest.

ISLE ROYALE NATIONAL PARK

1996 - 1999
Michigan

Park Character

Isle Royale National Park (ISRO) is an archipelago of islands in Lake Superior. It is comprised of one large island surrounded by hundreds of smaller islands. Including both land and water, ISRO covers approximately 571,790 acres. Terrain is rugged, with a complex pattern of valleys and steep ridges. Relief is generally low (65 – 131 feet), but reaches a maximum of 792 feet. Vegetation consists primarily of high elevation



Isle Royale National Park.

hardwood forests and low elevation boreal conifer forests. Almost the entire large island, and many smaller islands, have been disturbed by past human use (logging, mining, fires). Ninety-nine percent of the park is now designated as Wilderness.

Classification and Mapping

A total of 52 community types were identified for ISRO, with an additional five variants recognized for their different structural or floristic patterns. Ordination of 187 plots and 400 taxa revealed three basic vegetation groups for ISRO: upland forests and woodlands, upland open bedrock vegetation, and wetlands. These types were mapped using 37 map classes. The most abundant vegetation types in the park are forests comprised of various conifers mixed with aspen.

Applications of the Vegetation Inventory

The Great Lakes Network uses the vegetation maps extensively in a variety of research and monitoring projects. Examples include:

Research and Monitoring — The Network is using the vegetation data as their "start time" baseline for monitoring changes in land cover and land use. Change detection methods assist in identifying locations of disturbances and potential management issues, such as blowdown and fire.

The Network also sees future potential for analyses using other overlays (such as soil data) in conjunction with the vegetation data to identify areas where blowdown, fire, and other disturbances tend to occur, which will help managers understand the ecology and disturbance response of their vegetation types.



Aerial views of ISRO.

Representative Vegetation Types at ISRO*		
Map Class	**Acres**	**% of Park**
Aspen - Birch / Boreal Conifer Forest	24,572	19%
Spruce - Fir - Aspen Forest	19,143	14%
Spruce - Fir / Feathermoss Forest	17,182	13%
White Cedar - (Mixed Conifer) / Alder Swamp	15,266	12%
Maple - Yellow Birch - Northern Hardwoods Forest	8,009	6%
White Spruce Woodland Alliance	7,463	6%
Spruce - Fir and Sugar Maple - Yellow Birch Mosaic	4,832	4%
Yellow Birch - (Spruce) Forest	4,737	4%
Aspen - Birch / Sugar Maple - Mixed Hardwoods Forest	4,612	3%
Sedge Meadow Complex	3,648	3%

**The top 10 of 37 mapped classes, representing 84% of the Park.*

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?code=1047718.



Spruce - fir forest.



Birch forest.

VOYAGEURS NATIONAL PARK

1996 - 1998
Minnesota

Park Character

Voyageurs National Park (VOYA) covers 218,055 acres along the U.S. – Canadian border. Approximately 62% of the park is land, and the remainder is open water (lakes and ponds). The landscape is rugged terrain, with vegetation that consists of upland and wetland communities typical of southern boreal and northern hardwood forests. Almost all of the forests in the park have been logged since European settlement.



Aspen – paper birch forest.

Classification and Mapping

The project area covered 387,672 acres of VOYA and its environs (including part of Canada). A total of 50 community types were identified, and then grouped into six wetland groups (including bogs, fens, wet meadows, and marshes, as well as both forest and shrubland swamps) and six upland groups (including barrens and hardwood forests). The map of VOYA and its environs was created using 67 map units, 61 of which occur within VOYA boundaries. Fifty-three of these units represent USNVC vegetation types at formation, alliance, or association levels. Eight map units represent developed lands, and six map units represent park-specific types (small islands and ponds). Overall thematic map accuracy was assessed at 82.4%.

Applications of the Vegetation Inventory

The Great Lakes Network uses the vegetation maps extensively in a variety of research and monitoring projects. Examples include:

Vegetation monitoring — The Network is using the vegetation data as their "start time" baseline for monitoring changes in land cover and land use. Change detection methods assist ecologists in identifying locations of disturbances and potential management issues, such as blowdown, fire, development, and logging.

The Network also sees future potential for analyses using other overlays (such as soil data) in conjunction with the vegetation data to identify areas where blowdown, fire, and other disturbances tend to occur, which will help managers understand the ecology and disturbance response of their vegetation types.

Wildlife Management — Vegetation mapping data is being used at VOYA to investigate long-term effects of beaver (*Castor canadensis*) presence on upland forests. The vegetation types were also used to establish forest breeding bird survey point locations. Preferred vegetation types were identified, then points were located in the GIS using the vegetation map and appropriate buffers were applied.

Representative Vegetation Types at VOYA*		
Map Class	**Acres**	**% of Park**
Lakes	71,272	35%
Quaking Aspen-Paper Birch Forest	26,123	13%
Spruce-Fir-Aspen Forest	19,050	9%
White Pine-Red Pine-Quaking Aspen-Paper Birch Forest	12,919	6%
Jack Pine-Aspen Forest Mosaic	8,108	4%
Wet Meadow/Fen Mosaic/Complex	6,459	3%
Northern Pin Oak-Bur Oak-(Jack Pine) Rocky Woodland (mixed pine-oak phase)	6,433	3%
Boreal Pine Rocky Woodland (mixed pine phase)	4,682	2%
Jack Pine/Balsam Fir Forest	4,351	2%
Boreal Pine Rocky Woodland (jack pine phase)	3,513	2%

**The top 10 of 61 mapped classes within VOYA boundaries, representing 79% of the park.*

Education and Interpretive Programs — USGS has used the vegetation data to develop a field guide to their plant community types. The guide provides a user-friendly way for staff to access and use the data in the field, and has proven to be quite popular with the public as well. This pilot project has been so successful that USGS is seeking funds to create additional guides for other NPS units.

Fire Management — VOYA is using the vegetation mapping data in the creation of a new fire management plan that will define the use of prescribed fires. The USGS-NPS vegetation classes can easily be reclassed into fire fuel types. Percent canopy-cover and ground-to-base-of-crown information can be incorporated, and this information can then be used as an input into FARSITE or other fire behavior models. Fire behavior modeling programs are useful for managing both prescribed and wild fires.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?code=1047734.



Boreal pine rocky woodland.



Voyageurs National Park.

GRAND TETON NATIONAL PARK

2002 - 2005
Wyoming

Park Character

Grand Teton National Park (GRTE) is a 334,000 acre park situated within the Rocky Mountains. Topographic relief is extreme, ranging from 6,350 to 13,770 feet above sea level. This elevational gradient, combined with a complex underlying geology, creates a myriad of growing conditions that support a wide variety of vegetation communities. GRTE is adjacent to Yellowstone National Park and two National Forests. The surrounding landscape is comprised of vast wilderness areas, ranchland, and small towns.



Aspen woodland regeneration.

Classification and Mapping

The project area covered roughly 550,000 acres, including the park as well as the John D. Rockefeller Memorial Parkway, the National Elk Refuge, and a one mile buffer. The final classification resulted in 207 associations, including 167 USNVC associations, and 40 new local associations. Vegetation communities include low elevation sagebrush shrublands and grasslands, high elevation conifer forests and aspen woodlands, alpine communities, riparian forests, and wetlands. GRTE and its environs were mapped using 52 map classes (42 vegetation, 10 land cover). Fifty-one of the map classes are found within GRTE boundaries.The most frequent and the most abundant vegetation type was conifer forest. Vegetated map classes were mapped to the ssociation level, with an overall accuracy rate of 82%.

Applications of the Vegetation Inventory

The Greater Yellowstone Coordinating Committee - Whitebark Pine Subcommittee has used GRTE's vegetation data in:

- whitebark pine restoration and protection, and
- identification of habitat areas for a landbird monitoring design using permanent plots by habitat type.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047715.



Juniper woodlands.

Representative Vegetation Types at GRTE		
Map Class	**Acres**	**% of Park**
Subalpine Fir - Engelmann Spruce Forest	43,725	13%
Lodgepole Pine Forest	40,000	12%
Sagebrush spp. Dry Shrubland	39,903	12%
Natural and Artificial Lakes and Ponds	31,598	9%
Cliff and Talus Sparse Vegetation	21,572	6%
Bare Exposed Rock	15,032	5%
Douglas Fir Forest	14,598	4%
Mixed Grassland Herbaceous Vegetation	11,251	3%
Willow spp. Shrubland	10,210	3%
Whitebark Pine Forest	9,261	3%

**The top 10 of 51 mapped classes within the boundaries of GRTE, representing 70% of the park.*



View of the Grand Teton Mountains.

PADRE ISLAND NATIONAL SEASHORE

1998 Texas

Park Character

Padre Island National Seashore (PAIS) encompasses 128,364 acres along the south Texas coast. It protects the longest undeveloped stretch of barrier island in the world, as well as rare coastal prairie, a complex, dynamic dune system, and the Laguna Madre - one of the few hypersaline lagoon environments left in the world. PAIS stretches along 70 miles of sandy beaches, wind-carved dunes, vast grasslands, fragile



A trough in the fore-island dune ridge.

tidal flats, and warm, nearshore waters. These areas provide habitats and nursery grounds to many threatened and endangered species. However, they also contain oil and gas exploration and development activities.

Classification and Mapping

The map was produced using 12 map classes. The most extensive vegetation types within PAIS were associated with Laguna Madre waters and wind tidal flats. The overall accuracy was 86.9%.

Applications of the Vegetation Inventory

Research and Monitoring — PAIS depends on vegetation information to track disturbance from projects in the park (oil and gas, facilities management) to determine the likelihood of disturbing habitat for Threatened and Endangered species.

PAIS is mandated to maintain zero net loss of wetlands. The vegetation map is used to tailor proposals for new facilities so as not to encroach on existing wetlands. A specific example is a re-alignment of a proposed "Novillo" interpretative boardwalk to avoid impacts to wetlands.

The vegetation map and data are also used to monitor changes in the environment due to climate change.

Park Management — The vegetation map will be used in the development of an oil and gas management plan. A critical part of this plan is the ability to assess the location, extent, and contents of sensitive habitats that occur within PAIS.

Spatial vegetation data, maps, reports, and other products were not consistent with program standards. PAIS is planning for a new inventory at the park. Meanwhile, current vegetation inventory products are available at http://nrinfo.nps.gov/Reference.mvc/Profile?Code=2165643.

Representative Vegetation Types at PAIS*		
Map Class	**Acres**	**% of Park**
Laguna Madre	30,592	23%
Wind Tidal Flat	29,202	22%
Emergent Wetland	19,169	15%
Grassland	13,395	10%
Sand Dunes	6,046	5%
Sparse Vegetation	5,836	4%
Beach	3,212	2%
Washover Channel	1,149	1%

**The top 8 natural or semi-natural vegetation classes of 12 total mapped classes, representing 82% of PAIS.*



Scene near the island's midpoint across from the 54 mile marker on the Gulf beach.



The grasslands near the Malaquite Visitor Center.



Small channel which cut through the beach and fore-island dunes around 2002-2003 during a storm.

PALO ALTO BATTLEFIELD NATIONAL HISTORICAL PARK

2000 - 2006 Texas

Park Character

The defining feature of the 3,400 acre PAAL is the broad coastal prairie—scene to the 1846 battle between the United States and Mexico. This coastal plain is carpeted with clumps of razor-sharp cord grass and other low-lying grasses and flowers. The field stretches eastward for miles toward the Gulf of Mexico, interrupted only by scattered



A prairie view.

trees, yuccas, and prickly-pear cactus. To the north, south, and west, the open prairie gives way to dense thickets of mesquite, acacia, and thorny undergrowth that crown low rises and are believed to have inspired the name Palo Alto, or tall trees. PAAL is also criss-crossed by a series of shallow ravines which were former channels of the Rio Grande, known as resacas. The resacas once formed the bed of the ever-shifting Rio Grande. Although they remain dry for much of the year, occasional heavy rains create small pools in these former river channels and spur the growth of reedy plants that thrive in marshy areas.

Classification and Mapping

This project resulted in 10 land cover classes. The overall accuracy of the classification was 89.78%.

Applications of the Vegetation Inventory

Park Management — PAAL plans to restore the landscape appearance to that present at the time of the 1846 battle between the United States and Mexico. Since 1846, alterations to the landscape have included road construction (unpaved), a large drainage ditch just to the north of the battlefield, damming of the resacas for water storage, intermittent cultivation and ranching activities, and predevelopment construction. Restoration of the 1846 PAAL landscape requires multiple steps. First, NPS historians will examine the earliest photographic coverage of the PAAL. Second, researchers will use the current vegetation map to determine what alterations to the landscape have occurred, especially regarding the resaca's and cordgrass prairie, pivotal components of the battle outcome.

A vegetation management plan is currently being developed by PAAL to assist in the restoration of the cultural landscape, which includes the use of cyclical burning.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=2165641.



Resaca de la Palma.

Representative Vegetation Types at PAAL*		
Map Class	**Acres**	**% of Park**
Bushy Seaside Tansy Tidal Shrubland	1,235	36%
Gulf Cordgrass Tidal Herbaceous	981	29%
Tamaulipan Brush	405	12%
Dead and Sparse Grasses	264	8%
Mesquite Shrub Herbaceous	262	8%
Mesquite Shrubland	103	3%
Non-tidal Mud Flat Seasonally / Temporarily Flooded Sparse Vegetation	66	2%
Old Sorghum Field, dominated by *Colubrina texensis*	43	1%
Old Sorghum Field, dominated by *Sonchus asper*	17	1%
Sweet Acacia shrubland	12	0.4%

**All 10 mapped classes, representing 100% of the mapped area for PAAL.*



Resaca bed.



Gulf Cordgrass Prairie transitioning to Tamaulipan Brush. *Bob Woodman*



Gulf Cordgrass Prairie transitioning to Bushy Seaside Tansy Prarie. *Bob Woodman*

SAN ANTONIO MISSIONS NATIONAL HISTORIC PARK

2005 - 2006 Texas

Park Character

San Antonio Missions National Historic Park (SAAN) encompasses approximately 826 acres in the city of San Antonio and rural Wilson County, Texas. Situated in both the southern tallgrass prairie ecoregion in the north and the Tamaulipan thornscrub ecoregion in the south, SAAN contains an interesting mix of natural and introduced vegetation and plant communities in a semi-arid landscape.



San Juan Acequia during test flows.

The legacy of Spanish colonial resources has greatly altered the natural vegetation and created a very fragmented landscape. The availability of water is probably the most important influence on the distribution of vegetation in both upland and riparian areas. Four missions are located in SAAN along the San Antonio River, where serpentine, flood-prone waters historically ran. Vegetation with complex structures exists in these riparian oases, which are remnants of the old river channel. Two eighteenth century acequias (irrigation ditches) have also developed into areas with riparian vegetation.

Classification and Mapping

The multiple uses of the land in and around SAAN made it very challenging to both classify and map the vegetation into meaningful context for all levels of interest (local, regional, and national). This project resulted in 13 vegetation-based map classes out of a total of 32 mapped classes. Twenty-nine of these classes are known from within SAAN boundaries. The classification results reflect both the moderate amount of diversity in SAAN and a respectably high number of native species. Of all the map units, the most frequent was the Bermuda Grass Herbaceous Alliance. The most common natural community was Huisache – (Honey Mesquite) Woodland. It is also notable that three of the vegetation classes represent disturbed vegetation. Vegetation types were mapped to six associations and four alliances, with an overall accuracy of 89%.

Future Applications of the Vegetation Inventory

Although SAAN has not yet made extensive use of the vegetation map, the results of the project have been presented to various audiences. Planned future uses include:

Wildlife Management — In 2010, SAAN intends to use the vegetation map for mapping potentially suitable habitat for rare reptiles.

Park Management — A desired longer term goal for SAAN is to use the vegetation map to develop a vegetation management plan.

Representative Vegetation Types at SAAN*		
Map Class	**Acres**	**% of Park**
Pecan - Sugarberry Forest	187	22%
Huisache - (Honey Mesquite) Woodland	133	16%
Bermuda Grass Herbaceous Alliance	85	10%
Cedar Elm - Sugarberry / Possum-haw / Virginia Wild Rye Forest	65	8%
Silver Beardgrass - Johnsongrass Herbaceous Vegetation	63	8%
Honey Mesquite - Granjeno / Prickly-pear species - South Texas Ericameria Woodland	54	6%
Old Field Weedy Herbaceous Vegetation	21	3%
Chaparro - Prieto Shrubland	17	2%
Privet Shrubland Stand	14	2%
Eastern Cottonwood Temporarily Flooded Alliance	8	1%

**The top 10 natural or semi-natural vegetation classes of 29 total mapped classes, representing 78% of SAAN.*

Research and Monitoring —
Managers use the vegetation data to:

- develop fire models,
- identify habitat monitoring locations,
- prepare guides for rare plant surveys, and
- identify and inventory areas that likely contain exotic or invasive species.

Managers enhance their analyses by overlaying other GIS layers, such as geology, hydrology, elevation, and soils to examine:

- vegetation growth rates.
- regeneration after disturbance,
- biomass distribution, and
- stream morphology.

They also perform ecological studies of:

- vegetation and soil chemistry interactions,
- pollution,
- archeological sites, and
- weather patterns.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047728.



Pecan – Sugarberry Forest.
Roger Sanders



Huisache – (Honey Mesquite) Woodland.
Roger Sanders

EFFIGY MOUNDS NATIONAL MONUMENT

2001 - 2005 Iowa

Park Character

Effigy Mounds National Monument (EFMO) covers approximately 2,526 acres, comprised of two disjunct units along the bluffs and floodplain of the Mississippi River. Bluffs are characterized by steep, rugged topography, with narrow ridge tops and interior ravines and valleys covered by deciduous forests and woodlands. The floodplain consists of riparian forests, with shrublands, marshes, and wetlands. Much of the forested land has been harvested since European settlement. Most surrounding lands are now forests, croplands and pastures.



Scenic view of Hanging Rock.

Classification and Mapping

The project area encompassed 12,286 acres, including the EFMO units and their environs. The classification identified 17 USNVC plant communities, which were subdivided into 30 map classes to capture variations in communities (mostly disturbance history). Another nine map classes were used to represent Formation level communities from the USNVC, and eight map classes were used to depict non-vegetated land uses. A total of 47 map classes were used for the project, 40 of which occur within the EFMO boundaries.

Seventy-seven percent of the mapped area is comprised of natural and semi-natural vegetation. The North-central Maple-Basswood forest is by far the most common community. Vegetation was mapped to the alliance level, with an overall accuracy of 90%.

Applications of the Vegetation Inventory

Research and Monitoring — The Heartland Network has used EFMO vegetation data to post-stratify vegetation monitoring data to assist managers in reporting to specific vegetation types.

Decision Support — Heartland Network staff have used EFMO vegetation data in a decision support system that evaluates the condition of EFMO's multiple plant communities. Monitoring site data were integrated with spatial data from both the NPS Vegetation Inventory and NPS Natural Resource Condition Assessment conducted at the park. Community type was designated for each monitoring site according to vegetation map descriptions and condition assessment reference polygons.

For most areas in the reference frame, staff found moderate support for the current condition being acceptable. For other areas, results suggest needs for future management. The logic model can also be readily adapted to address management objectives or additional information. The report can be accessed via the HTLN website at http://science.nature.nps.gov/im/units/htln/library/Vegetation/PlantComm/EFMO_PlantCom_201003_r.pdf

Representative Vegetation Types at EFMO*		
Map Class	**Acres**	**% of Park**
Midwestern White Oak - Red Oak Forest (oak - hickory phase)	587	24%
North-central Maple - Basswood Forest (disturbed hardwoods phase)	276	11%
North-central Maple - Basswood Forest (disturbed oak phase)	254	10%
Silver Maple - Elm - (Cottonwood) Forest (maple phase)	230	9%
North-central Maple - Basswood Forest (disturbed maple - basswood phase)	169	7%
Silver Maple - Elm - (Cottonwood) Forest (hackberry phase)	137	5%
North-central Maple - Basswood Forest (north-facing maple phase)	133	5%
Reed Canary Grass Eastern Marsh	123	5%
North-central Maple - Basswood Forest (east-facing maple phase)	71	3%
Central Mesic Tallgrass Prairie	61	2%

**Top 10 of 40 mapped classes within EFMO boundaries, representing 81% of the park.*

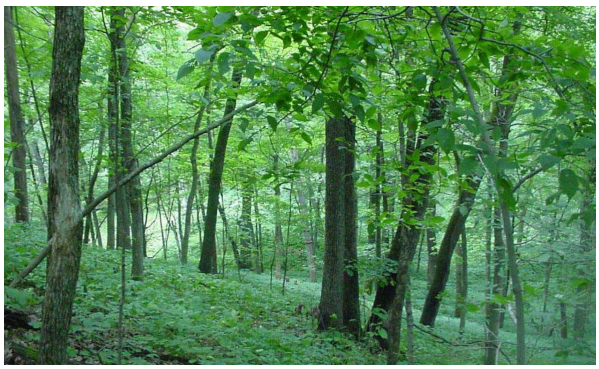
Planning — Staff at EFMO are using the vegetation data to describe park resources and desired future condition for their General Management Plan and their Resource Stewardship Strategy, as well as various implementation plans. Data are proving useful in planning for Integrated Pest Management, vegetation management, and fire management. Other uses for the vegetation data that have been identified during the planning process are predicting disturbance response, and (in conjunction with other datasets) identifying historic vegetation conditions related to cultural resources.



Effigy burial mound in the shape of a bear.

Wildlife Management — EFMO has recently begun fish and bird monitoring, and is using the vegetation types to describe species habitat needs (such as nesting) to determine which species may be attracted to certain sites. Vegetation data are also helping to develop species lists for the park.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047704.



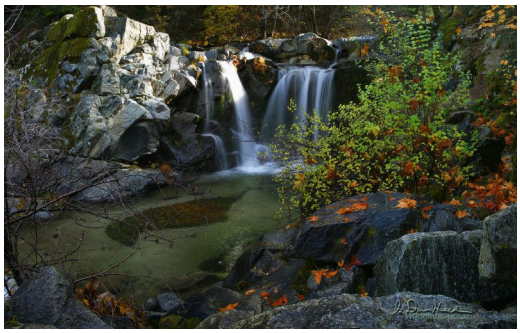
Maple - basswood forest.

WHISKEYTOWN NATIONAL RECREATION AREA

2003 - 2006 California

Park Character

Whiskeytown National Recreation Area (WHIS) is located at the juncture of the Klamath Mountain range and the northern edge of the Sacramento Valley. Topography is characterized by rolling to steep hills with steeply graded, high velocity watercourses. Elevations range from 800' to 6,234'. Biological resources at WHIS have been profoundly influenced by human activities, including historic logging and mining.



The upper falls of Crystal Creek.
CC Image: Flickr user Wildphoton

Classification and Mapping

The vegetation inventory focused on the Whiskeytown unit of the Whiskeytown-Shasta-Trinity NRA. Vegetation was classified and mapped to the association-alliance level, the alliance level, and for some classes, to the mixed alliance ("mapping unit") level. The association-alliance map offers maximum detail, with 31 plant associations, five alliances, and two other map classes. The mapping unit level map, with 13 alliances, 3 mixed alliances, and a combined barren-disturbed class, provides the best characterization of the landscape in terms of distinguishing significant differences in vegetation character. Accuracy was assessed for all three maps, with overall accuracy of 58.6% for association-alliance level, 77.4% for the alliance level, and 85.6% for the mapping unit level.

Applications of the Vegetation Inventory

Education and Interpretive Programs — Vegetation data were used to create a web-based resource education tool that focuses on the biodiversity of WHIS. The site provides general background on the components and drivers of biodiversity, as well as overviews of the Park's plant communities.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=2170228.



Whiskeytown Lake.
CC Image: Flickr user Chris D.

Representative Vegetation Types at WHIS*		
Map Class	**Acres**	**% of Park**
Mixed Pine - Mixed Oak	16,128	24%
Canyon Live Oak Forest	11,193	17%
Ponderosa Pine Forest	8,344	12%
Mixed Conifer Forest	7,538	11%
Mixed Conifer Shrubland	6,286	9%
Deciduous Oak Forest	4,686	7%
Douglas Fir Forest	3,602	5%
White Alder Temporarily Flooded Forest	1,958	3%
Montane Chaparral	1,515	2%
Chamise Shrubland	1,509	2%

**The top 10 of 17 mapped classes, representing 92% of the park.*



Kanaka Peak Trail from the peak with Whiskeytown Lake in the background.
CC Image: Flickr user Highdell

APPOMATTOX COURT HOUSE NATIONAL HISTORICAL PARK

2006 - 2009 Virginia

Park Character

Appomattox Court House National Historical Park (APCO) is a 1,743 acre park that commemorates the end of the Civil War. It preserves historic battlefields, as well as original structures and reconstructed buildings. Topographic relief is gentle, with elevations ranging from 600 to 830 feet. Vegetation in the park and surrounding landscape has been severely altered by a long history of human use, including clearing, logging, and agriculture. Most remaining native vegetation is forest composed of various deciduous trees, including oak, hickory, walnut, and others.



Cultural meadow with split rail fence.
Gary P. Fleming

Classification and Mapping

Vegetation data from seven National Parks in Virginia were combined with over 2,000 existing plot samples from The Mid-Atlantic Piedmont and Coastal Plain, and used to refine the USNVC for the mid-Atlantic region. The map for APCO was produced using 20 map classes, including 17 USNVC associations, two park-specific vegetation classes, and two Anderson Level II land use categories. Approximately 40% of the park is comprised of cultural map classes; 36% is early successional or transitional vegetation. Late successional vegetation, including upland forests and forested wetlands, covers 24% of the park. The largest map class is Cultural Meadow (Orchard Grass - Common Sheep Sorrel Herbaceous Alliance). These are grassy areas that are managed to maintain the open fields characteristic of Civil War battlefields. Overall accuracy was 84%.

Applications of the Vegetation Inventory

The Mid-Atlantic Network has used the vegetation maps extensively in development and implementation of monitoring projects. Examples include:

Research and Monitoring — The vegetation maps have been used to define the forested areas that are the limits for the forest vegetation monitoring protocol. Vegetation has not been stratified by type in the initial sampling design, but the maps will be used for post-stratification (e.g., evaluating trends in data by different vegetation types – probably at the formation or alliance level).

The Network is also using vegetation data stratified by forest/non forest for bird monitoring, and will also be using the maps for post-stratification. Maps have also been useful in helping to evaluate the best routes for the bird monitoring volunteers to take when traveling to each point.

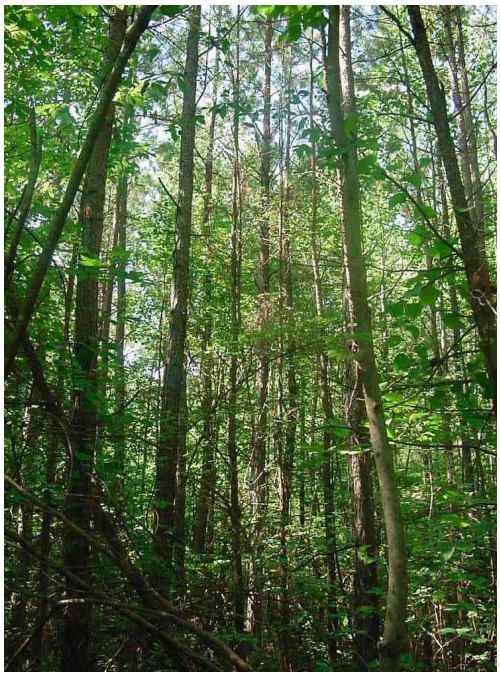
For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1048518.

Representative Vegetation Types at APCO*		
Map Class	**Acres**	**% of Park**
Orchard Grass - Common Sheep Sorrel Herbaceous Alliance	532	31%
Virginia Pine Forest Alliance	271	16%
White Oak - (Northern Red Oak, Hickory species) Forest Alliance	235	13%
Tuliptree Forest Alliance	214	12%
Dense Hardwood Regeneration	139	8%
Sycamore - (Sweetgum, Tuliptree) Temporarily Flooded Forest Alliance	116	7%
Other Urban or Built-up Land	59	3%
Loblolly Pine Planted Forest Alliance	47	3%
Transportation, Communications, and Utilities	35	2%
American Beech - Northern Red Oak - White Oak Forest Alliance	15	1%

**The top 10 of 20 mapped classes, representing 92% of APCO. These numbers represent the entire project area, which is somewhat larger than the boundaries of APCO.*



Cultural meadow.
Robert Tillotson



Loblolly Pine Plantation.
Robert Tillotson

BOOKER T. WASHINGTON NATIONAL MONUMENT

2002 - 2008 Virginia

Park Character

The 239-acre Booker T. Washington National Monument (BOWA) protects the birth site and childhood home of Booker T. Washington. The landscape consists of irregular, low elevation plains with numerous small streams and cold springs. Vegetation has been severely altered by a long history of human use, including agriculture and logging. Ongoing management is designed to maintain the historic and cultural landscape of an 1850s rural plantation, and this has considerable influence over vegetation at the park.



Booker T. Washington National Monument.

Classification and Mapping

Vegetation data from seven National Parks in Virginia were combined with over 2,000 existing plot samples from The Mid-Atlantic Piedmont and Coastal Plain, and used to refine the USNVC for the mid-Atlantic region. The map for BOWA was produced using 10 map classes, nine of which occur within the boundaries of BOWA. The map classes represent seven USNVC associations, one park-specific vegetation class, and two Anderson Level II land use categories. Cultural map classes make up 35% of the park. Another 34% is later successional forested vegetation, and 31% is early successional or transitional forests. Since vegetation polygons were observed in the field, a formal thematic accuracy assessment was not done.

Applications of the Vegetation Inventory

The Mid-Atlantic Network and BOWA have used the vegetation maps extensively in development and implementation of research, management, and monitoring projects. Examples include:

Research and Monitoring — Maps are being used to define the forested areas that are the limits for the vegetation monitoring protocol. Vegetation has not been stratified by type in the initial sampling design, but the maps will be used for post-stratification (for example, evaluating trends in data by different vegetation types – probably at the formation or alliance level).

The Network is using vegetation data stratified by forest/non-forest for bird monitoring, and will also be using the maps for post-stratification. Maps have also been useful in helping to evaluate the best routes for the bird monitoring volunteers to take when traveling to each point.

Wildlife Management — BOWA is currently finalizing a draft proposal entitled "Examination and Assessment of the Herbivorous Feeding Habits of White-Tailed Deer on BTWNM Forest Plant Composition." This project utilizes GIS technology and the vegetation map to depict the locations and groupings of vegetation types within the park. This information will be used to determine placement of

Representative Vegetation Types at BOWA*		
Map Class	**Acres**	**% of Park**
Orchard Grass - Common Sheep Sorrel Herbaceous Alliance	65	29%
Virginia Pine Forest Alliance	52	23%
White Oak - (Northern Red Oak, Hickory species) Forest Alliance	51	23%
Tuliptree Forest Alliance	24	11%
Sycamore - (Sweetgum - Tuliptree) Temporarily Flooded Forest Alliance	17	7%
Other Urban or Built-Up Land	10	5%
Dense Hardwood Regeneration	3	1%
Transportation, Communications, and Utilities	2	1%
Eastern White Pine Planted Forest Alliance	2	1%

**All nine map classes within BOWA boundaries, representing 100% of the park (not including mapped environs).*

exclosures. The primary goal of this project is to gain an enhanced and more complete understanding of the impacts of the white-tailed deer population's herbivorous feeding tactics on forest composition and growth.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047697.



Successional Virginia Pine Forest.



Cultural Meadow (Orchard Grass – Common Sheep Sorrel Herbaceous Alliance).

EISENHOWER NATIONAL HISTORIC SITE

2003 - 2006 Pennsylvania

Park Character

The 690 acre Eisenhower National Historic Site (EISE) preserves the presidential and retirement home of Dwight D. Eisenhower, and is maintained as a working farm. The landscape is gently rolling hills with a mosaic of agricultural fields, pastures, grasslands, woodlots, and forests (primarily oak). Most of the forests have been cleared for agriculture or development, or repeatedly logged. The ongoing management to maintain the historic and cultural landscape strongly influences vegetation within the park.



The Eisenhower home.

Classification and Mapping

Classification and mapping was conducted jointly for EISE and Gettysburg National Military Park (GETT) because they are geographically contiguous and are managed by the same natural and cultural resource personnel. Data from 70 vegetation plots were analyzed to identify and describe 15 park-specific vegetation associations. These associations were then crosswalked to the USNVC. The map was produced using 23 alliance-level vegetation and other cultural classes, with an overall accuracy rate of 87.6%.

Applications of the Vegetation Inventory

The Mid-Atlantic Network has used the vegetation maps extensively in development and implementation of monitoring projects. Examples include:

Research and Monitoring — Maps have been used to define the forested areas that are the limits for the forest vegetation monitoring protocol. Vegetation has not been stratified by type in the initial sampling design, but the maps will be used for post-stratification (e.g., evaluating trends in data by different vegetation types – probably at the formation or alliance level).

The Network is using vegetation data stratified by forest/non-forest for bird monitoring, and will be using the maps for post-stratification. Maps have also been useful in helping to evaluate the best routes for the bird monitoring volunteers to take when traveling to each point.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1048532.

Representative Vegetation Types at EISE*		
Map Class	**Acres**	**% of Park**
Agricultural Field	447	61%
Pasture	88	12%
White Oak - (Northern Red Oak, Hickory species) Forest Alliance	53	7%
Built-up Land	37	5%
Pasture / Bluejoint Seasonally Flooded Herbaceous Alliance	33	4%
Pin Oak - Red Maple Temporarily Flooded Forest Alliance	22	3%
Bluejoint Seasonally Flooded Herbaceous Alliance	12	2%
Sycamore - (Green Ash, Sugarberry, Silver Maple) Temporarily Flooded Forest Alliance	12	2%
Reed Canary Grass Seasonally Flooded Herbaceous Alliance	10	1%
River	9	1%

**The top 10 of 23 mapped classes, representing 98% of the park.*



Sycamore – Mixed Hardwood Floodplain Forest.



Pasture at EISE.

FREDERICKSBURG AND SPOTSYLVANIA NATIONAL MILITARY PARK

2002 - 2008 Virginia

Park Character

Fredericksburg and Spotsylvania National Military Park (FRSP) covers 7,800 acres, and is comprised of eight units spread out across 110 square miles of the Virginia Piedmont and Atlantic Coastal Plain. The park was established to commemorate four major engagements of the Civil War, and includes four battlefields, historic buildings, the Fredericksburg National Cemetery, and



Piedmont / Low Elevation Mixed Oak / Heath Forest.

an active farm program. The landscape ranges from flat to gently rolling terrain, with locally hilly areas. Vegetation has been severely altered by a long history of clearing, agriculture, logging, and other human uses. Remaining native vegetation is mostly upland, riparian, and swamp forests.

Classification and Mapping

This project included a regional classification analysis, which resulted in over 100 vegetation associations, including 20 new associations described for the USNVC, as well as 40 revisions of existing associations. The map (which was clipped to the park boundary) was produced using 21 map classes, including 16 USNVC associations, two park-specific vegetation classes, and three cultural land use classes. Ten map classes representing later successional forests cover 48% of the park. Early successional vegetation covers 31% and cultural map classes cover 21%. Overall accuracy was 81.1%.

Applications of the Vegetation Inventory

The Mid-Atlantic Network has used the vegetation maps extensively in development and implementation of monitoring projects. Examples include:

Research and Monitoring — Maps have been used to define the forested areas that are the limits for the forest vegetation monitoring protocol. Vegetation has not been stratified by type in the initial sampling design, but the maps will be used for post-stratification (e.g., evaluating trends in data by different vegetation types – probably at the formation or alliance level).

The Network is using vegetation data stratified by forest/non-forest for bird monitoring, and will also be using the maps for post-stratification. Maps have also been useful in helping to evaluate the best routes for the bird monitoring volunteers to take when traveling to each point.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047711.

Representative Vegetation Types at FRSP*		
Map Class	**Acres**	**% of Park**
Oak / Heath Forest	1,677	21%
Orchard Grass - Common Sheep Sorrel Herbaceous Alliance	1,277	16%
Virginia Pine Forest Alliance	1,241	16%
White Oak - (Northern Red Oak, Hickory species) Forest Alliance	1,146	15%
Tuliptree Forest Alliance	588	8%
Coastal Plain / Piedmont Floodplain Forest	465	6%
Willow Oak Seasonally Flooded Forest Alliance	310	4%
(Willow Oak, Diamondleaf Oak) Seasonally Flooded Forest Alliance	179	2%
Successional Mixed Scrub	179	2%
American Beech - Northern Red Oak - White Oak Forest Alliance	178	2%

**The top 10 of 21 mapped classes, representing 92% of the park.*



Fall colors at Stonewall Jackson Shrine.



FRSP landscape with cannon.

GETTYSBURG NATIONAL MILITARY PARK

2003 - 2006 Pennsylvania

Park Character

Gettysburg National Military Park (GETT) covers 6,034 acres, and encompasses a significant portion of the land across which the Battle of Gettysburg, its aftermath, and the commemoration occurred. It consists of a main unit surrounding the town of Gettysburg, several disjunct parcels nearby, and East Cavalry field.



Agricultural field at GETT.

The landscape is gently rolling hills with a mosaic of agricultural fields, pastures, grasslands, woodlots, and forests (primarily oak). One of the most influential environmental factors on GETT's vegetation is the Gettysburg Sill, the large diabase intrusion that supports the forested areas of the park. Dry Oak – Mixed Hardwood Forest is the most abundant forest association in GETT. Most of the forests have been cleared for agriculture or development, or repeatedly logged.

Classification and Mapping

Classification and mapping was conducted jointly for GETT and the Eisenhower National Historic Site, because they are geographically contiguous and are managed by the same natural and cultural resource personnel. Data from 70 vegetation plots were analyzed to identify and describe 15 park-specific vegetation associations. These associations were then crosswalked to the USNVC. The map was produced using 23 alliance-level vegetation and other cultural classes, with an overall accuracy rate 87.6%.

Vegetation at GETT is strongly influenced by the park's mandate to preserve the topographic, landscape, and cultural features as they were in 1863. Battlefield rehabilitation already has, and will continue to, alter the vegetation in many sections of the park. Once rehabilitation is complete, the map should be revised.

Applications of the Vegetation Inventory

The Mid-Atlantic Network has used the vegetation maps extensively for monitoring projects. Examples include:

Research and Monitoring — Maps have been used to define the forested areas that are the limits for the forest vegetation monitoring protocol. Vegetation has not been stratified by type in the initial sampling design, but the maps will be used for post-stratification (e.g., evaluating trends in data by different vegetation types – probably at the formation or alliance level).

The Network is using vegetation data stratified by forest/non-forest for bird monitoring, and will also be using the maps for post-stratification. Maps have also been useful in helping to evaluate the best routes for the bird monitoring volunteers to take when traveling to each point.

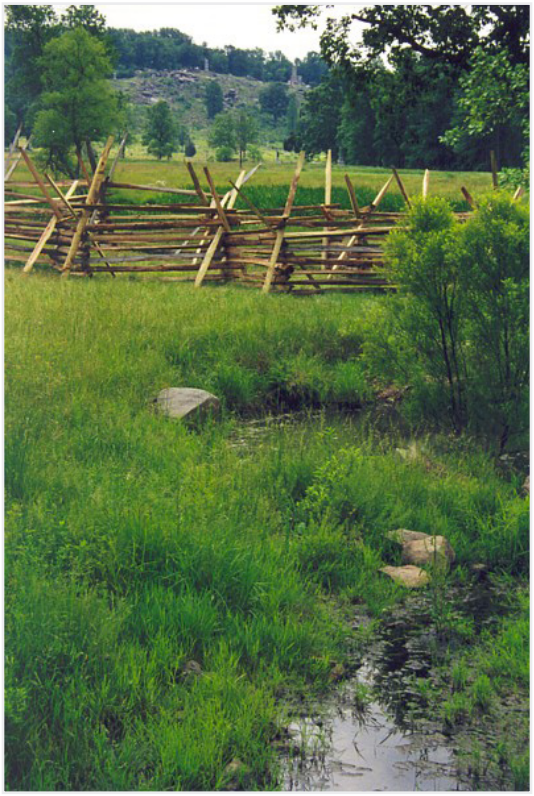
Representative Vegetation Types at GETT*		
Map Class	**Acres**	**% of Park**
Agricultural Field	2,530	37%
White Oak - (Northern Red Oak, Hickory species) Forest Alliance	1,217	18%
Built-up Land	837	12%
Orchard Grass - Sheep-sorrel Herbaceous Alliance	484	7%
Black Cherry - Red Maple - Canada Serviceberry - Oak species Forest Alliance	388	6%
Pasture	374	5%
Pin Oak - Red Maple Temporarily Flooded Forest Alliance	292	4%
Transportation Corridor	182	3%
Agricultural Field / Bluejoint Seasonally Flooded Herbaceous Alliance	153	2%
Bluejoint Seasonally Flooded Herbaceous Alliance	72	1%

**The top 10 of 23 mapped classes, representing 95% of the park.*

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1048532.



Pennsylvania Memorial.



Plum Run Stream cuts through the center of the Gettysburg Battlefield and into the "Valley of Death" near the Round Tops. *Katie Lawhon*

HOPEWELL FURNACE NATIONAL HISTORIC SITE

2002 - 2005 Pennsylvania

Park Character

The 890 acre Hopewell Furnace National Historic Site (HOFU) was an important iron smelting and casting community in the 18th and 19th Centuries. All of the pre-European vegetation within the park was removed or altered during the clearing and development of the iron plantation. The current landscape of the park is mostly forested land (especially early to mid-successional mixed oak forest) with interspersed agricultural land, developed land, and wetlands.



Hopewell Furnace National Historic Site.

Classification and Mapping

Twelve natural and semi-natural vegetation types were identified during classification sampling. Formation level information was reclassified to produce an alliance level vegetation map. The map was produced using 10 natural and semi-natural vegetation alliances and six cultural map classes. Overall accuracy was 88.77%.

Applications of the Vegetation Inventory

The Mid-Atlantic Network has used the vegetation maps extensively in development and implementation of monitoring projects. Examples include:

Research and Monitoring — Maps have been used to define the forested areas that are the limits for the forest vegetation monitoring protocol. Vegetation has not been stratified by type in the initial sampling design, but the maps will be used for post-stratification (e.g., evaluating trends in data by different vegetation types – probably at the formation or alliance level).

The Network is using vegetation data stratified by forest/non-forest for bird monitoring, and will also be using the maps for post-stratification. Maps have also been useful in helping to evaluate the best routes for the bird monitoring volunteers to take when traveling to each point.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047716.

Representative Vegetation Types at HOFU*		
Map Class	**Acres**	**% of Park**
White Oak - (Northern Red Oak, Hickory species) Forest Alliance	352	40%
Rock Chestnut Oak - (Scarlet Oak, Black Oak) Forest Alliance	150	17%
Tuliptree Forest Alliance	100	11%
Orchard Grass - Sheep-sorrel Herbaceous Alliance	91	10%
Red Maple - Green Ash Seasonally Flooded Forest Alliance	76	8%
Cropland	38	4%
Developed Land	23	3%
Modified Successional Forest	21	2%
Transportation Corridor	13	1%
Southern Highbush Blueberry - Black Highbush Blueberry Seasonally Flooded Shrubland Alliance	8	1%

**The top 10 out of 16 total mapped classes, representing 97% of the site area.*



Dry oak – Mixed Hardwood Forest.

PETERSBURG NATIONAL BATTLEFIELD

2002 - 2008 Virginia

Park Character

Petersburg National Battlefield (PETE) covers 2,698 acres, and is comprised of four units spread across two counties. The park protects resources associated with the siege and defense of Petersburg during the Civil War. It preserves battle sites, earthworks and other structures built by both armies, the Union Army Headquarters, and Poplar Grove National Cemetery. Vegetation in the region has been severely altered by a long history of human uses such as agriculture and logging. Today, the majority of the park is early successional or transitional vegetation. Ongoing management at the park is designed to maintain a landscape characteristic of Civil War battlefields.



Coastal Plain / Piedmont acidic seepage swamp.

Classification and Mapping

Vegetation data from seven National Parks in Virginia were combined with over 2,000 existing plot samples from The Mid-Atlantic Piedmont and Coastal Plain, and then used to refine the USNVC for the mid-Atlantic region. The map for PETE was produced using 20 map classes, representing 13 USNVC associations, five park-specific vegetation classes, and two cultural land use categories. The majority of land in the park (60%) is early successional or transitional vegetation. Later successional vegetation covers 24% and cultural map classes cover 16%. Overall map accuracy was 85.7%.

Applications of the Vegetation Inventory

The Mid-Atlantic Network has used the vegetation maps extensively in development and implementation of monitoring projects. Examples include:

Research and Monitoring — Maps have been used to define the forested areas that are the limits for the forest vegetation monitoring protocol. Vegetation has not been stratified by type in the initial sampling design, but the maps will be used for post-stratification (e.g., evaluating trends in data by different vegetation types – probably at the formation or alliance level).

The Network is using vegetation data stratified by forest/non-forest for bird monitoring, and will also be using the maps for post-stratification. Maps have also been useful in helping to evaluate the best routes for the bird monitoring volunteers to take when traveling to each point.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047724.

Representative Vegetation Types at PETE*		
Map Class	**Acres**	**% of Park**
Loblolly Pine Plantation / Early-Successional Loblolly Pine Forest	712	26%
Loblolly Pine Forest Alliance	613	23%
White Oak - (Southern Red Oak, Post Oak) Forest Alliance	292	11%
Tuliptree Forest Alliance	258	10%
Orchard Grass - Common Sheep Sorrel Herbaceous Alliance	237	9%
American Beech - Northern Red Oak - White Oak Forest Alliance	110	4%
White Oak - (Northern Red Oak, Hickory species) Forest Alliance	85	3%
Other Urban or Built-up Land	79	3%
Sweetgum - (Tuliptree, Red Maple) Temporarily Flooded Forest Alliance	74	3%
Transportation, Communications, and Utilities	58	2%

** Top 10 of 20 total map classes, representing 94% of the park.*



Battle of the Crater site at PETE.
CC Image by Flickr user Ken Lund



Acidic oak – hickory forest.

RICHMOND NATIONAL BATTLEFIELD PARK

2002 - 2008 Virginia

Park Character

Richmond National Battlefield Park (RICH) covers just over 2,300 acres in 10 units that are spread across three counties and the City of Richmond. It protects resources associated with the siege of Richmond, as well as the many Civil War battles fought in the vicinity. The surrounding landscape is primarily residential and industrial development, rural homes, and farmland.



Meadow at Gaines' Mill unit managed for native grasses and forbs. *Kristen Allen*

Vegetation in the area has been severely altered by a long history of human use such as agriculture and logging. Ongoing management within the park is designed to maintain the historical and cultural landscape of the Civil War, and this exerts a significant influence over vegetation in the park.

Classification and Mapping

Vegetation data from seven National Parks in Virginia were combined with over 2,000 existing plot samples from The Mid-Atlantic Piedmont and Coastal Plain, and used to refine the USNVC for the mid-Atlantic region. The map for RICH was produced using 21 map classes, representing 13 USNVC associations, five park-specific vegetation classes, and three cultural land use categories. Later successional vegetation (upland forests and forested wetlands) covers 43% of land in the park. Another 32% is early successional or transitional vegetation. Cultural map classes (agricultural fields, managed meadows and lawns) make up 25% of the park. Overall map accuracy was 85.9%.

Since this community classification was completed, the park has acquired over 600 additional acres and continues to receive land donations from friends groups. The park hopes to classify these new vegetation communities in the near future.

Applications of the Vegetation Inventory

The Mid-Atlantic Network and the staff at RICH have used the vegetation maps extensively in development and implementation of monitoring and management projects. Examples include:

Research and Monitoring — The Network has used the maps to define the forested areas that are the limits for the forest vegetation monitoring protocol. Vegetation has not been stratified by type in the initial sampling design, so the maps will be used for post-stratification (e.g., evaluating trends in data by different vegetation types – probably at the formation or alliance level.)

The park and the network are using vegetation data stratified by forest/non-forest for bird monitoring, and will also be using the maps for post-stratification. Maps have also been useful in helping to evaluate the best routes for the bird monitoring

Representative Vegetation Types at RICH*		
Map Class	**Acres**	**% of Park**
Orchard Grass - Common Sheep Sorrel Herbaceous Alliance**	201	14%
American Beech - Northern Red Oak - White Oak Forest Alliance	200	14%
White Oak - (Southern Red Oak, Post Oak) Forest Alliance	175	13%
Smooth Alder Seasonally Flooded Shrubland Alliance	121	9%
Tuliptree Forest Alliance	119	9%
White Oak - (Northern Red Oak, Hickory species) Forest Alliance	112	8%
Loblolly Pine Planted Forest Alliance	96	7%
Loblolly Pine Forest Alliance	95	7%
Willow Oak Seasonally Flooded Forest Alliance	66	5%
Forested Earthworks	62	4%

**The top 10 of 21 mapped classes, representing 90% of the park. **This map class includes lands managed in agricultural crops and hay as well as meadows managed for native grasses and forbs.*

volunteers to take when traveling to each point.

Fire Management — Staff at RICH currently burn two vegetation communities that are well adapted to fire, but there was interest in expanding the prescribed fire program to another unit to open up the landscape. However, using the vegetation data layer, managers were able to determine exactly which areas would not respond well to burning, and subsequently ruled out burning as a management tool in those areas. Maps of the vegetation communities have also been inserted into RICH's Fire Management Plan for this purpose, as well as to predict fire behavior during wildland fire.

Invasive Species Management — RICH managers routinely use the vegetation data to predict locations of fairly widespread invasive vegetation for treatment.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1048527.



Smooth alder saturated shrub community along Western Run, a large creek on the Malvern Hill unit. *Kristen Allen*



Coastal Plain Mixed Oak / Heath Forest. *Gary P. Fleming*

SHENANDOAH NATIONAL PARK

2007 - 2010
Virginia

Park Character

Shenandoah National Park (SHEN) covers over 197,000 acres of the Blue Ridge Mountains in the southern Appalachians. It is the largest fully protected area in the mid-Appalachian region. The range of elevation, slopes and aspects, rocks and soils, precipitation, and latitude create a mix of habitats. SHEN's natural features include: well-exposed strata of the Appalachians, one of the oldest mountain ranges in the world; diverse animal and plant populations and habitats; migratory bird stop-over points; and forested watersheds that perpetuate numerous streams flowing from uplands to lowlands. Most of SHEN's landscape is dominated by hardwood forests.



Fall Colors from Big Run Overlook.

Classification and Mapping

The most recent project was an update to the initial classification and mapping from 2006. The effort included additional accuracy assessment work, updating the classification scheme, and revising mapping methods. No new plots surveys were conducted. The project defined 35 natural community types, three modified/successional community types, and two broad modified/disturbed vegetation classes for a total of 40 community types. The final map was produced using 24 map classes, with an overall accuracy of 65.1%.

Applications of the Vegetation Inventory

Research and Monitoring — SHEN has used the vegetation map to:

- Determine the locations for additional forest monitoring plots;
- Determine which forest locations are most susceptible to acid rain and ozone damage;
- Locate areas of the park with conditions likely to support new rare plant or wildlife populations; and
- Assist researchers in study site selection.

Park Management — SHEN has used the vegetation map to:

- Assist in determining good search locations when search and rescue operations are underway;
- Identify areas in greatest danger of degradation from high human use (proximity of rock outcrop communities to trails and campsites), and to focus crowd control and other management in these areas;
- Determine the characteristics of the forest surrounding a restoration site (Hogwallow Flats overlook), and help staff determine appropriate species for restoration planting;
- Document boundaries of some cultural landscapes;
- Assist maintenance staff in avoiding impacts to sensitive vegetation from construction activities (road work, septic systems, etc.); and
- Assist with restoration activities after a large-scale disturbance, such as the landslide that occurred in SHEN in 1995.

Representative Vegetation Types at SHEN*		
Map Class	**Acres**	**% of Park**
Chestnut Oak - Northern Red Oak Forest Alliance	47,600	24%
Chestnut Oak - (Scarlet Oak, Black Oak) Forest Alliance	24,790	12%
(Pignut Hickory, Shagbark Hickory) - White Ash - (White Oak, Northern Red Oak) Forest Alliance	18,750	9%
White Oak - (Northern Red Oak, Hickory species) Forest Alliance	15,363	8%
Tuliptree Forest Alliance	13,329	7%
Tuliptree - Appalachian Basswood - Yellow Buckeye - Sugar Maple Forest Alliance	12,839	6%
Black Cherry - Red Maple - Canada Serviceberry - Oak species Forest Alliance	11,516	6%
Catastrophically Disturbed Forest	9,911	5%
American Basswood - White Ash - (Sugar Maple) Woodland Alliance	6,391	3%
Chestnut Oak - (White Oak, Southern Red Oak, Northern Red Oak, Black Oak) Forest Alliance	5,660	3%

**The top 10 of 21 mapped classes, representing 90% of the Park.*

Pest Management — The map has been used to predict which areas of the Park are most susceptible to damage from impending insect and disease infestations (sudden oak death, emerald ash borer, beech bark disease), and to prioritize these areas for monitoring. The map has also been used to help guide aerial spraying activities for Gypsy moth outbreaks.

Invasive Species Management — The vegetation data have been used to develop rare plant and invasive plant models. These models indicate the probability of occurrence for rare plants and invasive plants throughout the entire Park, which helps guide conservation and management actions.

Fire Management — The vegetation map has been used to model fire behavior and burn likelihood in different locations within the Park. Results help managers identify the locations of fire dependent communities and guides planning for prescribed burns.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=2165652.



Looking south from Mt. Marshall.



Shenandoah Valley in the spring.

VALLEY FORGE NATIONAL HISTORIC PARK

2000 - 2001 Pennsylvania

Park Character

Valley Forge National Historic Park (VAFO) is a 3,500 acre park that preserves cultural and natural resources associated with the winter encampment of General George Washington and the Continental Army during the Revolutionary War. The park is managed to reflect the land uses in the area immediately preceding the encampment. Thus, a significant portion of the park is maintained as open tall grassland to mimic small grain agriculture.



Valley Forge National Historic Park.

Classification and Mapping

Analysis of vegetation classification data identified 17 formation-level vegetation types, including six natural types and 11 anthropogenic types. These types were reclassified to produce an association-level map. The map for VAFO was produced using 21 map classes, including eight natural vegetation types and 13 anthropogenic types (for example, cropland, developed land, and managed grasslands). Grasslands predominate, covering over 40% of the park. Overall accuracy was 82.8%.

Applications of the Vegetation Inventory

The Mid-Atlantic Network has used the vegetation maps extensively in development and implementation of monitoring projects. Examples include:

Research and Monitoring — Maps have been used to define the forested areas that are the limits for the forest vegetation monitoring protocol. Vegetation has not been stratified by type in the initial sampling design, but the maps will be used for post-stratification (e.g., evaluating trends in data by different vegetation types – probably at the formation or alliance level).

The Network is using vegetation data stratified by forest/non-forest for bird monitoring, and will also be using the maps for post-stratification. Maps have also been useful in helping to evaluate the best routes for the bird monitoring volunteers to take when traveling to each point.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047733.



Grassland managed for tallgrass.

Representative Vegetation Types at VAFO*		
Map Class	**Acres**	**% of Park**
Orchard Grass - Sheep-sorrel Herbaceous Vegetation	1,291	37%
Black Cherry - Tuliptree - Red Maple - White Ash Forest	463	13%
Rock Chestnut Oak - (Northern Red Oak, Black Oak) / Northern Lowbush Blueberry Forest	331	10%
Tuliptree - Oak species Forest	316	9%
Transportation Corridor	197	6%
Cropland	171	5%
Developed Land	162	5%
Water	145	4%
Sycamore - Green Ash Forest	134	4%
Old Nursery Site	82	2%

*The top 10 of 21 mapped classes, representing 95% of the park.



Dry Oak / Heath Forest.



Tuliptree – Oak Forest with split rail fence.

ROCK CREEK PARK

1996 - 1998
District of Columbia

Park Character

At 1,750 acres, Rock Creek Park (ROCR) is one of America's largest forested urban parks. It is located on the fall line between the Atlantic Coastal Plain and the Piedmont Plateau provinces. The landscape is characterized by steep valleys and side slopes that bisect several significant ridgelines. The majority of the park is covered by mature, deciduous forest, mostly second growth. Land use within the park boundaries include historic sites and monuments, as well as maintained turf for picnic groves, community gardens, planted trees, and a golf course.



Boulder Bridge.

Classification and Mapping

ROCR was one of the prototype parks used to develop and test the national standards and protocols for classification and mapping. Vegetation was mapped to the alliance level. Six alliances – all forest types represented by a single association – were described and mapped. Areas dominated by shrubs or vines were classified as cultivated or disturbance categories. These were described and mapped at the request of park personnel.

Due to its proximity to urban development, highly invasive exotics are a significant management issue. Therefore, the minimum mapping unit criterion was ignored where detection of forest gaps could identify potential areas of invasion by aggressive vines and other exotics.

Applications of the Vegetation Inventory

Wildlife Management — ROCR staff have used their vegetation data in development of a deer management plan. The data helped them analyze deer habitat in the park, including the amount of forested versus unforested habitat, as well as percent and acreage of each species associations.

Invasive Species Management — The Emerald Ash Borer is an invasive insect that is spreading across the Midwestern and eastern U.S. This insect has not been documented at ROCR, but it occurs in neighboring states, and ROCR managers expect it to invade ROCR in the future. The vegetation data have enabled managers to identify areas with forest associations that may be vulnerable to invasion. This assists them in identifying trap sites for early detection and monitoring. Early detection will be key to managing this potentially significant threat.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047726.

Representative Vegetation Types at ROCR*		
Map Class	**Acres**	**% of Park**
Beech - White Oak / Mayapple Forest (classic type)	849	30%
Mixed Oak/Beech Variant of Beech - White Oak / Mayapple forest	560	20%
Managed Grass/lawns	239	9%
Tulip Poplar Forest Forest	211	8%
Beech - White Oak / Mayapple Forest (classic type) Beech/Tulip Component	185	7%
Urban/Disturbed	178	6%
Sycamore - Green Ash Forest (floodplain forest)	159	6%
Chestnut Oak Forest Forest	89	3%
Forest Canopy Gap	70	3%
Loblolly Pine - Mixed Oak Forest	64	2%

**The top 10 of 15 mapped classes, representing 94% of the park.*



Beech – white oak / mayapple forest.



Pierce Mill.



Aerial view of Rock Creek Park.

ASSATEAGUE ISLAND NATIONAL SEASHORE

1995 Virginia, Maryland

Park Character

In 1962, Assateague Island National Seashore (ASIS) was established on the shores of Maryland and Virginia. Despite its relatively small size (less than 18,000 acres), this windswept barrier island complex contains a surprising array of habitats and natural features on its sandy beaches, salt marshes, maritime forests and coastal bays. ASIS is vital for resting and feeding



The beach at ASIS.

migratory shorebirds and other abundant bird species (320 species). ASIS's wild horses are well known. The "wild" horses on Assateague are actually feral animals that have formed a unique wild horse society.

Differences in elevation (up to 16 meters in some places) and the proximity to surrounding water bodies give various areas of the island distinctly different plant populations. Along the seaward side, sandy beaches extend the length of the island. Beyond the beach, natural and human-made dunes protect inland habitats from salt spray and ocean waves, allowing shrub thickets and pine forests to thrive. During periods of rain, many freshwater pools form in depressions in these areas. Some are small and temporary, losing their water to the coarse, sandy soil or evaporation during the spring months. Other, larger ponds provide water for wildlife well into the dry summer months. Forests, marshes, beaches, shrublands, grasslands, and dunes, can all be found within ASIS's boundaries.

Classification and Mapping

Twenty-five distinct vegetation types were delineated for ASIS, including: four forest types, one woodland type, eight shrubland types, 11 herbaceous types and one sparsely vegetated type. Wild ponies that live on Assateague Island have created and maintain many disturbance vegetation types. Staff at ASIS have created several exclusion areas that demonstrate what the structure and composition of vegetation would be in the absence of grazing. Vegetation types were not spatially mapped for this project and thus there is no accuracy assessment available. A complete vegetation inventory may be completed in the future.

Applications of the Vegetation Inventory

Park Management — The Northeast Coastal and Barrier Network (NCBN) uses the vegetation mapping data for all park condition assessments to calculate habitat types, and other baseline information.

Research and Monitoring — NCBN has used the maps for developing sampling frames for salt marsh vegetation and nekton sampling protocols. ASIS also hosted research on Yellow-rumped warblers (*Dendroica coronata*). These birds winter

in the park, at which time one of the staples of their diet is wax myrtle (*Myrica cerifera*). Using the vegetation mapping data to select vegetation types containing wax myrtle allowed for a more robust research sampling design.

NCBN completed a pilot project with a remote sensing specialist at the University of Rhode Island which entailed attempting to recreate the vegetation maps using satellite imagery and compare the product to the existing vegetation maps in order to look at habitat change over time. The cooperators determined that without an accurate base vegetation map developed via aerial photos and field work, it would not be possible to produce a scientifically credible change analysis map using just satellite imagery. In the future, as the vegetation map products are completed, ASIS will be using the data to analyze habitat change through time.

Habitat Modeling — ASIS used the vegetation classification system in their potential habitat monitoring research from 1996-2007. The north end of Assateague Island had significantly eroded due to the stabilization of an inlet and the subsequent sand starvation of the northern end of the island. In order to avoid a possible break-up of the island, there was a proposal to add sand to the effected area at the northern tip of the island. However, this could change the amount of potential habitat available for two federally listed species found in the area, piping plover (*Charadrius melodus*) and seabeach amaranth (*Amaranthus pumilus*). By using the U.S. National Vegetation Classification within field plots, ASIS was able to monitor the amount of potential habitat available. The monitoring definitively concluded that vegetation change thresholds agreed upon prior to the restoration had been exceeded, and mitigative action was initiated. Also, use of the Vegetation Inventory products were instrumental in gaining credibility among concerned partners as to the vegetation metrics to be used as "vital signs."

The exotic species nutria (*Myocastor coypus*) disturbs the root matt of marsh plants while creating swim canals and foraging. This kills marsh plants and turns salt marsh to wash flats. ASIS has used the vegetation mapping data to derive a potential nutria habitat map for use in their eradication efforts.

The vegetation map and other products will soon be available at http://nrinfo.nps.gov/Reference.mvc/Profile?Code=2097270.



Horses on the beach at ASIS.



Salt marsh on Toms Cove overlooking the Coast Guard Station and boathouse.

COLONIAL NATIONAL HISTORICAL PARK

2001-2008 Virginia

Park Character

Colonial National Historical Park (COLO) is located in the middle of Virginia's Coastal Plain, between the James and York rivers. The 8,529 acre park is spread out over three counties and the City of Williamsburg. COLO preserves the historic resources of Yorktown Battlefield, scene of the culminating battle of the American Revolution in 1781, as well as Jamestown



Tidal Mesohaline and Polyhaline Marsh. *Karen D. Patterson*

Island, the site of the first permanent English settlement in North America. The Colonial Parkway, a 24-mile scenic road, links the two. In addition, the park maintains two land holdings not directly connected to the Colonial Parkway: Green Springs and Swanns Point. COLO provides a resource for interpretation of history from pre-colonial settlement through the American Civil War, as well as numerous opportunities for outdoor recreation.

The majority of the park is in a portion of the Coastal Plain known as the Atlantic Southern Loam Hills subsection. The area is characterized by smooth plains ranging from 100 to 300 feet above sea level. Topographic relief in COLO is typical for the Coastal Plain, where broad uplands are gently dissected by streams.

Classification and Mapping

This project resulted in 40 map classes representing 31 recognized USNVC types, and an additional seven nonstandard park-specific vegetation classes (two map classes were mapped outside of park boundaries in the Swann's Point easement). Vegetation map classes were determined through extensive field reconnaissance, data collection, and analysis. A total of 48 quantitative vegetation plots were used, with one outside of park boundaries (at Cheatham Annex, an area that has since returned to U.S. Navy ownership). Over the course of the project, 20 new associations were described for the USNVC and 40 existing associations were revised. Transitional vegetation covers nearly 40% of the park. Cultural map classes cover just under 20%, with wetlands and upland forests making up the remainder. Vegetation types were mapped to the alliance level, with an overall accuracy of 84.7%.

Applications of the Vegetation Inventory

The Northeast Coastal and Barrier Network (NETN) has used the vegetation maps extensively in development and implementation of monitoring projects.

Research and Monitoring — Maps have been used to define the forested areas that are the limits for the vegetation monitoring protocol. Vegetation has not been stratified

Representative Vegetation Types at COLO*		
Map Class	**Acres**	**% of Park**
Tuliptree Forest Alliance	3,090	36%
Tidal Oligohaline Marsh	909	11%
Orchard Grass - Common Sheep Sorrel Herbaceous Alliance	897	10%
American Beech - Northern Red Oak - White Oak Forest Alliance	855	10%
Loblolly Pine - (White Oak, Southern Red Oak, Post Oak) Forest Alliance	768	9%
Green Arrow-arum - Pickerelweed Tidal Herbaceous Alliance	308	4%
Sweetgum - (Tuliptree, Red Maple) Temporarily Flooded Forest Alliance	163	2%
Willow Oak Seasonally Flooded Forest Alliance	132	2%
Loblolly Pine Planted Forest Alliance	127	1%
Saltmarsh Cordgrass Tidal Herbaceous Alliance	106	1%

**Top 10 of 38 total mapped classes, representing 86% of the site area. Two mapped classes which occur outside of COLO boundaries in the Swann's Point easement are not included here.*

by type in the initial sampling design, but the maps will be used for post-stratification (e.g., evaluating trends in data by different vegetation types – probably at the formation or alliance level).

Invasive Species Management — Maps have been used to help identify wetland sites most important to control *Phragmites australis* (common reed) with spraying. *P. australis* is a non-native plant that can form dense thickets, choking out native plants and altering the hydrology and species composition of wetlands.

Mapping data is also being utilized for a wisteria eradication program that includes a monitoring component to compare succession vegetation with the vegetation types mapped for the area in order to measure the ecological restoration value of the efforts. These efforts will then be explained on interpretive panels.

Fire Management — The wetlands data have been valuable in the development of wetlands monitoring protocols.

Research and Monitoring — Maps have been used for fire planning.

Park Management — Maps have been used in natural resource overviews.

For the full vegetation classification, map, report, and other products, visit: http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047699.



Tidal Bald Cypress Forest / Woodland.

FIRE ISLAND NATIONAL SEASHORE

1999 - 2002
New York

Park Character

The Fire Island National Seashore (FIIS) is located on Fire Island, a member of Long Island barrier island system in the State of New York. Located in Suffolk County, Fire Island extends 32 miles from Fire Island Inlet to Moriches Inlet. The Fire Island National Seashore is bounded on the West by the Robert Moses State Park and on the East by the Smith Point County Park.



Barrier Island Cross Section. *P. Valentine*

The vegetation communities and spatial patterns on Fire Island, as on all barrier islands, is a direct result of dynamism. The forces of sand deposition, storm-driven over wash, salt spray, and surface water all play major roles in affecting vegetation distribution. More recently, disturbance from both humans and white-tailed deer have impacted vegetation communities on Fire Island.

Classification and Mapping

This project resulted in 39 map classes (36 of which are known from within FIIS boundaries), representing 24 recognized USNVC types, one complex of two USNVC alliances, and 14 non-USNVC classes. Four associations were identified on Fire Island and the William Floyd Estate but do not appear on the map due to their rarity, small relative size, and/or difficulties in identifying them with aerial photography. Vegetation types were mapped to the alliance level, with an overall accuracy of 66.3%.

Applications of the Vegetation Inventory

Research and Monitoring —The Nature Conservancy uses the vegetation map as an aid for salt marsh inventories.

FIIS completed a pilot project with a remote sensing specialist at the University of Rhode Island. Researchers attempted to recreate the vegetation map using satellite imagery and compare the product to the existing vegetation maps to analyze habitat change over time. The cooperators determined that without an accurate base vegetation map developed via aerial photos and field work, it would not be possible to produce a scientifically credible change analysis map using just satellite imagery. In the future, as the vegetation map products are completed, FIIS will be using them to evaluate habitat change through time.

The map is also being used to help target well locations for a USGS groundwater flow model.

Park Management — The vegetation map is being used at FIIS to help develop the new General Management Plan (GMP). Data are helping managers conduct impact analyses and develop management alternatives.

Representative Vegetation Types at FIIS*		
Map Class	**Acres**	**% of Park**
Maritime Deciduous Scrub Forest	645	12%
Open Beach	634	12%
Low Salt Marsh	555	10%
High Salt Marsh	491	9%
Northern Beach Grass Dune	489	9%
Northern Dune Shrubland	365	7%
Reedgrass Marsh	306	6%
Sparsely Vegetated Sand	285	5%
Coastal Oak-Heath Forest	237	4%
Residence/Building	204	4%

**Top 10 of 36 total mapped classes, representing 78% of FIIS. The vegetation inventory mapped a larger area; these numbers are limited to what occurs within FIIS boundaries.*

The vegetation map has been used to identify habitat types for shoreline restoration work, and to target land swaps needed for an Army Corp of Engineers storm water damage protection plan.

Planning — The map is currently used in the development of a fire management plan, as well as an integrated pest management plan. The pest management plan directs management of mosquitos and other pests, as well as FIIS's spraying program.



View from Watch Hill Nature Trail over Salt Marsh. *P. Valentine*

Future Applications

Research and Monitoring — FIIS staff would like to set up monitoring transects to analyze changes since the inventory was completed, especially in terms of climate change.

Wildlife Management — The map will be tasked to aid in the process of developing a vegetation deer management plan.

For the full vegetation classification, map, report, and other products, visit: http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047705.



View of Watch Hill Salt Marsh from Trail. *P. Valentine*

GATEWAY NATIONAL RECREATION AREA

2003 - 2008 New Jersey, New York

Park Character

Gateway National Recreation Area (GATE) covers about 26,607 acres of land and water. GATE was designated a National Recreation Area in 1972. It has an international reputation as a birding "hot spot." GATE comprises eleven park sites in three separate units. The Jamaica Bay Unit in Brooklyn and Queens includes much of the shoreline and water below the Shore Parkway



Maritime Dunes at Fort Tilden. *Gregory J. Edinger, NY Natural Heritage Program*

beginning at Plum Beach and ending at Kennedy International Airport, along with several dozen islands in Jamaica Bay, a tidal estuary. It also includes most of the western part of the Rockaway peninsula which separates Jamaica Bay from the Atlantic Ocean.

The Staten Island Unit is located on the southeastern shore of Staten Island within Lower New York Bay. It includes Hoffman and Swinburne Islands, both off-limits to visitation and managed primarily for the benefit of avian species.

The Sandy Hook Unit is a barrier peninsula in Monmouth County in northern New Jersey with two park sites.

A large portion of GATE is developed. Despite the degraded landscape and developed areas in and around the park, GATE has several vegetation associations with biodiversity significance at the state and global level. The rarest association in the park is the maritime holly forest in the Sandy Hook Unit, which at 231 acres is the largest one of only two known occurrences in the World. The low salt marsh in Jamaica Bay is currently the largest (1,237 acres) example in the state documented by the NY Natural Heritage Program.

Classification and Mapping

This project identified a total of 43 map classes for GATE. Of these, 35 vegetated types were identified and described in detail, and were mapped on the alliance level. Vegetation types were classified to the association level, with an overall map accuracy of 63.75%.

Applications of the Vegetation Inventory

The Northeast Coastal and Barrier Network (NCBN) uses the vegetation maps extensively in a variety of activities.

Park Management — NCBN uses the vegetation mapping data for all park condition assessments to calculate habitat types, and other baseline information.

Research and Monitoring — NCBN has used the maps for developing sampling

Representative Vegetation Types at GATE*		
Map Class	**Acres**	**% of Park**
Developed	1,912	21%
Saltmarsh Cordgrass Tidal Herbaceous Alliance	1,134	13%
Black Cherry - Red Maple - Canada Serviceberry - Oak species Forest Alliance	1,094	12%
Common Reed Tidal Herbaceous Alliance	872	10%
American Beachgrass Herbaceous Alliance	575	6%
Sea-rocket Sparsely Vegetated Alliance	393	4%
Paved road	355	4%
Quaking Aspen Woodland Alliance	342	4%
Marine intertidal gravel/sand beach	312	3%
Eastern Red-cedar Woodland Alliance	295	3%

**The top 10 of 43 total mapped classes representing 80% of GATE.*

frames for salt marsh vegetation and nekton sampling protocols.

NCBN completed a pilot project with a remote sensing specialist at the University of Rhode Island. Researchers attempted to recreate the vegetation maps using satellite imagery and compare the product to the existing vegetation maps in order to analyze habitat change over time. The cooperators determined that without an accurate base vegetation map developed via aerial photos and field work, it would not be possible to produce a scientifically credible change analysis map using just satellite imagery. In the future, as the vegetation map products are completed, NCBN will be using them to evaluate habitat change through time.

For the full vegetation classification, map, report, and other products, visit: http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1048524.



North Atlantic Low Salt Marsh (Saltmarsh Cordgrass Tidal Herbaceous Alliance), Jamaica Bay Unit.



Northern Tall Maritime Shrubland (Black Cherry - Red Maple – Canada Serviceberry - Oak species Forest Alliance), Jamaica Bay Unit.

GEORGE WASHINGTON BIRTHPLACE NATIONAL MONUMENT

2002 - 2008 Virginia

Park Character

George Washington Birthplace National Monument (GEWA), authorized in 1930, is located in the northernmost portion of Virginia's outer Coastal Plain where Pope's Creek joins the Potomac River. This portion of the Coastal Plain consists of flat plains with elevations ranging from 0–100 feet.



George Washington Birthplace. *Wikiphoto by J.G.Howes*

GEWA covers a total of 551 acres, and is representative of 18th-century Virginia tobacco farms. A Memorial House with 18th century furnishings is open to visitors. GEWA's farm buildings, groves of trees, livestock, gardens, and crops of tobacco and wheat represent the boyhood environment that Washington knew.

Classification and Mapping

Nineteen map classes representing 16 USNVC associations were identified. Of the 19 map classes, six are natural communities (two are globally rare). Vegetation types were mapped to the alliance level. Since all vegetation polygons were confirmed during this exercise, a formal thematic accuracy assessment was not carried out.

Applications of the Vegetation Inventory

The Northeast Coastal and Barrier Network (NCBN) uses the vegetation maps extensively in a variety of activities.

Park Management — NCBN uses the vegetation mapping data for all park condition assessments to calculate habitat types, and other baseline information.

GEWA resource managers consider the vegetation data critical in helping retain biodiversity at cultural parks. At units where one person often manages everything from cultural to natural resources, the integrated resources program managers rely on these data for uses such as evaluation of cultural and natural values for site management and planning, planning documentation, and communication of important natural values to superintendents and upper managers.

Research and Monitoring — NCBN has used the maps for developing sampling frames for salt marsh vegetation and nekton sampling protocols, as well as storm vulnerability assessment.

Fire Management — GEWA is utilizing their vegetation mapping results to inform a new fire management plan. For example, prescribed fires will be planned in part by using stratified vegetation maps to find treatment areas and potential risk areas. Future planned burns will all be reviewed by mapping data.

Education and Interpretive Programs— The vegetation map and data help to promote natural values to multiple audiences.

Representative Vegetation Types at GEWA*		
Map Class	**Acres**	**% of Park**
Orchard Grass - Common Sheep Sorrel Herbaceous Alliance	178	31%
Loblolly Pine Forest Alliance	85	15%
Other Urban or Built-up Land	73	13%
Loblolly Pine Plantation / Early-Successional Loblolly Pine Forest	72	13%
Water	36	6%
Transportation, Communications, and Utilities	27	5%
Sweetgum Forest Alliance	16	3%
Willow Oak Seasonally Flooded Forest Alliance	14	3%
Saltmarsh Cordgrass Tidal Herbaceous Alliance	13	2%
Groundsel-tree - Maritime Marsh-elder Tidal Shrubland Alliance	11	2%

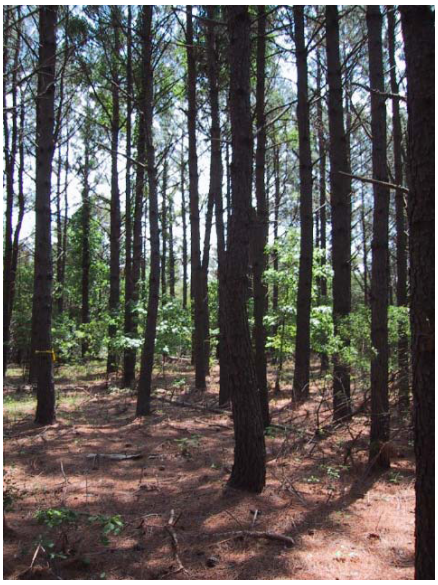
**Top 10 of 18 total mapped classes, representing 93% of GEWA. The vegetation inventory mapped a slightly larger area; these numbers are limited to what occurs within GEWA.*

Invasive Species Management — The vegetation map is used at GEWA for the Northeast Exotic Plant Management Team. Baseline information provided by the vegetation mapping is invaluable.

Future Applications

Park Management — According to recommendations in the park's 1999 Cultural Landscape Report, GEWA is considering integrating inventory data into a proposal to utilize native vegetation to create the appearance of farming without actually farming in open fields now in non-native fescue. The vegetation map would be used to help select appropriate native grasses and forbs. Because the vegetation mapping was completed during a drought, GEWA would like to get additional data from normal and wetter years.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047713.



Loblolly Pine Plantation.



Tidal Mesohaline and Polyhaline Marsh (Low Salt Marsh) on Bridges Creek. *Philip Coulling*

SAGAMORE HILL NATIONAL HISTORIC SITE

2009 New York

Park Character

Sagamore Hill National Historic Site (SAHI), established in 1963, was the home of President Theodore Roosevelt from 1885 until his death in 1919. SAHI is located in the town of Oyster Bay in Nassau County and covers about 83 acres of land and water.



Birds Eye View of Sagamore Hill in 1918.
Harpers Ferry Center

SAHI is located at about the midpoint of Cove Neck, a one mile wide by three miles long peninsula that extends into and divides Cold Spring Harbor and Oyster Bay Harbor on the North Shore of Long Island, NY. The site is roughly rectangular in shape and has an east–west orientation. The eastern-most edge touches Cold Spring Harbor and includes small patches of salt marsh, maritime beach, and maritime dunes. The site continues west, uphill through a relatively mature oak - tulip tree forest, then grades into the more-developed central and western half of the park that includes Roosevelt's home and other park facilities.

SAHI encompasses successional and mature forests, fields, and a section of 14 maritime communities including beach, dunes, and salt marsh. More than a hundred species of birds use these habitats at Sagamore Hill, including 26 confirmed breeding species and an additional 24 probable breeding species.

Classification and Mapping

This project resulted in nine vegetated map classes, and identified and characterized 10 USNVC associations in detail. A total of 16 plots were used for sampling. Developed/ modified classes made up the greatest spatial extent. Vegetation types were mapped to the alliance level, with an overall thematic accuracy of 71%.

Applications of the Vegetation Inventory

SAHI staff consider the vegetation inventory to be a milestone in natural resource management at SAHI. Uses to date include:

Park Management — SAHI uses the vegetation map and data in the implementation of its Cultural Landscape Plan.

The Northeast Coastal and Barrier Network (NCBN) uses the vegetation mapping data for each park condition assessment to calculate habitat types, and other baseline information.

Research and Monitoring — NCBN has used the maps for developing sampling frames for salt marsh vegetation and nekton sampling protocols.

Invasive Species Management — SAHI is preparing to conduct an invasive plant project. This is an effort to eradicate invasive plants in areas of the park deemed culturally critical, including those areas in

Representative Vegetation Types at SAHI *		
Map Class	**Acres**	**% of Park**
American Beech - Northern Red Oak - White Oak Forest Alliance	29	33%
Developed	25	28%
White Oak - (Northern Red Oak, Hickory species) Forest Alliance	7	8%
Black Cherry - Red Maple - Canada Serviceberry - Oak species Forest Alliance	6	7%
Sugar Maple - Yellow Birch - (American Beech) Forest Alliance	6	7%
Pastureland	3	3%
Saltmarsh Cordgrass Tidal Herbaceous Alliance	3	3%
American Beachgrass Herbaceous Alliance	2	2%
Saltmeadow Cordgrass - (Common Threesquare) Herbaceous Alliance	1	2%
Saltmeadow Cordgrass - (Saltgrass) Tidal Herbaceous Alliance	1	1%

**Top 10 of 19 total mapped classes, representing 94% of SAHI.*

proximity to Theodore Roosevelt's home, as well as in former agricultural areas now overrun with woody exotics. The next step will be revegetation with native grass seeds. SAHI utilized the vegetation map and referred to species lists in planning which species to remove or restore. SAHI will continue to use the vegetation inventory in the future for exotic plant control and revegetation of native species.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1048528.



Sagamore Hill.
Wikipedia Photo by user Marsky01

ACADIA NATIONAL PARK

1997 - 2003
Maine

Park Character

In 1919, President Wilson established Lafayette National Park; in 1929, the park's name was changed to Acadia National Park (ACAD). In total, ACAD consists of 30,300 acres on Mount Desert Island, 2,728 acres on Isle au Haut, and 2,366 acres on the Schoodic Peninsula. ACAD is comprised of a cluster of islands on the Maine coast positioned within the broad transition zone



Schoodic Coast.

between eastern deciduous and northern coniferous forests. These forests host several species and plant communities at the edge of their geographic range. ACAD includes Cadillac Mountain, which at 1,530 feet, is the highest point on the U.S. Atlantic coast. ACAD is interwoven with a wide variety of freshwater, estuarine, forest, and intertidal resources, many of which contain plant and animal species of international, national and state significance. Acadia has more than 1,100 vascular plant species that represent a wide diversity of plant life adapted to thrive in acidic, low nutrient bogs and rocky, treeless mountain summits. Grasses and wildflowers abound in park meadows, and lakes and ponds are home to emergent and floating aquatic vegetation. Almost one quarter of ACAD's flora is non-native, and about 25 species are state-listed rare plants.

Classification and Mapping

Samples from 179 vegetation sampling plots were collected during 1997–99 field seasons and subsequently analyzed with previously collected plot data. Fifty-three natural/semi-natural vegetation communities (associations of the USNVC) were recognized. The 53 vegetation communities are represented with 33 map classes. A total of 58 map classes, including land use/land cover and park specific categories, were used to map ACAD and environs, 55 of which are known from within ACAD boundaries. The Spruce - Fir Forests (conifer and mixed phases) together are the most extensive vegetated map classes, covering over 60% of natural vegetated classes and over half of all vegetated classes. Vegetation types were mapped to the association level, with an overall accuracy of 80%.

Applications of the Vegetation Inventory

Research and Monitoring — The Northeast Temperate Network (NETN) uses the vegetation inventory products in support of its water quality and forest health monitoring programs. For example, species data help augment plant lists, and community data aid in locating vernal pools.

Top 10 Map Classes at ACAD*		
Map Class	**Acres**	**% of Park**
Spruce - Fir Forest (conifer phase)	14,408	30%
Spruce - Fir Forest (mixed phase)	9,531	20%
Mixed Conifer Woodland	4,041	9%
Mixed Conifer - Deciduous Woodland	2,775	6%
Aspen Birch Woodland/Forest Complex (forest phase)	2,197	5%
White Pine - Hardwood Forest	1,680	4%
Red Oak Woodland	1,089	2%
Blueberry Bald - Summit Shrubland Complex	874	2%
Pitch Pine Woodland	854	2%
Conifer Swamp Woodland (spruce-mixed phase)	851	2%

**Top 10 of 55 mapped classes, representing 82% of ACAD. The vegetation inventory mapped an area larger than ACAD; these numbers are limited to what occurs within ACAD boundaries.*

Network parks are using their vegetation maps as a base layer in their Google Earth Portal: http://science.nature.nps.gov/im/units/NETN/googleMaps/parkMaps_GoogleEarth_flash.cfm. The parks use this portal for exploring a variety of resource and management-related data, with applications for research, management, and education. For example, NETN staff have used vegetation map data to show a contractor how he could identify new bird monitoring sites by selectively displaying the field/early-succession communities in Google Earth.

ACAD staff use the spatial data frequently and find it useful for several NETN monitoring protocols. ACAD uses the spatial data to analyze forest plot data by major forest type (i.e., spruce/fir vs. hardwood forest). The vegetation map has been particularly useful for developing and pilot testing a wetland monitoring protocol in different wetland types. Staff relied on the spatial data to determine plot locations for a stunted woodland monitoring protocol.

ACAD's Cultural Resources Specialist used the mapped cultural vegetation to look for new locations of orchards in the park.

Species data associated with the plot and accuracy assessment data are used to verify species identified for various projects, and to provide researchers in ACAD with a list of species found near their sampling locations.

Future Applications and Needs — The vegetation map for ACAD was one of the first to be developed in the region, and several important changes have been made since that inventory. For example, the species data associated with the accuracy assessment in ACAD were never entered into the PLOTS database or incorporated into the report species list. This makes locating the correct plot file with original species observations and notes difficult. As such, an updated inventory completed to meet the newer standards would be very useful for ACAD.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047691.

SAUGUS IRON WORKS NATIONAL HISTORIC SITE

2003 - 2008 Massachusetts

Park Character

The 13-acre Saugus Iron Works National Historic Site (SAIR) was dedicated a National Historic Site on April 5, 1968 to preserve the cultural and natural history of the first successfully integrated manufacturing facility for the production of cast and wrought iron in North America.



Cattail Brackish Tidal Marsh, Reed-grass Tidal Marsh, and Northeastern Modified Successional Forest. *NatureServe*

The historic structures of the Iron Works are nestled along the banks of the Saugus River. The tidally influenced Saugus River is a principal natural resource for a wide variety of plants, animals, and other organisms that depend on the river, riparian woodlands, and surrounding marshes as an important habitat. The predominant forest in the park is Northeastern Modified Successional Forest, a broadly defined forest type characterized by a number of early successional tree species and an herbaceous layer supporting many exotic species. This forest type reflects the altered composition caused by a variety of land uses.

Classification and Mapping

Nine mapping classes were used for SAIR. Although SAIR is largely developed, six vegetation associations occurred within the park, and these were identified and described in detail. The associations were Northeastern Modified Successional Forest, Reed Canarygrass Eastern Marsh, Reed-grass Tidal Marsh, Cattail Brackish Tidal Marsh, Skunk-cabbage - Orange Jewelweed Seep, and Central Atlantic Freshwater Subtidal River Bed. The most expansive vegetation community at the site is Reed-grass Tidal Marsh, covering 18% of the property. Vegetation types were mapped to the alliance level. A thematic accuracy assessment was not completed for this park because every minimum mapping unit was visited.

Applications of the Vegetation Inventory

Research and Monitoring — The Northeast Temperate Network (NETN) has used the vegetation map in support of water quality and forest health monitoring programs, to reference species (e.g., augment plant lists) and community data (e.g., finding vernal pools).

Network parks are using their vegetation maps as a base layer in their Google Earth Portal: http://science.nature.nps.gov/im/units/NETN/googleMaps/parkMaps_GoogleEarth_flash.cfm. The parks use this portal for exploring a variety of resource and management-related data, with applications for research, management, and education. As the vegetation mapping effort was ending, the NPS undertook restoration of

Representative Vegetation Types at SAIR*		
Map Class	**Acres**	**% of Park**
Mixed Urban or Built-Up	6	45%
Common Reed Tidal Herbaceous Alliance	2	18%
Black Cherry - Red Maple - Canada Serviceberry - Oak species Forest Alliance	2	14%
(Narrowleaf Cattail, Southern Cattail) Tidal Herbaceous Alliance	1	11%
River	1	6%
Skunk-cabbage - Yellow Marsh-marigold Saturated Herbaceous Alliance	1	5%
Other Urban or Built-Up Land	0.2	1%
Reed Canarygrass Seasonally Flooded Herbaceous Alliance	0.05	0.4%
Sago Pondweed - Horned Pondweed Permanently Flooded - Tidal Herbaceous Alliance	0.001	0.01%

**All 9 mapped classes, representing 100% of SAIR.*

the wetlands along the Saugus River. Prior to restoration, invasive non-native common reed (*Phragmites australis*) dominated park riverine wetlands. All vegetation from the phragmites-dominated wetlands were removed, and the surface was re-graded to support high and low marsh, and tidal mudflat habitat. High and low marsh areas were planted with native freshwater tidal wetland plants. Survivorship of low marsh plantings was very low, thus providing more tidal mudflat habitat than anticipated. The extensive mudflat has provided valuable forage and resting areas for migrating shorebirds in summer and early fall. Possible causes of low plant survivorship include goose herbivory (observed) and/or anoxic or hypersaline conditions in the root zone. The vegetation map provides a baseline for the site pre-restoration, and hopefully will be updated in the future to reflect the change in park land cover.

Education and Interpretative Programs — NETN parks are in the process of updating natural resource information on their websites for the education of the public. Vegetation mapping products will be employed to update this information.

For the full vegetation classification, map, report, and other products, visit: http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1048529.



Successional forest.



2008-2009 wetland restoration.

WEIR FARM NATIONAL HISTORIC SITE

2009 Connecticut

Park Character

The U.S. Congress established the Weir Farm National Historic Site (WEFA) in 1990 for the purpose of preserving and interpreting the historically significant properties and landscapes associated with the life and work of the American painter J. Alden Weir. WEFA is composed of two disconnected parcels, 59.3 and 8.9 acres in size, in the towns of Ridgefield and Wilton, Connecticut. Adjoining Weir Farm is additional open space, owned by the Weir Farm Art Center and the Town of Ridgefield (26.9 acres).



Burlingham House Visitor's Center.

The vegetation of WEFA is deciduous forest, except in areas too wet to support trees and in the man-made fields maintained by mowing. The two parcels that make up WEFA differ in access and habitat diversity. The main parcel, excluding the historic site, is wooded with a mixed upland forest of oak, hickory, maple, and birch. Forested wetlands and intermittent watercourses dissect much of this parcel, and a small man-made pond, regulated by an earthen dam, occurs in the eastern portion. The northern parcel is characterized by a dry to mesic oak, hickory, maple, and birch forest. There are no wetlands or watercourses in the northern parcel.

Classification and Mapping

The vegetation inventory identified nine natural vegetation types in the park: four upland forest types, one upland non-vascular type, two forested wetland types, and two wetland shrub thicket types. In addition, there are four semi-natural vegetation types - one successional forest and three non-forested types (two in mowed upland fields, and one herbaceous wetland seep).

A total of 24 map units were developed to map the vegetation. The Northeastern Dry Oak - Hickory Forest (Northern red oak / Mapleleaf viburnum community) is the most common upland vegetation, although extremely altered by land-use history and heavy deer browse. Vegetation types were mapped to the alliance level. Overall thematic mapping accuracy was not calculated because all minimum mapping units and polygons were visited on this small site.

Applications of the Vegetation Inventory

Research and Monitoring— NETN has used vegetation map products in support of monitoring programs. Water quality and forest health monitoring programs both reference species (helps augment plant lists) and community data (aids in finding vernal pools at WEFA) to help guide efforts.

Network parks are using their vegetation maps as a base layer in their Google Earth Portal: http://science.nature.nps.gov/

Representative Vegetation Types at WEFA*		
Map Class	**Acres**	**% of Park**
White Oak - (Northern Red Oak, Hickory species) Forest Alliance & Chestnut Oak - (Scarlet Oak, Black Oak) Forest Alliance	18	26%
White Oak - (Northern Red Oak, Hickory species) Forest Alliance	11	17%
Orchard Grass - Common Sheep Sorrel Herbaceous Alliance & Broomsedge Bluestem Herbaceous Alliance	10	14%
Red Maple - Green Ash Seasonally Flooded Forest Alliance	5	8%
Northern Red Oak - (Sugar Maple) Forest Alliance	4	5%
Water	3	5%
Sugar maple - White Ash - American Basswood Forest Alliance	2	3%
Red Maple - Blackgum Saturated Forest Alliance	2	3%
Weir Complex Domestic Grounds	2	3%
Chestnut Oak - (Scarlet oak, Black oak) Forest Alliance	2	2%

**Top 10 of 24 total mapped classes, representing 86% of WEFA.*

im/units/NETN/googleMaps/parkMaps_GoogleEarth_flash.cfm. The parks use this portal for exploring a variety of resource and management-related data, with applications for research, management, and education. For example, NETN staff have used vegetation map data to show a contractor how he could identify new bird monitoring sites by selectively displaying the field/early-succession communities in Google Earth.

Education and Interpretative Programs — WEFA is in the process of updating the natural resource information on its website for the education of the public. The vegetation inventory products will be employed to update this information.

Park Management — As a smaller park, WEFA has a small staff who are required to perform multiple roles. The staff believes that the vegetation mapping data will provide immeasurable assistance in the oversight of natural resource management projects. WEFA will leverage NETN expertise to best make use of the data for their projects.

For the full vegetation classification, map, report, and other products, visit: http://nrinfo.nps.gov/Reference.mvc/Profile?Code=2170233.



Northeastern Dry Oak - Hickory Forest.



Northeastern Old Field
(Orchard Grass – Common Sheep Sorrel Herbaceous Alliance).

ARCHES NATIONAL PARK

2003 - 2009
Utah

Park Character

Arches National Park (ARCH) is a 76,545 acre park located in southeastern Utah on the Colorado Plateau. Elevations range from about 4,000 to 5,700 feet above sea level. This high desert area is world famous because of its awe-inspiring rock formations, including over 2,000 arches, spires, fins, and balanced rocks.



Pinyon Pine–Utah Juniper / Blackbrush–mixed shrub woodland.

The dominant plant community at Arches is blackbrush shrublands. The area also supports grasslands, pinyon pine-Utah juniper woodlands, shrublands, and riparian areas with Fremont cottonwood, netleaf hackberry, box elder, and willows. Cryptobiotic soils and potholes are also noteworthy.

Mapping and Classification

The project area was 129,868 acres (52,556 hectares), encompassing ARCH as well as adjacent public and private lands. Analysis of plot data revealed 75 USNVC plant associations, alliances or park special vegetation types. Thirty-one natural and semi-natural vegetation map classes were developed, as well as two unvegetated geologic formations and three anthropogenically disturbed areas such as transportation corridors. Map accuracy was assessed at 90.1%.

Applications of the Vegetation Inventory

Wildlife Management — Resource managers at Arches overlaid bighorn sheep GPS collar data on the vegetation map to determine habitat preferences at various times of the year. In the future, they will be doing similar work for elk, deer, bear, and Mexican Spotted Owls, as well as other species of concern. The vegetation map will become a critical data layer in a "sensitive resources GIS map" that managers consult when doing compliance/impact analysis for proposed projects.

Fire Management — ARCH staff have used the map to help determine fire management actions. For example, they use the map while deciding to suppress lightning caused fires, or let them burn.

Invasive Species Management — The vegetation map was useful in tracking the spread of tamarisk beetles through Arches National Park.

Park Management — The vegetation map was used to develop a "Technical Support for Trail Restoration and Maintenance for Arches and Canyonlands National Parks" report authored by Henry Shovic. It is the first step towards a larger effort to increase road and trail sustainability in these National Parks, responding to growing visitor use, increasing resource damage, and climate

Representative Vegetation Types at ARCH*		
Map Class	**Acres**	**% of Park**
Blackbrush Shrublands	14,798	19%
Moab Tongue Slickrock Woodlands	10,862	14%
Pothole and Jointed Sandstone Woodlands	9,332	12%
Sandstone Ledges Woodlands	7,551	10%
Sand Dune Woodlands	5,169	7%
Talus Sparse Vegetation Complex	3,418	4%
Mormon Tea - Mixed Grass Shrublands	3,157	4%
Shale Barrens Desert Scrub	3,008	4%
Entrada Sandstone	2,621	3%
Sandsheet Shrublands	2,529	3%

**Top 10 of 33 total mapped classes, representing 80% of ARCH.*

change. Using vegetation and soil maps, the report concluded that some trail segments should be relocated to more suitable soils and vegetation types that would reduce active erosion and encourage natural recovery.

The Arches vegetation map was also used to develop a distribution map of biological soil crusts in the park. Biological soil crust retention and restoration are important management issues for all desert National Parks. Much is known about crust composition, importance to ecosystem health, ecosystem and soil relationships, and disturbance effects. By knowing where soil crust is distributed, the park can more effectively and sustainably manage their trail system.

Other Applications — Reporting under the Government performance and Results Act is much easier now that staff can quantify the vegetation to determine acres of each vegetation type. Because vegetation is a basic ecological component in any ecosystem, any ecological research in Arches will likely use the vegetation map as a base layer to analyze other data.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1048519.



Utah Juniper–(Pinyon Pine) / Blackbrush-Cliffrose–Sand shinnery Oak Wooded Shrubland.



Blackbrush Shrubland.

CAPITOL REEF NATIONAL PARK

2002 - 2009
Utah

Park Character

Located in Utah on the Colorado Plateau, the 243,768 acre Capitol Reef National Park (CARE) includes a unique geological feature: a 100 mile long monocline, or fold in the earth's crust. The desert landscape includes dramatic, multicolored sandstone rock formations, and vegetation dominated by pinyon-juniper woodlands, mixed shrublands, and grasslands. Pioneer settlers occupied the area as evidenced by a wide variety of fruit trees in the vicinity of the visitor center.



Waterpocket Fold, Capitol Reef National Park.

Mapping and Classification

The mapping area is 362,637 acres (146,754 hectares), encompassing the entire park as well as adjacent public and private lands. Analysis of plot data revealed 175 USNVC plant associations, alliances, or park special vegetation types, representing 75 map classes. Four of the 75 map classes are unvegetated geological classes.

Map accuracy was assessed within the CARE boundary only. Results indicated an estimate of 77% overall map accuracy. Eleven map classes did not meet the 80% standard, but were retained due to their relative rarity and/or value to park managers.

Applications of the Vegetation Inventory

The vegetation map has many applications for resource managers at Capitol Reef including:

Research and Monitoring —

- Determining plot locations in upland and riparian monitoring efforts.
- Interpreting and analyzing monitoring results.
- Characterizing the vegetation communities within the two active livestock grazing allotments in the park, and assisting in selecting locations for allotment evaluations including utilization and trend monitoring, and rangeland health assessments.
- Vegetation communities are often associated with specific geologic or soil types. Therefore, the vegetation mapping could be used to help characterize the geology or soils of an area.

Planning and Park Management —

- Writing vegetation descriptions for NEPA and park planning documents.
- Determining appropriate locations for proposed projects.
- Providing information for development of revegetation plans for disturbed areas throughout the park.
- Providing information for the park's interpretation and education programs.

Representative Vegetation Types at CARE*		
Map Class	**Acres**	**% of Park**
Pinyon - Juniper / Mesic Shrubs Woodland Complex	67,819	28%
Little-leaf Mountain Mahogany Slickrock Sparse Vegetation	25,362	10%
Mixed Desert Shrubland Complex	24,565	10%
Unvegetated Sandstone	17,261	7%
Shadscale Shrubland Complex	14,951	6%
Pinyon - Juniper / Xeric Shrubs Woodland Complex	11,936	5%
Gypsum Badlands Sparse Vegetation	10,595	4%
Saltbush Badlands Shrubland Complex	8,999	4%
Mixed Grasslands Complex	7,775	3%
Pinyon - Juniper / Mixed Grass Woodland Complex	7,334	3%

**Top 10 of 75 total mapped classes, representing 81% of CARE.*

- Reporting under the Government Performance and Results Act.

Wildlife Management —

- Predicting distributions of wildlife species, including special status species and migratory birds, in and near the park.
- Predicting distributions of the park's rare plants. CARE has numerous special status plant species, many of which are associated with specific vegetation communities.

Fire Management —

- In the event of a wildfire in or near the park, the vegetation map will help staff to predict how a wildfire may spread and behave, and determine what control strategies, if any, to use.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1048522.



Pinyon Pine–Utah Juniper / Gambel Oak Woodland with interspersed Ponderosa pine and copperweed.



Last Chance Townsendia, a federally listed species that occurs within CARE.

COLORADO NATIONAL MONUMENT

2003 - 2007
Colorado

Park Character

Established in 1911, Colorado National Monument (COLM) is located near the northeast corner of the Colorado Plateau. The elevation range of the 20,454 acre (32 square mile) Monument is roughly 4,700-7,200 feet above sea level. Landscapes are characterized by exposures of colorful, gently dipping sediments that have been differentially eroded to form high plateaus, bold escarpments, and deep canyons.



Monument Canyon.

Vegetation within the Monument and surrounding lands is primarily pinyon-juniper woodland, which receives less than 12 inches average annual precipitation. Shrubs associated with this woodland include rabbitbrush, big sagebrush, single-leaf ash, broom snakeweed, Utah serviceberry, yucca, Mormon tea, mountain mahogany, and cliff rose. Seasonal drainages provide habitat for Fremont's cottonwood, coyote willow, and tamarisk.

Mapping and Classification

The COLM Vegetation Classification and Mapping Project Report identifies 18 ecological systems, 38 mapped classes, and 67 USNVC associations. The overall map accuracy of 68% is below the national standard of 80%, primarily because of confusion among the pinyon-juniper map classes. Even when pinyon-juniper associations were well defined, it was not possible to map them consistently because the differences among them were based on elements in the understory that are impossible to model and invisible to photo interpreters. Despite the low accuracy, these map classes were retained because of their value to monument managers, and because a combined pinyon-juniper map class would have resulted in significant loss of detail. Several individual map classes exceeded the 80% standard. However, the pinyon–juniper map classes must be used with caution, since in some cases accuracy is less than 50%.

Applications of the Vegetation Inventory

The vegetation map has many applications for land managers at COLM including:

Research and Monitoring —

- Assisting with plot location for upland and riparian monitoring.
- Locating and surveying potential *Sclerocatcus glaucus* (rare cactus) habitat.
- Establishing monitoring design and analyzing monitoring results.

Fire Management —

- Assisting with accurately modeling how fires will behave in certain areas

Representative Vegetation Types at COLM*		
Map Class	**Acres**	**% of Park**
Two-Needle Pinyon Pine - Utah Juniper / Multiple Shrub Woodland	6,117	30%
Utah Juniper / Talus Mixed Shrub Woodland	3,556	17%
Two-Needle Pinyon Pine - Utah Juniper / Wyoming Big Sagebrush Woodland	2,749	13%
Two-Needle Pinyon Pine - Utah Juniper / Black Sagebrush Woodland	1,667	8%
Utah Serviceberry Shrubland	1,286	6%
Two-Needle Pinyon Pine - Utah Juniper / Sparse Understory Woodland	1,157	6%
Wyoming Big Sagebrush Shrubland	800	4%
Black Sagebrush and Grasses Shrubland-Graminoids	660	3%
Wingate Sandstone	645	3%
Slickrock Member of the Entrada Sandstone	482	2%

**Top 10 of 38 total mapped classes, representing 94% of COLM.*

(important for controlling wildland fires and managing prescribed burns).

Wildlife Management —

- Providing information relating to available habitat and food resources for animals (important for assessing how different species are faring and what the population numbers of those species should be).

Education and Interpretive Programs —

- Educating staff and visitors about the different plant species in the Monument through interpretive displays and Monument website.

Planning —

- Writing vegetation descriptions for Environmental Assessments and Environmental Impact Statements.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047698.



Wyoming Big Sagebrush / (Crested Wheatgrass, Russian Wildrye) Seeded Grasses Semi-natural Shrubland.



Monument Canyon.
Sally Bellacqua

DINOSAUR NATIONAL MONUMENT

2002 - 2008
Colorado, Utah

Park Character

Dinosaur National Monument (DINO) is located in Colorado and Utah, on the Northern Colorado Plateau, at approximately 4,700 to 9,000 feet above sea level. Originally established for its world renowned fossil resources, the Monument now includes over 200,000 acres, most of which is proposed for Wilderness designation.



Yampa River Canyon, Dinosaur National Monument.
Janet Coles

The Yampa and Green rivers, prominent waterways stretching for miles through the Monument, have created spectacular canyons. Canyon of Lodore is especially spectacular, and is over 3,000 feet deep from the rim to the river in several places. Vegetation in the Monument is characterized by pinyon-juniper woodlands and sagebrush shrublands, with smaller areas of grasslands and ponderosa pine woodlands.

Mapping and Classification

This project identified 174 USNVC plant associations, alliances, or park special vegetation types within the Monument and its environs, representing a total of 66 map classes. Thirty-seven of the 66 map classes were natural and semi-natural vegetation classes. Results from an accuracy assessment of the 37 vegetation map classes indicated an 81% overall map accuracy. Seven map classes did not meet the 80% standard, but were retained because of their relative rarity and/or value to Monument managers.

Applications of the Vegetation Inventory

The vegetation map has many applications for resource managers including:

- Identifying random plot locations for upland and riparian monitoring.
- Using the map as the basis for an Electronic Ranger in the visitor center. The Electronic Ranger is a touch screen computer where visitors can learn about major vegetation communities as well as park plants and animals.

In the future, resource managers at DINO hope to use the vegetation map in conjunction with soil maps to better inform fire management in the Monument. For example, the distribution of cheat grass (*Bromus tectorum*) in relation to specific vegetation types and soils may help resource managers determine where natural fires should be allowed to burn, and where controlled burns should be initiated.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047703.

Representative Vegetation Types at DINO*		
Map Class	**Acres**	**% of Park**
Sagebrush / Rabbitbrush Shrubland	78,320	20%
Pinyon-Juniper / Herbaceous Woodland	69,021	17%
Pinyon-Juniper / Sagebrush Woodland	34,801	9%
Native Grasslands	31,045	8%
Pinyon-Juniper / Sparse Understory Woodland	27,894	7%
Pinyon-Juniper / Littleleaf Mtn Mahogany Shrubland and Woodland	19,862	5%
Mixed Mountain Shrubland	17,047	4%
Pinyon-Juniper / True Mountain Mahogany Woodland	16,463	4%
Pinyon-Juniper / Soil Crust Woodland	11,249	3%
Ponderosa Pine Woodland	9,962	3%

**Top 10 of 66 mapped classes, representing 79% of the National Monument.*



Confluence of Jones Creek and the Green River.



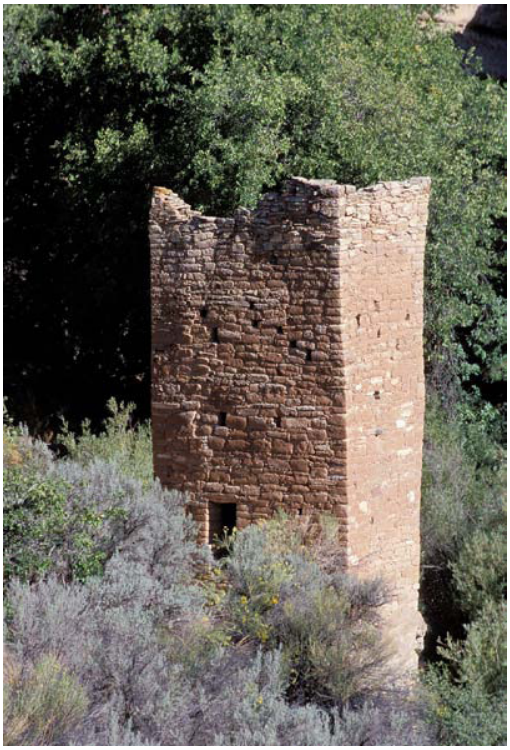
Alderleaf Mountain Mahogany / Bluebunch Wheatgrass Shrubland.

HOVENWEEP NATIONAL MONUMENT

2001 - 2008
Colorado, Utah

Park Character

Hovenweep National Monument (HOVE) was established in 1923 to protect the ruins of Ancestral Puebloan-era villages in the canyons of southwestern Colorado and adjacent Utah. "Hovenweep" means "deserted valley" in the Paiute language. The Monument includes a total of 805 acres spread over a twenty-mile expanse of mesa tops and canyons. Most of the structures



Square Tower. *Neal Herbert*

at Hovenweep were built between A.D. 1200 and 1300. Multi-story towers perched on canyon rims and balanced on boulders comprise some of the Monument's unique structures.

Hovenweep is noted for its solitude and undeveloped, natural character. The vegetation of the Monument is characterized by sagebrush shrublands and pinyon-juniper woodlands.

Mapping and Classification

This project identified a total of 33 map classes. Twenty-nine are natural and semi-natural USNVC plant associations or park special vegetation types within the Monument. Two geologic map classes and two land use map classes were also described. Because each polygon was visited and delineated in the field, an accuracy assessment of the map classes was not conducted. A thorough field verification of map polygons was employed instead.

Applications of the Vegetation Inventory

The vegetation map has many applications for resource managers including:

Wildlife Management — The vegetation map will become a critical data layer in a "sensitive resources GIS map" that managers consult when doing compliance/impact analysis for proposed projects. Having the spatial vegetation layer will help managers more easily quantify various impacts.

Invasive Species Management — The vegetation map was useful in tracking the spread of tamarisk beetles through HOVE.

Park Management — The vegetation map at HOVE will be used to increase road and trail sustainability, responding to growing visitor use, increasing resource damage, and climate change. Using vegetation and soil maps, resource managers can determine whether some trail segments should

Representative Vegetation Types at HOVE*		
Map Class	**Acres**	**% of Park**
Wyoming Sagebrush Disturbed Shrubland	192	24%
Pinyon-Juniper / Wyoming Sagebrush Woodland	163	20%
Pinyon-Juniper / Bitterbrush Woodland	98	12%
Juniper Woodland	83	10%
Pinyon-Juniper / Sparse Understory Woodland	43	5%
Wyoming Sagebrush / Native Grass Shrubland	38	5%
Slickrock (unvegetated)	25	3%
Shadscale / Galleta Shrubland	21	3%
Wyoming Sagebrush / Sparse Understory Shrubland	20	2%
Snakeweed - Sparse Grasses Dwarf Shrubland	17	2%

**Top 10 of 33 mapped classes, representing 87% of HOVE.*

be relocated to more suitable soils and vegetation types that would reduce active erosion and encourage natural recovery.



Pinyon Pine – Utah Juniper / Cliffrose Woodland.

Other Applications — Reporting under the Government Performance and Results Act is much easier now that staff can quantify acreages of each vegetation type. Also, because vegetation is a basic ecological component in any ecosystem, any ecological research in Hovenweep will likely use the vegetation map as a base layer to analyze other data.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047717.



Wyoming Sagebrush / Disturbed Understory Semi-natural Shrubland.

NATURAL BRIDGES NATIONAL MONUMENT

2003 - 2008 Utah

Park Character

Established in 1908, Natural Bridges National Monument (NABR) is named for three spectacular natural sandstone bridge formations. Located on the Colorado Plateau in Utah, the Monument encompasses 7,637 acres of rugged mesa, canyon, and rim topography, ranges from 6,000 to 6,600 feet in elevation, and preserves some of the finest examples of natural stone architecture in the southwest. The Abajo Mountains provide a dramatic backdrop to the desert landscape and natural features of Natural Bridges.



Owachomo Bridge, Natural Bridges National Monument.

The vegetation at NABR is characterized by pinyon-juniper woodlands, mixed shrublands, yucca, cacti, and cottonwoods and willows along rivers and streams. Biological soil crust and ephemeral pools are also noteworthy.

Mapping and Classification

The vegetation mapping area included the entire Monument and 5,653 acres of adjacent public lands. The total project mapping area is 13,290 acres.

The project identified 35 USNVC plant associations or park special vegetation types within the Monument and environs. These fall within 16 natural and semi-natural vegetation map classes. Three unvegetated land use/land cover types were also delineated, including roads and Monument facilities.

Map accuracy was assessed within the NABR boundary only. Results indicated an overall map accuracy of 86.8%. Five map classes did not meet the 80% accuracy standard, but were retained because of their relative rarity and value to Monument managers.

Applications of the Vegetation Inventory

The vegetation map has many applications for resource managers including:

Wildlife Management — The vegetation map will become a critical data layer in a "sensitive resources GIS map" that managers consult when doing compliance/ impact analysis for proposed projects. Having the spatial vegetation layer will help managers more easily quantify various impacts.

Invasive Species Management — The vegetation map was useful in tracking the spread of tamarisk beetles through NABR.

Park Management — The vegetation map is used to increase road and trail sustainability in NABR, responding to growing visitor use, increasing resource damage, and climate change. Using vegetation and soil maps, resource managers

Representative Vegetation Types at NABR*		
Map Class	**Acres**	**% of Park**
Pinyon-Juniper / Mixed Shrubs Woodland	2,728	37%
Pinyon-Juniper / Sparse Understory Woodland	1,444	20%
Pinyon-Juniper / Littleleaf Mountain Mahogany Woodland	1,211	16%
Slickrock Sparse Vegetation	952	13%
Pinyon-Juniper / Sagebrush Woodland	533	7%
Canyon Bottom Vegetation	189	3%
Douglas-fir Woodland	87	1%
Stream Channel - Sand Bar Sparse Vegetation	66	1%
Pinyon-Juniper / Native Grass Woodland	48	1%

**Top 10 (vegetation) out of 16 total mapped classes, representing 98% of NABR.*
The project mapped a larger area; these numbers are limited to what occurs within the Monument boundaries.

can determine when trail segments should be relocated to more suitable soils and vegetation types and thereby reduce active erosion and encourage natural recovery.

Other Applications

- Reporting under the Government Performance and Results Act is much easier now that staff can quantify the vegetation to determine acreages for each vegetation type.
- Because vegetation is a basic ecological component in any ecosystem, any ecological research in Natural Bridges will likely use the vegetation map as a base layer to analyze other data.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047723.



Pinyon Pine – Utah Juniper / (Silverleaf Buffaloberry, Utah Serviceberry) Woodland.



Pinyon Pine – Utah Juniper / Littleleaf Mountain Mahogany Woodland.

PIPE SPRING NATIONAL MONUMENT 2007 - 2008 Arizona

Park Character

Pipe Spring National Monument (PISP) is a 40-acre park located in the Kaibab-Paiute reservation in northern Arizona. The Monument was established in 1923 to preserve Pipe Spring and an early dwelling area. American Indians, Mormon pioneers, plants, animals, and others have depended on the life-giving water found at Pipe Spring.



View looking toward Moccasin Mesa as it dips into the Sevier Fault. The location of the Monument is marked by the line of cottonwood trees on the right side of the photograph.

The vegetation at PISP is characterized by fourwing saltbush shrublands, pinyon-juniper and oak woodlands, grasslands, and a stand of Fremont cottonwood. A large portion of the Monument is maintained in a historic agricultural context (orchards, for example).

Mapping and Classification

The mapping project area was 87.4 acres (35.4 hectares), encompassing the lands within the Monument boundary (40 acres) and an area extending 330 feet (100 meters) into the surrounding Kaibab Paiute Reservation (47.4 acres).

The map was created using 26 map classes, including 12 natural vegetation classes, 6 developed land use classes, and 8 introduced or cultivated vegetation classes. Twenty-three of these classes are found within the PISP boundary.

Because each polygon was visited, verified, and delineated in the field, an accuracy assessment of the vegetated map classes was not employed.

Applications of the Vegetation Inventory

Research and Monitoring —
PISP resource managers have used the vegetation map to assist with plot locations for vegetation monitoring, and will continue to use the map in the context of establishing monitoring design and analyzing monitoring results.

In the future, PISP staff would like to use the map to develop a method for tracking changes in the vegetation over time (i.e., changes to vegetation after a fire or following a noxious weed infestation, or as a result of management). For example, in late 2008, PISP created a quarter-acre revegetation plot using native grasses. The map could be updated following changes such as these, and thereby serve as a living database. Periodic updates every 15 years or so would also be an effective way of tracking changes in the Monument vegetation over time.

PISP will likely use the vegetation map for planning, reporting under the Government Performance and Results Act, interpretation

Representative Vegetation Types at PISP*		
Map Class	**Acres**	**% of Park**
Fourwing Saltbush Shrubland	17	43%
Pinyon-Juniper / Scrub Oak-Bitterbrush Woodland	3	8%
James Galleta Grassland	3	7%
Roads and Staging Areas - Bare Dirt	3	6%
Fremont Cottonwood Woodland	2	4%
Corrals	2	4%
Fourwing Saltbush - Rabbitbrush Degraded Shrubland	2	4%
Sand Sagebrush Shrubland	2	4%
Black Greasewood Shrubland	1	3%
Orchard	1	3%

**Top 10 out of 23 total map classes, representing 86% of PISP. The project mapped a larger area; these numbers are limited to what occurs within the Mounment boundaries.*

and education, understanding how climate change may be affecting the Monument, and other modeling research.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047725.



Revegetation plot installed in 2008, with rice-grass, needle-and-thread grass, and other native grasses and forbs.



Fourwing saltbush shrubland at West cabin.



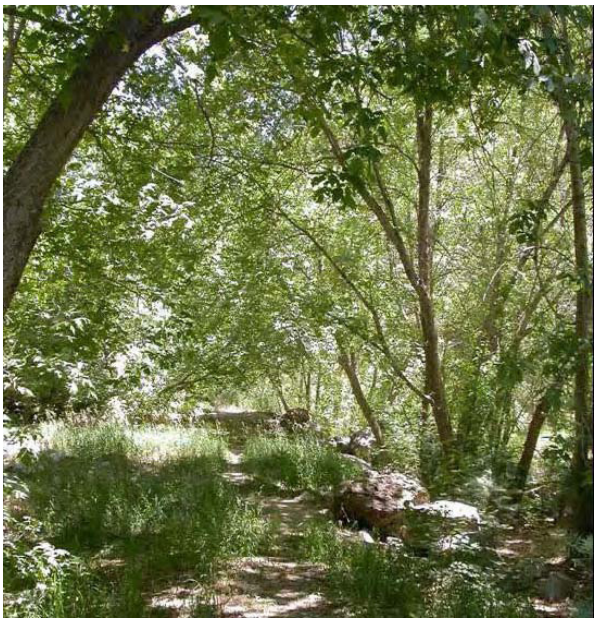
Open juniper woodlands on the slopes and flats surrounding the sandstone mesa.

TIMPANOGOS CAVE NATIONAL MONUMENT

2007 - 2009 Utah

Park Character

Timpanogos Cave National Monument (TICA) is located in northeastern Utah between Provo and Salt Lake City, on the western slope of the Wasatch Mountain Range, at approximately 5000-9500 feet above sea level. The 248-acre Monument was established in 1922 by proclamation of President Warren G. Harding.



American Fork River riparian vegetation, Timpanogos Cave National Monument. *Janet Coles*

The word "Timpanogos" is derived from the name of the Timpanogots Ute tribe that lived in the American Fork Canyon area beginning approximately 600 years ago. The name translates as "rock" (tumpi), and "water mouth" or "canyon" (panogots).

TICA was created to preserve an unusually diverse, fault-controlled limestone cave system and protect it from mining and casual damage. The vegetation at TICA is characterized by mixed-conifer forests, woodlands, shrublands, and rock outcrops.

Mapping and Classification

The mapping area for this project was 248 acres, encompassing only the lands within the Monument boundary. Analysis of the plot data revealed 13 USNVC plant associations or park special vegetation types. Four other vegetation types were not documented by plot or observation point data, but were included in the map classes.

A total of 21 map classes were delineated for the TICA mapping project, representing 16 natural and semi-natural vegetation map classes, 3 developed land use, and 2 geologic map classes. Because many polygons were visited or viewed and delineated in the field, a standard thematic accuracy assessment of the 16 vegetated map classes was not employed.

Applications of the Vegetation Inventory

The vegetation map has many applications for resource managers including:

- Determining plot locations in upland and riparian monitoring efforts, and
- Interpreting and analyzing monitoring results.

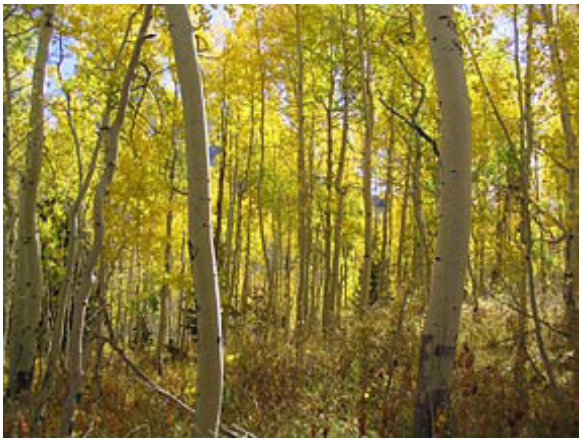
TICA managers will likely use the results in the future for:

- Government Performance and Results Aact reporting,
- Fire and fuels management, and
- Interpretation and education.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1048530.

Representative Vegetation Types at TICA*		
Map Class	**Acres**	**% of Park**
White fir - Douglas-fir / Gambel Oak - Bigtooth Maple Forest	71	29%
Douglas-fir - Limber Pine Woodland	41	16%
Rock Outcrop Sparse Vegetation (Rocky Mountain Juniper Phase)	30	12%
Gambel Oak - Bigtooth Maple Shrubland	20	8%
Douglas-fir / Mountain Maple Woodland	16	7%
White fir - Douglas-fir / Rocky Mountain Juniper / Gambel Oak Woodland	13	5%
Narrowleaf Cottonwood-Conifer Riparian Woodland	13	5%
Cliff Band	8	3%
Rock Outcrop Sparse Vegetation (Littleleaf Mtn Mahogany Phase)	8	3%
Talus	7	3%

**Top 10 of 21 mapped classes, representing 91% of the Monument.*



Quaking Aspen Forest at the top of TICA.
Cami Pulham



Sparse to open mixed conifer woodlands on relatively dry sites with a subcanopy commonly containing Rocky Mountain juniper. *Janet Coles*

ZION NATIONAL PARK

1999 - 2004
Utah

Park Character

Located in the southwestern corner of Utah, Zion National Park (ZION) stretches over 148,016 acres (229 square miles), ranging in elevation from 3,666 to 8,726 feet above sea level. ZION is well known for its massive sandstone cliffs, deep canyons, arches, and monoliths. ZION occurs on the western edge of the Colorado Plateau.



Pinus ponderosa Slickrock Sparse Vegetation.

Mapping and Classification

The ZION Vegetation Mapping Project, completed in 2004, was one of the first National Park mapping projects. The classification included ZION and adjacent lands, and resulted in 95 distinct plant associations; 53 are recognized USNVC types and an additional 42 are types specific to ZION. Seventy-six map units were developed and directly cross-walked or matched to corresponding plant associations and land-use classes. Seventy-one of these map units are known within the ZION boundaries.

Woodlands comprise the greatest number of classified types in ZION, as well as the greatest spatial extent. Vegetation types were mapped to the association level, with an overall accuracy of 82%.

Applications of the Vegetation Inventory

The vegetation map has many applications for resource managers including:

Fire Management — ZION resource mangers have used the map to improve fire and fuels management objectives. The map has assisted with understanding where different vegetation types occur, and have informed management prescriptions for proposed prescribed fires. The map has also been helpful for establishing fire effects monitoring plots in representative samples of vegetation.

Research and Monitoring — ZION resource mangers have used the map to assist with plot locations for upland and riparian monitoring, and will continue to use them in the context of establishing monitoring design and analyzing monitoring results. They have also used the map for predictive modeling of invasive plant species distributions.

Invasive Species Management — ZION resource managers expect that the vegetation mapping data will be used to predict areas of infestation of invasive exotic species such as cheatgrass (*Bromus tectorum*), tamarix (*Tamarix ramossisima*), Scotch thistle (*Onopordum acanthium*), and mullein (*Verbascum thapsus*) which will allow for better planning and focusing of restoration work.

Representative Vegetation Types at ZION*		
Map Class	**Acres**	**% of Park**
Pinyon - Juniper Woodland Complex	34,337	23%
Navajo Formation (Sandstone)	22,046	15%
Ponderosa Pine / Greenleaf Manzanita Woodland	15,750	11%
Gambel Oak Shrubland Alliance	10,995	7%
Ponderosa Pine / Gambel Oak Woodland Complex	8,767	6%
Greenleaf Manzanita Shrubland Complex	7,863	5%
Pinyon - Juniper / Gamble Oak Woodland Complex	7,115	5%
Ponderosa Pine Slickrock Sparse Vegetation	4,924	3%
Mixed Mountain Shrubland Complex	3,988	3%
Littleleaf Mountain-mahogany Slickrock Sparse Vegetation	3,725	3%

**Top 10 of 71 mapped classes, representing 81% of the park. The project mapped a larger area;these numbers are limited to what occurs within the park boundaries.*

Other Applications — In the future, park staff would like to use the map to develop a method for monitoring changes to the vegetation over time (i.e., changes to vegetation after a fire or following a noxious weed infestation). The map could be updated following changes, and thereby serve as a living database. Periodic updates to the map every 15 years or so would also be an effective way of tracking changes in the park vegetation over time.

ZION will also likely use the vegetation map for planning, reporting under the Government Performance and Results Act, interpretation and education, understanding how climate change may be affecting the park, wildlife habitat modeling, and other modeling research.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047740.



A view down into the valley from a ZION trail.
CC image: Paul Kehrer



Kolob Terrace.

AGATE FOSSIL BEDS NATIONAL MONUMENT

1995 - 1998 Nebraska

Park Character

Agate Fossil Beds National Monument (AGFO) is located in the high Great Plains, and occupies 4.5 square miles of land straddling the Niobrara River in the middle of the Nebraska Panhandle. It preserves a unique unglaciated area of the High Plains that contains important information about the life of mammals in the Miocene Era, some 20 million years ago.



Fossil Hills.

The landscape consists of the east-west trending cap-rocked northern and southern hills, with the treeless Niobrara River floodplain running down the middle of the valley. AGFO contains prairie, hill, and riverine environments, with vegetation types that include prairie grasslands, riparian woodlands, and wetlands. Wetlands stretch out from the river and meet terraces that lead to the breaks and buttes.

Classification and Mapping

AGFO was divided into four unique physiographic areas with a description of the typical vegetation types for each area: Northern Hills, Southern Hills, Niobrara River Valley Bottom, and Niobrara River Floodplain. The project resulted in 13 types being defined, including one woodland type, two shrubland types, and 10 herbaceous types. Four non-USNVC herbaceous types are heavily dominated by exotic and/or invasive species. Vegetation types were mapped to the association level, with an overall accuracy of 99%.

Applications of the Vegetation Inventory

Invasive Species Management — The vegetation map was used as part of environmental assessments of the Northern Great Plains Exotic Plant Management Plan.

Fire Management — The vegetation inventory map has been used in the writing of a fire management plan.

Park Management — The vegetation inventory and mapping were consulted for the newly constructed Fossil Hills Trail and a new waterline, as well as restoration of Buckley Field disturbed area.

For the full vegetation classification, map, report, and other products, visit

.

Representative Vegetation Types at AGFO*		
Map Class	**Acres**	**% of Park**
Prairie Sandreed - Sand Bluestem Herbaceous Vegetation	1,355	44%
Needle and Thread Grass - Blue Grama - Threadleaf Sedge Herbaceous Vegetation	583	19%
Western Wheatgrass Herbaceous Vegetation	266	9%
Mountain Rush Herbaceous Vegetation	160	5%
Needle and Thread Grass - Blue Grama - Threadleaf Sedge Herbaceous Vegetation/ Little Bluestem - Grama (Sideoats, Blue) - Threadleaf Sedge Herbaceous Vegetation Mosaic	91	3%
Broadleaf Cattail Western Herbaceous Vegetation	35	1%
Coyote Willow Shrubland	23	1%
Little Bluestem - Grama (Sideoats, Blue) - Threadleaf Sedge Herbaceous Vegetation	23	1%
Plains Cottonwood - (Peachleaf Willow) / Coyote Willow Woodland	20	1%
Needle and Thread Grass - Blue Grama Gravel Herbaceous Vegetation	2	0.1%

** Top 10 of 16 total mapped classes, representing ~84% of AGFO.*



The Niobrara River Valley at AGFO.
CC Image by Flickr user WyoLibrarian



Niobrara River.



AGFO Riparian Vegetation on the Niobrara River. *CC Image by Flickr user JimmyWayne*

BADLANDS NATIONAL PARK

1997 - 1999
South Dakota

Park Character

Badlands National Park (BADL), situated in the northern Great Plains grasslands, is a relatively level mixed grass prairie ecosystem. BADL consists of 242,756 surface acres and contains extensive badlands erosion features. The geology, topography, and varying land use differences exert a significant influence over the vegetation at BADL, which is predominantly



View from Cedar Pass looking north.

sparse vegetation of highly eroded soils and mixed grass prairie. Both the North Unit and the South Unit contain predominantly badlands erosion features and mixed-grass prairie interspersed with swales, draws, and drainages containing trees and shrubs.

Classification and Mapping

Twenty-eight natural and semi-natural associations and two complexes were idenfitied in BADL. The natural associations are comprised of four woodland, ten shrubland, six upland herbaceous/grassland, four wetland and four sparse vegetation types. The semi-natural associations are comprised of one woodland and three grassland types. Sparse vegetation associated with badland formations and mixed grass prairie found throughout the Great Plains physiographic region comprise the greatest spatial extent, followed by minor components of shrublands and woodlands. Vegetation types were mapped to the association level, with an overall accuracy of 80.6%.

Applications of the Vegetation Inventory

The BADL vegetation inventory data were used to choose random sampling points within the badlands-sparse vegetation type for pilot data collection when developing the vegetation monitoring protocol for the Northern Great Plains Network.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047696.

Representative Vegetation Types at BADL*		
Map Class	**Acres**	**% of Park**
Badlands Sparse Vegetation Complex	110,074	45%
Western Wheatgrass Grassland Alliance	89,799	37%
Blue grama Grassland	7,176	3%
Introduced Grassland	6,065	3%
Little Bluestem - Grama grasses - Threadleaf sedge Grassland	5,062	2%
Prairie Dog Town Complex	4,854	2%
Silver sagebrush / Western wheatgrass Shrubland	3,811	2%
Rocky Mountain juniper / Little-seed ricegrass Woodland	2,644	1%
3-Leaved Sumac / Threadleaf sedge Shrub Grassland	1,855	1%
Sand sagebrush / Prairie sandreed Shrubland	1,481	1%

**Top 10 of 33 total mapped classes, representing 97% of BADL.*



Landscape of BADL showing pronounced erosion features and mixed-grass prairie. *D. Cogan.*



Woodland in the South Unit of BADL containing a near equal mix of ponderosa pine and Rocky Mountain juniper.

DEVILS TOWER NATIONAL MONUMENT

1996 - 1998 Wyoming

Park Character

Devils Tower National Monument (DETO) is located in Crook County in northeast Wyoming, part of the westernmost Black Hills. DETO encompasses 1,347 acres covered with pine forests, woodlands, and grasslands. Devils Tower, a volcanic neck revealed by erosion, rises 1,267 feet above the Belle Fourche River. Many outside influences affect the plants, animals, and



Ponderosa around the base of Devils Tower
Michael Menefee

landscape at DETO. Humans manipulate the environment for a variety of purposes; fires are suppressed; non-native plants make their way into the area, competing with native plants, and, in many cases, out-competing them.

Classification and Mapping

The vegetation classification at DETO identified 16 vegetation types, including two forest types, five woodland types, seven herbaceous types, and two sparsely vegetated types. One of the herbaceous types is heavily dominated by non-native species, and the other is the result of continuing and extensive disturbance by prairie dogs. The map was produced using 17 map classes, 12 of which are vegetation types (formed by the combination of the 16 USNVC classes). Vegetation types were mapped to the association level, with an overall accuracy of 81.6%.

Applications of the Vegetation Inventory

Park Management — The vegetation map has been used in the Southwest Meadow restoration project. The goal of this project is to restore 50 acres of impacted meadows to native species.

Research and Monitoring — Data have been used to establish transects for future monitoring of woodland and grassland areas as part of habitat monitoring through the Northern Great Plain Inventory and Monitoring Network.

Data are being used in the preparation of a Natural Resource Condition Assessment project being conducted at DETO in 2009-2010.

Invasive Species Management — The vegetation map has been used to monitor the efficacy of exotic vegetation treatments through the years in conjunction with the Northern Great Plains Exotic Plant Management Team.

Vegetation inventory data have also been used to constrain and stratify the sampling design for a research project investigating the location of targeted invasive plant

Representative Vegetation Types at DETO*		
Map Class	**Acres**	**% of Park**
Ponderosa Pine Complex 1	437	33%
Grassland Complex	340	25%
Ponderosa Pine Complex II	200	15%
Mosaic - Kentucky Bluegrass / Little Bluestem Grassland	70	5%
Ponderosa Pine / Bur Oak Woodland	64	5%
Bare Exposed Rock	60	4%
Mosaic - Western Wheatgrass / Little Bluestem Grassland	45	3%
Eastern Cottonwood Peach Leaf Willow / Narrow Leaf Willow Woodland	35	3%
Green Ash - American Elm / Wolfberry Forest	29	2%
Prairie Dog Town	25	2%

**The top 10 of 17 mapped classes, representing 97% of DETO.*

species relative to various environmental characteristics (including vegetation types) and prescribed fire in ponderosa pine forests at DETO, JECA, and WICA.

Fire Management — The vegetation map has been used to write a Fire Management plan, to develop maps for burn unit projects, and to develop monitoring protocols.

Vegetation Inventory Product Updates

2003 – A survey for Invasive Plants was completed by Montana State University.

2008 – A survey for Special Plant Species of Concern was completed by the Wyoming Natural Diversity Database of the University of Wyoming.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047701.



2002 prescribed fire at DETO.



Silver Sagebrush / Western Wheatgrass Shrub Prairie in the ancient floodplain of the Belle Fourche River.

FORT LARAMIE NATIONAL HISTORIC SITE

1996 - 1998 Wyoming

Park Character

Fort Laramie National Historic Site (FOLA) occupies 833 acres on the Laramie River, west of its confluence with the North Platte River in western Wyoming. The old fort site, located in the western end of the park, contains a complex of restored buildings and ruins, dating from mid and late 19th century, surrounding a lawn quadrangle. The remainder of the park contains disturbed



Fort Laramie.

prairie and floodplains. FOLA lies mainly on the floodplain terrace of the Laramie River, with a portion on the North Platte River floodplain terrace just west of their confluence. A small portion of the northwest corner of the park lies above the terrace.

Classification and Mapping

The vegetation classification of the vegetation at FOLA resulted in 16 types being defined, including one woodland type, one shrubland type, 11 herbaceous types, and three sparsely vegetated types. Three of the herbaceous types are dominated by exotic and/or invasive species. The map was produced using 18 vegetation map classes. Vegetation types were mapped to the association level, with an overall accuracy of 95%.

Applications of the Vegetation Inventory

Information on applications of the vegetation inventory are not available for FOLA at this time.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047707.



FOLA grounds.
CC image by Flickr user rdwatson78

Representative Vegetation Types at FOLA*		
Map Class	**Acres**	**% of Park**
Western Wheatgrass Herbaceous Vegetation	172	20%
Needle and Thread Grass - Blue Grama - Threadleaf Sedge Herbaceous Vegetation	136	16%
Upland Weedy Community	105	12%
Plains Cottonwood / Western Snowberry Woodland	104	12%
Sand Dropseed Disturbed Community	87	10%
Smooth Brome Disturbed Community	51	6%
Upland Sand and Gravel Sparse Vegetation	36	4%
Nebraska Sedge Herbaceous Vegetation	27	3%
Riverine Sand Flats - Bars Sparse Vegetation	26	3%
Coyote Willow Shrubland	11	1%

**Top 10 (vegetation) out of 15 total mapped classes, representing 87% of FOLA.*



Fort Laramie historical area.
CC image by Flickr user rdwatson78

FORT UNION TRADING POST NATIONAL HISTORIC SITE

2002 Montana, North Dakota

Park Character

Fort Union Trading Post National Historic Site (FOUS) straddles the Montana/North Dakota state line along the Missouri River. At an elevation of 1,900 feet, FOUS is located on the southern edge of the glaciated subsection of the vast Missouri Plateau. This area, a segment of the Badlands Vegetation Zone, includes mixed-grass prairie, coulees, deciduous groves, and river bottoms that



Fort Union Trading Post.

encompass mixed grasses, riparian, and Rocky Mountain plant species. The present vegetation is a mixture of native plant communities and remnant or invasive exotics. The transformation from a frontier to an agricultural environment led to the reduction and extirpation of native plant species, followed by the introduction or invasion of exotics. The park is actively restoring the native shortgrass prairie.

Classification and Mapping

Vegetation classification was done using existing descriptions compiled by NatureServe. During the ground survey, 13 vegetation alliances and 13 vegetation associations were classified using the International Classification of Ecological Communities: Terrestrial Vegetation (ICEC). FOUS is largely composed of non-natural or highly modified land cover types. FOUS has a significant portion of its vegetation within the riparian corridor and therefore, has representative vegetation of a very small percentage of total woody corridors in North Dakota. The final mapping classification resulted in total of 17 mapped land cover classes, 12 of which are native or semi-native classes. The overall accuracy of the classification was 100%.

Applications of the Vegetation Inventory

Vegetation inventory data are being used in the development of a vegetation management plan for FOUS.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1048523.

Representative Vegetation Types at FOUS*		
Map Class	**Acres**	**% of Park**
Crested Wheatgrass Semi-Natural Herbaceous Alliance	27	6%
Plains Cottonwood Temporarily Flooded Woodland Alliance	26	6%
Cattail (Narrowleaf, Broadleaf) - (Bulrush spp.) Semipermanently Flooded Herbaceous Alliance	20	5%
Willow (Coyote, Sandbar) Temporarily Flooded Shrubland Alliance	19	4%
Reed Canarygrass Seasonally Flooded Herbaceous Alliance	19	4%
Western Wheatgrass Herbaceous Alliance	18	4%
Green Ash - (American Elm) Temporarily Flooded Forest Alliance	16	4%
Green Ash - (American Elm) Woodland Alliance	14	3%
Smooth Brome Semi-Natural Herbaceous Alliance	7	2%
Needle and Thread Grass - Blue Grama Herbaceous Alliance	5	1%

**The top 10 (natural or semi-natural vegetation) out of 17 total mapped classes, representing 39% of FOUS.*



Crested Wheatgrass (Western Wheatgrass - Needle-and-Thread) Semi-natural Herbaceous Vegetation.



Eastern Cottonwood – (Peachleaf Willow) / Coyote Willow, Sandbar Willow) Woodland on the south bank of the Missouri River.

JEWEL CAVE NATIONAL MONUMENT

1996 - 1998
South Dakota

Park Character

Jewel Cave National Monument (JECA) is located in Custer County and is part of the southwestern Black Hills. At 146 miles, Jewel Cave, filled with calcite crystals, is the second longest cave in the world. JECA encompasses 1,275 acres of ponderosa pine forest, and hosts a rich diversity of native plants. JECA also contains many



Cave Entrance, trail, and CCC Ranger's Cabin from across Hell's Canyon, 2003.

introduced non-native plant species. Jewel Cave National Monument is also home to a variety of native plants and animals, and has a fascinating wildfire history. The grassy meadows developed when the Jasper Fire killed many of the ponderosa pines which previously forested the surface of JECA.

Classification and Mapping

The classification identified 13 vegetation types, including four forest types, three woodland types, one shrubland type, and five herbaceous types. One herbaceous type is heavily dominated by exotics. The map was produced using five vegetation map classes and three cultural map classes. Vegetation types were mapped to the association level, with an overall accuracy of 80.8%.

Applications of the Vegetation Inventory

The vegetation inventory data have been used to constrain and stratify the sampling design for a research project investigating the location of targeted invasive plant species relative to various environmental characteristics (including vegetation types) and prescribed fire in ponderosa pine forests at DETO, JECA, and WICA.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047719.

Representative Vegetation Types at JECA*		
Map Class	**Acres**	**% of Park**
Ponderosa Pine Complex II	705	55%
Ponderosa Pine Complex I	510	40%
Grass / Shrub Complex	45	4%
Commercial and Services	5	0.4%
Transportation, Communications, and Utilities	5	0.4%
Cropland and Pasture	2	0.2%
Residential	1	0.1%
Ash Leaf Maple / Choke Cherry Forest	0	0.02%

**All 8 mapped classes, representing 100% of JECA.*



Aerial view of historic area, 1984.



Landscape along the Canyons Trail between the historic area and the Monument visitor Center, east of the historic area. Damage from the Jasper Fire of 2000 is still very much apparent in 2003.

KNIFE RIVER INDIAN VILLAGES NATIONAL HISTORIC SITE

2002 North Dakota

Park Character

Knife River Indian Villages National Historic Site (KNRI) is a 1,759 acre park situated on both sides of the Knife River just upstream of its confluence with the Missouri River. The park lies approximately in the middle of that portion of the Missouri River that has not been flooded by dam building. While most of the park has been intensively cultivated or grazed for many years, it still remains an area where, with proper management and use, natural habitats can be re-established or improved.



Aerial view of Knife River Indian Villages.

The Knife River meanders along through Mercer County, North Dakota arriving at the confluence of the Missouri River near Stanton. KNRI land borders both sides of the rivers creating a forested peninsula throughout a portion of KNRI. The rest of KNRI's 1,759 acres are within a few hundred yards of these water sources. The area is dominated by native shortgrass prairie, but is also comprised of exotic grasslands, 450 acres of hardwood forest, cultural village sites and even some sandbars and wetland areas. Despite clearcutting, farming and grazing, KNRI still contains remnants of native vegetative communities.

Classification and Mapping

Vegetation classification was done using existing descriptions compiled by NatureServe using the International Classification of Ecological Communities: Terrestrial Vegetation (ICEC). Seventeen vegetation alliances and 19 vegetation associations were identified for KNRI. The typical vegetation includes prairie types such as Big Bluestem - Prairie Dropseed - Little Bluestem - Western Wheatgrass Herbaceous Vegetation and Needle-and-Thread - Blue Grama - Threadleaf Sedge Herbaceous Vegetation. The more rare types include the Green Ash – American woodland and forest elements. The map was produced using 22 map classes. The overall accuracy of the classification was 100%.

Applications of the Vegetation Inventory

KNRI vegetation inventory data have been used to constrain forest structure sampling plots and near vicinity for the Northern Great Plains Network's plant community composition and structure monitoring.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1048525.

Representative Vegetation Types at KNRI*		
Map Class	**Acres**	**% of Park**
Smooth Brome Semi-Natural Herbaceous Alliance	279	18%
Green Ash - (American Elm) Woodland Alliance	259	16%
Big Bluestem - (Indiangrass) Herbaceous Alliance	124	8%
Needle and Thread Grass - Blue Grama Herbaceous Alliance	116	7%
Green Ash - (American Elm) Temporarily Flooded Forest Alliance	109	7%
Planted - Sideoats Grama - Western Wheatgrass	97	6%
Western Wheatgrass Herbaceous Alliance	93	6%
Planted - Big Bluestem	63	4%
Planted - Smooth Brome	52	3%
Willow (Coyote, Sandbar) Temporarily Flooded Shrubland Alliance	39	2%

**Top 10 of 22 total mapped classes,representing 77% of KNRI.*



Sakakawea Big Bluestem - Prairie Dropseed - Little Bluestem - Western Wheatgrass Herbaceous Vegetation – Big Hidatsa Prairie.



Green Ash - American Elm / Choke Cherry Woodland – North Big Hidatsa Floodplain.

MOUNT RUSHMORE NATIONAL MEMORIAL

1995 - 1998 South Dakota

Park Character

Mount Rushmore National Memorial (MORU) is located in the southwestern Black Hills. The topography is generally very rugged and ranges from moderate to very steep. Much of the area is punctuated with a variety of exposed granite that forms knobs, pinnacles and mountains. Elevation ranges from 5,000 to 7,735 feet. The Black Hills are a very unique ecosystem as several plant ranges overlap here. Only about 5% of the plant species in the hills are indigenous to the area.



View from Grandview Terrace. *Ed Menard*

Classification and Mapping

The vegetation classification of MORU identified nine vegetation types, including two forest types, four woodland types, two herbaceous types, and one sparsely vegetated type. The final vegetation map was produced using four vegetation map classes and four non-vegetated or cultural map classes. Vegetation types were mapped to the association level, with an overall accuracy of 74.3%.

Applications of the Vegetation Inventory

The vegetation inventory data have been used to eliminate large areas of bedrock (as mapped during the inventory) from the Northern Great Plains Network's sampling frame for plant community composition and structure monitoring.

For the full vegetation classification, map, report, and other products, visit
.



Old-growth Ponderosa Pine woodland with Quaking Aspen in Starling Basin.

Representative Vegetation Types at MORU*		
Map Class	**Acres**	**% of Park**
Ponderosa Pine Complex I	545	42%
Ponderosa Pine / Common Juniper Woodland	494	38%
Bare Exposed Rock	113	9%
Ponderosa Pine Complex II	73	6%
Transportation, Communications, and Utilities	56	4%
Commercial and Services	9	1%
Residential	2	0%
Nonforested Wetland	2	0%

**All 8 mapped classes, representing 100% of MORU.*



Ponderosa Pine Woodland in the southeast corner of MORU.



Recently thinned Ponderosa Pine / Common Juniper Woodland.

SCOTTS BLUFF NATIONAL MONUMENT

1995 - 1998
Nebraska

Park Character

Scotts Bluff National Monument (SCBL) occupies approximately 3,000 acres adjacent to the North Platte River in Scotts Bluff County, Nebraska. SCBL lies within the high western Great Plains in an area that was once almost continuous mixed and shortgrass prairie, and that is now largely utilized for farming and ranching. SCBL is surrounded on three sides by agriculture in the form of cropland and pastureland.



Scotts Bluff.

SCBL encompasses prairie, bluff, and riverine environments, with vegetation types that include upland woodland, prairie grassland, and riverine woodland and grassland. The vegetation is divided into three major plant associations: moderately dense mixed-grass prairie, ponderosa pine/ Rocky Mountain juniper/eastern red cedar forests, and the hardwood association along the floodplain of the North Platte River. SCBL also contains several remnant tablelands or bluffs of the ancient Great Plains, including Scott's Bluff, a prominent "star-shaped" body composed of siltstone and sandstone interlaced with layers of volcanic ash rising about 450 feet above the floor of the prairie below.

Classification and Mapping

The vegetation classification at SCBL identified 20 vegetation types, including three woodland types, three shrubland types, nine herbaceous types and five sparsely vegetated types. In addition, two mosaic types were designated that combine a prairie type and sparsely vegetated types for a total of 22 mapped classes.

The upland herbaceous communities (grasslands) and the sparsely vegetated communities occupy the vast majority of SCBL, with communities dominated by woody or wetland herbaceous vegetation forming minor components. Natural prairie grasses are the predominant vegetation cover (~ 40%) of SCBL's more level areas. In addition, there are other areas of the Monument that have been impacted by various past human activities (hog farm, cattle feedlot, golf courses, row crops, and a residence). These areas have been invaded to various degrees by weedy and exotic species, but yet have maintained a component of their native vegetation. For a variety of reasons, the accuracy per class was 5- 60%, well below the desired overall accuracy of 80%.

Applications of the Vegetation Inventory

Park Management — The vegetation data support managers' efforts on a variety of management activities, including:

- Development of the Business Plan,
- Prairie Restoration,
- Environmental Assessments, and
- Historical 106 Compliance and NEPA Documents.

Representative Vegetation Types at SCBL*		
Map Class	**Acres**	**% of Park**
Needle-and-Thread - Blue grama / Carex filfolia Herbaceous Vegetation	1,263	39%
Mixed Grass Prairie (reseeded)	270	8%
Snowberry Shrubland	243	8%
Burningbush / Brome spp. Early Seral Community	202	6%
Rock Outcrop / Prairie Mosaic	189	6%
Western Wheatgrass Herbaceous Vegetation	147	5%
Siltstone - Clay Butte Sparse Vegetation	124	4%
Open Bluff / Cliff & Eroding Great Plains Badlands Sparse Vegetation	121	4%
Sand Bluestem -- Prairie Sandreed Herbaceous Vegetation	120	4%
Unvegetated landuse / disturbance	102	3%

**Top 10 of 22 mapped classes, representing 87% of SCBL.*

Additionally, the vegetation classification and map have been used for:

- Fire Management, and
- the National Parks Conservation Association "State of the Park" Report.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047729.



North Platte River.



Scotts Bluff National Monument.

THEODORE ROOSEVELT NATIONAL PARK

1997 - 2000 North Dakota

Park Character

Theodore Roosevelt National Park (THRO), situated in the Northern Great Plains of western South Dakota, encompasses 70,200 surface acres, including 29,920 acres of designated wilderness. The predominant features at THRO are badlands erosion features, mixed grass prairie, the Little Missouri River floodplain, swales, draws, and intermittent and small perennial drainages that support trees and shrubs.



Badlands Overlook, South Unit. *Sarah Nystrom*

Classification and Mapping

The classification identified 29 vegetation map classes, 27 natural and semi-natural alliances and associations and two complexes, out of a total of 38 total mapped classes. The natural associations are comprised of eight woodland, eight shrubland, five upland herbaceous/grassland, two wetland, and four sparse vegetation types. The semi-natural associations are comprised of three grassland types and two associations of exotic forbs. Woodlands, shrublands, grasslands, and sparse plant communities are nearly equally represented. The overall map accuracy was 74.3%.

Applications of the Vegetation Inventory

Park Management — The vegetation layer provided by the vegetation inventory project is one of the most widely used spatial datasets at THRO.

Research and Monitoring — Almost every resource related product benefits from the use of the vegetation layer at some point, either in study design, data analysis, or interpretation of results.

The data have been used to aid planning for vegetation monitoring, and to develop wildlife habitat selection models. The data have also been modified for use as an input into a forage allocation model.

Fire Management— The vegetation map has been used to assist in the delineation of prescribed fire units.

Updates to the Vegetation Inventory

The vegetation layer is updated annually through the incorporation of new delineations of prairie dog colonies.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047731.

Representative Vegetation Types at THRO*		
Map Class	**Acres**	**% of Park**
Needle-and-Thread Herbacious Alliance	23,134	33%
Badlands Sparse Vegetation Complex	13,684	19%
Rocky Mountain Juniper Woodland Alliance	9,416	13%
Wolfberry Temporarily-Flooded Shrubland Alliance	3,923	6%
Green Ash - American Elm Woodland Alliance (Draws)	2,991	4%
Western Wheatgrass Herbacious Alliance	2,971	4%
Silver Sagebrush - Western Wheatgrass Shrubland	2,958	4%
3-Leaved Sumac Shrubland Alliance	2,417	3%
Introduced Grassland Herbacious Alliance	1,430	2%
Prairie Dog Town Complex	1,387	2%

**The top 10 of 38 mapped classes, representing 90% of THRO.*



Little Missouri River, North Unit, River Bend Overlook. *Mary Brazell*



Buck Hill, South Unit. *Mary Brazell*

WIND CAVE NATIONAL PARK

1997 - 1999
South Dakota

Park Character

Wind Cave National Park (WICA) lies on an interface between the northern Great Plains grasslands and the Black Hills ponderosa pine forests. WICA encompasses 28,295 surface acres and 136 miles of known passages in the Wind Cave complex. Though WICA is predominantly mixed grass prairie, roughly 30% is comprised of pondersosa pine communities. WICA has been recognized as an exemplary site for Black Hills vegetation due to diversity, vegetation condition, stand size, and the relative intactness of the landscape, including the presence of many natural or simulated ecological processes.



Bison on a western wheatgrass - Kentucky bluegrass grassland.

Classification and Mapping

The vegetation classification resulted in 33 map classes that represent 28 community types: eight forest and woodland types, five shrubland types, ten herbaceous types and five sparse vegetation types. Overall map accuracy was 73.0%.

Applications of the Vegetation Inventory

Research and Monitoring — The vegetation classification and synoptic key, which cover plant community types only in WICA, contributed to a more broad-scale and very useful Black Hills Community Inventory (BHCI) completed by The Nature Conservancy and the Association of Biodiversity Information (now NatureServe) in 1999-2000. This classification includes several additional years of refinement, and includes WICA plant communities in the context of other plant communities in the southern Black Hills and greater Black Hills area.

WICA vegetation inventory data have also been used to constrain forest structure sampling plots and near vicinity for the Northern Great Plains Network's plant community composition and structure monitoring.

Park Management — WICA personnel are currently using both the BHCI and WICA vegetation classifications as the basis for describing the plant communities of WICA as part of the development of a vegetation management plan.

WICA personnel began a project in 2010 to partner with NPS's Biological Resources Division, Northern Great Plains Fire, and Northern Great Plains Inventory and Monitoring to update areas of the vegetation map where the vegetation has changed significantly since 1999 (mainly due to wildfire, prescribed fire, and variable wildlife populations). An interim map/analysis product has been developed that portrays park-wide risk to mountain pine

Top Ten Mapped Classes at WICA*		
Map Class	**Acres**	**% of Park**
Western Wheatgrass - Kentucky Bluegrass Complex	10,696	38%
Little Bluestem - Grama Grass Herbaceous Vegetation	4,672	17%
Ponderosa Pine Woodland Complex II	3,470	12%
Ponderosa Pine / Little Bluestem Woodland	2,741	10%
Purple three-awn - Fetid marigold Herbaceous Vegetation	1,312	5%
Western Snowberry Shrubland	811	3%
Ponderosa Pine Woodland Complex I	796	3%
Ponderosa Pine / Chokecherry Forest	648	2%
Chokecherry Shrubland	489	2%
Young Ponderosa Pine Dense Cover Complex	401	1%

**Top 10 of 33 mapped classes, representing 93% of WICA.*

beetle. This is being used as foundational information for a WICA mountain pine beetle management strategy.

Invasive Species Management —WICA has used the vegetation data to identify high quality native plant communities to help prioritize weed management. The data were also useful in identifying plant communities of conservation concern and plant community types that WICA staff had not previously recognized, such as Creeping Juniper/Little Bluestem Dwarf-shrubland, Prairie Dog Town Grassland Complex, Kentucky Bluegrass Herbaceous Vegetation, and sparse vegetation/rock outcrop communities.

The vegetation inventory data have also been used to constrain and stratify the sampling design for a research project investigating the location of targeted invasive plant species relative to various environmental characteristics (including vegetation types) and prescribed fire in ponderosa pine forests at DETO, JECA, and WICA.

Future Applications

Wildlife Management — Development of a crosswalk between range/ecological sites and plant community types is a critical need in order for the vegetation data to be used for wildlife population planning and modeling.

Research and Monitoring — Mapping vegetation at a finer scale, especially for WICA's most critical community types (riparian communities, deciduous woodland stands, and woody draws in the prairie), would improve WICA's ability to use the vegetation map for site-specific projects - especially those with small areal extent.

In 2010, WICA began collaborating with NPS's Biological Resource Management Division, Northern Great Plains Fire, and Northern Great Plains Inventory and Monitoring Network to explore tools park personnel can use to revise the map.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047738.

FLORISSANT FOSSIL BEDS NATIONAL MONUMENT

2001 - 2004 Colorado

Park Character

Florissant Fossil Beds National Monument (FLFO) covers approximately 5,998 acres on the eastern slope of the Rocky Mountains in central Colorado. It is situated in a relatively dry park setting within the montane coniferous forest zone, and includes the valleys, hills, and ridges typical of lower and middle elevations. Topographic relief is moderate, with elevations ranging from 8,300 to 8,950 feet.



Granite outcrops at FLFO.

Prior to European settlement, FLFO and the surrounding area were occupied by two Ute tribes. The fossil deposits were first professionally described by A.C. Peale in 1873 as part of the Hayden Geological and Geographical Survey. At this time, the area was recognized as a petrified forest because of the tremendous number of stumps and limbs remaining above ground (these have since been removed from the landscape by collectors). During the 1880s, ranching and farming operations became established around the town of Florissant. Between 1887 and 1918, the Colorado Midland Railroad maintained tracks and provided services to Florissant and hauled both visitors and petrified wood to and from the Monument area.

Classification and Mapping

The project area covered roughly 8,000 acres, including FLFO well as approximately 2,000 acres of surrounding area. The final classification resulted in 38 vegetation types, including four forest, five woodland, 11 shrubland, and 18 herbaceous types. The map was produced using 27 map units, including 25 vegetation map units and 2 Anderson Level II land-use units. Overall thematic accuracy was 77%. Although this is below the program standard of 80%, the map was accepted by the park and program staff because they felt it was more important to capture the diversity of vegetation in FLFO, rather than to merge map units to meet the program standards.

Applications of the Vegetation Inventory

Research and Monitoring — FLFO's vegetation map has been used to develop a wetland protocol sample frame for use in long-term vegetation monitoring.

Similar work has been conducted using the vegetation data to develop a sample frame for FLFO's upland vegetation monitoring protocol.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047706.

Representative Vegetation Types at FLFO*		
Map Class	**Acres**	**% of Park**
Ponderosa Pine Woodland	2,269	38%
Arizona Fescue - Mountain Muhly Herbaceous Vegetation	1,704	28%
Colorado Blue Spruce - Douglas-fir Forest	723	12%
Smooth Brome Semi-natural Herbaceous Vegetation	390	7%
Mountain Mahogany / Mountain Muhly Shrubland	232	4%
Aquatic Sedge - Beaked Sedge - Baltic Rush Herbaceous Vegetation	224	4%
Arizona Fescue - Slimstem Muhly Herbaceous Vegetation	85	1%
Parry Oatgrass Herbaceous Vegetation	80	1%
Quaking Aspen Forest	69	1%
Roads	39	1%

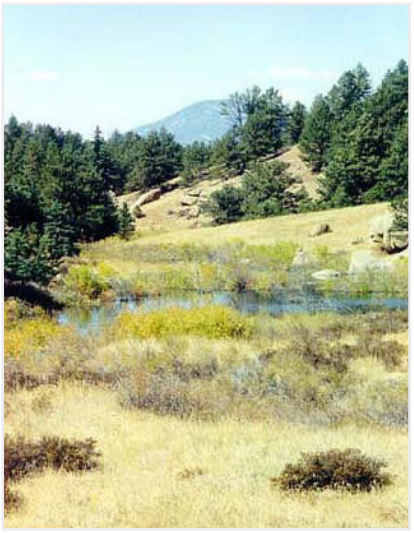
**The top 10 of 27 mapped classes, representing 97% of FLFO.*



Valley topography.



Ponderosa pine woodland.



Shrubland.

GLACIER NATIONAL PARK

1998 - 2007
Montana

Park Character

Glacier National Park (GLAC) is a 1,000,000+ acre park in the northern Rocky Mountains. It is almost entirely surrounded by other public and tribal lands. The park contains rugged mountain terrain, glacial cirques, lakes, and valleys, at elevations from 3,116 to 10,466 feet. Vegetation ranges from foothills grasslands and woodlands to conifer forests and high alpine wetlands and fellfields. Anthropogenic influences have been intensive but limited in extent.



Cedar-hemlock forest above Avalanche Lake.

Classification and Mapping

Classification and mapping for GLAC were done jointly with Waterton Lakes National Park in Canada. This abstract focuses on the GLAC portion of that work. The classification identified 222 plant associations for GLAC and its environs. The map was produced using 47 map classes, 45 of which occur within the boundaries of GLAC. Twenty-one of the map classes represent vegetation types associated with the USNVC. The majority of the area is dominated by the Forest and Woodland Class. Overall accuracy was estimated at 87.4%.

Applications of the Vegetation Inventory

Vegetation Monitoring — GLAC's vegetation map will be used to develop a sample frame for a survey design-based selection of long-term wetland monitoring sites by the Rocky Mountain Inventory and Monitoring Network. The Network and its partners will also develop detailed crosswalks for map units to wetland classes within the National Wetland Inventory (NWI) and Ecological System classifications which will expand the use of the vegetation map data to non-USNVC based approaches and allow comparisons of the extent of wetlands in historical NWI maps.

Planning — GLAC's vegetation data have been used to conduct a watershed condition assessment. This assessment was a multi-faceted GIS analysis that evaluated connectivity and a variety of other natural resource factors. The reports are also used to describe ecosystems and habitats for compliance documents.

Park Management — GLAC staff are using their data in a wide variety of management efforts, including:

- Site selection for whitebark and limber pine monitoring and restoration, and for a related Clark's nutcracker project.
- Determining likely pathogens in infested forests. The latest forest insect / disease aerial survey identified much of the area around St. Mary Lake as infested by a lodgepole pine pathogen. According to the vegetation map, most of this area is spruce/fir, and thus biologists were able to conclude that the infestation was more likely to be a

Representative Vegetation Types at GLAC*		
Map Class	**Acres**	**% of Park**
Subalpine Fir - Engelmann Spruce Forest	241,913	24%
Dwarf-shrub / Herbaceous Complex: Dry - Mesic	103,861	10%
Subalpine Fir - Engelmann Spruce Woodland	74,636	7%
Cliff / Talus Sparse Vegetation	72,084	7%
Lodgepole Pine Forest	66,827	7%
Douglas Fir Forest	58,812	6%
Whitebark Pine Woodland	52,795	5%
Western Larch Forest	45,227	4%
Douglas Fir Woodland	30,478	3%
Natural/Artificial Lake/Pond	27,647	3%

**The top 10 of 45 total mapped classes within the boundaries of GLAC (not including mapped environs), representing 77% of the park.*

western spruce budworm.
- Describing project settings in compliance documents.
- Interpreting fuels for fire management planning.
- Mapping of glaciers and permanent ice for the park's glacier margin mapping spatial database.

Research Applications — Vegetation data from GLAC are assisting NPS staff and outside researchers in:

- Investigating specific forest types such as cedar/hemlock.
- Identifying rare plant survey areas and delineating boundaries for the Logan Pass Important Plant Area.
- Developing proposals to study climate change impacts on forests and herbaceous communities.
- Analyzing wolverine den habitat and habitat associated with travel preference.
- Habitat analysis for snowshoe hare (Lynx prey base).
- Stratify habitat for bat inventory.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047714.



Diverse landscape carved by glacial activity.



Spruce-fir forest at Siyeh Pass. *Dave Anderson*

GREAT SAND DUNES NATIONAL PARK AND PRESERVE

2005 - 2010 Colorado

Park Character

Great Sand Dunes National Park (GRSA) lies in south-central Colorado in the northeastern portion of the San Luis Valley, and extends east into the Sangre de Cristo Mountains. GRSA consists of two connected units – a Park and a Preserve. The National Park section is situated on the valley floor and contains the point of lowest elevation (7,525 feet) at the southwest corner near San Luis Lake. The area is mostly flat playa lake deposits that can be seasonally



Fall colors peak in GRSA.

flooded. As one moves northeast, the area is sand dominated and very hummocky, due to the presence of small relict and active dunes which eventually encounter either the alluvial fans of the Sangre de Cristo Mountains, the main dunefield, or areas where sand ramps onto the lower slopes of the Mountains. The majority of the main dunefield consists of large (as tall as 750 feet) north-south trending dune ridges separated by troughs.

The National Preserve portion, characterized by deep canyons and steep slopes, is located in the Sangre de Cristo Mountains, which rise abruptly from the valley floor, creating a very steep elevational gradient. Within this gradient, life zones appear to be compressed, and species and communities from adjacent zones intersperse and overlap. Consequently, the vegetation in this area is quite diverse.

Classification and Mapping

The project area encompassed 413,031 acres, and consisted of several management units from a variety of government and private agencies (and a small amount of private property). Analysis of plot data identified 198 distinct plant associations, 22 of which of were newly described. These associations were combined into 34 vegetated map units (out of a total of 58 map units).

The most frequently occurring map unit within the entire mapping area was Greasewood Flat Shrubland and Steppe Alliances. The most abundant map unit was Sandsheet Rabbitbrush Shrubland and Steppe Alliances. The final map was created with an overall accuracy of 73.7%.

Future Applications of the Vegetation Inventory

Research and Monitoring — The vegetation map will be used to model habitat suitability for elk and bison.

The vegetation map will be used to develop a sample frame for a survey design-based selection of long-term wetland monitoring sites by the Rocky Mountain Inventory and Monitoring Network (ROMN). The Network and its partners have also developed detailed crosswalks for map units to wetland classes within the National Wetland Inventory (NWI) and Ecological System

Representative Vegetation Types at GRSA*		
Map Class	**Acres**	**% of Park**
Sandsheet Rabbitbrush Shrubland and Steppe Alliances	56,641	38%
Barren Sand Dune	17,366	12%
Subalpine Spruce-Fir Forest and Woodland Alliances	9,291	6%
Herbaceous Stabilized Dune and Sandsheet Alliances	9,163	6%
Pinyon Pine Woodland with Herbaceous or Sparse Understory	6,587	4%
Greasewood Flat Shrubland and Steppe Alliances	5,689	4%
White Fir - Douglas-fir Forest and Woodland Alliances	4,613	3%
Aspen Forest Alliances	4,113	3%
San Luis Valley Mesic Meadow Alliances	4,069	3%
Subalpine-Montane Limber-Bristlecone Pine Woodland Alliances	2,983	2%

**The top 10 of 53 mapped classes, representing 81% of GRSA. The vegetation inventory mapped a larger area; these numbers are limited to what occurs within GRSA boundaries.*

classifications, which have expanded the use of the vegetation map data to non-USNVC based approaches and allowed comparisons of the extent of wetlands in historical NWI maps.

The vegetation map and other products will soon be available at http://nrinfo.nps.gov/Reference.mvc/Profile?Code=2097270.



Panorama from Star Dune, the tallest dune at 750' tall. Star dunes have three or more ridges from their summit, giving them a star shape from an aerial perspective. In the distance are the 14,000' Crestone Peaks.

ROCKY MOUNTAIN NATIONAL PARK

2001 - 2005
Colorado

Park Character

Rocky Mountain National Park (ROMO), situated in north-central Colorado, is a high elevation park in the Southern Rocky Mountains. The park is bisected by the Continental Divide; elevations ranges from 7,860 to 14,259 feet. This elevational gradient exerts a significant influence over the vegetation at the park. The majority of vegetation within the park is characteristic of the alpine, subalpine, and montane life zones.



High elevation spruce-fir at Sprague Lake.
Michael Menefee

Classification and Mapping

The classification for this project resulted in 172 distinct vegetation types; 167 of these are recognized USNVC types, and an additional five are local types specific to the park. Forty-six map classes were used to map ROMO and its environs, including 34 vegetated classes and 12 unvegetated classes. Forests and woodlands comprise the greatest number of classified types, as well as the greatest spatial extent. Vegetation types were mapped to the association level, with an overall accuracy of 74.7%.

Applications of the Vegetation Inventory

Research — ROMO's vegetation map has been used to develop a sample frame for a survey design-based selection of long-term wetland monitoring sites by the Rocky Mountain Inventory and Monitoring Network. The Network and its partners have also developed detailed crosswalks for map units to wetland classes within the National Wetland Inventory (NWI) and Ecological System classifications, which have expanded the use of the vegetation map data to non-USNVC based approaches and allowed comparisons of the extent of wetlands in historical NWI maps.

Vegetation data are being used in a number of climate change research applications, including pika surveys in fell field areas, an ozone study, impacts of climate change on white-tailed ptarmigan, paleoenvironmental baseline research and long-term climate change modeling, and the Rocky Mountain Atmospheric Nitrogen and Sulfur Study (RoMANS). In addition, the National Ecological Observatory Network (NEON) is using the vegetation data to establish a nitrogen and dust deposition science theme for the Central Plains Domain at ROMO. They will use the vegetation map in their research to detect and enable forecasting of ecological change at continental scales over multiple decades.

Habitat Modeling — ROMO is using the vegetation data to model habitat suitability for elk and beaver.

Fire Management — ROMO's fire management branch uses the data extensively on developing prescribed

Representative Vegetation Types at ROMO*		
Map Class	**Acres**	**% of Park**
SubAlpine Mixed Conifer	82,353	31%
Lodgepole Pine - Low Elevation < 9500 ft	21,293	8%
Lodgepole Pine - High Elevation > 9500 ft	21,049	8%
Herbaceous Wetland SubAlpine / Alpine - Alpine Meadow	17,631	7%
Herbaceous Upland Alpine Fellfield	16,660	6%
Cliff Face - Bare Soil / Rock	14,064	5%
Herbaceous Upland Alpine > 9600 ft	13,505	5%
Talus	12,511	5%
Montane Douglas Fir	9,630	4%
Krummholz	7,656	3%

The top 10 of 46 mapped classes, representing 81% of the park.

fire burn plans, updating the park's Fire Management Plan, and in various fire behavior models such as STARFire. It is also used to prepare Biological Assessments for fuel treatments in the Wildland Urban Interface.

Planning — Vegetation data were used extensively in development of the park's Natural Resource Condition Assessment to identify wildlife corridors and beaver habitat, and the protected area centered ecosystem (PACE). The data are also being used in considering whether or not the park should develop a reintroduction plan for wolverine.

Wildlife Management — Uses include: identification of potential Canada lynx habitat and Mexican spotted owl habitat for compliance and consultation with the U.S. Fish and Wildlife Service; setting up transects in major habitat types for bird monitoring; and vegetation monitoring for an Elk and Vegetation Management Plan.

Invasive Species Management — Uses include identifying locations of invasive plants, and development of a Bark Beetle Management Plan. The vegetation data help park managers identify acres of habitat and habitat types being impacted by mountain pine beetles and other bark beetles, and prepare for restoration. For example, the vegetation inventory was extremely helpful in identifying 17 patches of limber pine in a matrix of spruce/fir and lodgepole pine, and then stratifying sample plots by elevation. The goal is to save high-value seed trees from bark beetles by using a pheromone, collecting seed from these trees, and testing for white pine blister rust resistance.

Other Applications — Search and Rescue teams use the vegetation map when laying out search grids. The map allows them to anticipate conditions they might encounter in the field, and thus to determine whether canopy cover will allow for aerial searches or if they will need to send in ground search parties.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047727.

GOLDEN GATE NATIONAL RECREATION AREA

1997 - 2003 California

Park Character

Golden Gate National Recreation Area (GOGA) spreads across roughly 73,000 acres in a 60-mile swath of California coastal lands, with inholdings by other agencies and private owners incorporated into the park's legislative boundaries. The landscape offers windswept beaches, dramatic cliffs, coastal chaparral, low mountains, swaths of prairie, live oak woodlands, salt marshes, freshwater wetlands and creeks, and redwood forests.



Wildflowers of Mori Point.

Classification and Mapping

The project area encompassed 155,000 acres, and included GOGA and Point Reyes National Seashore (PORE), and adjacent state lands. Eighty-seven plant communities were described for the study area, including 46 that occur within GOGA. The map was produced using 74 mapping units, including both the USNVC and a custom classification hierarchy. The custom classification was used as the basis of a modified "fuzzy" approach for accuracy assessment. Overall thematic accuracy varied from 44% at the association level to 87% at the life form level.

Applications of the Vegetation Inventory

Ecologists are finding the GOGA-PORE map useful for a wide variety of purposes, from simple map displays to complicated analyses. Examples include:

Research — NPS ecologists are collaborating with the University of California at Berkeley to monitor how Sudden Oak Death is changing the forest structure and composition. For this project, the vegetation map is being used as the starting point for determining plot locations.

The vegetation map for GOGA (including Muir Woods National Monument), Point Reyes National Seashore, Pinnacles National Monument, and John Muir National Historic Site are being used to inform the development of long-term wetland and vegetation monitoring programs. The map has helped identify unique, rare, and common vegetation types that managers can monitor to evaluate the effects of natural or anthropogenic stressors such as fire, disease, and climate change.



Redwood forest.

Representative Vegetation Types at GOGA*		
Map Class	**Acres**	**% of Park**
Coyote Brush	17,219	24%
California Annual Grassland	10,949	15%
Douglas-fir	9,763	13%
Coast Live Oak	6,744	9%
California Bay	5,314	7%
Coast Redwood	4,753	7%
Built-up Urban disturbance	4,707	6%
Coffeeberry	1,655	2%
California Annual Grassland with Native Component	1,280	2%
Chamise	1,247	2%

**The top 10 of 46 mapped classes within the boundaries of GOGA, representing 87% of the park.*

Habitat Modeling — Golden Gate National Recreation Area, in cooperation with Point Reyes Bird Observatory Conservation Science, superimposed the park's vegetation map with bird habitat requirements to develop a landbird habitat model. The resulting maps identified important habitats for species of conservation concern, as well as areas that are likely to have high species diversity. The model can now be used by managers to minimize adverse impacts to birds when implementing management activities throughout the park.

Future Needs — Park ecologists hope to undertake regular updating of the vegetation map, ideally on a 10-20 year cycle. Lack of accurate and up-to-date vegetation maps are a huge handicap when conducting research on natural resources.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=2165650.



Oak woodland on Mount Tamalpais.



California poppies.

JOHN MUIR NATIONAL HISTORIC SITE

2004
California

Park Character

John Muir National Historic Site (JOMU) covers approximately 335 acres, and includes John Muir's residence, as well as vineyards and orchards typical of those that would have been present during his lifetime. The majority (326 acres) of the Site is Mt. Wanda – an undeveloped area of grassland and woodland where Muir took evening walks. Much of the surrounding landscape is residential development of varying densities. There is one private open space that is grazed.



Landscape at John Muir National Historic Site.

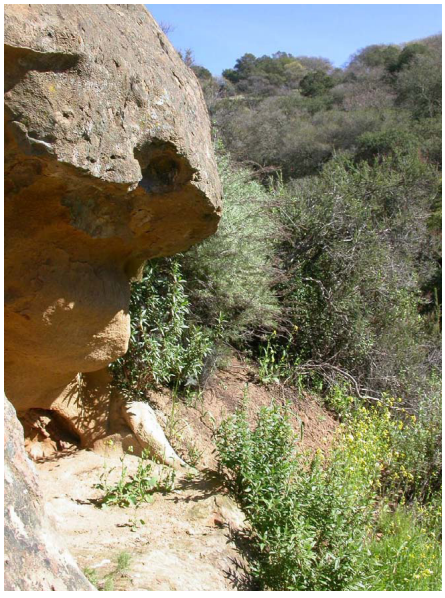
Classification and Mapping

Due to the small size of the study area, several steps in the standardized method for classification, mapping, and accuracy assessment were either not done, or were modified. A formal site-specific classification was not performed. Mapping was done using a rapid assessment approach using GPS and aerial photography. A formal accuracy assessment was not done since plant community types were determined in the field.

Applications of the Vegetation Inventory

Research and Monitoring —
The vegetation maps for JOMU, Golden Gate National Recreation Area (including Muir Woods National Monument), Point Reyes National Seashore, and Pinnacles National Monument are being used to inform the development of long-term wetland and vegetation monitoring programs. The maps have helped identify unique, rare, and common vegetation types that managers can monitor to evaluate the effects of natural or anthropogenic stressors such as fire, disease, and climate change.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=2165638.



JOMU shrubland community.

Representative Vegetation Types at JOMU		
Map Class	**Acres**	**% of Park**
Wild Oats Grassland	91	27%
Blue Oak Woodland	86	25%
Coast Live Oak Forest	66	19%
California Laurel Forest	44	13%
Valley Oak Woodland	27	8%
Buckeye Woodland	9	3%
Olive Forest	5	1%
Facilities	4	1%
Chamise Shrubland	4	1%
Coyotebrush Shrubland	2	1%

**The top 10 of 14 mapped classes, representing 99% of the Site.*



Present-day view of the John Muir homesite.



Historic view of the John Muir homesite.

POINT REYES NATIONAL SEASHORE 1997 - 2003 California

Park Character

Point Reyes National Seashore (PORE), established in 1962, encompasses approximately 71,000 acres of diverse habitats, including grasslands, coastal scrub, broadleaved evergreen woodlands, and coniferous forests on a peninsula along the California coast. The San Andreas fault bisects the peninsula from the California mainland. The other three sides of the peninsula border the Pacific Ocean, and include a mosaic of beaches, sea cliffs, and intertidal zones. Uplands support conifer forests and rolling coastal prairie. Several towns and other developed areas are nearby, and the wildland/urban interface can be a significant management issue.



An overhead view of Wildcat Camp.
CC Image: Flickr user Brothergrim

Classification and Mapping

The project area encompassed 155,000 acres, and included PORE and Golden Gate National Recreation, and adjacent state lands. Eighty-seven plant communities were described for the study area, 39 of which occur within PORE. The map was produced using 74 mapping units, including the USNVC as well as a custom classification hierarchy. The custom classification was used as the basis of a modified "fuzzy" approach for accuracy assessment. Overall thematic accuracy varied from 44% at the association level to 87% at the life form level.

Applications of the Vegetation Inventory

Ecologists are finding the GOGA-PORE map useful for a wide variety of purposes, from simple map displays to complicated analyses. Examples include:

Research and Monitoring — NPS ecologists are collaborating with the University of California at Berkeley to monitor how Sudden Oak Death is changing the forest structure and composition. For this project, the vegetation map is being used as the starting point for determining plot locations.

The map is also being used to analyze vegetation change following the 1995 Vision Fire. Even though the mapping project was conducted after the Vision fire, it was based on imagery from 1994. Thus, significant vegetation changes that occurred after the fire were not captured on the vegetation map. However, the map does provide a pre-fire baseline that allows scientists to analyze the impacts of that fire.

The vegetation maps for PORE, Golden Gate National Recreation Area (including Muir Woods National Monument), Pinnacles National Monument, and John Muir National Historic Site are being used to inform the development of long-term wetland and vegetation monitoring

Representative Vegetation Types at PORE*		
Map Class	**Acres**	**% of Park**
Coyote Brush	16,124	25%
Douglas-fir	13,668	21%
California Annual Grassland	12,283	19%
Bishop Pine	3,559	5%
Active Pasture or Agriculture	3,378	5%
California Annual Grassland with Native Component	2,673	4%
California Bay	2,530	4%
Red Alder	1,366	2%
Rush	1,224	2%
Introduced Coastal Perennial Grassland Alliance	885	1%

**The top 10 of 39 mapped classes, representing 88% of the park.*

programs. The maps have helped identify unique, rare, and common vegetation types that managers can monitor to evaluate the effects of natural or anthropogenic stressors such as fire, disease, and climate change.

In cooperation with Point Reyes Bird Observatory Conservation Science, Golden Gate National Recreation Area and PORE have used the vegetation maps to model all suitable habitat for the endangered Northern Spotted Owl. By identifying potential habitat, ecologists were able to target for inventory areas that had not been previously surveyed for owls. The model was also used to inform the sample design for long-term spotted owl monitoring, and continues to guide the timing and location of park management activities, such as trail maintenance, to reduce potential disturbances to owls.



Ocean Lake, Alamere Falls, Double Point, Stormy Stack, and Wildcat Beach from the Coast Trail.
CC Image: Flickr user Brothergrim

Fire Management — The vegetation data, which includes a fuel model field, have been used for potential fire behavior modeling. The results of this modeling are integral to the fire risk map developed for PORE.

Future Needs — Park ecologists hope to undertake regular updating of the vegetation map, ideally on a 10-20 year cycle. Lack of accurate and up-to-date vegetation maps are a huge handicap when conducting research on natural resources.

Map Updates — The PORE/GOGA map was updated to reflect changes in vegetation following the 1995 Vision Fire. Updating was based on "heads up" digitization of the burn area using aerial photography.

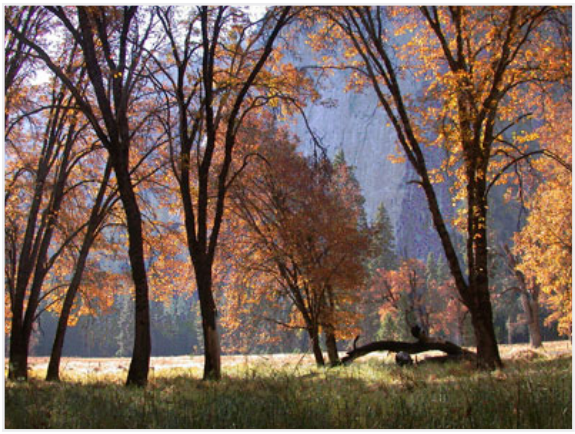
For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=2165650.

YOSEMITE NATIONAL PARK

1998 - 2007
California

Park Character

Yosemite National Park (YOSE) covers nearly 747,958 acres (1,200 square miles) in the central Sierra Nevada of California. The park is characterized by massive granitic outcrops, deep river valleys, world-record waterfalls, and extensive forests including giant sequoia groves, and large open meadows. The vegetation of the park is highly diverse. Across an elevational gradient of 2,000 to over 13,000 feet, the vegetation changes from oak woodlands to chaparral scrublands, from lower montane to upper montane forests, and from subalpine forests to alpine meadows. Over 95% of the park is designated Wilderness.



Black oaks grow in the open meadows of Yosemite Valley. A study seeks to determine if the oaks are declining in Yosemite National Park.

Mapping and Classification

The existing vegetation map of YOSE was a multi-party project involving the National Park Service, the U.S. Geological Survey, NatureServe, Aerial Information Systems, the Environmental Systems Research Institute, and the California Department of Fish and Game. The map includes a large buffer area around the park, nearly doubling the mapping area and informing cross-boundary issues such as fire and ecosystem management. The map was created over a 10-year period and is the first vegetation map created for the park since the 1930s. It combines detailed interpretation of 1,500 aerial photographs and hundreds of field surveys to provide information on the distribution and character of vegetation types across the park and surroundings. The map was created by collapsing 114 alliances and over 220 associations into 107 broader vegetation types that were mappable using aerial photography.

Yosemite's vegetation was mapped at the association level where possible, at the alliance level where necessary, and at the habitat scale where needed (e.g., alpine boulder field, semi-permanently to permanently flooded meadow).

Applications of the Vegetation Inventory

The vegetation map has many applications for resource managers including:

Fire Management — Comparing the new vegetation map with the data gathered in the 1930s has shown that, in areas where severe fires occurred, forest vegetation has changed to shrubland. Vegetation data have been translated into a fuels (dead and down woody debris and flammable vegetation) map so that fire management staff can model more accurately how a fire will behave in certain areas. This is important for managing wildland fires, including prescribed fires, within the park.

Representative Vegetation Types at YOSE*		
Map Class	**Acres**	**% of Park**
Sierra Lodgepole Pine Forest Alliance	80,060	10%
Jeffrey Pine Woodland Alliance	61,645	8%
California Red Fir Forest Alliance	60,100	8%
Western White Pine - (California Red Fir-Sierra Lodgepole Pine) Forest Superalliance	59,953	8%
California Red Fir - White Fir Forest Alliance	51,688	7%
Whitebark Pine Woodland Alliance	44,698	6%
Mountain Hemlock Forest Alliance	41,711	5%
Ponderosa Pine - Incense-cedar Forest Alliance	39,306	5%

**Top 8 most common types at the dominant species (Alliance) level among 128 mapped vegetation classes, representing 56% of the Park.*

Wildlife Management — An understanding of where certain plant communities occur allows for a better idea of where different animals are likely to be found. It provides information relating to available habitat and food resources for those animals, which in turn allows wildlife managers to better assess how a species may be faring and what the population numbers of those species should be.

Research and Monitoring — The vegetation map is an important tool for understanding the extent and pattern of old growth forests, predicting rare plant habitat, modeling the spread of invasive species, and modeling how vegetation might change under various climate change scenarios.

Other Applications — The vegetation map for YOSE has also had important applications in watershed management, archeological site prediction, park planning, and vista management. The map have been used for selecting study sites, and have provided context for more detailed assessments of pack-stock impacts in subalpine meadows (and location of control meadows). They have been fundamental to writing vegetation descriptions for numerous Environmental Assessments and Environmental Impact Statements. They have provided a foundation for seeding and planting plans used in road rehabilitation projects, and have been used as a base layer for many vegetation monitoring projects and final reports.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?code=2170174.



Half Dome and Yosemite highlands.
CC Image by Flickr user DJSchulte

TUZIGOOT NATIONAL MONUMENT

1995 - 1996
Arizona

Park Character

Tuzigoot National Monument (TUZI) is located in the Sonoran Desert in central Arizona. TUZI is an 834 acre park. Currently, only 58 acres of the legislated amount are in National Park Service ownership.

Tuzigoot is an ancient village or pueblo built by a culture known as the Sinagua. The pueblo consisted of 110 rooms including second and third story structures. The first buildings were built around A.D. 1000. The Sinagua were agriculturalists with



Tavasci Marsh with Tuzigoot on the hill in the middle distance.

trade connections that spanned hundreds of miles. The people left the area around 1400. The dominant plant community at TUZI is creosote bush and purple threeawn (*Larrea tridentata*/*Aristida purpurea*) shrublands. The Verde River flows through the site.

Mapping and Classification

When the mapping project took place, the Monument was comprised of 42 acres. The small size of the Monument permitted sampling of the entire TUZI area. The full mapping project included a total of 548 acres. This project resulted in the definition of 22 vegetation types, including five woodland types, eight shrubland types, and nine herbaceous types. Many of the vegetation types recognized were highly disturbed, due to past human influence. Altered hydrologic regimes created the greatest difficulty to vegetation classification because residual species from a previous hydrologic regime were mixed with indicators of other site conditions.

Applications of the Vegetation Inventory

Information on applications of the vegetation inventory are not available for TUZI at this time.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047732.

Representative Vegetation Types at TUZI*		
Map Class	**Acres**	**% of Park**
Creosote / Purple Three-awn Needlegrass Shrubland	123	22%
Canotia/Purple Three-awn Needlegrass Shrubland	64	12%
Velvet Mesquite — Snakeweed Shrubland	60	11%
Velvet Mesquite / Netleaf Hackberry Shrubland	42	8%
Narrowleaf Cattail Herbaceous Alliance	42	8%
Alkali Muhly — Spike Rush Herbaceous Vegetation	38	7%
Bermuda Grass Herbaceous Alliance	30	6%
Velvet Mesquite / Foxtail bBrley Shrubland	28	5%
Purple Three-awn Needlegrass — Range Ratany Herbaceous Vegetation	24	4%
Redberry Juniper — Canotia Woodland	8	1%

**Top 10 out of 22 total mapped classes, representing 84% of the mapped area.*



Summer growth of cattails in the Tavasci Marsh Middle Section stretching through the mesquite bosque.



Tuzigoot Pueblo with tailings. In 2006 the tailings were capped, to minimize runoff and polluion of the Verde River and groundwater.

CONGAREE NATIONAL PARK

1996 - 2000
South Carolina

Park Character

Congaree National Park (CONG) contains nearly 27,000 acres, over three quarters of which are located on the Congaree and Wateree River floodplains. Elevation ranges from approximately 80 to 100 feet above sea level. The extreme northern portions of CONG lie primarily in uplands above the active river floodplain. Two major blackwater creeks enter CONG from the north. Temporary seasonal flooding exerts a significant influence over the vegetation, which is predominantly bottomland hardwood forest. CONG is noted for containing one of the last significant stands of old growth bottomland hardwood forest - over 11,000 acres in all. Much of the eastern third of CONG has undergone recent timbering and agriculture activities in the past 30 years.



Bald Cypress trees. *Theresa Thom.*

Classification and Mapping

For the vegetation inventory, CONG was divided into five sections based on location and flooding regime: Upland Zone, Transitional Zone, Floodplain Zone, Congaree River Bank and Natural Levee Zone, and Disturbance Areas. The map was produced using 26 mapped classes. Twenty-three of these are known from within CONG boundaries. Twenty-two of CONG's map classes are vegetation types, including twenty forests, one woodland, and one shrubland. Twelve map classes represent newly described plant associations, and one is a broadly defined upland successional forest. Overall map accuracy was 87%.

Applications of the Vegetation Inventory

Research and Monitoring — Vegetation data have been used to aid in sampling design for many research projects conducted through the Old Growth Bottomland Forest Research and Education Center, including baseline invertebrate inventories, rare plant surveys, herpetological studies and other ecological studies.

Vegetation information is routinely used by CONG staff and cooperating scientists to classify research and monitoring sites, classify telemetry data, and interpret findings for CONG management. Specific examples include use of these data to:

- Compile baseline geologic maps;
- Classify telemetry points related to roosting and foraging ecology of rare Rafinesque's big-eared bats;
- Classify research plots and interpret data related to coarse woody debris and stream morphology research; and
- Help understand differences in groundwater dynamics studied with the Congaree Observation Well Network.

The vegetation map was critical in targeting and prioritizing locations for a recent, four-year intensive field survey for the

Representative Vegetation Types at CONG*		
Map Class	**Acres**	**% of Park**
Sugarberry - Sweetgum - Diamondleaf Oak / American Hornbeam / Giant Cane / Hop Sedge Forest	12,914	60%
Bald-cypress - Water Tupelo / Water Ash Forest	2,868	13%
Sugarberry - Sweetgum - Diamondleaf Oak / American Hornbeam / Giant Cane / Hop Sedge Forest	867	4%
Sweetgum - Water Oak - Diamondleaf Oak / Giant Cane / Concealed Sedge Forest	699	3%
Bald-cypress - Green Ash - Diamondleaf Oak / Red Maple / Lizard's Tail Forest	689	3%
Plantation Pine	593	3%
Muscadine - Peppervine - Trumpetvine Vine-Shrubland	591	3%
Swamp Blackgum - (Red Maple) / American Holly / Coastal Doghobble / Howe Sedge Forest	556	3%
Successional Pine - Mixed Hardwood Upland Forest	492	2%
Sugarberry - Green Ash - Box Elder - (Black Walnut) / Common Pawpaw / Gray's Sedge Forest	416	2%

**The top 10 of 23 mapped classes, representing 96% of CONG.*

endangered Ivory-billed Woodpecker. The map was utilized to plan active ground searches, as well as for deploying acoustic recording units and remote cameras.

Education and Interpretive Programs — The map has been used to illustrate the importance of using vegetation as an indicator for park ecotones and associated hydrology, elevation, and soil types across the landscape.

Vegetation Inventory Product Updates

Future Needs — CONG was expanded in 2004 by approximately 4,500 acres. An updated complete vegetation map for the entire park, including these new lands, is a critical outstanding need.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047700.



Weston Lake
Theresa Thom (NPS)

AZTEC RUINS NATIONAL MONUMENT

2005-2009
New Mexico

Park Character

The Aztec Ruins National Monument (AZRU) preserves ancestral Pueblo structures in northwest New Mexico. It is located on the southern edge of the Colorado Plateau close to the town of Aztec and northeast of Farmington, near the lower end of the Animas River valley. AZRU was established in 1923 and encompasses approximately 257 acres. Terrain varies from a low of approximately 5,630 feet at the Animas River to an elevation of approximately 5,820 feet.



Looking back at the Great Kiva. *J. Berens*

Classification and Mapping

This project resulted in 28 distinct map classes to describe the entire project area, 25 of which are known from within AZRU boundaries. Fourteen map classes are recognized USNVC types, and the other 14 are "local" types specific to AZRU. Of the local types, four are vegetated but represent either picnic areas, agricultural areas, or weedy map units/land-cover types that do not fit into the USNVC. The remaining 10 are non-vegetated land-cover types, including industrial, commercial, and urban areas. Shrublands and woodlands are the most common USNVC types. Vegetation types were mapped to the association level, with an overall accuracy of 100% (due to the small size of AZRU, each point collected was re-visited).

Applications of the Vegetation Inventory

Because the AZRU vegetation inventory has just been completed and delivered to the Southern Colorado Plateau Network, there has not yet been any chance to apply the results specifically in AZRU.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1048520.



Artemisia tridentata / Pleuraphis jamesii Shrubland.
U.S. Bureau of Reclamation/D. Salas

Representative Vegetation Types at AZRU*		
Map Class	**Acres**	**% of Park**
Abandoned Field / Other weedy areas	79	25%
Basin Big Sagebrush / James' Galleta Shrubland	73	23%
Irrigated Field / Pasture	29	9%
Russian-olive Semi-natural Woodland Alliance	17	5%
Snakeweed / Alkali Sacaton - James' Galleta Shrub Herbaceous Vegetation	16	5%
Fremont Cottonwood Seasonally Flooded Woodland Alliance	16	5%
Utah Juniper - One-seed Juniper / Sparse Understory Woodland	16	5%
Black Greasewood Shrubland	13	4%
James' Galleta Herbaceous Vegetation	10	3%
Fourwing Saltbrush / Indian Mountain-ricegrass	10	3%

**Top 10 of 25 total mapped classes, representing 87% of the AZRU. The mapping project mapped a larger area; these numbers are limited to what occurs within AZRU boundaries.*



Populus fremontii Seasonally Flooded Woodland Alliance.
U.S. Bureau of Reclamation /D. Salas

MESA VERDE NATIONAL PARK

2004 - 2009
Colorado

Park Character

Mesa Verde (MEVE) occupies over 52,000 acres on the Colorado Plateau, and includes 8,500 acres of federally designated wilderness. The park protects over 4,000 known archeological sites, including 600 cliff dwellings. These sites are some of the most notable and best preserved in the United States. Elevations range from about 6,000 to over 8,500 feet.



Mesa Verde National Park.

Mesa Verde (Spanish for "green table") lies in the transition zone between arid scrublands to the south and the forested montane environment of the Rocky Mountains to the north. The park supports four major plant communities: the shrub-steppe community, pinyon-juniper forests, mountain shrub communities, and areas of Douglas-fir and Ponderosa pine.

Mapping and Classification

The project described 47 plant communities. The USNVC served as a framework for classifying these plant communities to the alliance and association level. Eleven of the 47 plant communities were classified as "park specials" (plant communities with insufficient data to describe them as new alliances or associations). The vegetation map includes 46 map classes, which consist of associations, alliances, and park specials. Fourty-four of these are found within the MEVE boundary. Overall map accuracy was 43.5%.

Applications of the Vegetation Inventory

Wildlife Management — Mesa Verde has long sought to re-establish a herd of bighorn sheep in the park, but the park was considered a poor location due to lack of open country. However, a series of large wildfires from 1996 to 2003 greatly increased the amount of open country within MEVE. The vegetation map can now be used to re-evaluate the feasibility of a translocation project.

This information also can be used to model the habitat suitability for other animals. In addition, this information is necessary to model carrying capacities of species such as elk and mule deer.

Fire Management — Mesa Verde has experienced a number of wildfires and a new fire management plan is in progress. Fire management units are being mapped in large part based on vegetation types. This newest map allows the park to segregate the park into management units using the best available information. Based on expected rates of plant succession, the map also provides a better expectation for the park of future changes in vegetation cover over different time scales. These data also will provide opportunities to model

Representative Vegetation Types at MEVE*		
Map Class	**Acres**	**% of Park**
Gambel Oak Shrubland	11,542	22%
Mixed Montane Shrubland	9,670	18%
Gambel Oak - Mixed Montane Shrubland	7,694	14%
Colorado Pinon - Utah Juniper / Mixed Montane Shrub Woodland	6,040	11%
Post-Fire Mixed Herbaceous Vegetation	5,792	11%
Colorado Pinon - Utah Juniper / Bitterbrush / Muttongrass Woodland	4,051	8%
Colorado Pinon - Utah Juniper / Gambel Oak Woodland	2,852	5%
Colorado Pinon - Utah Juniper / Big Sagebrush Woodland	890	2%
Colorado Pinon - Utah Juniper / Shale Sparse Woodland	821	2%
Crispleaf Wild Buckwheat Mancos Shale Sparse Vegetation	792	1%

**Top 10 of 44 total mapped classes, representing 94% of the park.*

fire management activities such as fuel treatments to explore alternatives in the planning stages and support the execution of such activities.

Invasive Species Management — Certain vegetation classes have shown a tendency to be more vulnerable to infestation by invasive species. These data will help to better quantify which areas and how many acres are likely to be of management concern. The USGS has developed a vegetation model that can help predict future vegetation cover and fire activity based on the spread and density of cheatgrass and varying climatic conditions. The model would be expected to perform better with the latest information available to it.

Planning — Over a hundred on-going and new projects are scheduled for completion in FY2010 and the vegetation map is being used in the planning of these projects and to assist in accomplishment of the environmental compliance. Project managers are better able to plan their projects and the park's Interdisciplinary Team can resolve compliance issues more rapidly when using contemporary information with known reliabilities.

Research Applications — Vegetation data have been used as the basis for research into fire response by Dr. Lisa Floyd-Hanna. A result of Dr. Floyd-Hanna's study is more detailed mapping of the "post-fire mixed herbaceous" vegetation type. The park is currently integrating these data into the vegetation map.

The vegetation inventory is also being used in a Joint Fire Sciences study to investigate fuel structures in piñon-juniper and post-fire native and invasive communities that is being lead by Dr. Lisa Floyd-Hanna. This study is scheduled for completion in 2011.

Other Applications — Models can better predict natural processes, including upland erosion potential and sediment loads in the Mancos River, when using the best available information such as the vegetation inventory data. The USGS has used Mesa Verde as an example in such a modeling exercise.

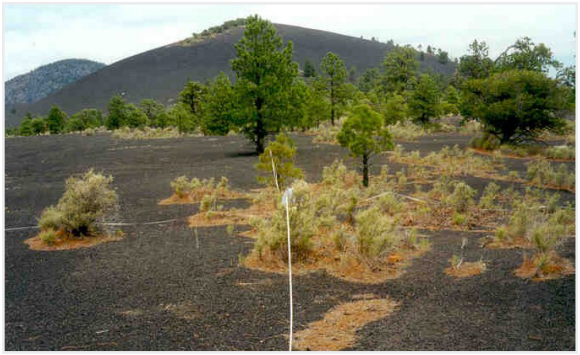
For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1048533.

SUNSET CRATER VOLCANO NATIONAL MONUMENT

1999 - 2004 Arizona

Park Character

Sunset Crater Volcano National Monument (SUCR) was authorized by President Herbert Hoover in 1930. This 3,040-acre park features the geologically young and approximately 8,029 feet high Sunset Crater cinder cone - the Colorado Plateau's most recent volcanic eruption. SUCR is best known for extensive geologic processes and exposures relating to volcanism



Black cinder beds and adjacent cinder cone, Lenox Crater, among ponderosa pine trees and apache plume shrubs.

(i.e., cinder cones, cinder beds, and lava flows). The significance of SUCR extends beyond geology. This volcano and its relatively undeveloped landscape provide an unparalleled opportunity to study plant succession and ecological change in an arid volcanic landscape.

Vegetation of SUCR and its environs is diverse, including nearly barren beds of cinder or lava and rock outcrops, to grassy meadows, open stands of trees with sparse understory shrublands, and dense forests on more moist aspects of the highest slopes, drainages, and ridges. SUCR is probably most noted for the sparsely vegetated cinder cones, lava beds, and lava rock outcrops. Most of these geologically dominated landform features consist of very sparse to no vegetation.

Classification and Mapping

In addition to the Monument, a buffer of approximately 15,710 acres of surrounding USDA Forest Service lands and privately owned residential land was also included in the project area. The total project area including the environs was 18,750 acres. Sixteen vegetation map classes with five modifiers, three land cover map classes, and six Anderson Level II land-use map classes were used (a total 18 map classes at the alliance level). Seven map classes occurred in the environs project area outside of park boundaries. Vegetation map classes were determined through extensive field reconnaissance, data collection, and analysis in accordance with the USNVC. Volcanic features and woodlands comprise the greatest number of classified types, as well as the greatest spatial extent. Vegetation types were mapped to the alliance level, with an overall accuracy of 70.3%.

Applications of the Vegetation Inventory

Park Management — The vegetation map has been used to target restoration activities. Vegetation data are regularly consulted for planning, often in preliminary stages as a surrogate to document dominant vegetation classes. This information helps managers to carefully plan future management activities in accordance with biodiversity values.

Research and Monitoring — The Southern Colorado Plateau Network (SCPN) and SUCR have used the vegetation

Representative Vegetation Types at SUCR*		
Map Class	**Acres**	**% of Park**
Ponderosa Pine Woodland Alliance	1,131	37%
Cinder Sparse Mosaic	950	31%
Lava Beds	545	18%
Lava Bed Sparsely Vegetated Alliance	193	6%
Apache Plume Sparsely Vegetated Alliance	79	3%
Sand Bluestem Herbaceous Alliance	79	3%
Crispleaf Wild Buckwheat Sparsely Vegetated Alliance	39	1%
Transportation, Communications, and Utilities	16	1%
Complex: [Pinyon Pine Forest Alliance or Pinyon Pine - (Juniper species) Woodland Alliance]	2	0.1%
Facilities	1	0.05%

**Top 10 of 11 total mapped classes, representing ~99% of SUCR. The vegetation inventory mapped a larger area; these numbers are limited to what occurs within SUCR boundaries.*

maps extensively in development and implementation of monitoring projects.

Future Applications

Research and Monitoring — SUCR's vegetation map was completed prior to the millennial drought. Updated vegetation mapping would be of interest to determine whether any forest community types are receding in response to drought. SUCR would also like to use vegetation mapping data to help set up a study of primary ecological succession at Sunset Crater Volcano. This very young 900-year-old eruption provides a world class research site to monitor succession following volcanic eruption.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047730.



Dense forests occur at higher elevations.



Sparsely Vegetated Lava Bed.

WALNUT CANYON NATIONAL MONUMENT

1999 - 2009 Arizona

Park Character

Walnut Canyon National Monument (WACA) was first designated as a National Monument in 1915 to protect significant cultural artifacts preserved as cliff dwellings. Since establishment, WACA's boundary has expanded four times to today's size of approximately 3,600 acres. A local advocacy group, Friends of Walnut Canyon, is currently seeking to further expand the park.



Walnut Canyon.

WACA is located approximately 7.5 miles east of Flagstaff, Arizona. The Monument lies adjacent to the Coconino National Forest, the city limits of Flagstaff, and Arizona State lands. The National Monument is visited mostly for its extensive remains of cliff dwellings, which were inhabited by the Sinagua people from A.D. 1000 to A.D.1250. Contemporary Native American tribes continue to have significant ties to the landscape.

WACA also has unique biological value, being located within the largest contiguous ponderosa pine forest in the world. The National Monument also acts to preserve unique biotic communities of locally rare mesic plant communities, ecotonal communities ranging from semi-arid grasslands to mesic forests, and diverse animal communities.

Classification and Mapping

Thirteen vegetation map classes, three land cover map classes, and eight Anderson Level II land-use map classes were used for interpretation of approximately 20,700 acres, encompassing the Monument and approximately 17,100 surrounding acres. Eighteen map classes occurred within the WACA administrative boundaries. Woodlands comprise the greatest number of classified types, as well as the greatest spatial extent. Vegetation types were mapped to the association level, with an overall accuracy of 69.2%.

Applications of the Vegetation Inventory

Research and Monitoring — The Southern Colorado Plateau Network (SCPN) has used the vegetation maps extensively in development and implementation of monitoring projects.

Park Management — The vegetation map has been used to target applications for riparian restoration work on Walnut Creek.

Vegetation data are regularly consulted for planning. They are often used in the preliminary stages as a surrogate to document dominant vegetation classes.

Representative Vegetation Types at WACA*		
Map Class	**Acres**	**% of Park**
Ponderosa Pine - Pinyon Pine - Juniper / Blue Grama Woodland	1,158	32%
Pinyon Pine - Utah Juniper / Blue Grama Woodland	950	26%
Limestone Rim Complex	558	16%
Douglas-fir / Gambel Oak Forest	380	11%
Ponderosa Pine / Gambel Oak Woodland	164	5%
Canyon Floor Complex	119	3%
Sparsely Vegetated Coconino Sandstone	54	2%
Snakeweed / Modified Grassland Complex	49	1%
Ponderosa Pine / Mixed Graminoid Woodland Complex	45	1%
Rabbitbrush / Blue Grama Shrub Herbaceous Vegetation	37	1%

**Top 10 of 18 total mapped classes, representing 98% of WACA. The vegetation inventory mapped a larger area; these numbers are limited to what occurs within WACA.*

This helps managers carefully plan future management activities in accordance with biodiversity values.

Fire Management — WACA has lumped USNVC classes into physiognomic fire regimes and used these to develop fire management plans for the park. The vegetation map is regularly consulted for prescribed fire planning, and are also used as inputs for fire fuel models.

Habitat Modeling — WACA has made use of the vegetation map to define habitat for the Mexican Spotted Owl.

Invasive Species Management — The vegetation map has been utilized to develop a more detailed map of the extent of invasive plant species at WACA.

Future Applications

Research and Monitoring — WACA's vegetation map was completed prior to the millennial drought. Since mapping was completed, about a third of conifers in the park have died due to drought stress. WACA would like to update the vegetation mapping set to determine whether the Douglas Fir-Gamble oak type has shrunk in distribution in response to the drought. WACA would also like to remap riparian deciduous trees at the bottom of Walnut Canyon and use the updated map for Walnut Creek riparian monitoring protocols.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047737.



Mixed ponderosa pine/ pinyon pine/ Utah juniper ecotonal areas.

WUPATKI NATIONAL MONUMENT

1999 - 2009
Arizona

Park Character

The Wupatki National Monument (WUPA) is a 35,478 acre park located in north-central Arizona, near Flagstaff. Rich in archeological ruins from the ancient Pueblo people, the Monument is administered in close conjunction with the nearby Sunset Crater Volcano National Monument. WUPA was established in December 9, 1924 and was listed on the National Register of Historic Places on October 15, 1966. The dynamic processes of volcanism, tectonics, and erosion have created the geologic formations and abrupt elevation changes that provide, within a short distance, a wide variety of habitats for plants and animals.



Wupatki National Monument.

Classification and Mapping

In addition to the monument, the project area included an environs area of approximately 70,902 acres, for a total project area of 106,380 acres. The environs include USDA Forest Service lands, privately owned land, Arizona state land, Bureau of Land Management (BLM), Indian Allotments, and Navajo Nation land.

Twenty-six vegetation map classes, including two unique stands identified only in the photo interpretation, two land cover map classes, and seven Anderson Level II land-use map classes, were used for interpretation, with 33 mapping classes represented within the administrative boundaries of WUPA. Grasslands are the most common formation type in WUPA; they consist of pure stands (herbaceous vegetation), mixed grass/shrub steppe vegetation (shrub herbaceous vegetation), and as understory in wooded types (wooded herbaceous vegetation). Herbaceous vegetation types comprise the greatest spatial extent. Overall thematic mapping accuracy was calculated at 69.7%.

Applications of the Vegetation Inventory

Park Management — The vegetation map has been used to provide baseline information for completing the park's habitat descriptions, in many cases helping to stratify habitats by dominant vegetation types.

Vegetation data are regularly consulted for planning. They are often used in preliminary stages as a surrogate to document dominant vegetation classes. This helps managers carefully plan future management activities in accordance with biodiversity values.

Research Applications — WUPA utilizes its vegetation map to develop monitoring plans and protocols for the Monument. For example, biologists conducting a pocket mouse survey used vegetation map data to develop a habitat model for the species. The results will be used to analyze changes

Representative Vegetation Types at WUPA*		
Map Class	**Acres**	**% of Park**
Galleta Mixed Grasslands	7,277	21%
Moenkopi Shale Sparse Vegetation	5,021	14%
Rabbitbrush Shrubland	4,418	12%
Oneseed Juniper Woodland	4,236	12%
Black Grama Coconino Plateau Mixed Shrubland	2,867	8%
Apache Plume Cinder Shrubland	2,471	7%
Sand Sagebrush Shrubland	1,889	5%
Moenkopi Sandstone Sparse Vegetation	1,808	5%
Wupatki Wash System	1,385	4%
Galleta Mixed Shrublands	1,315	4%

**Top 10 of 33 total mapped classes, representing 92% of WUPA. The vegetation inventory mapped a larger area; these numbers are limited to what occurs within WUPA boundaries.*

in the population's range and any potential response to climate change.

Vegetation Monitoring — Park staff regularly utilize WUPA's vegetation map data to post-stratify vegetation monitoring data to assist managers in reporting to specific vegetation types.

Future Applications

Research and Monitoring — WUPA's vegetation map was completed prior to the peak of the millennial drought. An updated vegetation map would be of interest to determine whether any forest community types are receding in response to drought.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047739.



Wupatki Grasslands.



Sparsely vegetated sandstone outcrops.

ALIBATES FLINT QUARRIES NATIONAL MONUMENT

2004 - 2006 Texas

Park Character

The 1,371 acre Alibates Flint Quarries National Monument (ALFL) ALFL was originally authorized as Alibates Flint Quarries and Texas Panhandle Pueblo Culture National Monument in 1965. The designation was shortened to the current name in 1978.



Alibates Scenic View.

ALFL protects historically significant flint quarries. Alibates Flint is only found in a small section of the Canadian River valley in the Texas panhandle. Demand for this high quality, rainbow-hued flint is reflected in the distribution of Alibates Flint through the Great Plains and beyond.

ALFL is adjacent to Lake Meredith National Recreation Area (LAMR) on the dry plains of the Texas Panhandle, along the Canadian River breaks. The region is characterized by arid grasslands and the presence of open stands of mesquite among the grasses. The landscape consists of flat to rolling plains, and includes mesas and buttes in some areas.

Classification and Mapping

To classify the vegetation, 182 representative plots located in ALFL, LAMR, and surrounding environs were sampled during the summer of 2004. Analysis of the plot data using ordination and clustering techniques produced 29 vegetation communities, composed of one alliance, 18 existing associations and 10 additional associations that were newly described for this area.

A total of 34 map units were developed and cross-walked or matched to corresponding plant associations and land use classes for the entire project area (including both ALFL and LAMR). At ALFL, the Upland Slopes/Rolling Hills Vegetation Complex is the most extensive vegetated map class, covering 64% of the Monument area. Vegetation types were mapped to the association level, with an overall accuracy for the entire project area of 63%. When the accuracy assessment data were analyzed with relaxed requirements, the overall map accuracy of the classification was 86%.

Applications of the Vegetation Inventory

The Southern Plains Network (SOPN) has used the vegetation maps extensively in development and implementation of monitoring projects.

Research and Monitoring — SOPN has used vegetation maps to select samples for monitoring, and has worked in conjunction with its partners to refine sample plots using the maps.

Representative Vegetation Types at ALFL*		
Map Class	**Acres**	**% of Park**
Upland Slopes / Rolling Hills Vegetation Complex	898	65%
Perennial Bottomland / Upper Terrace / Valley Floor HV Complex	239	17%
Honey Mesquite Shrubland Complex	155	11%
Steep Slope Vegetation Complex	69	5%
Intermittent Streams	16	1%
Transportation	4	0.3%
Oil/Gas Development Sites	1	0.05%
Blue Grama - Buffalograss Herbaceous Vegetation	1	0.05%

**All 8 mapped classes, representing 100% of ALFL. The vegetation inventory mapped a larger area; these numbers are limited to what occurs within ALFL boundaries.*

Park Management — SOPN has done preliminary comparisons of vegetation types between parks to identify commonalities and opportunities for parks to cooperate on management. Degraded areas are easily identified for consideration in prairie restoration efforts.

Education and Interpretative Programs — SOPN plans to make the vegetation inventory information available on a park website for the general public. The defined vegetation types will be useful for a variety of audiences in a variety of ways. For example, birdwatchers can target certain areas for the specific species they are seeking.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=2165615.



Alibates Flint.



Alibates Contact Station and surrounding area.

BENT'S OLD FORT NATIONAL HISTORIC SITE

2005 - 2009 Colorado

Park Character

The 800 acres Bent's Old Fort National Historic Site (BEOL) was established in 1960 to preserve and commemorate an early trading post located along the Santa Fe Trail in what is now southeastern Colorado. During the period from 1833 to 1849, Bent's Fort was influential in the westward expansion of the United States into the American southwest. Since the time of its establishment, the site of Bent's Fort and the surrounding landscapes have undergone many ecological changes.



Bent's Old Fort. *CNHP/Stephanie Neid*

BEOL is situated on a series of low benches along the Arkansas River in southeastern Colorado, between upland shortgrass prairie and riparian willow shrublands and cottonwood gallery forests. It is located on the western edge of the Great Plains at an elevation of 4,035 feet. This area is short grass prairie, with blue grama and buffalo grasses predominating on the high benches. The river bottoms are comprised of mixed grasses, riparian, and wetland plant species. The current vegetation is a mixture of native plant communities impacted by exotics and grassland recovering from agricultural use.

Classification and Mapping

Thirteen map classes were used to describe the landscape of BEOL. Among these were six plant associations, one alliance, two non-natural map classes (Disturbed, Development), three local types, and one un-vegetated natural class (Open Water). Vegetation types were mapped to multiple levels, with an overall accuracy of 92%.

Applications of the Vegetation Inventory

The Southern Plains Network (SOPN) has used the vegetation maps extensively in development and implementation of monitoring projects.

Research and Monitoring — SOPN has used the vegetation map to select samples for monitoring, and has worked in conjunction with its partners to refine sample plots using the map.

Park Management— SOPN has done preliminary comparisons of vegetation types between parks to identify commonalities and opportunities for parks to cooperate on management. Degraded areas are easily identified for consideration in prairie restoration efforts.

Education and Interpretative Programs— SOPN plans to make the vegetation mapping information available on a park website for the general public. The defined vegetation types will be useful for a variety of audiences. For example, birdwatchers can target certain areas for the specific species.

Representative Vegetation Types at BEOL*		
Map Class	**Acres**	**% of Park**
Alkali Sacaton – Inland Saltgrass Herbaceous Vegetation	205	26%
Plains Cottonwood Temporarily Flooded Woodland	194	24%
Reclaimed agricultural land	77	10%
Prairie Dog Complex	54	7%
Coyote Willow / Mesic Graminoids Shrubland	48	6%
Sand Sagebrush / Grama (Sideoats, Blue) Shrubland	44	6%
Disturbed	42	5%
Plains Cottonwood / Inland Saltgrass Woodland	40	5%
Broadleaf Cattail Marsh	33	4%
Open Water	32	4%

**Top 10 of 13 total mapped classes, representing 97% of BEOL.*



Populus deltoides Temporarily Flooded Woodland Alliance.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=2165619.



Sporobolus airoides – Distichlis spicata Herbaceous Vegetation.

FORT LARNED NATIONAL HISTORIC SITE

2009 Kansas

Park Character

In August of 1964, Fort Larned was designated a National Historic Site. Fort Larned National Historic Site (FOLS) encompasses 705 acres across two sites in central Kansas, just west of the town of Larned. FOLS is the larger of the two sites and preserves and commemorates the original buildings and Fort grounds. Fort Larned is located on the upper floodplain



Smooth Brome Semi-natural Herbaceous Alliance.

of the Pawnee River, situated next to a historic oxbow lake south of the active river channel. FOLS contains large, flat grasslands common to the Southern Plains region. Until recently these large fields were actively farmed and ranched, heavily influencing the composition of the vegetation.

The smaller Santa Fe Ruts site preserves some of the original wagon ruts left by the immigrants on the Santa Fe Trail. This unit contains a few remnants of the original tallgrass prairie vegetation, and is inhabited by a colony of black-tailed prairie dogs.

Together, these unique sites support over 240 species of plants and include many examples of native riparian vegetation, as well as remnants of the tallgrass prairie plant communities indigenous to this area.

Classification and Mapping

Just over 1,898 acres, including 705 acres in the authorized boundary of FOLS and an additional 1,193 acres in the environs, were mapped. The project sampled 61 plots in 2005 that resulted in five USNVC plant associations (including the Prairie Dog Town Grassland Complex), six USNVC vegetation alliances, and five non-vegetated cover types, for a total of 16 map classes. One map class, the Agricultural Business type, only occurred outside park boundaries. Of all the map units, the most frequent was *Bromus inermis* Semi-natural Herbaceous Alliance. Over a third of FOLS was mapped as active agriculture (Planted / Cultivated fields), which are being restored to native vegetation. The most abundant map unit in terms of area other than the Planted / Cultivated fields in the environs was Planted Semi - Natural Restored Grassland Prairie (or *Andropogon gerardii* - (*Sorghastrum nutans*) Herbaceous Alliance). Vegetation types were mapped to the association and alliance level, with an overall thematic accuracy of 92%.

Applications of the Vegetation Inventory

The Southern Plains Network (SOPN) has used the vegetation maps extensively in development and implementation of monitoring projects.

Research and Monitoring — SOPN has used the vegetation map to select samples for monitoring, and has worked

Representative Vegetation Types at FOLS*		
Map Class	**Acres**	**% of Park**
Planted / Cultivated	247	35%
Smooth Brome Semi-Natural Herbaceous Alliance	138	20%
Planted Semi - Natural Restored Grassland Prairie	126	18%
Green Ash - Elm - Common Hackberry Forest	45	6%
Old Field Weedy Herbaceous Vegetation	35	5%
Prairie Dog Town Grassland Complex	34	5%
Transportation	25	3%
Buffalo Grass Herbaceous Alliance	22	3%
Stream / River	15	2%
Eastern Cottonwood - Black Willow Forest	11	2%

**Top 10 of 15 total mapped classes, representing 99% of the site area. The vegetation inventory mapped a larger area; these numbers are limited to what occurs within FOLS boundaries.*

in conjunction with its partners to refine sample plots using the map.

Park Management— SOPN has done preliminary comparisons of vegetation types between parks to identify commonalities and opportunities for parks to cooperate on management.

Degraded areas are easily identified for consideration in prairie restoration efforts.



Fort Larned National Historic Site.

Education and Interpretative Programs— SOPN plans to make the vegetation mapping information available on a park website site for the general public. The defined vegetation types will be useful for a variety of audiences in a variety of ways. For example, birdwatchers can target certain areas for the specific species they are seeking.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047708.



Planted Semi - Natural Restored Grassland Prairie.

FORT UNION NATIONAL MONUMENT

2002 - 2004
New Mexico

Park Character

Fort Union National Monument (FOUN) is located in northeast New Mexico in a wide valley of the lower Wolf Creek watershed, a tributary of the Mora River. FOUN was established in 1956 to preserve the remains of Fort Union, a complex of three historical forts established beginning in 1851 along the Mountain route of the Santa Fe Trail.



Fort Union National Monument.

FOUN is comprised of 721 acres across two units. The largest unit (637 acres east of Wolf Creek), which lies upslope along a broad alluvial fan piedmont, houses the ruins of the "Star Fort" and "Third Fort." These were the focus of the heaviest usage during the active days of the Fort. The gentle terrain is primarily broken by old trails and arroyos that are artifacts of the old Santa Fe Trail system that converged at the Forts.

The smaller unit (83.6 acres west of Wolf Creek) lies up against a bluff of Black Mesa on a short piedmont slope. This is the site of the "First Fort" established in 1851, which later became an arsenal site after the building of the Third Fort on the opposite slope. Forty years of use at Fort Union brought extensive changes to landscape as the Fort became a focal point for not only military activities, but also trade and agriculture in the Mora Valley and the region. Following abandonment in 1891, the land reverted to general rangeland use until the site was donated by the Fort Union Ranch to a local preservation society, and then to the National Park Service. Since that time, livestock have been removed from FOUN to protect the cultural resources as well as improve range conditions.

Classification and Mapping

A total of 142 taxa were identified over the three year period of sampling. Sixteen plant associations among 11 alliances were identified for FOUN. The map was produced using 10 mapping units which were developed using the vegetation classification as a foundation.

The most significant vegetation types at FOUN are grassland associations belonging to the Western Great Plains Shortgrass Prairie Alliance Group. The most abundant grass was blue grama (*Bouteloua gracilis*), the characteristic species of the short grass prairie from Canada to Mexico. The most common associations on the Monument were the Blue Grama/Fringed Sage Grassland (*Bouteloua gracilis/ Artemisia frigida*) and the Blue Grama-Purple Threeawn (*Bouteloua gracilis-Aristida purpurea*). The preponderance of purple threeawn in the Blue Grama-Purple Threeawn association is indicative of the long disturbance history of the Monument.

Applications of the Vegetation Inventory

The Southern Plains Network (SOPN) has used the vegetation maps extensively in development and implementation of monitoring projects.

Representative Vegetation Types at FOUN*		
Map Class	**Acres**	**% of Park**
Blue Grama - Mixed Grassland/Ruderal Vegetation	158	22%
Blue Grama/Fringed Sage Grassland	128	18%
Blue Grama-Mixed Grassland	105	15%
Western Wheatgrass - Hairy Grama Old Trail Grassland	92	13%
Disturbed Grassland/Ruderal Vegetation- Old Fort Undeveloped	57	8%
Disturbed Grassland / Ruderal Vegetation - Old Fort Restored	38	5%
Disturbed Grassland/Ruderal Vegetation - Adobe Field	37	5%
Disturbed Grassland	26	4%
Modern Road, Facilities, and Planted Vegetation	24	3%
Ruderal Vegetation/Bare Ground	19	3%

**Top 10 of 19 total mapped classes, representing 96% of FOUN. The vegetation mapping project mapped a larger area; these numbers are limited to what occurs within FOUN.*

Research and Monitoring — SOPN has used the vegetation map to select samples for monitoring, and has worked in conjunction with its partners to refine sample plots using the map.

Park Management— SOPN has done preliminary comparisons of vegetation types between parks to identify commonalities and opportunities for parks to cooperate on management.

Degraded areas are easily identified for consideration in prairie restoration efforts.



Blue Grama - Mixed Grassland/Ruderal Vegetation.

Education and Interpretative Programs— SOPN plans to make the vegetation mapping information available on a park website site for the general public. The defined vegetation types will be useful for a variety of audiences in a variety of ways. For example, birdwatchers can target certain areas for the specific species they are seeking.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=2165632.



Blue Grama / Fringed Sage Grassland.

LAKE MEREDITH NATIONAL RECREATION AREA

2004 - 2006 Texas

Park Character

Lake Meredith National Recreation Area (LAMR), adjacent to Alibates Flint Quarries National Monument (ALFL), was dedicated in 1965 to offer water and land-based recreation and to provide water supply storage. LAMR encompasses 44,978 land acres on the dry plains of the Texas Panhandle. It is centered on the roughly 10,000-acre Lake Meredith (lake area varies depending on inflow and demand), an artificial reservoir created by Sanford Dam on the Canadian River. Lake Meredith's shores are dotted with mesquite, prickly pear, yucca, and grasses of the arid plains. Cottonwoods, soapberry, and sandbar willows occur up the sheltered creek beds. The region is characterized by arid grasslands and the presence of open stands of mesquite among the grasses. The landscape consists of flat to rolling plains, with mesas and buttes in some areas.



A view of Lake Meredith from a steep slope below Fritch Fortress.

Classification and Mapping

To classify the vegetation, 182 representative plots located in ALFL, LAMR, and surrounding environs were sampled during the summer of 2004. Analysis of the plot data using ordination and clustering techniques produced 29 vegetation communities, composed of one alliance, 18 existing associations and 10 additional associations that were newly described for this area. The vegetation of LAMR is quite diverse. Even with several previous vegetation studies, a number of new USNVC associations were described during the vegetation inventory.

A total of 34 map units were developed and cross-walked or matched to corresponding plant associations and land use classes for the entire project area (including both ALFL and LAMR). Within the boundaries of LAMR, the Upland Slopes/Rolling Hills Vegetation Complex is the most extensive vegetated map class, covering 17% of the NRA. Vegetation types were mapped to the association level, with a final overall accuracy of 86%.

Applications of the Vegetation Inventory

The Southern Plains Network (SOPN) has used the vegetation maps extensively in development and implementation of monitoring projects.

Research and Monitoring — SOPN has used vegetation map to select samples for monitoring, and has worked in conjunction with it partners to refine sample plots using the map.

Representative Vegetation Types at LAMR*		
Map Class	**Acres**	**% of Park**
Reservoirs	7,056	17%
Upland Slopes / Rolling Hills Vegetation Complex	6,879	17%
Steep Slope Vegetation Complex	5,948	14%
Honey Mesquite Shrubland Complex	4,313	10%
Drawdown Areas	4,213	10%
Perennial Bottomland / Upper Terrace/Valley Floor HV Complex	3,336	8%
Perennial Bottomland Grassland Complex	1,996	5%
Tamarisk spp. Temporarily Flooded Shrubland	1,919	5%
Sand Sagebrush / (Sideoats Grama, Hairy Grama) Shrubland	947	2%
Willow Baccharis Shrubland	912	2%

**Top 10 of 34 total mapped classes, representing 90% of LAMR. The mapping project mapped a larger area; these numbers are limited to what occurs within LAMR boundaries.*

Park Management — SOPN has done preliminary comparisons of vegetation types between parks to identify commonalities and opportunities for parks to cooperate on management.

Degraded areas are easily identified for consideration in prairie restoration efforts.

Education and Interpretative Programs — SOPN plans to make the vegetation mapping information available on a park website for the general public. The defined vegetation types will be useful for a variety of audiences. For example, birdwatchers can target certain areas for the specific species they seeking.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=2165615.



Upland Slopes/Rolling Hills Vegetation Complex.



Honey Mesquite Shrubland Complex.

LYNDON B. JOHNSON NATIONAL HISTORICAL PARK

2009
Texas

Park Character

Lyndon B. Johnson National Historical Park (LYJO) encompasses approximately 674 acres in two districts - the LBJ Ranch District near Stonewall, and the Johnson City District in the heart of Johnson City. Both units are managed to preserve and maintain the heritage of Lyndon B. Johnson, the 36th President of the United States. The park was authorized on December 2, 1969



The Lyndon B. Johnson ranch house, partially hidden by live oak trees. *NPS Photo*

as Lyndon B. Johnson National Historic Site and was redesignated as a National Historical Park on December 28, 1980.

The park is situated in the Texas Hill Country, approximately 60 miles north of San Antonio and 50 miles west of Austin. This unique terrain supports over 450 species of vascular plants and includes many examples of native plant communities indigenous to this area.

Classification and Mapping

To classify the vegetation, 36 representative plots located throughout the approximately 4,600 acre project area (including the park and its environs) were sampled during the summer of 2005. The final classification for LYJO resulted in eight associations and three alliances, three of which were newly described in the USNVC. In addition, during ground-truthing efforts, two more alliances and one distinctive stand of vegetation (a "park special") were described. The classification results reflect both the moderate amount of diversity of vegetation in the park and a respectably high number of native species. It is also notable that two of the three new vegetation classes, *Cynodon dactylon* Herbaceous Vegetation and *Bothriochloa laguroides – Sorghum halepense* Herbaceous Vegetation, represent disturbed vegetation. Non-natural and human-altered types comprise the greatest number of classified types, as well as the greatest spatial extent.

A total of 27 map classes were used for mapping cover types, 22 of which are known from within LYJO boundaries. Vegetation types were mapped to the alliance level, with an overall accuracy of 92%.

Applications of the Vegetation Inventory

Research and Monitoring — The Southern Plains Network (SOPN) has used the vegetation maps extensively in development and implementation of monitoring projects. SOPN has used vegetation maps to select samples for monitoring, and has worked in conjunction with its partners to refine sample plots using the maps.

Park Management — SOPN has done preliminary comparisons of vegetation types between parks to identify commonalities and opportunities for parks to cooperate on management.

Representative Vegetation Types at LYJO*		
Map Class	**Acres**	**% of Park**
Bermuda Grass Herbaceous Alliance	170	24%
Planted / Cultivated	157	22%
Silver Beardgrass - Johnsongrass Herbaceous Vegetation	61	9%
Plateau Live Oak Woodland Alliance	60	8%
Orchards / Vineyards / Groves	55	8%
Hairy Grama Herbaceous Alliance	39	6%
Transporation	33	5%
Post Oak - Blackjack Oak Woodland Alliance	22	3%
Pecan - (Sugarberry) Temporarily Flooded Forest Alliance	18	3%
Ashe's Juniper Woodland Alliance	12	2%

**Top 10 of 22 total mapped classes, representing 90% of LYJO. The vegetation inventory project mapped a larger area; these numbers are limited to what occurs within LYJO boundaries.*

Degraded areas are easily identified for consideration in prairie restoration efforts.

Education and Interpretative Programs — SOPN plans to make the vegetation mapping information available on a park website for the general public. The defined vegetation types will be useful for a variety of audiences. For example, birdwatchers can target certain areas for the specific species they are seeking.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047721.



Bermuda Grass Herbaceous Alliance.



Silver Beardgrass - Johnsongrass Herbaceous Vegetation.

SAND CREEK MASSACRE NATIONAL HISTORIC SITE

2005 - 2007 Colorado

Park Character

Sand Creek Massacre National Historic Site (SAND) is located on the high plains of southeastern Colorado in the rain shadow of the Rocky Mountains. The site occupies 12,500 acres that are authorized by Congress to protect, interpret, memorialize, and commemorate the Sand Creek Massacre. Within the authorized boundary, 1,555 acres have been acquired and established, and some portions of SAND are now open to the public.



Big Sandy Creek from near SAND.
Stephanie Neid

SAND is bisected by Big Sandy Creek, a sub-irrigated, intermittent stream typical of a sandy Great Plains riparian system. Loamy, level plains of shortgrass prairie and agricultural fields expand away from Big Sandy Creek to the north and east. Sandhills with sand sagebrush shrublands occupy the south and west side of Big Sandy Creek, much of which is in native rangeland. The authorized boundary of SAND surrounding the established boundary is in private ownership. It is surrounded by dryland agricultural fields and rangeland.

Classification and Mapping

The vegetation inventory project evaluated 31 vegetation plots and 48 additional data collection points within the established SAND boundary to classify and map the vegetation. Six plant associations of the USNVC were identified and described. Four additional non-natural mapping units were identified from the plot and observation point data to complete the map. In total, nine mapping units were used for the established SAND boundary, with one additional type (agriculture) used within the full authorized SAND study area. The most frequently occurring map unit within the entire project area was Blue Grama – Buffalograss Herbaceous Vegetation. The most abundant map unit in terms of area was Sand Sagebrush / Sand Bluestem. Vegetation types were mapped to multiple levels, with an overall thematic accuracy of 94%.

Applications of the Vegetation Inventory

Research and Monitoring — The Southern Plains Network (SOPN) has used the vegetation maps extensively in development and implementation of monitoring projects. SOPN has used vegetation maps to select samples for monitoring, and has worked in conjunction with its partners to refine sample plots using the maps.

Park Management — SOPN has done preliminary comparisons of vegetation types between parks to identify commonalities and opportunities for parks to cooperate on management. Degraded areas are easily identified for consideration in prairie restoration efforts.

Representative Vegetation Types at SAND*		
Map Class	**Acres**	**% of Park**
Sand Sagebrush / Sand Bluestem Shrubland	677	28%
Reclaimed agricultural land	558	23%
Sand Sagebrush / Grama (Sideoats, Blue) Shrubland	538	23%
Blue Grama - Buffalograss Herbaceous Vegetation	347	15%
Alakli Sacaton - Inland Saltgrass Herbaceous Vegetation	156	7%
Plains Cottonwood / Western Wheatgrass - Switchgrass Woodland	55	2%
Developed	37	2%
Bulrush Wet Meadow	12	0.5%
Disturbed	2	0.1%

**All 9 mapped classes, representing 100% of SAND.*

Education and Interpretative Programs — SOPN plans to make the vegetation mapping information available on a park website for the general public. The defined vegetation types will be useful for a variety of audiences. For example, birdwatchers can target certain areas for the specific species they are seeking.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=2165651.



Artemisia filifolia / Bouteloua gracilis Shrubland.



Artemisia filifolia / Andropogon hallii Shrubland.



Bouteloua gracilis – Buchloe dactyloides Herbaceous Vegetation.

WASHITA BATTLEFIELD NATIONAL HISTORIC SITE

2009 Oklahoma

Park Character

Washita Battlefield National Historic Site (WABA) was established in 1996 to preserve the battlefield where Lt. Col. George A. Custer led a surprise attack against the Southern Cheyenne village of Peace Chief Black Kettle in 1868, during the western expansion of the United States. WABA encompasses approximately 315 acres in a rural area of the Osage and High Plains section of western Oklahoma. This area is historically characterized as having vast tracts of tall and midgrass prairie interspersed with stands of oak and juniper. Wetlands are common in the area, including ponds, lakes and streams supporting cottonwood and other deciduous trees and shrubs.



Sunrise at Washita National Battlefield.

WABA occurs within a transitional area, and has historically supported plant species common to both the western and eastern portions of the United States. The vegetation at WABA contains a mix of native plants common to the western portion of Oklahoma and introduced non-native species. WABA has been described as supporting three general habitat types - riparian, sand dunes/hills, and disturbed old field vegetation.

Classification and Mapping

To classify the vegetation, 31 representative plots located throughout the approximately 924 acre project area (including the park and its environs) were sampled during the summer of 2005. The project identified 20 distinct plant associations and alliances, one of which was newly described in the USNVC. In addition, four more alliances, one more association and four distinctive stands of vegetation (park specials) were described.

A total of 27 map units were developed and directly cross-walked or matched to corresponding plant associations/alliances and land-use classes (four were outside park boundaries in the environs). Of all the map units, the most frequent was Eastern Cottonwood - American Elm - Sugarberry Forest. The most abundant map unit in terms of area was Big Bluestem – Yellow Indiangrass Western Great Plains Herbaceous. Vegetation types were mapped to the alliance level, with an overall thematic accuracy of 88%.

Applications of the Vegetation Inventory

Research and Monitoring — The Southern Plains Network (SOPN) has used the vegetation maps extensively in development and implementation of monitoring projects. SOPN has used vegetation maps to select samples for monitoring, and has worked in conjunction with its partners to refine sample plots using the maps.

Representative Vegetation Types at WABA*		
Map Class	**Acres**	**% of Park**
Big Bluestem - (Yellow Indiangrass) Herbaceous Alliance	68	21%
Little Bluestem - Sideoats Grama Herbaceous Alliance	40	13%
Cheatgrass Semi-Natural Herbaceous Alliance	36	11%
Sumpweed - (Cockleburr) Temporarily Flooded Herbaceous Vegetation	25	8%
Western Soapberry Woodland Alliance	24	7%
Blue Grama Herbaceous Alliance	23	7%
Eastern Cottonwood Temporarily Flooded Forest Alliance	21	6%
Western Wheatgrass Herbaceous Alliance	17	5%
Sand Bluestem Herbaceous Alliance	12	4%
Switchgrass Temporarily Flooded Herbaceous Alliance	11	3%

** Top 10 of 24 mapped classes, representing 85% of WABA. The vegetation inventory mapped a larger are; these numbers are limited to what occurs within WABA boundaries.*

Park Management — SOPN has done preliminary comparisons of vegetation types between parks to identify commonalities and opportunities for parks to cooperate on management.

Degraded areas are easily identified for consideration in prairie restoration efforts.

Education and Interpretative Programs — SOPN plans to make the vegetation mapping information available on a park website for the general public. The defined vegetation types will be useful for a variety of audiences. For example, birdwatchers can target certain areas for the specific species they are seeking.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1047736.



Big Bluestem – Yellow Indiangrass W. Great Plains Herbaceous Vegetation.



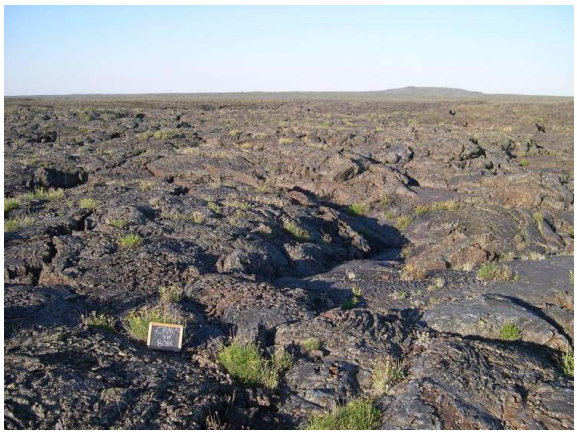
Little Bluestem - Sideoats Grama W. Great Plains Herbaceous Vegetation.

CRATERS OF THE MOON NATIONAL MONUMENT AND PRESERVE

2006 - 2009
Idaho

Park Character

Craters of the Moon National Monument and Preserve (CRMO) encompasses approximately 753,222 acres in south central Idaho. This unique area includes volcanic cones, craters, lava flows, and kipukas characteristic of the Great Rift on the broad Eastern Snake River Plain. CRMO is cooperatively managed by the NPS and Bureau of Land Management, and consists



Pahoehoe Lava Sparsely Vegetated Shrubland Complex.

of three main lava flows - the Craters of the Moon, Kings Bowl and Wapi lava fields.

This unique, moon-like terrain supports approximately 701 species of vascular plants, and includes examples of native plant communities common to cider fields and lava beds. The landscape within CRMO is characterized by ridges, slopes, shield volcanoes, cinder (tephra) cones (100-700 feet tall), lava cones, lava flows (Aa, Pahoehoe, and Blocky Pahoehoe), cracks and fissures, longitudinal sand dunes, and loess flats and plains. CRMO encompasses rugged to nearly flat topography.

Classification and Mapping

The classification resulted in 93 USNVC plant associations and 47 vegetation alliances. Of these, 92 were described at the plant association level and one was described at the alliance level. Sixty-one of the communities are shrubland types, including 59 upland shrubland associations, and two riparian shrubland types. Thirteen communities are classified as woodlands (six riparian), and 17 as herbaceous vegetation types (one wetland). Eighteen plant associations were considered semi-natural, dominated by non-native plant species. The map contains a total of 50 map units, 34 vegetated, three geology, and 13 land-use/land-cover classes. Overall accuracy of the final map was 82%.

Applications of the Vegetation Inventory

Research and Monitoring — The first application of the CRMO vegetation map was to delineate pika habitat using the information on the different types of lava, Aa and Pahoehoe. The American pika has emerged as another potential casualty of accelerated climate change in the western U.S. Presence-absence surveys of pika were conducted and then a 10-m digital elevation model and the vegetation map were used as predictors to model pika distribution. The model successfully predicted pika occurrence 81% of the time.

After accounting for elevation, pikas are more than twice as likely to occur on Pahoehoe lava flows, and are found only in the northern, higher elevation portions of CRMO. This finding has important implications for the long-term persistence

Representative Vegetation Types at CRMO*		
Map Class	**Acres**	**% of Park**
Pahoehoe Lava Sparsely Vegetated Shrubland Complex	143,065	30%
Wyoming Big Sagebrush Shrubland Alliance	110,019	23%
Barren Aa Lava	41,817	9%
Mountain Big Sagebrush Shrubland Alliance	37,530	8%
Aa Lava Sparsely Vegetated Shrubland Complex	36,485	8%
Juniper (Rocky Mountain, Utah) / Mixed Shrub Complex	16,121	3%
Wyoming Big Sagebrush / Cheatgrass - (Crested Wheatgrass) Shrubland Complex	13,970	3%
Limber Pine / Sagebrush spp. Woodland	9,998	2%
Barren Pahoehoe Lava	8,095	2%
Basin Big Sagebrush Shrubland Alliance	7,967	2%

**The top 10 of 43 mapped classes, representing 90% of CRMO. The vegetation inventory mapped a larger area; these numbers are limited to what occurs within CRMO boundaries.*

of pika in CRMO, which is completely isolated from other montane pika habitats. When viewed at a coarse scale, the extensive contiguous lava flows of CRMO appear to provide substantial habitat for the species. However, when considered at the scale of the vegetation map (minimum mapping unit is 25 meters), potential habitat is much less extensive and more fragmented.

The CRMO vegetation map is also currently being used in tandem with new satelite imagery and a new soils inventory to improve the delineation of kipukas, hundreds of isolated pockets of mostly undisturbed sagebrush steppe habitat found throughout the interior of the three lava fields. CRMO is in the process of pooling all research, photos, and other observations gathered across several hundred of these kipukas to form a geodatabase that will aide in the prioritization of future management efforts of these unique park resources.

The vegetation map has also been very helpful in monitoring efforts, especially with delineating sampling frames. For example, the Upper Columbia Basin Network has used the map to develop sampling frames for monitoring sagebrush steppe vegetation and limber pine population dynamics in CRMO. By overlaying target map class polygons with SSURGO soils coverages, and considering access points from roads and trails, the Network has been able to develop ecologically relevant and logistically feasible survey designs for this large park.

Future Applications

Research and Monitoring — Delineation of community types support novel syntheses of UCBN monitoring data. Predictive maps such those produced for the pika are planned for sagebrush steppe communities using the vegetation map, monitoring plot data, and other predictive GIS data to show areas of high risk of weed invasion and areas that have more resilience. Ideally, funds would be available in the future to update the vegetation inventory.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=2170231.

HAGERMAN FOSSIL BEDS NATIONAL MONUMENT

2006 - 2009 Idaho

Park Character

Hagerman Fossil Beds National Monument (HAFO), situated within the Great Basin, encompasses approximately 4,351 acres of the Snake River canyon in south-central Idaho. Elevation ranges from 2,800 to 3,500 feet. The majority of the Monument is comprised of steep canyon walls, but it also includes flat areas on both sides of the River. Flat areas adjacent to the Monument are



Big sagebrush with cheatgrass understory.

used primarily for agricultural purposes such as cultivation of corn and potatoes. Historically, vegetation was a mix of sagebrush-bunch grass steppe on the uplands, juxtaposed with narrow bands of riparian vegetation along streams and rivers. Human disturbance has introduced many non-native species, and natural plant communities now appear to be located in isolated patches on benches and on steeper slopes.

Classification and Mapping

The project area covered roughly 21,000 acres including and surrounding HAFO. Thirty-eight map classes were identified for the study area (21 vegetated, 17 non-vegetated). Of all the map units, the most frequent were *Elaeagnus angustifolia* Woodland Alliance and *Bromus tectorum* / *Sisymbrium altissimum* Herbaceous Vegetation. The most abundant map unit in terms of area was Planted / Cultivated (representing agricultural fields in the environs) and *Artemisia tridentata* spp. *wyomingensis* / *Bromus tectorum* Shrubland Alliance. Vegetated map classes were mapped at mixed levels, with an overall accuracy rate of 87% (78% for the binary assessment).

Applications of the Vegetation Inventory

A large and fast-moving wildfire burned 75% of Hagerman Fossil Beds National Monument in August 2010. The Burned Area Emergency Rehabilitation (BAER) team and the Upper Columbia Basin Network Inventory and Monitoring Team (UCBN) were poised for action and able to respond quickly to the event. The UCBN provided GIS support, including burn intensity maps with overlays of vegetation plot locations and measurement values, as well as plot and landscape photos obtained during vegetation field surveys prior to the burn. The vegetation map completed in 2009 provided baseline information of existing habitat that burned. The UCBN sagebrush steppe vegetation monitoring protocol had been implemented in the park in 2008 and 2009, and pre-burn data of plant and bare ground cover estimates were available from 380 plots distributed throughout the intensity range of subsequently burned and unburned areas of the park. The design of the UCBN sagebrush-steppe protocol will enable both

Representative Vegetation Types at HAFO*		
Map Class	**Acres**	**% of Park**
Wyoming Big Sagebrush / Cheatgrass Shrubland Alliance	1,120.4	26%
Wyoming Big Sagebrush Shrubland Alliance	667.3	15%
Sparsely Vegetated Badlands Complex	607.3	14%
Cheatgrass / Tumble Mustard Herbaceous Vegetation	578.5	13%
Badlands	408.1	9%
Rubber Rabbitbrush spp. Shrubland Complex	253.9	6%
Basin Big Sagebrush / Cheatgrass Shrubland Alliance	225.2	5%
Black Greasewood Intermittently Flooded Shrubland Alliance	99.4	2%
Russian Olive Woodland Alliance	66.4	2%
Bitterbrush Shrubland Alliance	59.4	1%

**The top 10 of 27 mapped classes, representing 95% of HAFO. The vegetation inventory mapped a larger area; these numbers are limited to what occurs within HAFO boundaries.*

short-term monitoring of BAER restoration and long-term monitoring of ecosystem trends.

Future Applications of the Vegetation Inventory

Ideally, funds would be available in the future to update the vegetation inventory for each Park. This will allow managers to monitor change in vegetation over time. Novel syntheses of monitoring data, the park vegetation map, and other GIS information such as remotely-sensed estimates of primary productivity, topography, and distance to roads and the park boundary are forthcoming by the UCBN to show areas that are at high risk of weed invasion and other areas that have more resilience.

For the full vegetation classification, map, report, and other products, visit http://nrinfo.nps.gov/Reference.mvc/Profile?Code=1049314



Common spikerush herbaceous vegetation.



Shadscale / Indian ricegrass community.

The Department of the Interior protects and manages the nation's natural resources and cultural heritage; provides scientific and other information about those resources; and honors its special responsibilities to American Indians, Alaska Natives, and affiliated Island Communities.

NPS 909/107245, March 2011

National Park Service
U.S. Department of the Interior



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