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Natural Resource Stewardship and Science

A Vegetation Classification and Map

Pecos National Historical Park

Natural Resource Technical Report NPS/SOPN/NRTR–2012/601

ON THE COVER
View of Pecos National Historical Park looking southeast to Glorieta Mesa (photo: Yvonne Chauvin).

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Natural Resource Technical Report NPS/SOPN/NRTR–2012/601

Authors
Esteban Muldavin, Yvonne Chauvin, Teri Neville, Lisa Arnold, Paul Arbetan, and Anthony Fettes
Natural Heritage New Mexico Division
Museum of Southwestern Biology
University of New Mexico, Albuquerque, NM

Paul Neville
Earth Data Analysis Center
University of New Mexico, Albuquerque, NM

Project Coordinator

Rob Bennetts
National Park Service
Southern Plains Network
Johnson City, TX 78636

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Acronyms and Abbreviations

AA	Accuracy Assessment
DOQQ	Digital Orthophotograph Quarter Quadrangle
ERDAS	Earth Resource Data Analysis System
ESRI	Environmental Systems Research Institute
ETM	Enhanced Thematic Mapper
FGDC	Federal Geographic Data Committee
GIS	Geographic Information System
GPS	Global Positioning System
IFOV	Instantaneous Field of View
I&M	Inventory and Monitoring Program
ITIS	Integrated Taxonomic Information System
MU	Map Unit
NDVI	Normalized Difference Vegetation Index
NDSVI	Normalized Difference Senescent Vegetation Index
NGO	Non-governmental Organization
NHNM	Natural Heritage New Mexico
NPS	National Park Service
NRCS	Natural Resource Conservation Service
NVC	National Vegetation Classification
NVCS	National Vegetation Classification Standard
PA	Plant Association
PECO	Pecos National Historical Park
SOPN	Southern Plains Network
TNC	The Nature Conservancy
UNM	University of New Mexico
USDA	United States Department of Agriculture
USGS	United States Geological Survey

Executive Summary

A vegetation classification and high-resolution vegetation map were developed for Pecos National Historical Park, New Mexico as part of the U.S. Geological Survey (USGS)-National Park Service (NPS) National Vegetation Mapping Program. The monument is located in the foothills of the Sangre de Cristo Mountains in north-central New Mexico (between Santa Fe and Las Vegas). At 2,423 ha (5,988 ac) in size, the park is known for its rich tapestry of historical Native American, Spanish, and Anglo-American cultural legacies set against a backdrop of rolling plains, mesas, mountain foothills, and stream and river valleys. In this complex landscape, we find Douglas-fir and ponderosa pine forests at the higher elevations and northern aspects of the foothill canyons and ridges, pinyon-juniper woodlands extending down the south-facing slopes, and plains and mesas at the mid elevations. Intermixed among the woodlands are extensive grasslands dominated by blue grama-dominated grasslands. Much of this grassland was created and maintained by clearing ponderosa pine and pinyon-juniper woodlands in modern times. Along the stream and river courses, narrowleaf cottonwood forests and coyote willow shrublands are found, as well as small patches of herbaceous wetlands. The riparian zone of the Pecos River within the park is one of the finest examples found in northern New Mexico. We formally described this vegetation pattern following the National Vegetation Classification Standard (NVCS) and identified 46 plant associations among 13 NVC groups based on 223 field plots. The vegetation classification was used in turn to define a suite of vegetation map units. The vegetation map was developed using a combination of automated digital processing (supervised classifications and image segmentation) and direct image interpretation of 2005 high-resolution, color, aerial ortho-photography in combination with 2006 DigitalGlobe QuickBird satellite imagery. The map was designed to facilitate ecologically based natural resources management at a 1:12,000 scale with a 0.25-ha minimum map unit size. The map legend was hierarchically structured with an upper Level 1 of 10 map units; eight of these correspond to the Group Level NVCS and two are miscellaneous land-cover classes. Level 2 is a further refinement composed of 24 nested map units defined by specific plant associations in the vegetation classification that reflect variations in plant community structure as well as species composition within the broader Level 1units. Overall accuracy at Level 1 was estimated at 95.3% and 80.5% at Level 2 based on 339 independent field samples. For many natural resource management applications, Level 1 units will likely be sufficient and most appropriate, while Level 2 units provide added fine-scale information within major ecological groups. To support the map as a management tool, an annotated map legend is provided along with descriptions of each plant association, a corresponding diagnostic key, field forms, and a plant species list. The map was delivered in both hard copy and digital form as part of a geographic information system (GIS) compatible with that used in the park and the USGS-NPS mapping program. The GIS allows flexibility to update the map as new information becomes available or as major vegetation changes, such as fire, disease or other impacts, occur in the park.

Acknowledgements

This project was supported by the USGS-NPS National Vegetation Mapping Program and the Southern Plains Network as part of a cooperative agreement with Natural Heritage New Mexico. At NHNM, Amanda Kennedy, Charlie Jackson, and Eric Lindahl provided fieldwork and data entry support; Rebecca Keeshen provided management support and editorial review. Heidi Sosinski and Robert Bennetts from the NPS Southern Plains Network provided logistical support, consultation, and editorial review; Tom Forsyth and Lynelle Wright at the NPS Intermountain Region assisted with contract development. From the USGS-NPS Vegetation Mapping Program national office, important guidance and review were provided by Karl Brown, Tammy Hamer, and Chris Lea.

Introduction

Background, scope, and products

Pecos National Historic Park was established in 1965 to protect the legacy of a cultural heritage in the Southwest that dates back to 600 CE or earlier, and extends through the Spanish Colonial period beginning in 1540 to that of Anglo-American settlement in the mid-nineteenth century into the late twentieth century. This rich historical tapestry is set against the backdrop of a diverse landscape of fertile river and stream valleys surrounded by rolling hills and mountain footslopes that supported a wide variety of grasslands, shrublands, woodlands and forests. While the park is known for its outstanding archeological sites, the National Park Service has sought to manage the biological resources with the same care and attention as given to cultural values. Accordingly, along with comprehensive biological inventories and monitoring, a key to effective biological management is the development of high-resolution vegetation maps that can support such activities as flora and fauna habitat modeling, recreation planning, fire management, ecological research, and broad-scale facilities planning.

To meet this objective, the U.S. Geological Survey (USGS)-National Park Service (NPS) Vegetation Mapping Program and the NPS Southern Plains Network (SOPN) of parks in cooperation with Natural Heritage New Mexico (NHNM, a division of the Museum of Southwestern Biology at the University of New Mexico), and the staff at Pecos National Historical Park (PECO), set out to develop vegetation maps that meet or exceed USGS-NPS standards of 1:24,000-scale and 0.5-ha minimum map unit size (USGS 2010). The maps were based on high-resolution aerial photography along with extensive ground sampling. The project was initiated in 2006 with ensuing field surveys of the vegetation communities through 2011. The vegetation survey data were entered into a database and used to develop a park-wide vegetation classification following the National Vegetation Classification System (FGDC 1997, 2008; Grossman et al. 1998) guidelines.[*] Then, using the vegetation classification and associated ground control points, vegetation maps were generated at a 1:12,000 scale using a combination of automated image analysis (image segmentation and supervised classifications) and direct image interpretation. Map units were designed to support ecologically based natural resources management with an emphasis on use in fire and wildlife management.

We provide here the details on how the maps were constructed, an overview of the classification and ecology of the vegetation communities of the monument, the vegetation maps with associated map unit descriptions, plant community descriptions and a diagnostic key, and a vouchered species list. The maps are presented in both paper and digital form as part of a geographic information system (GIS) compatible with that used in the park and national USGS-NPS national mapping program. In addition, all field data were compiled into a relational database compatible with USGS-NPS database guidelines, and all data and report elements made

[*] See Federal Geographic Data Committee, Vegetation Subcommittee Vegetation Classification Standard Version 1.0 (1997) and 2.0 (2008) at http://www.fgdc.gov/standards/projects/FGDC-standards-projects/vegetation/.

ready for web-based applications. Finally, we provide an accuracy assessment that reflects both user and producer confidence in the map.

The USGS-NPS Vegetation Characterization/Mapping Program

The USGS-NPS Vegetation Characterization Program is a cooperative effort by USGS and NPS to classify, describe, and map vegetation communities in more than 280 national park units across the United States. Consistent vegetation classification, mapping, and accuracy assessment protocols and standards are applied across projects supported by this program. The National Vegetation Mapping Program is administered by the USGS Center for Biological Informatics in cooperation with the NPS Inventory & Monitoring (I&M) Program and its Vegetation Mapping Inventory. Through implementation of the NPS Natural Resource Challenge (NPS 1999), significant funding became available for completing important natural resource baseline inventories in park units, including vegetation classification and mapping. This support provided NPS with the opportunity to move forward with dozens of new park unit vegetation classification and mapping projects, including PECO. Vegetation classification and mapping products produced by this program are incorporated into the USGS National Biological Information Infrastructure Program, which serves as an information-sharing network (see: http://biology.usgs.gov/npsveg/).

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

- Vegetation classification guidelines: National Park Service Vegetation Inventory, version 2.0 (Lea 2011);
- Thematic accuracy assessment procedures: National Park Service Vegetation Inventory, version 2.0. (Lea and Curtis 2010) ;
- National Vegetation Classification Standard (FGDC 2008);
- Spatial Data Transfer Standard (FGDC 1998b);
- Content Standard for Digital Geospatial Metadata (FGDC 1998a);
- United States National Map Accuracy Standards (USGS 1999);
- Integrated Taxonomic Information System;
- 12-Step Guidance for NPS Vegetation Inventories.

Park Environment

Location and cultural setting

PECO is located in north-central New Mexico in the Pecos River Valley some 45 km (25 mi) south and east of Santa Fe (Figure 1). The park consists of 2,699 ha (6,670 ac) that are split into the main Pecos Unit (2,423 ha 5,988 ac) and the satellite Glorieta Battlefield Unit (276 ha; 682 ac) comprised of the Pigeon's Ranch and Cañoncito Sub-units. The former contains the ancient Pecos Pueblo and colonial Spanish ruins along with the Forked Lightning Ranch donated to the park in 1990 (Figure 2). Glorieta Unit was also added in 1990 for the express purpose of preserving the Civil War Glorieta Battlefield features (Johnson et al. 2011) (Figures 3 and 4).

> "Historically, the Pecos River Valley was a diverse area, with successive populations funneling through it. Paleo-Indians, archaic people, basket makers, and Puebloan peoples

all left evidence of early use and settlement in the valley. At PECO, a fortress-like pueblo was established during the 15th century and became a trading center for the region. The Spanish established a mission at PECO in the late 16th century. PECO became a trading post in the 19th century, and was later used for military expeditions during the U.S.–Mexican and Civil Wars. The Battle of Glorieta, which occurred at this site, is considered one of the most important southwestern battles of the Civil War (NPS, Southern Plains Network 2008).

In addition, while the park is surrounded by livestock ranches, the park itself has been excluded from grazing since 1976, providing a benchmark for comparison to the surrounding managed landscape.

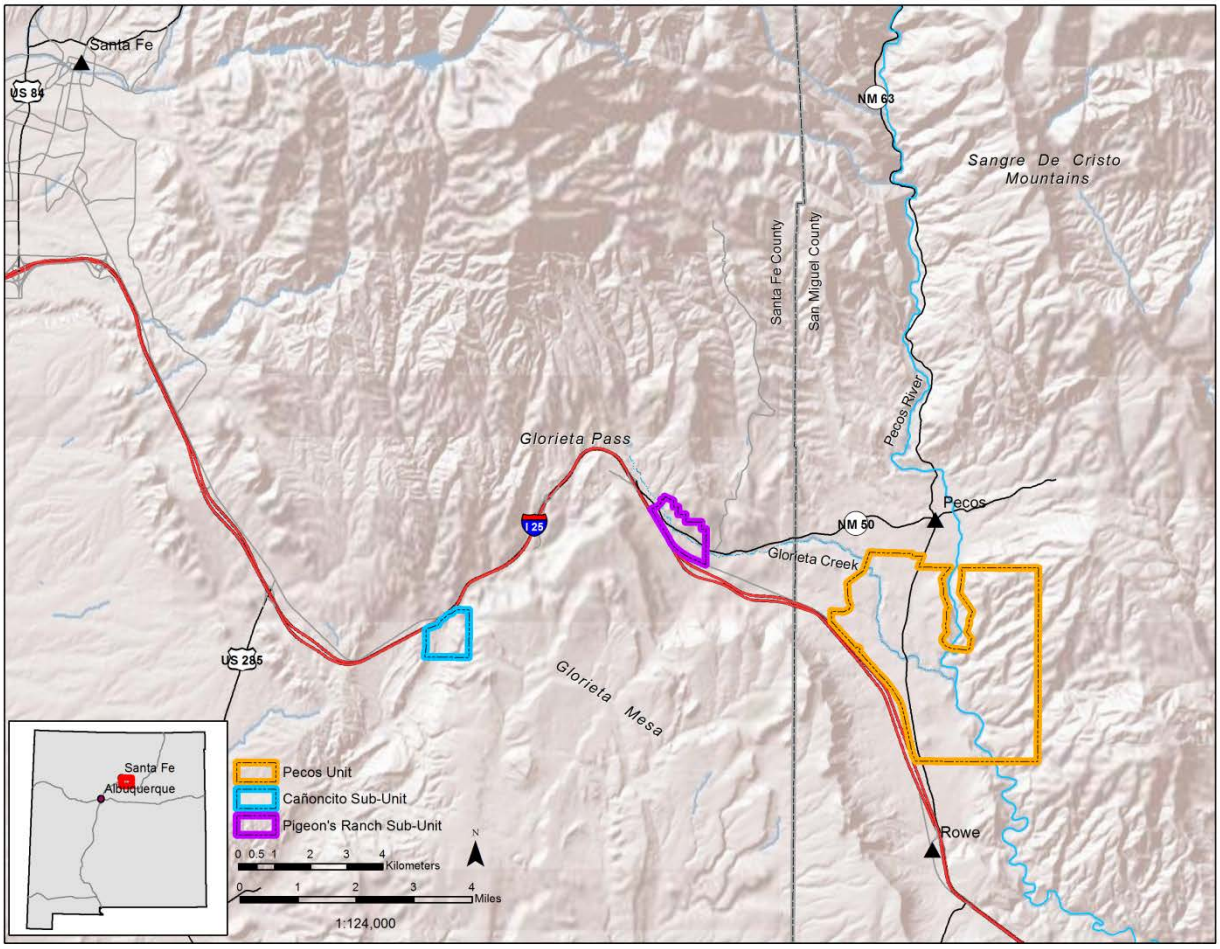

Figure 1. Pecos National Historical Park main unit is located just south of the town Pecos, NM in north-central New Mexico. The additional Glorieta Battlefield Unit is composed of the Pigeon's Ranch and Cañocito Sub-units to the east and west of Glorieta Pass, respectively.

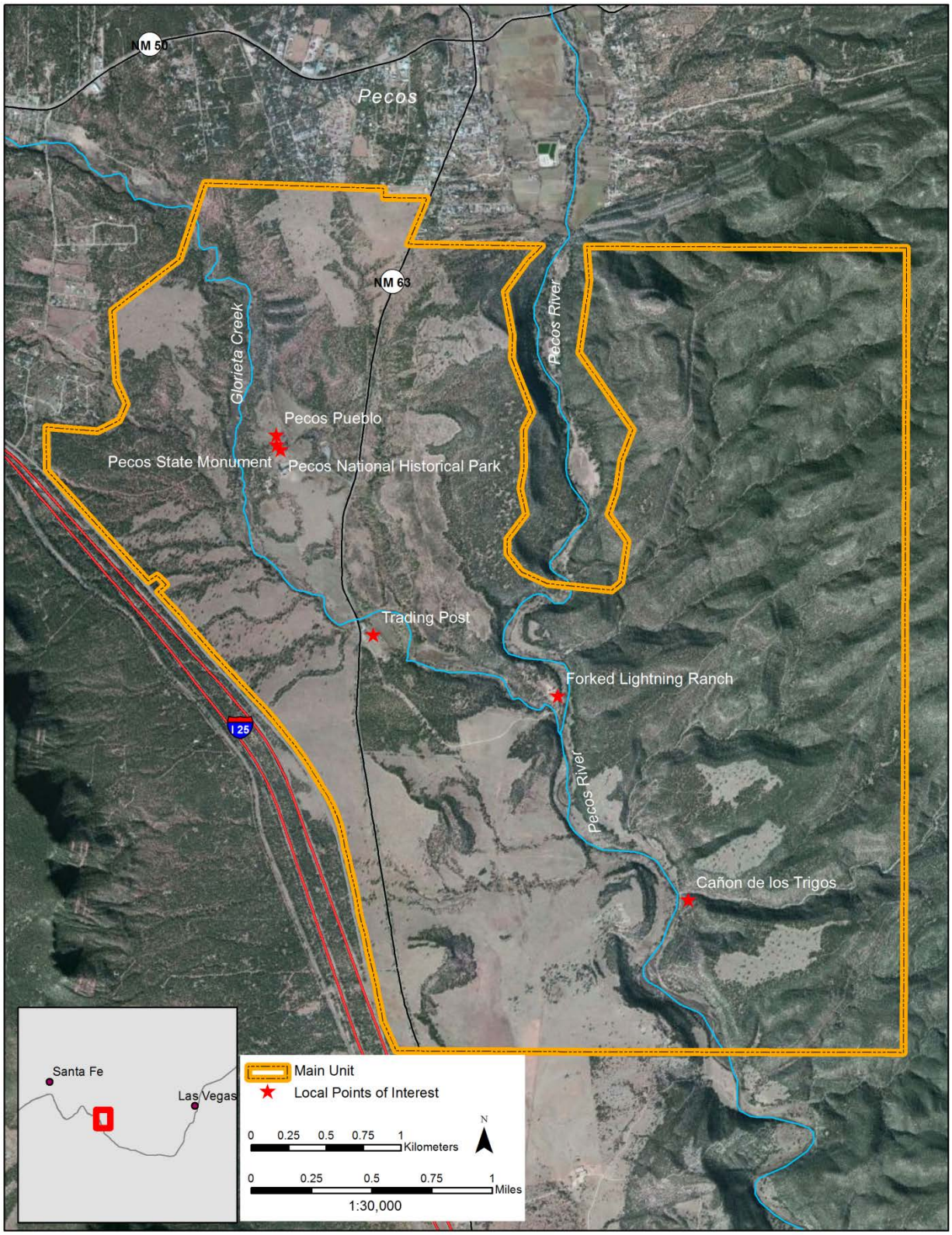

Figure 2. Pecos National Historical Park Main Unit detail.

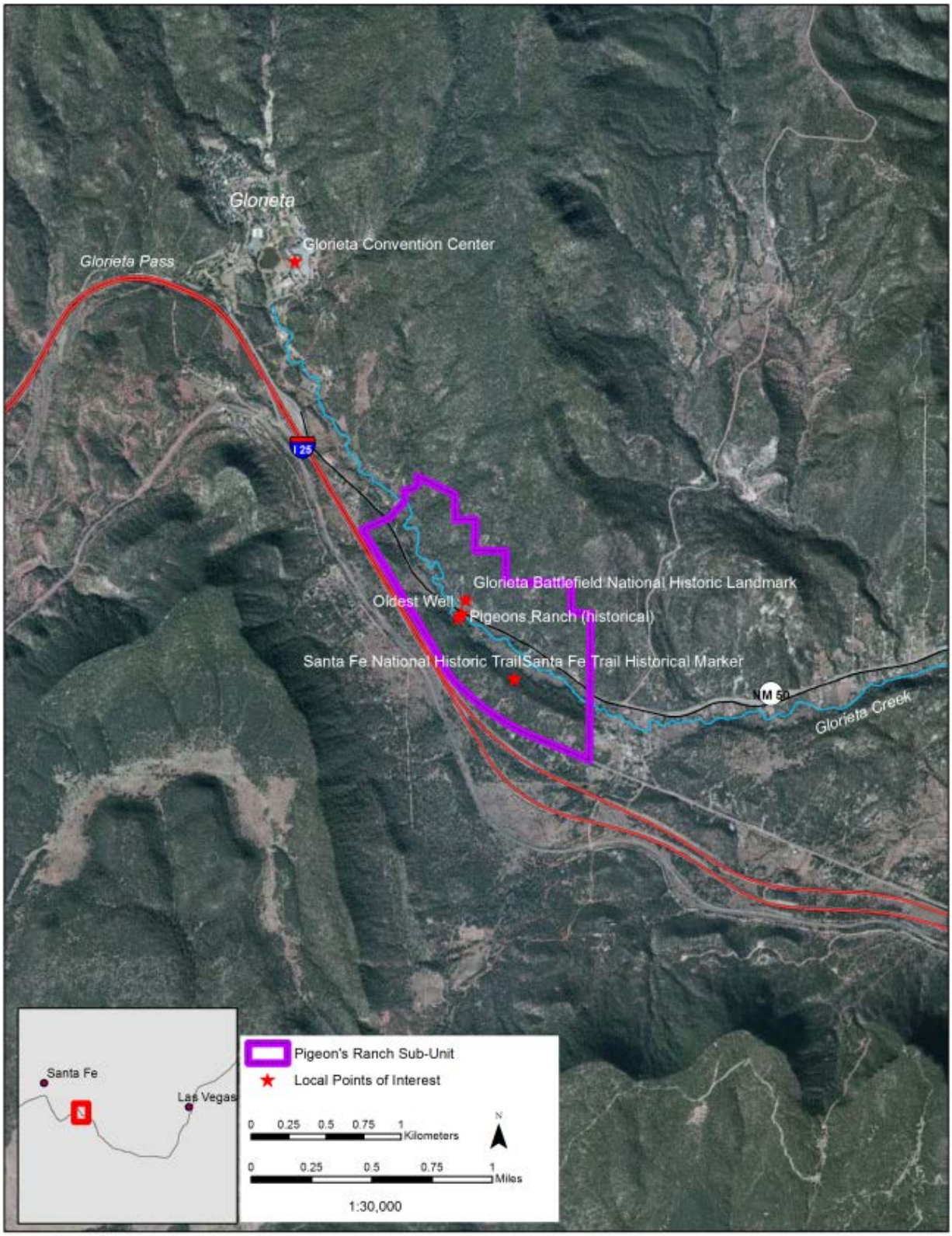

Figure 3. Pecos National Historical Park Pigeon's Ranch Sub-unit of the Glorieta Battlefield Unit.

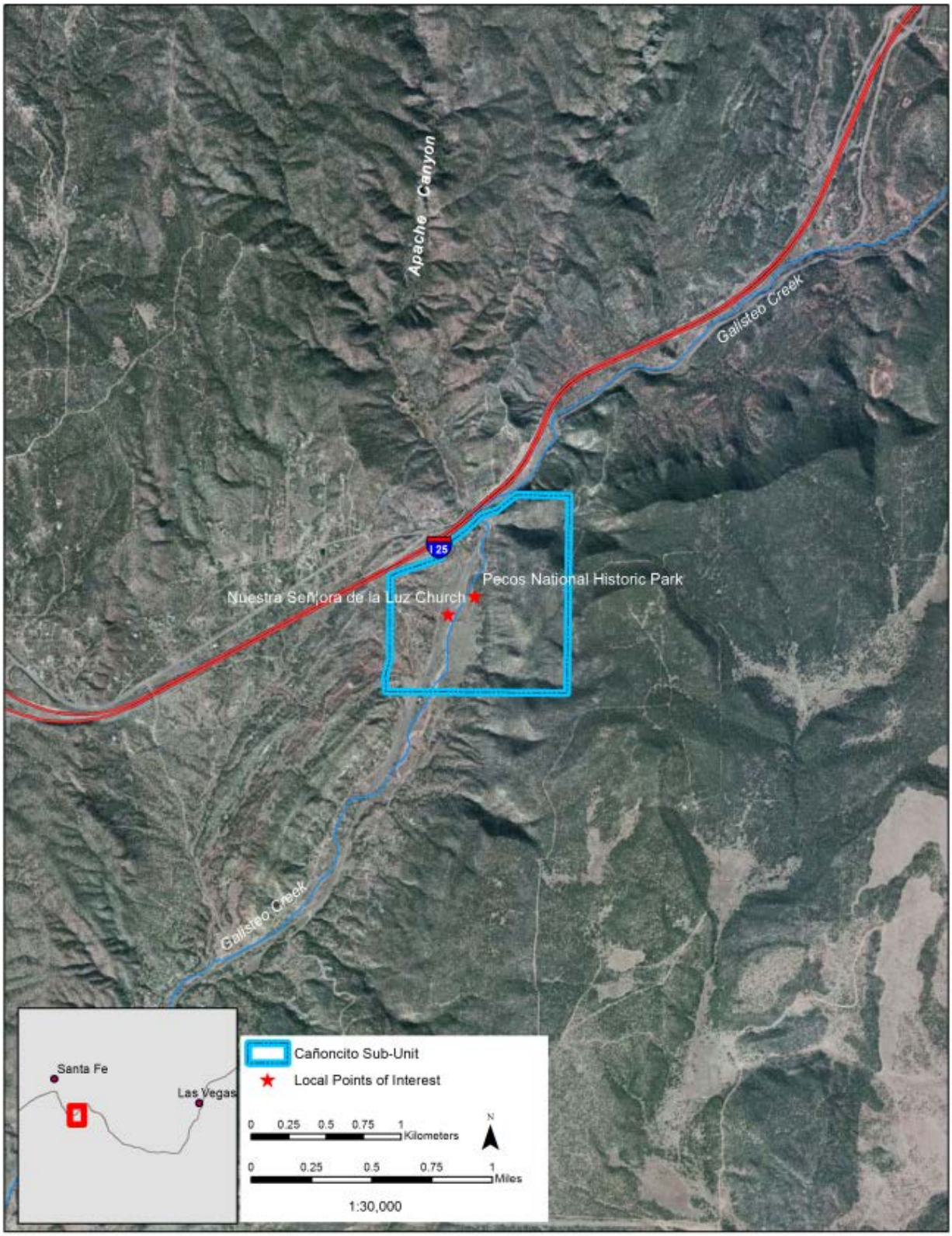

Figure 4. Pecos National Historical Park Cañoncito Sub-unit of the Glorieta Battlefield Unit.

Climate

The climate of PECO is fundamentally semi-arid and continental, with cool-to-cold and predominantly dry winters followed by warm and usually moist summers. The mean annual precipitation is 412 mm (16.2 in) as recorded at Pecos, New Mexico (station 296676) between 1916 and 2012 (Figure 5). About 70% of precipitation (286 mm; 11.3 in) falls in the summer months as part of both the Arizona monsoon and storms out of the Gulf of Mexico (particularly in hurricane season). The winter precipitation (126 mm; 5.0 in) comes mostly in the form of snow out of the north Pacific, following a southerly path across the continent between November and March.

With respect to temperature, winters can be cold, with mean monthly minimums dipping below freezing from November into April with an extreme daily low of -34°C (-29°F) (Figure 6). Fall freezes are likely to occur by the first week in October or earlier, and the last freeze can extend into the middle of May or later. Summers are warm to hot with July the warmest month at 29.6°C (85.3°F) on average; daily extremes can reach 37.8°C (100°F).

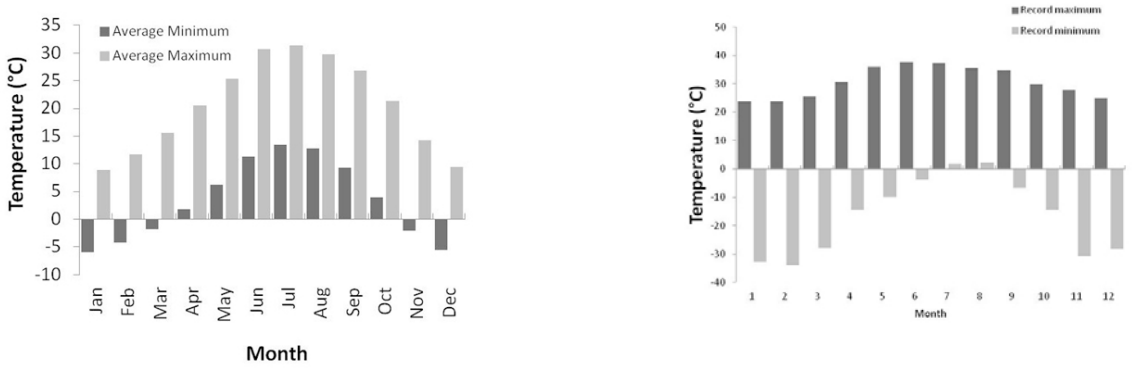

Figure 5. a) average monthly minimum and maximum daily temperatures, and b) record monthly minimums and maximums at Pecos National Historical Park, NM (Coop station 296676; Western Regional Climate Center http://www.wrcc.dri.edu retrieved March 08, 2012.).

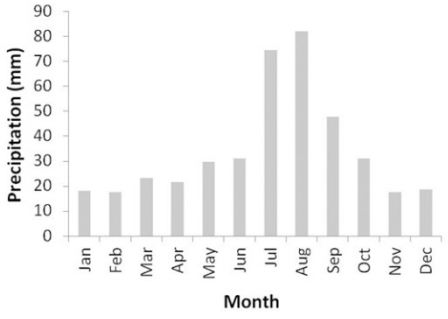

Figure 6. Average monthly precipitation distribution at Pecos National Historical Park, NM. Summer rainfall predominates, but in any given year winter precipitation can be significant, particularly in years where the El Niño/Southern Oscillation (ENSO) index is positive (i.e., an El Niño year). (Coop station 296676; Western Regional Climate Center http://www.wrcc.dri.edu retrieved March 08, 2012.).

Physical setting

Physiographically, PECO lies within the upper Pecos River Valley, nestled against the foothills of the Southern Rocky Mountains. The primary ruins of the main Pecos Unit lie to the west of the river on an elevated, gently rolling plain or "mesilla" that is also bisected by the northwest-to-southwest trending Glorieta Creek (see Figure 2). Glorieta Creek itself is entrenched some five to ten meters below the mesilla surface. At the Pecos River, the mesilla dramatically drops off an escarpment into the river canyon below. The river is some 10-15 meters wide, and unlike Glorieta Creek, not significantly entrenched. It supports vigorous riparian and wetland vegetation communities as well as cold-water sport fishery. Across the river to the east lie the foothills of the Sangre de Cristo Mountains. The foothills are dissected by a series of northeast- to-southwest trending ephemeral drainages that form steep and rugged canyons, creating a de-facto wilderness in the eastern portion of the park (most roads are now seldom travelled as well). This unit of the park has been out of livestock grazing since establishment.

The Pigeon's Ranch Sub-unit sits similarly on rolling plains west of the main unit 4 km (2.5 miles) and also has a section of Glorieta Creek running through it (see Figure 3). The Cañoncito Sub-unit lies over the divide at the west entrance to Glorieta Pass and captures a portion of the west escarpment face of Glorieta Mesa (see Figure 4 and the geology description below). At the base of the escarpment is a south-trending ephemeral/intermittent stream channel which is in turn is bounded to the west by a set of low hills that extend to the unit boundary.

With respect to geology, soils, and hydrology, Johnson et al. (2011) in their overview of park resources state:

> PECO sits in the Pecos River Valley in the foothills of the Sangre de Cristo Mountains (Rawling 2010). The park is located in a transition zone of three geophysical provinces: Southern Rocky Mountains, Great Plains, and Basin and Range. The conjunction of these three provinces creates a diversity of geologic features at the park (Figures 7, 8, & 9). The rock layers at PECO are mainly horizontal with minor structural undulations. The shales and sandstones forming these rock layers were formed from sediments shed from the Ancestral Rocky Mountains (NPS 2006). The pueblo and mission were built on a low ridge of red, maroon, and purple mudstones and tan-to-red sandstones and conglomerates of the Sangre de Cristo Formation, which were deposited by meandering rivers on floodplains over 280 million years ago (mya). Surrounding the ruins and covering much of the valley floor are much younger Pleistocene sand and gravel layers deposited by the Pecos River 150,000 to 300,000 years ago (Rawling 2010).
>
> The most distinctive geologic feature is Glorieta Mesa, visible to the west of the park. The base of the mesa is formed from river and floodplain deposits of the Sangre de Cristo Formation (>286 mya, grayish red and gray Pennsylvanian sandstones). The mesa contains additional rock formations, including the Santa Rosa Formation (yellow Triassic sandstone), Moenkopi Formation (245 mya, grayish-red Triassic sandstones), Artesia Formation (orange Permian siltstones), Glorieta Formation (yellow sandstone), and Yeso Formation (<286 mya, reddish-brown Permian sandstones and siltstones) (NPS 2006). The rocks of the Yeso Formation were deposited in coastal tidal flats called *sabkhas* (Rawling 2010*)*. A portion of the west end of the mesa lies within the Cañoncito Sub-unit.

North, northeast, and northwest of the park are the Sangre de Cristo Mountains, underlain by Madera limestones and sandy limestones. The oldest rocks in the area, igneous and metamorphic rocks over one billion years old, have been uplifted along faults and are visible in the exposed summits of Glorieta Baldy, Thompson Peak, and Santa Fe Baldy (Rawling 2010).

Most of PECO lies in the Upper Pecos River Valley. Four miles of the Pecos River lie within the park boundary. Additional surface waters include Glorieta Creek, a riparian restoration area, a pond, and several marshy habitats. The section of the Pecos River that flows through PECO has been classified as impaired due to temperature and turbidity levels exceeding federal standards. The Pecos River has been experiencing a decline in water quality and quantity because of drought conditions and from upstream activities outside of the park (NPS, Southern Plains Network 2008).

Soils of the Pecos Unit are identified as Vibo-Ribera and Ribera-Sombordoro-Vibo associations, and Tuluso-Sombordoro-Rock outcrop and Laporte-Rock outcrop complexes. There are frequently flooded soils on the Pecos River and Glorieta Creek floodplains. The upland soils vary from deep fine sandy loams on relatively flat slopes to very shallow stony loams on the ridges. Generally the park's soils are moderately to well drained, have moderate permeability and erosion hazards, and moderate-to-severe limitations for construction. Soils of the Glorieta Unit are identified as Cueva very stony clay, Capillo-Rock outcrop complex, Ortiz gravely loam, Prewitt loam and Rednum loam. These soils generally have moderate-to-slow permeability, medium-to-very-rapid runoff, and severe-to-very-severe erosion hazards. Soils in the Cañoncito Sub-unit were mapped as Pojoaque-Rough broken land complex, Travessilla-Rock outcrop, and Fivemile loam, potentially a prime agricultural soil. These soils have moderate permeability, medium-to-rapid runoff, and moderate-to-severe erosion hazards (NPS 1995).

Previous botanical and vegetation studies

With respect to botanical surveys, Sivinski (1995) indentified 353 plant species from the main park unit. Out of eight potential sensitive species, he found only one, *Asclepias uncialis* (dwarf milkweed), a federal C2 candidate species. Johnson et al. (2010) conducted surveys in 2008 in the Pigeon's Ranch and Cañoncito Sub-units that were focused on sensitive species. While they did not detect any sensitive species, they reported 45 and 112 plant species for Pigeon's Ranch and Cañoncito, respectively. Folts-Zettner et al. (2010) surveyed for exotic and invasive species and reported 18 species of concern in 2009.

Muldavin (1991) conducted a riparian and wetlands survey along the Pecos River within the park. He installed 10 river cross-sections to measure channel and floodplain geomorphology in order to model flood flows in relation to vegetation composition. One or more vegetation plots were established on each cross-section line and full species composition and abundance recorded along with soil characteristics from a hand auger hole. He identified 15 plant associations among the *Populus angustifolia* (narrowleaf cottonwood), *Salix exigua* (sandbar willow), *Typha latifolia* (cattail), *Carex aquatilis* (water sedge), *Bouteloua gracilis* (blue grama), *Pinus edulis* (pinyon pine), *Poa patensis* (bluegrass), and *Ericameria nauseosa* (rubber rabbitbrush) alliances (series). These data were later integrated into the statewide riparian/wetland classification of Muldavin et

al. (2000) and are integrated here as part of the vegetation classification reported below. At the same time, Muldavin (1991) constructed a plant association-scale vegetation map of the riparian communities along the river at 1;6,000 scale. Although no longer available in a digitized format from NPS, the hard-copy map information was also used to inform the map presented here.

A riparian and wetland vegetation assessment was conducted on Glorieta Creek in 1997 as part of a larger restoration project (Muldavin et al. 1997). Nine associations were provisionally identified within the riparian zone in the lower portion of Glorieta Creek near its confluence with the Pecos River. This information has also been integrated into the classification presented here. Wagner and Martin (2011) conducted an assessment of both Glorieta Creek and the Pecos River using the proper functioning condition (PFC) assessment tools.

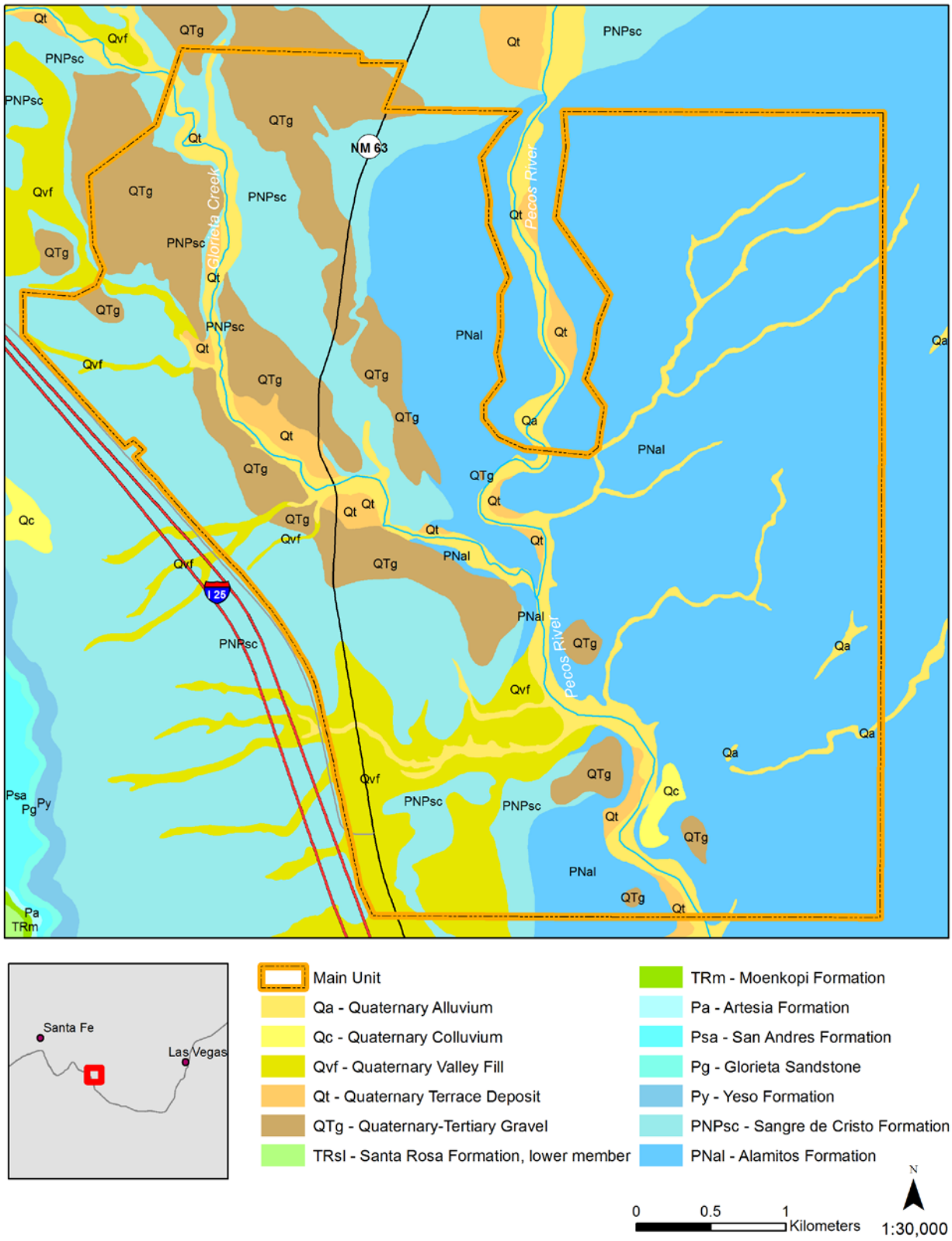

Figure 7. The geology of Pecos National Historical Park Main Unit as mapped by Rawling (2010).

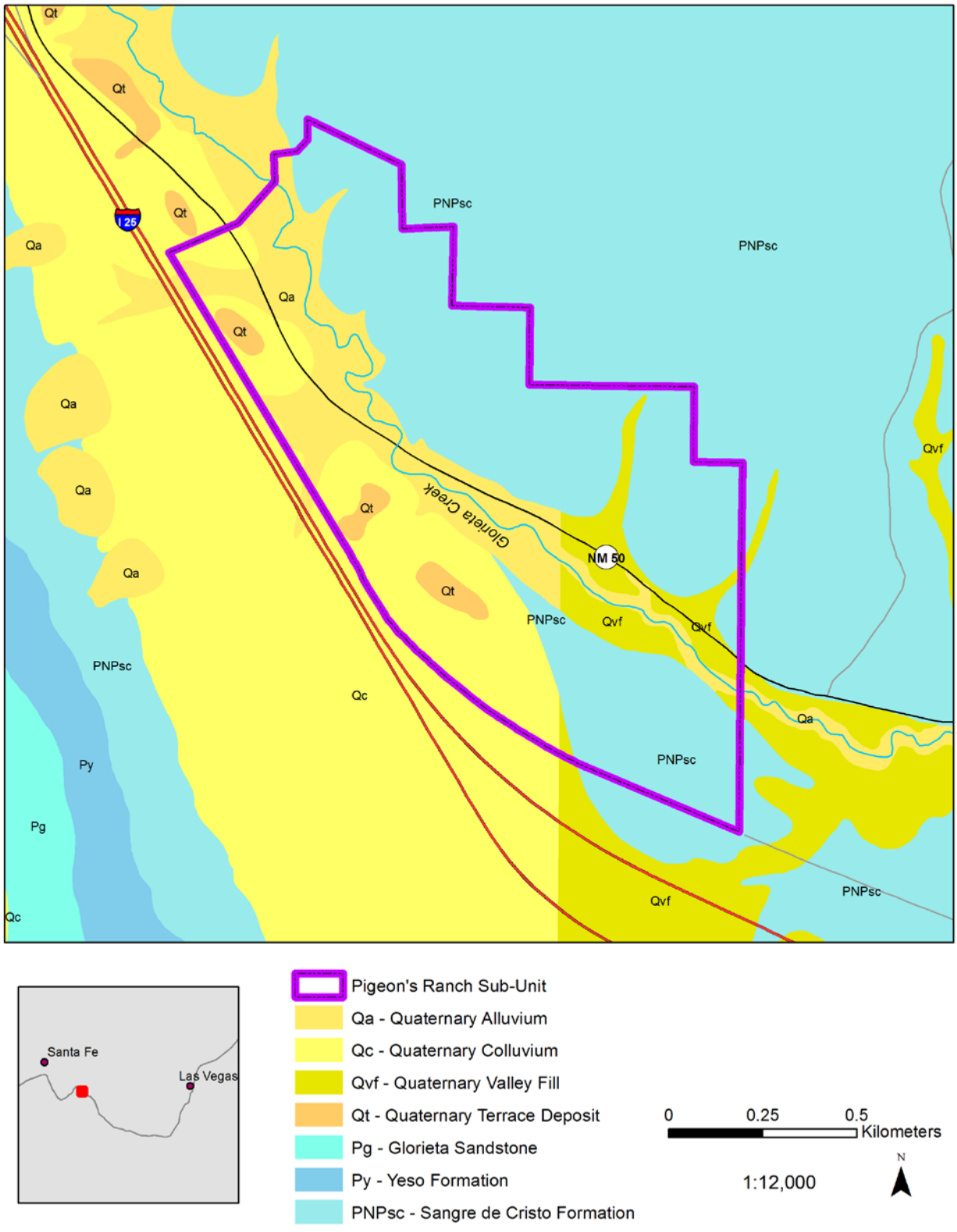

Figure 8. The geology of Pecos National Historical Pigeon's Ranch Sub-unit as mapped by Rawling (2010).

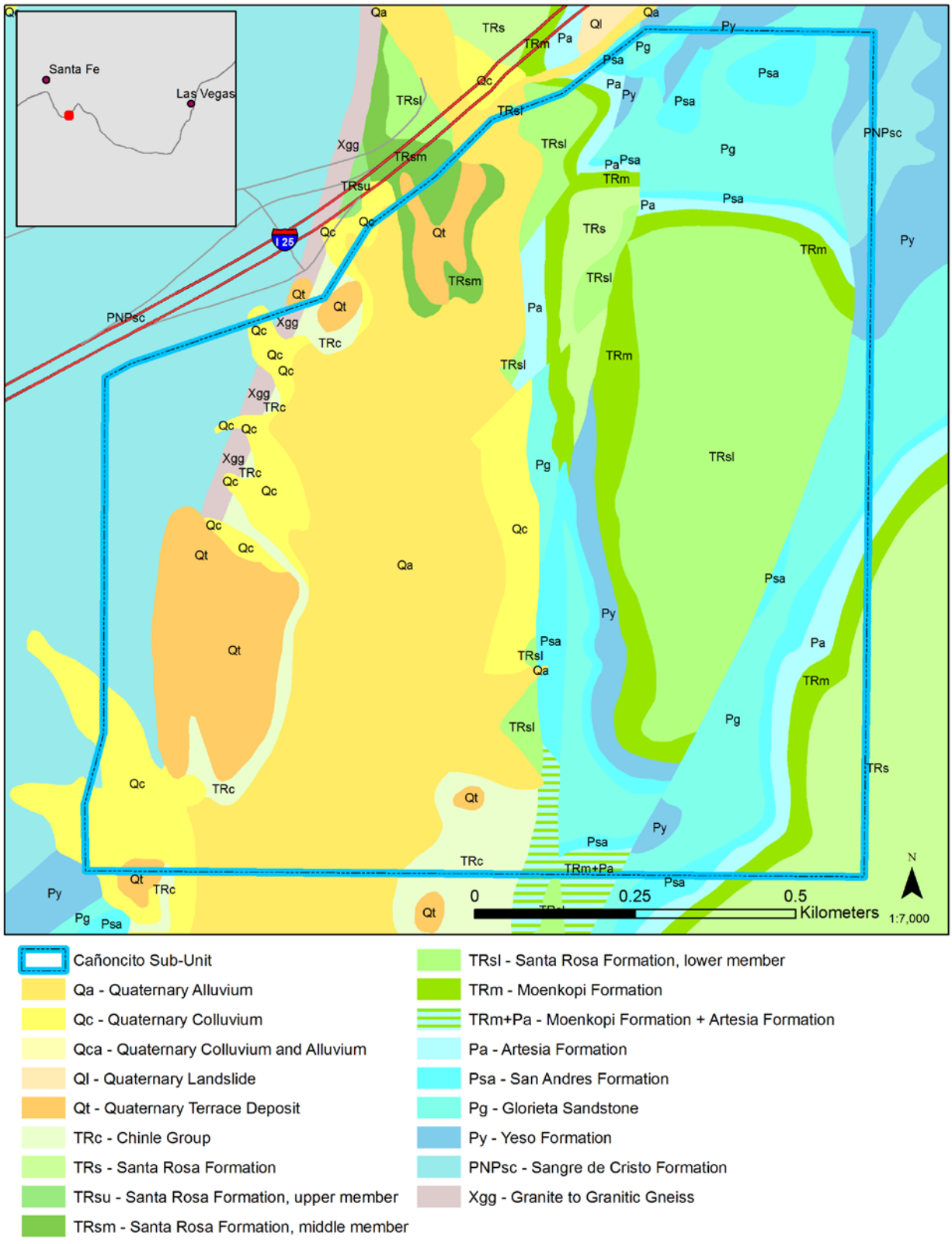

Figure 9. The geology of Pecos National Historical Cañoncito Sub-unit as mapped by Rawling (2010).

Vegetation Classification

A consistent, ecologically based vegetation classification is the foundation for the development of an information–rich vegetation map. Vegetation classifications are ground-based descriptions of vegetation patterns that take into account floristic composition and abundance, site characteristics, and ecological dynamics. Accordingly, for PECO, we used extensive field sampling and analysis to develop a hierarchical classification following the National Vegetation Classification Standard (FGDC 2008). The outcome was the identification and description of a suite of plant associations that are singularly, or in combination, components of map units, depending on cartographic standards and constraints and the targeted uses of the map (see Chapter 3). Below we describe our methods for classification development and provide an overview and discussion of the PECO classification.

Classification methods

The National Vegetation Classification Standard

The classification system used in SOPN vegetation mapping projects is based on the National Vegetation Classification Standard (NVCS) adopted by the Federal Geographic Data Committee in 1997 and updated in 2008 (FGDC 1997 & 2008). The 2008 revised standard adopted by the FGDC contains substantial revisions to the upper levels of the NVCS hierarchy (Version 2; FGDC 2008) and now includes eight levels (Table 1). The upper three levels indicate physiognomic characteristics that reflect geographically widespread (global) topographic and edaphic factors. The middle three levels are new to the NVCS hierarchy and focus on largely biogeographic and habitat factors, along very broad, regional-to-continental topographic, edaphic, and disturbance gradients. The lower two levels, alliance and association, are distinguished by differences in floristic composition. Alliances are physiognomically distinct groups of plant associations sharing one or more differential or diagnostic species (Mueller-Dombois and Ellenberg 1974). These are commonly the dominant(s) found in the uppermost strata of the vegetation. The plant association is the fundamental unit of the classification and, following the International Botanical Congress of 1910, is defined as a community of definite floristic composition (i.e., a repeating assemblage of species), uniform physiognomy, and habitat conditions (Mueller-Dombois and Ellenberg 1974). NPS classification and mapping now follow the FGDC (2008) standard and focus on the group and plant association levels (the alliance level is in flux within the classification because of the heterogeneity nationally and internationally in the application of the concept).

The NVCS provides a framework for levels of classification but does not provide descriptions of vegetation types at all levels. The actual National Vegetation Classification (NVC) is maintained in a database by NatureServe and the network of affiliated natural heritage programs and conservation data centers for use by government agencies including the NPS, along with NGOs and the public. The NVC database tracks plant communities defined in the U.S. down to the association level and provides at least initial narrative descriptions of most alliances and associations. The database is available online through NatureServe Explorer (http://www.natureserve.org/explorer/), which provides public access to regularly updated versions of the NVC plant community listings and descriptions. NatureServe's documentation of alliances and associations is the most accessible national listing currently available. However, the

plant community descriptions within the NVC are not complete, and projects such as the one described in this report constantly add to the documentation and listing of NVC types.

Table 1 National Vegetation Classification hierarchy for terrestrial vegetation following the FGDC (2008) standard.

Level	Level name	Criteria	Example
Upper levels			
L1	Formation Class	Broad combinations of general dominant growth forms that are adapted to basic temperature (energy budget), moisture, and/or substrate or aquatic conditions.	Mesomorphic Shrub and Herb Vegetation (Shrubland and Grassland)
L2	Formation Subclass	Combinations of general dominant and diagnostic growth forms that reflect global macroclimatic factors driven primarily by latitude and continental position, or that reflect overriding substrate or aquatic conditions.	Temperate and Boreal Shrub and Herb Vegetation (Temperate and Boreal Shrubland & Grassland)
L3	Formation	Combinations of dominant and diagnostic growth forms that reflect global macroclimatic factors as modified by altitude, seasonality of precipitation, substrates, and hydrologic conditions.	Temperate Shrub and Herb Vegetation (Temperate Shrubland & Grassland)
Mid levels			
L4	Division	Combinations of dominant and diagnostic growth forms and a broad set of diagnostic plant taxa that reflect biogeographic differences in composition and continental differences in mesoclimate, geology, substrates, hydrology,and disturbance regimes.	*Andropogon – Stipa – Bouteloua* Grassland & Shrubland Division (North American Great Plains Grassland & Shrubland)
L5	Macrogroup	Combinations of moderate sets of diagnostic plant species and diagnostic growth forms that reflect biogeographic differences in composition and subcontinental to regional differences in mesoclimate, geology, substrates, hydrology, and disturbance regimes.	*Andropogon gerardii – Schizachyrium scoparium – Sorghastrum nutans* Grassland & Shrubland Macrogroup (Great Plains Tall Grassland & Shrubland)
L6	Group	Combinations of relatively narrow sets of diagnostic plant species (including dominants and co-dominants), broadly similar composition, and diagnostic growth forms that reflect biogeographic differences in composition and sub-continental to regional differences in mesoclimate, geology, substrates, hydrology, and disturbance regimes.	*Andropogon gerardii – Sporobolus heterolepis* Grassland Group (Great Plains Mesic Tallgrass Prairie)
Lower levels			
L7	Alliance	Diagnostic species, including some from the dominant growth form or layer, and moderately similar composition that reflect regional to subregional climate substrates, hydrology, moisture/nutrient factors, and disturbance regimes.	*Andropogon gerardii – (Calamagrostis canadensis – Panicum virgatum)* Herbaceous Alliance (Wet-mesic Tallgrass Prairie)
L8	Association	Diagnostic species, usually from multiple growth forms or layers, and more narrowly similar composition that reflects topo-edaphic climate, substrates, hydrology, and disturbance regimes.	*Andropogon gerardii – Panicum virgatum – Helianthus grosseserratus* Herbaceous Vegetation (Central Wet-mesic Tallgrass Prairie)

Field methods

Vegetation sampling was designed to capture as wide a variety of vegetation types as possible within the seasonal time frame available for field work (typically during the rainy season of July 15 to October 15 when botanical expression is at its best). Sampling campaigns were planned to optimize field crew efficiency while still capturing as wide a range of vegetation types as possible on any given day. Accordingly, we used a cluster-sampling approach where a series of daily routes for the sampling crews were designed in a GIS using digital ortho-photography and preliminary vegetation maps. The locations of eight to ten sampling points per route were driven by differences in vegetation, soils, and geologic pattern, plus logistics, i.e., what could be accomplished in one day's travel time by vehicle and foot by a field crew (sampling days were ten hours to further increase daily efficiency). Routes were distributed as widely as possible throughout the study area, but the emphasis was on capturing the range of variation within the park. While using the GIS was an excellent planning tool, final plot locations were decided in the field based on positioning the sampling point in homogenous stands of vegetation and habitat.

Field crews were composed of two people: a senior technician crew chief responsible for botany and vegetation sampling, and a second member responsible for site measurements, photographs, and Global Positioning System (GPS) locations. Plots were established in large stands of vegetation representative of the typical vegetation at a site (greater than one ha). Plots were generally 400 m^2 and square, but occasionally other sizes and shapes were used to fit the structure of a community, especially along drainages where vegetation stands conform to the channel shape.

For standard plots, a list of all vascular plant species, stratified by lifeform (tree, shrub, subshrub, grass and forb layers) was compiled and cover estimated for each species using a modified Domin-Krajina Scale (Table 2) (Mueller-Dombois and Ellenberg 1974). Site attributes included slope percent, aspect, slope shape, surface rock type, and ground cover (percent rock, gravel, bare soil and litter), along with detailed narratives on species composition and site conditions. Plot locations were recorded with a Garmin GPS Model 12 with +/- 10-m accuracy. For each plot, at least four photos were taken in the four directions from plot center with each photo containing a placard noting the project, sampling date, and plot number. The compass direction and focal length of each shot were logged for future reference. See Appendix A for NHNM field-survey handbook and examples of sampling forms.

Standard plots were used primarily to support vegetation classification development, and three to five can be established in a day. To maximize ground control for the mapping process, stripped-down mapping plots (quick plots) were employed where only the cover of dominant species in each strata was recorded along with a reduced set of site parameters. Anywhere from 6 to 12 of these quick plots could be established in a day, depending on logistics (all accuracy-assessment plots were of this style). In addition, reconnaissance observation points were used in which only the diagnostic species were recorded for determining the plant association using diagnostic keys (see Vegetation Analysis section below) along with a GPS point and a photograph. Between 2005 and 2011 we collected 223 samples, 161 of which were standard plots, 20 were mapping plots, and 42 were observation points (Figures 10, 11, and 12).

Plant voucher specimens were collected to confirm field identifications as necessary and were deposited at the University of New Mexico Herbarium. Specimens were identified by NHNM botanist Yvonne Chauvin to lowest level possible given the material at hand and names assigned

according to the PLANTS database (USDA-NRCS 2009) and the Integrated Taxonomic Information System (ITIS). Qualifying specimens were accessioned with both UNM accession numbers and NPS record numbers tied to the Herbarium and NPS databases. A species list derived from the plot data is provided in Appendix B.

Table 2. Modified Domin-Krajina Vegetation Cover Scale from Mueller-Dombois and Ellenberg (1974). Cover Class is the scalar value assigned in the field; Percent Canopy Cover is the range of cover the class represents; m2/ 400 m2 is the actual area represented by the cover class within the 400m2 plot; and Midpoint % Cover is the midpoint canopy cover value used in data analysis.

Cover Class	Percent Canopy Cover	m^2 / 400 m^2	Midpoint % Cover
+0	[Undefined]	[Outside plot]	[0.001]
+	<.05	<0.04 m	0.01
1	<0.1	≥ 0.04 & < 0.5	0.05
2	<1	≥ 0.5 & < 4	0.5
3	1 – 4	≥ 5 & < 20	2.5
4	5 – 10	≥ 20 & < 40	7.5
5	10 - 25	≥ 40 & <100	17.5
6	25 - 33	≥ 100 & <132	29.0
7	33 - 50	≥ 132 & <200	41.5
8	50 - 75	≥ 200 & <300	62.5
9	> 75	≥ 300 m	87.5

All vegetation and site data were entered into the Microsoft Access NHNM Ecology database and quality controlled through error-checking computer routines and manual read-backs. Each record contains documentation of the plot location, dimensions, vegetation composition, site characteristics, vegetation classification, and photo points. All plot data and associated location information and metadata were transferred to a stand-alone NPS-developed Microsoft Access relational database (PLOTS_v3_BE_ PECO.MDB). While no structural changes were made to the NPS database template, we did add selected fields that allow the tracking back of all data to the NHNM database.

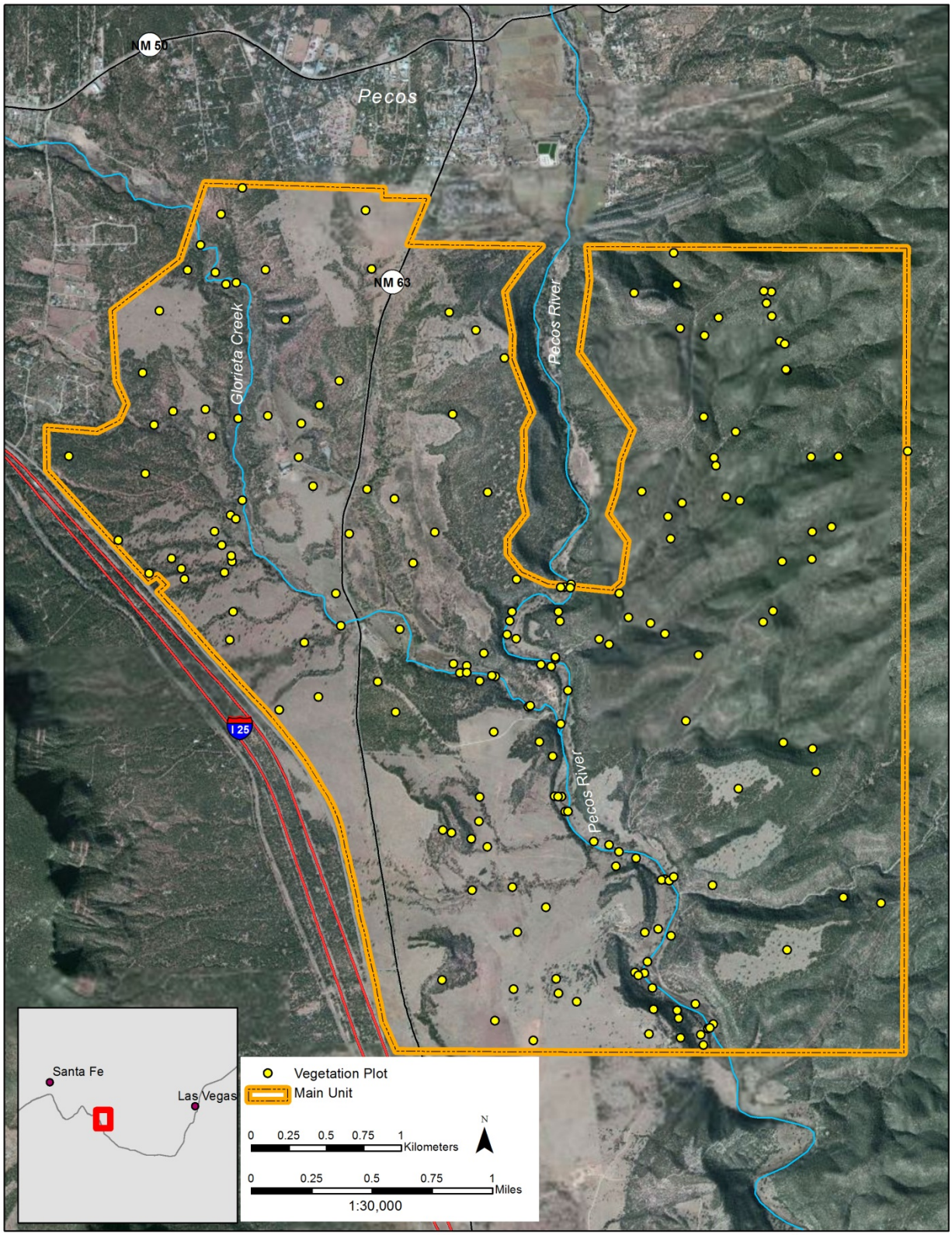

Figure 10. Distribution of vegetation plots used in the development of the vegetation classification and map for the Pecos National Historical Park Main Unit.

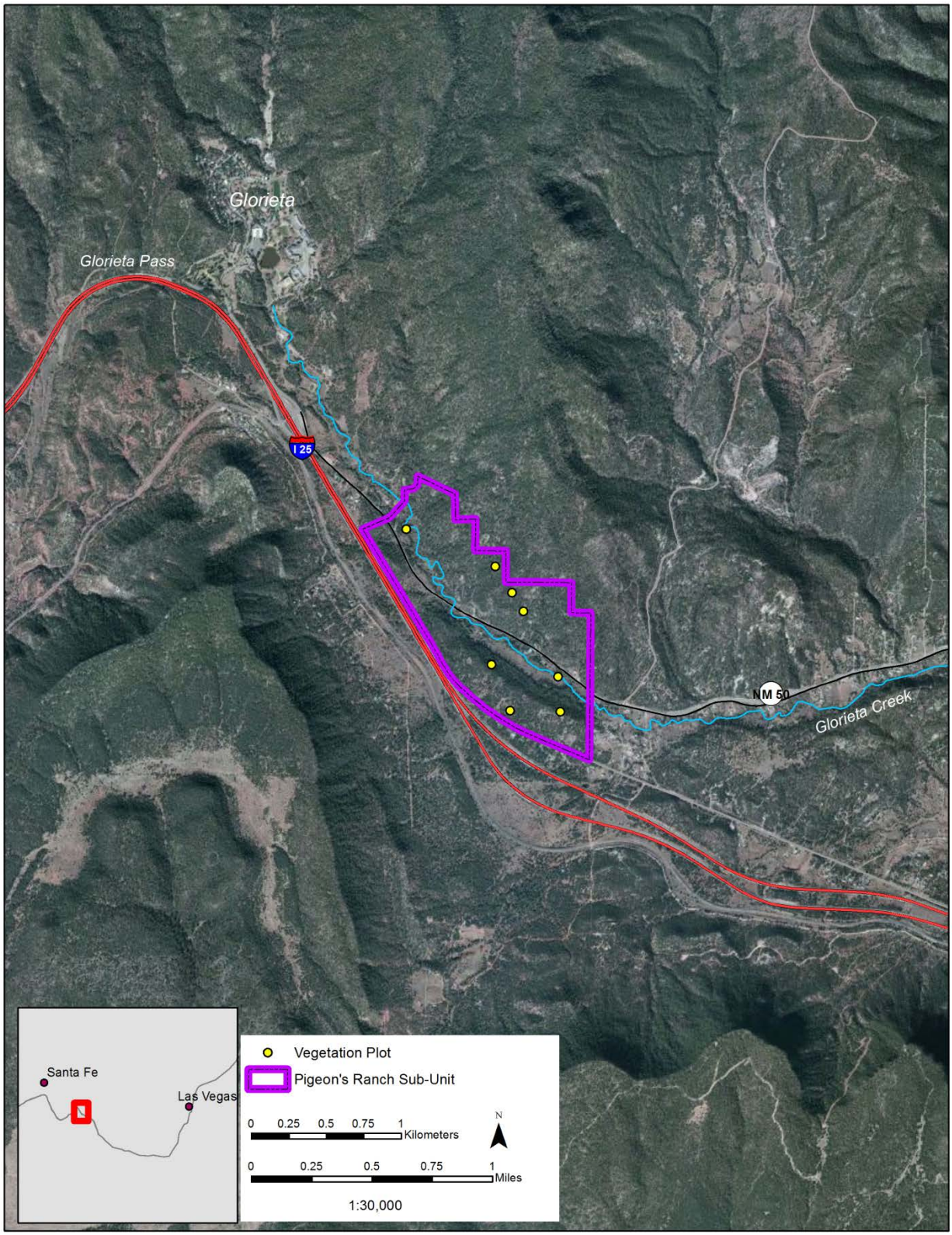

Figure 11. Distribution of vegetation plots used in the development of the vegetation classification and map for the Pecos National Historical Park Pigeon's Ranch Sub-unit

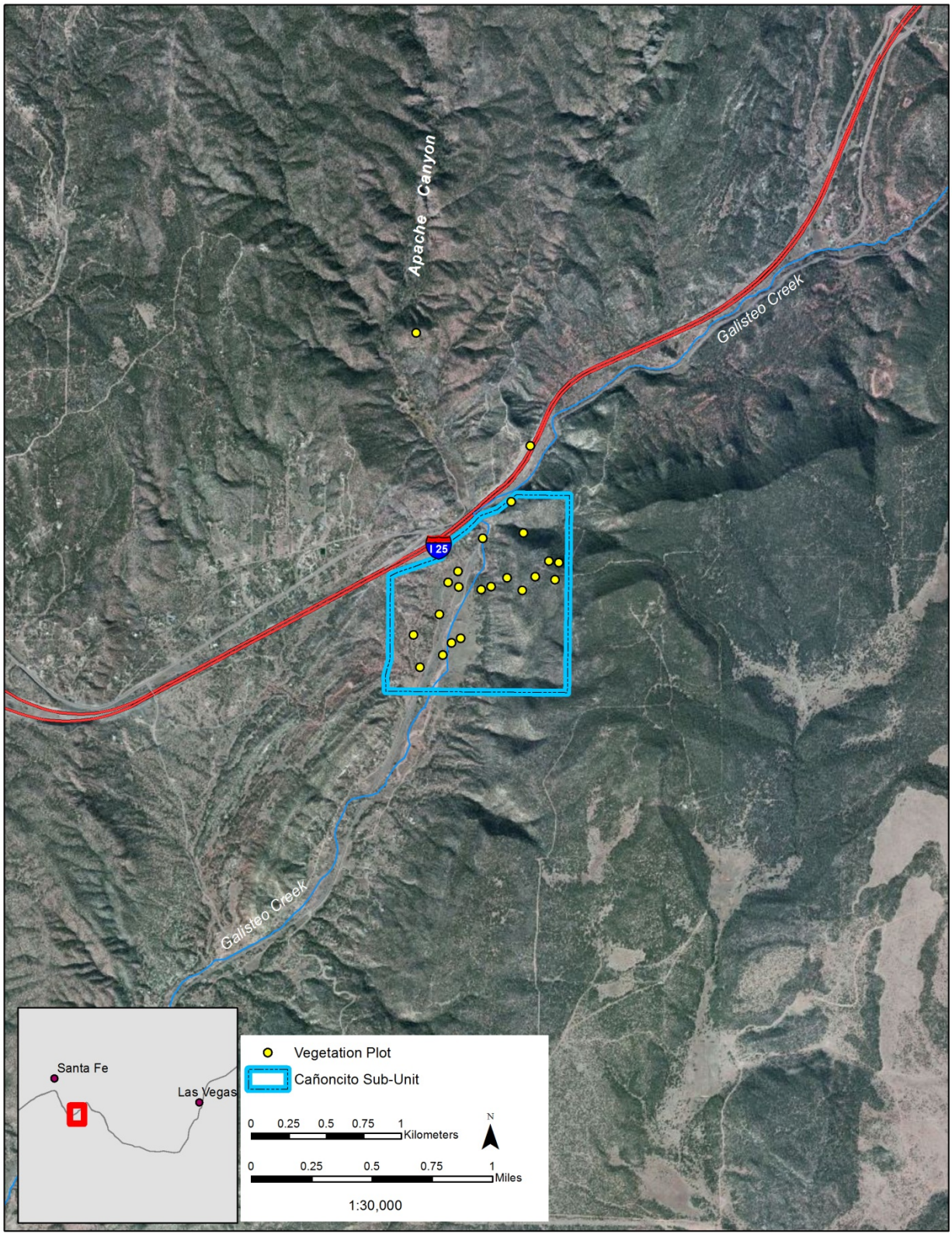

Figure 12. Distribution of vegetation plots used in the development of the vegetation classification and map for the Pecos National Historical Park Cañoncito Sub-unit.

Vegetation analysis

To develop the vegetation classification, the plot data were analyzed using standard tabular comparison techniques (Becking 1957; Mueller-Dombois and Ellenberg 1974; Ludwig and Reynolds 1988; McCune and Grace 2002). These analyses were based primarily on species-level canopy-cover values with some grouping at the genus level where taxonomic units were ambiguous (abundance scalar values were converted to percent-cover mid-point values). Data on site characteristics such as elevation, slope, aspect, and landform were also used to supplement the analysis. In general, each plot was classified into a particular plant association (PA) based on codominance and/or a set of differential species. Phases of associations were assigned as necessary to further define the character of the plant community. For the new NVCS (FGDC 2008), associations were assigned to groups based on a working classification developed by NatureServe in collaboration with government agencies and Natural Heritage network ecologists (pers. comm., M. Reid, NatureServe Senior Regional Ecologist 2008). The outcome is a draft hierarchical classification ready for review by NatureServe ecologists responsible for maintenance and consistency of the NVCS. Currently, the NVCS continues to be revised to meet the new standard and not all groups have been defined. Final summary floristic and site tables by plant association were computed and were the basis for plant association descriptions and dichotomous keys.

Classification Results

For Pecos National Historical Park, we identified 46 plant associations (PAs) that reflect the complex pattern and composition of vegetation communities across the park (Table 3). There were 18 associations from among forests and woodlands, the dominant vegetation of the park. Intermixed among the woodlands were ten grassland and shrubland associations, while 18 riparian and wetland communities were described along the stream and river channels. In Table 3, we present the PAs ordered by the NVCS hierarchy, along with the number of PECO plots, classification status, and NatureServe/NHNM database code. Twenty-four PAs were considered established according to the NVC, i.e., they are well documented, either in the park or in the region, and have been entered in the NVC database and assigned a NatureServe database code (beginning “CEGL). Another 20 have limited documentation within and outside the park, and are, hence, considered provisional “Park Specials,” which need further documentation before being included officially in the NVC (codes beginning with either “NHNM”, “GRCA”, or “NPS). For the established and park special associations, we provide local descriptions of floristic composition site characteristics along with diagnostic keys in Appendices C and D. Lastly, we have cross-walked each PA to the map units in which they are either a primary or secondary component, or inclusions (see Chapter 3 for a description of map unit structure and Table 5).

Below we summarize the information on composition, structure, and environments of vegetation communities in the context of the new NVCS hierarchy. We focus on the middle tiers of the hierarchy, i.e., Division, Macrogroup, and Group (with group numbers given parentheses for cross-reference to Table 3). See Appendix D for details on plant association composition and environments.

Table 3. A hierarchical vegetation classification for the Pecos National Historical Park following the National Vegetation Classification System of seven levels: Class, Subclass, Formation, Division, MacroGroup, Group, and Plant Association (see table 1 for hierarchical level definitions). The "n" refers to the number of quantitative plots gathered for the association on PECO (excludes semi-quantitative observation points). The status (S) of a plant association is indicated as either established (E) in the national classification or provisional (P) pending review as a regional or local (park special) association. "Code" refers to the plant association database code (CEGLcodes are NatureServe database codes for established associations; NPS or NHNM codes for provisional associations from Natural Heritage New Mexico's database). "Map Units" refers to the vegetation map units in which the plant association is considered to be either a primary component, secondary component, or inclusion (incl) (see table 5).

Class	Subclass	Formation	Division	Macrogroup	Group	Plant associatiion	*n*	S	Code	Map Units	
										1 & 2 Comp	Inclusions
1 Forest & Woodland (Mesomorphic Tree Vegetation)											
	1.C Temperate Forest										
		1.C.2 Cool Temperate Forest									
			1.C.2.b Western North American Cool Temperate Forest								
				M022	Southern Rocky Mountain Lower Montane Forest						
					G228	Southern Rocky Mountain Ponderosa Pine Forest & Woodland Group					
						Pinus ponderosa / *Poa fendleriana* Forest	2	P	GRCA_New6		2C
						Pinus ponderosa / *Quercus gambelii* Woodland	2	E	CEGL000870	2A	
						Pinus ponderosa / *Quercus X pauciloba* Woodland	3	E	CEGL000874	2A	
						Pinus ponderosa / Sparse Understory Woodland	3	E	CEGL002384		2A, 2B, 2C
					G229	Southern Rocky Mountain Ponderosa Pine Savanna Group					
						Pinus ponderosa / *Bouteloua gracilis* Woodland	8	E	CEGL000848	2B, 2C	
						Pinus ponderosa / *Schizachyrium scoparium* Woodland	2	E	CEGL000201	2C	
					G226	Southern Rocky Mountain White Fir - Douglas-fir Dry Forest Group					
						Pseudotsuga menziesii / *Quercus gambelii* Forest	4	E	CEGL000452	1A	
			1.C.2.c Western North American Cool Temperate Scrub Woodland & Shrubland								
				M027	Rocky Mountain Two-needle Pinyon - Juniper Woodland						

Table 3. A hierarchical vegetation classification for the Pecos National Historical Park, continued

Class	Subclass	Formation	Division	Macrogroup	Group	Plant associatiion	*n*	S	Code	Map Units	
										1 & 2 Comp	Inclusions
				G253	Southern Rocky Mountain Pinyon - Juniper Woodland Group						
						Juniperus scopulorum / Rhus trilobata Woodland	2	P	NHNM000474	3H	
						Pinus edulis - (Juniperus monosperma, Juniperus deppeana) / Bouteloua gracilis Woodland	18	E	CEGL002151	3F, 3G, 3H, 3I	3E,
						Pinus edulis - Juniperus monosperma / Bouteloua curtipendula Woodland	11	P	NHNM000570	3C, 3D, 3E,	3A, 3B, 3G
						Pinus edulis - Juniperus monosperma / Muhlenbergia montana Woodland	1	P	NHNM000572		3C
						Pinus edulis - Juniperus monosperma / Quercus X pauciloba Woodland	11	E	CEGL000793	3A, 3B	
						Pinus edulis - Juniperus scopulorum / Pascopyrum smithii Woodland	2	P	NHNM000576	3G, 3H	
						Pinus edulis - Juniperus scopulorum / Schizachyrium scoparium Woodland	1	P	NHNM000578	3D	
						Pinus edulis - Juniperus spp. / *Cercocarpus montanus* - Mixed Shrubs Woodland	4	E	CEGL000780	3B	3D
						Pinus edulis - Juniperus spp. / *Quercus gambelii* Woodland	5	E	CEGL000791	3A	
						Pinus edulis / Achnatherum scribneri Woodland	9	E	CEGL000798	3C	3D
						Pinus edulis / Sparse Understory Woodland	5	E	CEGL000795	3C, 3F	3E, 3G
		1.C.3 Temperate Flooded & Swamp Forest									
			1.C.3.c Western North American Flooded & Swamp Forest								
				M034	Rocky Mountain and Great Basin Flooded & Swamp Forest						
				G503	Rocky Mountain & Great Basin Lowland & Foothill Riparian Forest Group						
						*Populus deltoides (*ssp. *wislizeni,* ssp. *monilifera) / Salix exigua* Woodland	2	E	CEGL002685		4B
				G506	Rocky Mountain & Great Basin Montane Riparian Forest Group						
						Populus angustifolia - Acer negundo / Poa pratensis Woodland	5	E	CEGL005961	4A	

Table 3. A hierarchical vegetation classification for the Pecos National Historical Park, continued

Class	Subclass	Formation	Division	Macrogroup	Group	Plant associatiion	*n*	S	Code	Map Units	
										1 & 2 Comp	Inclusions
						Populus angustifolia / Invasive Perennial Grasses Semi-natural Woodland	11	E	CEGL003749	4B	
						Populus angustifolia / *Salix exigua* Woodland	4	E	CEGL000654	4A, 4B	
2 Shrubland & Grassland (Mesomorphic Shrub & Herb Vegetation)											
	2.C Temperate & Boreal Shrubland & Grassland										
		2.C.1 Temperate Grassland, Meadow & Shrubland									
			2.C.1.b Great Plains Grassland & Shrubland								
				M053	Great Plains Shortgrass Prairie & Shrubland						
					G144	Great Plains Shortgrass Prairie Group					
						Artemisia frigida / *Bouteloua gracilis* Dwarf-shrubland	2	E	CEGL002782	7A	
						Bouteloua gracilis - *Bouteloua curtipendula* Herbaceous Vegetation	3	E	CEGL001754		7A
						Bouteloua gracilis - *Muhlenbergia torreyi* - *Aristida purpurea* Herbaceous Vegetation	7	E	CEGL005389	7A	
						Pascopyrum smithii - *Bouteloua gracilis* Herbaceous Vegetation	5	E	CEGL001578	7B	
					GSW7	Southwest Plains-Mesa Ruderal Shrubland & Grassland					
						Bouteloua gracilis / Old Field Herbaceous Vegetation	3	P	NPS_NM042		7D
						Bouteloua gracilis / Ruderal Herbaceous Vegetation	4	P	NPS_NM043	7D, 7E, 10A, 10B, 10E	7A-7C
						Pascopyrum smithii / Ruderal Herbaceous Vegetation	2	P	NPS_NM045	7B, 10A, 10B, 10E	
						Psathyrostachys juncea / Monotypic Herbaceous Vegetation	1	P	NHNM000236	7D	
						Ruderal Disturbance Vegetation	2	P	NPS_NM027	7E, 10A-10E	
		2.C.5 Temperate & Boreal Freshwater Wet Meadow & Marsh									
			2.C.5.b Western North American Freshwater Wet Meadow & Marsh								
				M073	Western North American Lowland Freshwater Wet Meadow, Marsh & Shrubland						
					G526	Rocky Mountain & Great Basin Lowland & Foothill Riparian & Seep Shrubland Group					

Table 3. A hierarchical vegetation classification for the Pecos National Historical Park, continued

Class	Subclass	Formation	Division	Macrogroup	Group	Plant associatiion	*n*	S	Code	Map Units	
										1 & 2 Comp	Inclusions
						Salix exigua - Ericameria nauseosus Shrubland	1	P	NHNM000773		6B
						Salix exigua / Eleocharis palustris Shrubland	1	P	NHNM000779	6B	
						Salix exigua / Invasive Perennial Grasses Semi-natural Shrubland	9	P	NHNM000856	6B	
						Salix exigua / Juncus arcticus Shrubland	6	P	NHNMNew7	6B	
						Salix irrorata / Festuca arundinaceae Shrubland	1	P	NHNM000789		6B
				G518	Western North American Temperate Interior Freshwater Marsh Group						
						Juncus arcticus / Typha latifolia Herbaceous Vegetation	1	P	NHNM000186		8A
						Typha (latifolia, angustifolia) Western Herbaceous Vegetation	3	E	CEGL002010		8A
			M075	Western North American Montane Wet Meadow & Low Shrubland							
				G504	Rocky Mountain & Great Basin Montane Alder & Birch Riparian Shrubland Group						
						Alnus incana ssp. *tenuifolia - Salix amygdaloides* Shrubland	3	P	NHNM000323	6A	
				G521	Vancouverian & Rocky Mountain Montane Wet Meadow Group						
						Carex nebrascensis - Eleocharis palustris Herbaceous Vegetation	1	P	NHNM000135		8A
						Juncus arcticus - Festuca arundinaceae Semi-natural Herbaceous Vegetation	1	P	NHNM000183	8A	
						Juncus arcticus - Schoenoplectus pungens Herbaceous Vegetation	1	P	NHNM000448		8A
						Juncus arcticus / Anemopsis californica Herbaceous Vegetation	1	P	NHNM000185		8A
						Juncus balticus Herbaceous Vegetation	2	E	CEGL001838	8A	

Table 3. A hierarchical vegetation classification for the Pecos National Historical Park, continued

Class	Subclass	Formation	Division	Macrogroup	Group	Plant associatiion	*n*	S	Code	Map Units	
										1 & 2 Comp	Inclusions
3 Semi-Desert (Xeromorphic Scrub & Herb Vegetation)											
	3.B Cool Semi-Desert Scrub & Grassland										
		3.B.1 Cool Semi-Desert Scrub & Grassland									
			3.B.1.a Western North American Cool Semi-Desert Scrub & Grassland								
				M171 Great Basin & Intermountain Dry Shrubland & Grassland							
					G310 Intermountain Semi-Desert Shrubland Group						
						Ericameria nauseosa / Bouteloua gracilis Shrub Herbaceous Vegetation	3	E	CEGL003495	5A, 7C	
						Ericameria nauseosa Shrubland	3	E	CEGL002713	5A	

Upland vegetation Communities

1.C Temperate Forest

1.C.2 Cool Temperate Forest

Western North America Cool Temperate Forest Division

M022 Southern Rocky Mountain Lower Montane Forest Macrogroup

The forests on PECO extend from about 7,400 ft (2,250 m) down to 6,750 ft (2,060 m) and are distributed among a variety of local environments (Figure 13). At the coolest and most mesic end of the gradient, Southern Rocky Mountain White Fir-Douglas-fir Dry Forest (G226) represented by the Douglas-fir-Gambel Oak (*Pseudotsuga menziesii - Quercus gambelii*) association is found. While elsewhere in the Southwest these forests can be co-dominated by an array of conifers, on PECO, Douglas-fir is the dominant with ponderosa pine (*Pinus ponderosa*) as a co-dominant, usually forming closed canopies (>60% cover). Rocky Mountain juniper (*Juniperus scopulorum*), oneseed juniper (*Juniperus monosperma*), and pinyon pine (*Pinus edulis*) often occur in the understory as small-statured trees. On PECO, these forests are limited in extent and are found on the east side of the park as small stands on the relatively moist northerly, mid to lower slopes of canyons and sometimes extending down the canyon as "stringers" to the Pecos River.

On warmer and drier slopes, the Douglas-fir-dominated forests give way to the Southern Rocky Mountain Ponderosa Pine Forest & Woodland (G228) (Figure 14). Here, ponderosa pine is the clear dominant and Douglas-fir is uncommon or absent, but low-statured conifers such as pinyon pine, oneseed juniper, and Rocky Mountain juniper may still be common in the understory. The canopies range from open to closed (25 to 75% cover). The understories can be dominated by shrubby oaks (Gambel oak, wavyleaf oak (*Q. pauciloba*)). The herbaceous layer tends to be sparse (< 5% cover) and made up of up scattered bunch grasses such as Scribner's needlegrass (*Achnatherum scribneri*), mutton bluegrass (*Poa fendleriana*), and sideoats grama (*Bouteloua curtipendula*) along with deer sedges (e.g., *Carex inops* ssp. *heliophila*).

Southern Rocky Mountain Ponderosa Pine Savanna (G229) occurs on gentler slopes (<5%) primarily on the rolling hills and plains of the western side of the park (Figure 15). Overall, these are very open to open canopied woodlands (10 to 60% canopy cover) that are typically dominated in the understory by bunch grasses with covers commonly between 5 and 30% and as high as 60%; shrubs are scattered or absent. The most common associations are Ponderosa Pine / Little Bluestem (*Pinus ponderosa / Schizachyrium scoparium*), Ponderosa Pine / Blue Grama (*Pinus ponderosa / Bouteloua gracilis*), and Ponderosa Pine / Western Wheatgrass (*Pinus ponderosa / Pascopyrum smithii*). The graminoid component of these associations has strong affinities with the Great Plains grasslands as reflected not only in the dominance of little bluestem, blue grama and western wheatgrass, but also the presence of forbs such as white prairieclover (*Dalea candida*), hairy goldenaster (*Heterotheca villosa*), and slimflower scurfpea (*Psoralidium tenuiflorum*). These associations typically occur below from about 7,000 ft (2,130 m) where stands are often inter-fingered with Rocky Mountain Pinyon-Juniper Woodland (G253), particularly on rockier sites and in small canyons.

Figure 13. Southern Rocky Mountain White Fir-Douglas-fir Dry Forest dominated by Douglas-fir along with ponderosa pine and pinyon pine is commonly found on north-facing lower slopes in the upper canyons in the eastern portion of the main unit and in pockets of the Cañoncito Sub-unit (photo: Y. Chauvin) .

Figure 14. Southern Rocky Mountain Ponderosa Pine Forest & Woodland dominated by ponderosa pine occurs on north-facing lower slopes and along the canyon bottoms and draws of the main unit (photo: Y. Chauvin) .

Figure 15. Southern Rocky Mountain Ponderosa Pine Savanna dominated by ponderosa pine occurs as open stands among the rolling hills and plains on the western side of the main unit. These woodlands have often been treated to reduce stand density (photo: Y. Chauvin).

In addition to soils, terrain and climatic factors, fire has played an important role in shaping the structure and composition of the Douglas-fir and ponderosa pine forests of the park. Because ponderosa pine is highly fire tolerant (Bradley et al. 1992) and relatively drought tolerant, it often occupies sites that are drier and that have higher natural fire frequencies than those of the mixed conifer zone (DeVelice et al. 1986; Allen and Peet 1990; Touchan et al. 1996). Based on fire history studies from elsewhere in the southern Rocky Mountains of New Mexico, in the past low-intensity fires would burn through ponderosa pine stands every 8 to 15 years, removing competing understory vegetation and woody debris (Weaver 1951; Cooper 1960; Mehl 1992; Swetnam and Baisan 1996; Touchan et al. 1996). Savanna woodlands with their high grass cover were likely to have the most frequent ground fires, while forests tend to occur on steeper, rocky slopes with fewer "fine fuels," hence fire-return intervals were likely longer. After fires, the shade-intolerant seedlings such as those of ponderosa pine become established in open areas, usually in pulses correlated to favorable precipitation years (Mast et al. 1997; Mast el al. 1998; Savage et al. 1995). The other conifers such as Douglas-fir are less drought and fire tolerant and are at a disadvantage on these sites. Hence, either they fail to become established or are removed by subsequent surface fire, leading to forest stands dominated by ponderosa pine (with even-aged tree groups embedded in the stands depending on recruitment pulses). On the more mesic sites of the rugged canyons, Douglas-fir does survive naturally and can come to dominate or co-dominate stands with ponderosa pine. At the other end of the spectrum, ponderosa pine has been shown to have invaded adjacent grasslands where fires have been suppressed (Allen 1984, 1989). Hence, some stands of the various savanna associations may be considered invasive, depending on edaphic conditions and disturbance history.

With the cessation of natural fire regimes during the twentieth century that typically occurred across the Southwest (and presumably on PECO), younger age classes of both ponderosa pine and Douglas-fir have become more prevalent and are leading to potential shifting fire regimes from frequent, low-intensity surface fire to mixed regimes of surface fires and patch-crown fires, or ultimately stand-replacement fires. The evidence for increases in young age-class tree densities on PECO is limited. Most ponderosa savanna stands have some ponderosa saplings and poles (Douglas-fir is usually absent), but whether densities are high enough to pose an increased risk of crown fire needs to be evaluated. The more mesic sites of the eastern canyons tend to have both young ponderosa pine and Douglas-fir in them, but similarly, whether they are over-stocked or within the natural range of variability (NRV) remains to be measured and understood. Mixed fire regimes of surface and patch-crown fire tend to be the norm in these types of forests, but the relative amount and frequency of surface fire in the canyon forest may be dependent on the degree of landscape connectivity between the woodland savanna and grassland eco systems (with their natural surface fire regimes). That is, where terrain is heterogeneous or streams potentially break the run of fire out of the grass-dominated ecosystems, the expectation would be for less surface fire and more patch-crown fire or stand-replacement fires as the norm. In addition, shrubby oak-dominated associations that create a natural ladder-fuel matrix in the understory may be more prone to crown fire. Ultimately, to understand whether the PECO forests are out of natural range of variability will require investigations of the fire history, current stand structure and fuel loads in a landscape context.

Western North America Scrub Woodland and Shrubland Division

M027 Rocky Mountain Two-needle Pinyon - Juniper Woodland Macrogroup

This division is represented by Southern Rocky Mountain Pinyon - Juniper Woodland (G253), which dominates the rolling plains and foothills of PECO between 6,700 ft (2,040 m) and 7,500 ft (2,290 m). In general, tree canopies vary from very open to nearly closed (10 to 60% cover) and are dominated by pinyon pine with oneseed juniper and/or Rocky Mountain juniper as either codominant or subordinate associates (Figure 16). Ten plant associations have been described for the park that vary with respect to understory shrub and grass composition. Five of them are savanna-like with moderately open canopies and grassy inter-canopy spaces dominated by either mountain muhly (*Muhlenbergia montana*), blue grama (*Bouteloua* gracilis), sideoats grama, little bluestem, or western wheatgrass (e.g., associations with database codes CEGL002151, NHNM000570, NHNM000572, NHNM000576 and NHNM000578 in Table 3). Shrubs in these associations are scattered and seldom exceed 5% total cover. These grassy, savanna-like associations tend to be most prevalent in the rolling hills of the western portion of the park. In contrast, the other five woodland associations occurred in the rockier foothills and canyons of the east side where grasses play a minor role. These tend to be shrub-dominated in the understory where Gambel's oak, wavyleaf oak, or mountain mahogany (*Cercocarpus montanus*), along with a variety of other montane shrubs, can approach 50 to 60% total cover, or they may lack shrubs entirely. The herbaceous layer is relatively sparse (seldom over 5% cover) and represented by scattered bunch grasses and forbs such as mutton bluegrass, Scribner's needlegrass (*Achnatherum scribneri*), and littleseed ricegrass (*Piptatherum micranthum*). The latter is most common in the shady understory of individual trees.

Figure 16. Southern Rocky Mountain Pinyon - Juniper Woodland dominated by pinyon pine along with oneseed juniper and Rocky Mountain juniper occurs throughout the park and is the most abundant vegetation type. Understories vary from nearly barren inter-tree spaces to either shrub dominated by oaks (particularly on rocky sites) to more grass-dominated savanna-like stands. These woodlands have also often been treated to reduce stand density or undergone type conversion to grasslands (photo: Y. Chauvin).

Fire is also an important disturbance factor in pinyon-juniper woodlands, and most recently, Romme et al. (2009) provided an overview of fire's role in the dynamics and structuring of western U.S. pinyon-juniper woodlands. They recognized the "savanna woodlands" as a separate element with a specific fire regime of high-frequency, low-intensity surface fires. The shrub-dominated associations described here would be considered part of their "wooded shrubland" with a mixed fire regime of crown and surface fires of moderate-to-high intensity and frequency. They also described a "persistent woodland" with limited surface fuels that would have either low-frequency, high-intensity crown fires or none, depending on canopy density. The closest analogue to this type of woodland on PECO would be the Two-needle Pinyon / Scribner's Needlegrass Woodland association. Romme et al. (2009) state that spreading, low-intensity, surface fires had a very limited role in molding stand structure and dynamics of many or most shrubland and persistent pinyon woodlands. On PECO, many stands have likely naturally gone long periods without fire other than isolated lightning ignitions that burned only single trees or small patches and produced no significant changes in stand structure.

While tree density and canopy coverage have increased substantially during the past 150 years in many pinyon and juniper woodlands, the pattern of infill and expansion has not been uniform, and may have not changed or declined in others (Romme et al. 2009). Apparent infill can be a function of many factors beyond alterations of fire regimes, e.g., recovery from past, severe disturbance; natural, ongoing, Holocene range expansion; livestock grazing; and effects of climatic variability and rising atmospheric CO2. Given the intensive human-influenced

ecological history at PECO, woodland stand structures have likely been altered extensively by people over the past half millennium—from pre-Columbian wood harvest through to the clearing of woodlands by chaining in the 1950's and 1960's to create open pasture. While the evidence of direct impacts of intensive grazing on infill and expansion has been equivocal, the lowering of surface fire frequency because of reduced fine fuels in the savanna-like types, and concurrent detected tree infill and expansion seems a logical conclusion. Yet, by and large, and specifically on PECO, we lack evidence of what the actual fire frequency was in the grass-dominated woodland ecosystems by which to gauge if infill is a function of reduced fire frequency or other causes. Accordingly, why pinyon-juniper woodlands are currently structured as they are on PECO remains an open and complex question requiring thorough evaluation of many factors to guide management. Specifically on PECO, understanding stand structure among the different pinyon woodland associations in conjunction with past fire evidence and in the context of environmental history and landscape controls would significantly aid resource planning.

2 Shrubland & Grassland (Mesomorphic Shrub & Herb Vegetation)

2.C Temperate & Boreal Shrubland & Grassland

2.C.1 Temperate Grassland, Meadow & Shrubland

2.C.1.b Great Plains Grassland & Shrubland

M053 Great Plains Shortgrass Prairie & Shrubland

While PECO lies at the base of the Sangre de Cristo Mountains, to the east some 80 km (50 mi) is the gateway to the southern Great Plains, and grassland communities common in that biome occur in the park as patches interspersed among the woodlands (Figure17). We identified four grassland associations dominated by short to medium-tall bunch grasses: blue grama (*Bouteloua gracilis*), sideoats grama (*B. curtipendula*), western wheatgrass (*Pascopyrum smithii*), purple three-awn (*Aristida purpurea*), and ring muhly (*Muhlenbergia*). Some have a significant subshrub component where such species as *Yucca glauca* (soaptree yucca) and *Artemisia frigida* (prairie sagewort) are well represented to abundant (i.e., *Artemisia frigida glauca / Bouteloua gracilis* Dwarf-Shrub Herbaceous Vegetation). Stands where *P. smithii* is dominant or co-dominant are often located in swales and other lowland areas where water tends to accumulate. These associations belong to the Great Plains Shortgrass Prairie Group (G144).

We have identified another set of five disturbance-related associations that we provisionally grouped under Southwest Plains-Mesa Ruderal Shrubland & Grassland (GSW7) (Figure 18). This group encompasses communities where prehistoric and/or historic human disturbances, including residential/commercial development, past agriculture practices, high-intensity grazing, or type conversion of woodlands to grasslands by chaining have imparted a legacy of abundant ruderal (weedy) species, often in a heterogeneous mix of perennial grasses, introduced pasture grasses and annual and short-lived perennials forbs (e.g., [Russian wildrye [*Psathyrostachys juncea*]). We have included here a general Ruderal Disturbance Vegetation association to represent vegetation on highly disturbed sites composed of various admixtures of annual and short-lived perennial forbs.

Figure 17. Great Plains Shortgrass Prairie on PECO is dominated by blue grama with sideoats grama, western wheatgrass, and ring muhly as common associates. It occurs among the rolling hills, plains, and mesa tops primarily on the western side of the main unit. The majority of the grasslands are the result of historic and current treatments to remove trees (photo: Y. Chauvin).

Figure 18. Southwest Plains-Mesa Ruderal Shrubland & Grassland is a mix of typical prairie grasses such as blue grama, sideoats grama, and western wheatgrass but with a significant component of ruderal, weedy forbs and grasses, both native and introduced (e.g., thistles, sneezeweed, sweetclover, and Russian wildrye). These sites are typically associated with past human disturbance including old field, cleared woodlands, old trails, etc. (photo: E. Lindahl).

Regionally, these grasslands would be considered part of Brown et al. (1979)'s Plains Grassland Biome which includes a Bluestem "tall-grass" Series, Grama "short-grass" Series, and a Mixed "short-grass" Series. Dick-Peddie (1993) was the first to coin the term "Plains-Mesa Grassland" for those communities that were potentially unique to the Southwest, and to New Mexico in particular. Under this heading he identified Grama Grass Series, and Grama-Western Wheatgrass Series that we suggest would include the various grassland PAs we identified for PECO.

3 Semi-Desert (Xeromorphic Scrub & Herb Vegetation)

3.B Cool Semi-Desert Scrub & Grassland

3.B.1 Cool Semi-Desert Scrub & Grassland

3.B.1.a Western North American Cool Semi-Desert Scrub & Grassland

M171 Great Basin & Intermountain Dry Shrubland & Grassland

Intermixed in the woodland and grassland mosaic are patches of shrub-steppe dominated by a combination of rubber rabbitbrush (*Ericameria nauseosa*) and blue grama that is considered an extension of cool-desert ecosystems from the Colorado Plateau and Great Basin, i.e., the Intermountain Semi-Desert Shrubland Group (G310) (Figure 19). Overall, grasses are predominant and shrubs are typically less than 25% cover, and these sites are often associated with past disturbances such tree removals by chaining or intensive livestock grazing. When rabbitbrush cover exceeds 25%, these are considered shrublands rather than shrub-steppes (Figure 20). These shrublands, a relatively minor element on PECO, are often associated with drainage ways alluvial terraces and dry washes.

Figure 19. Intermountain Semi-Desert Shrubland is represented on PECO by both a mix of shrubs such rubber rabbitbrush and grasses such as blue grama forming a shrub-steppe, or by predominantly shrub-dominated sites. These shrub-steppes are also commonly associated with past human disturbance including intensive livestock grazing and clearing of woodlands (photo: A. Kennedy).

Figure 20. Intermountain Semi-Desert Shrubland is also represented on PECO by dense rubber rabbitbrush shrublands that typically occur on alluvial terraces in or adjacent to drainages (photo: A. Kennedy).

Riparian and Wetland communities

The riparian zone of the Pecos River and to some extent Glorieta Creek is made up of several forested, shrub, and herbaceous wetland communities that make up a complex riparian ecological system that is driven by river hydrology. Periodic flooding, channel movement, sediment deposition and erosion are all part of the dynamics that create a shifting mosaic of communities along the river corridor. PECO lies at the transition between montane communities of narrow, confined stream channels and canyons, and broad lowland floodplains and this is reflected in the classification.

1.C.3.c Western North American Flooded & Swamp Forest

M034 Rocky Mountain and Great Basin Flooded & Swamp Forest

On PECO, extensive riparian forests (forested wetlands) occur along perennial stream channels of moderate gradient (1 to 5%) of the Pecos River and Glorieta Creek between 6,700 ft (2,040 m) and 7,250 ft (2,210 m). We have identified three montane riparian plant associations belonging to the Rocky Mountain & Great Basin Montane Riparian Forest Group (G506) that are dominated by the broadleaf deciduous trees narrowleaf cottonwood (*Populus angustifolia*) and box elder *(Acer negundo*) with various combinations of shrub- or graminoid-dominated understories (Figure 21). On PECO, the shrub understories are largely native (e.g., skunkbush sumac (*Rhus trilobata*), Wood's rose (*Rosa woodsii*), coyote willow (*Salix exigua*), bluestem willow (*Salix irrorata*), etc.), while herbaceous layers tend to be dominated by exotic grasses and forbs (e.g., smooth brome (*Bromus inermis*), Kentucky bluegrass (*Poa pratensis*), tall fescue (*Festuca arundinacea*), etc.). Toward the southern boundary of the main unit, plains cottonwood

(*Populus deltoides*) becomes more prevalent and the hybrid between narrowleaf and plains, lanceleaf cottonwood (*P. acuminata*), may occur as well and is considered part of the lower elevation Rocky Mountain & Great Basin Lowland & Foothill Riparian Forest Group (G503). Most of the forested wetlands occur on floodplain terraces and side bars adjacent to the river, but some can also occur on rocky substrates in the upper, more confined reach of the river within the park.

While there may be an occasional Russian olive (*Eleagnus angustifolia*) and saltcedar (*Tamarix chinensis*), native shrub species prevail, but exotics dominate among the grasses and forbs.

Figure 21. Rocky Mountain & Great Basin Montane Riparian Forest is represented on PECO by stands of narrowleaf cottonwood that line the banks of the Pecos River through the park, with scattered occurrences in the Pigeon's Ranch and Cañoncito Sub-units (photo: E. Muldavin).

2 Shrubland & Grassland (Mesomorphic Shrub & Herb Vegetation)

2.C Temperate & Boreal Shrubland & Grassland

2.C.5 Temperate & Boreal Freshwater Wet Meadow & Marsh

2.C.5.b Western North American Freshwater Wet Meadow & Marsh

M073 Western North American Lowland Freshwater Wet Meadow, Marsh & Shrubland

M075 Western North American Montane Wet Meadow & Low Shrubland

Interspersed among the forested wetlands are shrub and herbaceous wetlands that fall into three macrogroups. Within M073 is the Rocky Mountain & Great Basin Lowland & Foothill Riparian & Seep Shrubland Group (G526) of shrublands dominated by sandbar or coyote willow (*Salix exigua*) or bluestem willow (*S. irrorata*). These are typically dense shrub canopies with grassy understories dominated by sedges (*Juncus articus*) and/or exotic pasture grasses (Figure 22). These shrubland communities are associated with depositional island and sidebars along the channel and become more prevalent at lower elevations in New Mexico. Also included in the macrogroup are herbaceous wetlands dominated by cattails (*Typha latifolia*) that typically occur in side channels or seeps. These are widely distributed wetlands that belong to the Western North American Temperate Interior Freshwater Marsh Group (G518) and, although native, are considered potentially invasive.

Figure 22. Rocky Mountain & Great Basin Lowland & Foothill Riparian & Seep Shrubland is represented on PECO by shrublands dominated by willows and most commonly coyote willow. These shrubland are intermixed in a mosaic of forest and herbaceous wetlands along the Pecos River and Glorieta Creek (photo: E. Lindahl).

M075 incorporates the more montane, upper-elevation communities, and particular communities dominated by *Alnus incana* ssp. t*enuifolia* (G504). It can form dense shrublands along rocky banks of confined portions of the streams and becomes the dominant shrub wetland community further upstream in the watershed. Also part of this Macrogroup are native herbaceous wetlands dominated by Baltic sedge, rushes (*Carex nebrascensis,* among others), and spike rushes (e.g., *Eleocharis palustris*). These are often the first emergent communities on recently deposited sandbars and in side channels that are later succeeded by willows and cottonwoods.

The lack of significant incursion of exotic shrubs into these montane riparian ecosystems is the norm throughout most of northern New Mexico. On the other hand, herbaceous exotics tend to dominate the herbaceous layer with respect to abundance (as they do elsewhere in the West), but with respect to richness, the number of native species outnumbers exotics four to one. This is suggestive of a relatively functional riparian system that is further supported by the presence of reproducing native trees, particularly native cottonwoods, and stands of apparent different ages along the riparian corridor. This likely reflects the more or less intact hydrological regime both within and above the park, with limited draw-downs for agriculture or domestic use.

Classification Discussion

Several of the groups and associations described here are new under the current FGDC (2008) NVCS hierarchy. They have not had a formal review by either NatureServe (currently managing the NVC database) or the Ecological Society of America Vegetation Panel (responsible for final decisions regarding the classification) to confirm or reject the assignment of plots to the various classification categories. Accordingly, the classification remains provisional, and we would recommend that it be submitted for review to either NatureServe and/or the ESA panel before it and the accompanying plots are incorporated into the NPS national database (PLOTS). In addition, the descriptions provided in Appendix D are localized for the park and lack global content to provide a context for management and applied research. We would recommend that these locals also be incorporated into NatureServe's global framework and database and the global descriptions provided back to the park as a separate report.

Daubenmire (1974) suggested that plant communities integrate all impinging environmental conditions and, hence, the classification and description of plant associations provides a framework for understanding the ecological composition and structure of a given landscape. Accordingly, plant associations are used in the mapping process to define map-unit components, providing the information linkage between a vegetation community's spatial distribution and its ecology. The outcome is that by grouping land areas based on their ability to support similar associations, general management observations and recommendations can be made for each grouping. In addition, resource managers have found that the classification of vegetation into plant associations has provided insight and the ability to predict vegetation changes in response to various disturbance processes. Yet, the development of a vegetation classification is an incremental process of successive approximation (Shimwell 1971). In particular, on PECO, we suggest that further work is needed in evaluating the provisional associations identified in Table 3 to come to a better understanding of the ecosystem structure, composition, and processes in the park.

Vegetation Communities of Conservation Interest

From a regional perspective of conservation value, the narrowleaf cottonwood and willow communities that line the riparian corridor of the Pecos River are some of the finer examples found in northern New Mexico. NatureServe ranks these communities as G3, or vulnerable in a global context (http://www.natureserve.org/explorer). With the cessation of grazing, these groves have had a chance to fully develop diverse herbaceous understories in the context of a relatively intact hydrological regime and exhibit little evidence of ongoing site degradation.

Pecos National Historical Park Vegetation Map

Mapping process overview

The vegetation map for Pecos National Historical Park was developed using a combined strategy of automated digital-image classification and direct analog-image interpretation of aerial photography and satellite imagery. Initially, the aerial photography and satellite imagery were processed and entered into a GIS along with ancillary spatial layers. A working legend of ecologically based vegetation map units was developed using the vegetation classification described in Chapter 2 as the foundation. The intent was to develop map units that targeted the plant-association level wherever possible within the constraints of image quality, information content, and resolution. With the provisional legend and ground-control points provided by the field-plot data (the same data used to develop the vegetation classification), a series of automated image segmentation and supervised image classifications were conducted, followed by fine-scale map refinement using direct image interpretation and manual editing. The outcome was a vegetation map composed of a suite of map units defined by plant associations and represented by sets of mapped polygons with similar spectral and physical characteristics.

Per the guidance of the National Vegetation Mapping Program (http://biology.usgs.gov/npsveg/), the key mapping standards call for spatial data to be provided with a horizontal positional accuracy meeting National Map Accuracy Standards of at least the 1:24,000 scale (i.e., that each well-defined object in the spatial database be within 1/50-of-an-inch display scale or 12.2 m (40 ft) of its actual location).

Mapping methods

Data sources and processing

Initially, DigitalGlobe QuickBird satellite imagery was used as the foundation for the map and the initial classification from which polygon primitives were developed. As that imagery was found to have significant geometric errors in areas of high relief, our mapping process incorporated aerial digital ortho-photography (Digital Orthophoto Quarter Quads, or DOQQ) as the foundation for the final development of the map. The DOQQs used were the statewide one-meter resolution, natural color, and color infrared imagery from 2005. All imagery was processed using ERDAS Imagine 9.2. The final image products and other spatial data layers were compiled into a geodatabase and GIS using ArcGIS 10.0 (ESRI 2010, http://www.esri.com). To support the mapping process, we acquired as a standard set of relevant spatial data layers (e.g., roads, buildings, topographic maps, etc.). QuickBird imagery was acquired over the main park area and Pigeon's Ranch unit on August 30, 2006. Due to cloud cover, a second image was acquired over the Cañoncito unit on October 18, 2006. The QuickBird data consisted of the four-band multi-spectral imagery at 2.4-meter spatial resolution (Table 4) and the 0.6-meter spatial panchromatic band (0.4-0.9 μms). Despite having the best spatial resolution, the panchromatic integrates the spectral reflectance over the visible and near infrared wavelengths into just one output response per pixel. Multi-spectral satellite imagery, on the other hand, records different reflectance values of the variable natural radiation of surface materials such as rocks, plants, soils, and water over the Instantaneous Field of View (IFOV), which denotes the image's spatial resolution. Variations in plant reflection and absorption due to biochemical composition produce distinct spectral "signatures" (Jensen 2007). These signatures

provide a quantitative measure of reflectance at specific wavelengths, which can be analyzed statistically to develop a vegetation map of spectrally similar plant communities.

Table 4. Multi-spectral band descriptions for Quickbird satellite imagery used in the mapping of Pecos National Historical Park.

Landsat Band	Wavelength (μms)	Surface Response
Band 1	Visible Blue (0.45-0.52)	Absorption by most materials except saline or sandy soils.
Band 2	Visible Green (0.52-0.6)	Minor green vegetation reflectance peak.
Band 3	Visible Red (0.63-0.69)	Green vegetation absorption, but senescent vegetation reflectance and iron-stained soils reflect in these wavelengths.
Band 4	Near-Infrared (0.76-0.9)	Green vegetation reflectance peak.

A Normalized Difference Vegetation Index (NDVI) was computed from the QuickBird imagery. The NDVI (Equation 1) emphasizes vigorous green plant growth by comparing a strong chlorophyll reflectance in the near-infrared wavelengths (Band 4) against chlorophyll absorption in the visible red wavelengths (Band 3).

NDVI = ((Band 4 – Band 3) / (Band 4 + Band 3) + 1) * 100 (Equation 1)

Band ratios, in general, are designed to divide a reflectance peak against an absorption low to distinguish unique surface features. Due to the potential differences between image data ranges, the difference between bands is normalized against the total data range of the image bands. The adding of "1" and multiplying by "100" in each equation takes the original result, which would be a positive or negative fractional value centered around 0, and turns it into a positive integer value centered around 100.

In addition a 7 x 7 texture filter was derived from the NDVI image. The resulting texture image enhanced areas of heterogeneity (forests and woodlands) over areas that were more homogenous (fields and grasslands) which showed little contrast change in the imagery. This image in turn was divided into the NDVI in order to better discriminate between communities with a more woody vegetative component from those which had a more herbaceous vegetative component in areas where their NDVIs were similar.

The QuickBird multi-spectral imagery was merged together with the panchromatic imagery using a multiplicative data fusion technique. The resulting file provided much of the spectral capabilities inherent in the above images but at the spatial resolution of the panchromatic imagery. The imagery was resampled up to a one-meter spatial resolution, to reduce its file size and provide a more logical unit of a pixel being 1 m^2. These files and their derived NDVI and texture products were combined into one image file to be classified using a supervised classification approach.

Vegetation map units and legend development

The development of map units (map classes) and construction of a map legend is an iterative process that integrates the ecological vegetation classification units (plant associations, alliances,

etc.) described above with their spatial distribution as determined by the quality of the remote sensing imagery and on-the-ground reconnaissance work. Following NPS guidelines, our goal was to develop map units that utilize the plant-association level of the national classification, but this was contingent on being able to discern differences in the available imagery at that level using various remote-sensing techniques.

Initially, we used simple aerial-photo interpretation to develop a working legend of plausible map units based on the true-color and infrared photography, and ground-control sample points. While some units were defined by one or two primary plant associations and were relatively simple, others were either structured or unstructured complexes of plant associations. Structured complexes are composed of two or more plant associations that either form fine-scale patterns, not separable at the scale of mapping (i.e., below the minimum map unit size of 0.5 ha), or they are not separable spectrally, but the spatial organization of the associations within the unit are understood to some degree. In unstructured complexes, however, the environmental/spatial relationships among spectrally similar associations are poorly understood.

We hierarchically structured the legend into two tiers: a basic lower Level 2 composed of simple map units or complexes as defined by plant associations from Table 3, and an upper Level 1, which groups the Level 2 map units where possible following the Group level of the NVCS as currently implemented by NatureServe and the Ecological Society of America National Vegetation Panel (FGDC 2008). The Level 1 grouping allows the map to be comparable at regional scales to other mapping efforts, such as Gap and Landfire (Keane et al. 2002; Prior-Magee 2007).

For each map unit, the most predominant associations are identified as Primary Components of the unit (collectively greater than 50% of the aerial extent of the unit), while associations known to be less common from ground reconnaissance are designated as Secondary Components (collectively <50% of the area). In addition, those associations estimated to occupy less than an estimated 10% of the area of unit are designated as inclusions. In general, these are related inclusions that are floristically similar to the primary and secondary components, but are relatively rare (and usually not found in other map units). Contrasting inclusions of very different associations can also occur, usually as small patches. These are typically major components of other map units and are generally considered mapping errors, and are not listed. Map unit component association assignment is based on the plot data gathered for the classification and mapping. That is, each plot was intersected with the map layer in the GIS and then each map unit attributed based on the distribution of plots among plant associations for that unit.

The hierarchical working legend formed the foundation for subsequent image analysis and classification. Based on the results of the image analysis and subsequent heads-up screen editing, the legend was further refined, both by lumping and splitting the draft units. The map and its legend went through several iterations as ground data was gathered through the years and new imagery was acquired.

Image analysis and map development

Base map development

To efficiently develop a base map with a polygon structure (versus raster/pixel) per NPS specifications we employed eCognition, Definiens Cognition Network Technology® object-oriented classification software (Definiens http://www.definiens.com). This software uses an image segmentation technique to delineate the imagery into objects (polygons) of similar color, contrast, and shape. The advantage of this approach is that these objects will preserve edge boundaries of detailed surface features such as roads, cliffs, and drainages – features that would be lost or misclassified in a more traditional pixel-based classification. In this automated polygon delineation framework, the level of detail is controlled by a unitless scale parameter[†] that considers each polygon object based on its homogeneity of color and shape, each of which is weighted from zero to one. The smaller the scale parameter, the more detail is represented and the more the image is segmented into polygon objects, with a scale factor of "1" theoretically representing individual pixels of the original photography base. In this project, the scale parameter varied from 75 to 125 from region to region of analysis. The scale parameter is dependent on the weighting of the shape and color factors. In this case, the color factor and the shape factor were given equal weight at 0.5. The shape sub-factors of smoothness and compactness were weighted equally (0.5). This process generated over 15,000 raw polygons over the three sub-units.

Supervised Classification

A simultaneous raster-based image classification was conducted based on 'seed' polygons that were digitally drawn in spectrally homogeneous areas around selected vegetation field plots with the help of the ancillary data such as field notes and photographs. From these polygons, image statistics were collected to perform a supervised classification. Supervised classifications are based on a maximum likelihood decision rule containing a Bayesian classifier that uses probabilities to weight the classification toward particular classes. In this study, the probabilities were unknown, so the maximum likelihood equation (Eq. 2) for each of the classes is given as:

$$D = [0.5\ln(cov_c)]-[0.5(X-M_c)^T * (cov_c^{-1})*(X-M_c)] \text{ (Eq.2)},$$

where **D** is the weighted distance, $\mathbf{cov_c}$ is the covariance matrix for a particular class, **X** is the measurement vector of the pixel, $\mathbf{M_c}$ is the mean vector of the class and $^{\mathbf{T}}$ is the matrix transpose function (ERDAS 2010, http://www.erdas.com). Each pixel is then assigned to the class with the lowest weighted distance. This technique assumes the statistical signatures have a normal distribution.

[†] The scale parameter is an abstract term that determines the maximum allowed heterogeneity for the resulting image objects (polygons). In heterogeneous data the resulting objects for a given scale parameter are smaller than in more homogeneous data. By modifying the value in the "scale parameter" control, you can vary the size of the polygons.

This decision rule is considered the most accurate, because it not only uses a spectral distance as the minimum-distance decision rule, but also takes into account the variance of each of the signatures. The variance is important when comparing a pixel to a signature representing, for example, a woodland community, which can be fairly heterogeneous due to numerous canopies and non-canopy interspaces, as compared to a grassland community, which is more homogeneous.

Final map classification and ancillary layers

The final supervised raster classification with 39 Level 2 map units was then used to classify the image polygons developed from the object-oriented classification. The image objects (primitives) were imported as a feature of the dataset polygon layer in ESRI ArcGIS (v. 10.0), the file quality controlled, and a topology built. The image polygons were then overlaid onto the recoded raster classification and the majority map unit assigned as that polygon's map unit.

Since Quickbird can have significant geometric error in areas of high relief, we used the available 2005 natural color and color infrared DOQQs to improve the geometric accuracy of the line work and this was the basis for the final photo-interpretive editing of the polygons (particularly in canyon bottoms than run north to south). This also sets a more standardized baseline as new imagery becomes available to potentially be used to evaluate changes in the landscape. In addition, for the final edit, we were able access recent sub-meter Digital Globe imagery through 2012 Microsoft Corporation Bing Imagery available via ESRI ArcGis 10.0. As with all Bing imagery, the exact image date is not provided, but a search of the Digital Globe library indicates three possible dates: 2009-01-13, 2011-11-18, 2012-01-09, or a combination thereof. We think that it is not likely that the 2012 imagery had been posted to Bing, and that the 2011 imagery is the most likely candidate, but this will need to be field verified.

Using the draft legend as the guide, Level 2 map unit polygons were edited using heads-up photo-interpretative digitizing in ArcGis based on 223 ground-control plots and all available image layers. During the process, the number of Level 2 map units was reduced from 39 to 32. While the required minimum mapping requirements were 1:24,000 scale with map unit delineations or polygons 0.5 ha or larger, given the relatively small size FODA, an operational scale of 1:12,000 was chosen for the output of poster-sized maps of around ten square feet. Adjacent polygons of the same class were merged for the final map. The minimum mapping polygon size was also reduced from 5,000 m^2 to 1,000 m^2 with even smaller areas allowed for isolated wetlands of interest. Throughout the mapping process, map units were evaluated for coherence and the legend modified accordingly. Final map products included the geodabase and a 1:12,000 poster map at Level 2.

Mapping Results

Vegetation Map and Map Legend

The vegetation map for PECO is presented in Figure 23 along with an abbreviated legend in Table 5. We also produced a 1:12,000-scale poster map that is available as both a PDF and shape file for GIS use at http://biology.usgs.gov/npsveg/products/parkname.html. There are eight Level 1 units that correspond to the group level of the NVCS, plus a set of three land-cover units that identify sparsely-vegetated ephemeral dry washes (MU 9) and human land uses such as urban and built-up land, including residential vegetation, structures and buildings, roads, trails and

water (MUs 10 and 11). At Level 2, there 24 were vegetation units and eight miscellaneous land cover units. They were further defined by one or more plant associations per the PECO vegetation classification in Table 5; each is identified as either a primary or secondary component, or a related or contrasting inclusion. The Level 2 map units are also cross-referenced by a map symbol in the vegetation classification table (see Table 3). The map-unit name reflects the primary component associations of the unit. A complete annotated legend with summary descriptions of the units, distribution maps, aerial photo examples of map unit polygons, and representative photos is provided in Appendix E.

Park vegetation patterns in the main unit are distinctively different from the east to the west side of the Pecos River. To the east, in the foothills of the Sangre de Cristo Mountains, Douglas-fir, ponderosa pine, and pinyon-dominated forests and woodlands with understories of Gambel's and wavyleaf oak tend to prevail on the ravine slopes (MUs 1A, 2A, 3A, and 3B), particularly on north-facing slopes. But there are large areas where oaks are minimal, particularly on ridge summits and gentler slopes (3C). These sites tend to have denser tree canopies and as a result often have sparse understories with only scattered grasses. Similar vegetation also occurs in the Pigeon's Ranch and Cañocito Sub-units.

Across the river to the west, oaks become less and less prevalent, and grassy understories are the norm in the woodlands. Even on escarpments above the river, shrubs are limited (3D) or on highly eroded woodland sites (3E). On rolling hills and plains, open woodlands with grassy inter-tree spaces dominated by blue grama are common (2B and3F), but many of these areas have been cleared of trees either historically or recently and are now mapped as open, treated woodland (3I) if at least 10% trees remain, or as grasslands, if not (7A-E). In fact, most of the extant grasslands in the park are a legacy of this practice (the exceptions are scattered, isolated meadows among the woodlands). Distributed across the western portion of the park are shallow drainages (draws) where woodlands remain. These are dominated by ponderosa (2C) or pinyon (3G) and also tend to have grassy understories. In the major drainages, Pecos and Glorieta, we have mapped a separate pinyon woodland on the high alluvial terraces that were likely flood deposited (3H). These drainages have either continuous perennial river flows (Pecos) or intermittent perennial flow (Glorieta), but flooding is expected and ground water is near the surface. Hence, these areas support extensive narrowleaf cottonwood riparian forests, willow shrublands, and herbaceous wetlands (4A, 4B, 6A, 6B, and 8A). These also occur in the Pigeon's Ranch and Cañocito Sub-units. Higher and drier terraces can also support dense rabbitbrush shrublands, particularly along Glorieta Creek and the dry wash in the Cañocito Sub-unit(5A).

The Urban or Built-up Land map unit contains various units for archeological sites, modern development, and roads with associated disturbance vegetation types (10A-E). And lastly, there are units for demarking open waters of rivers and ponds, either natural or impoundments (11A and 11B).

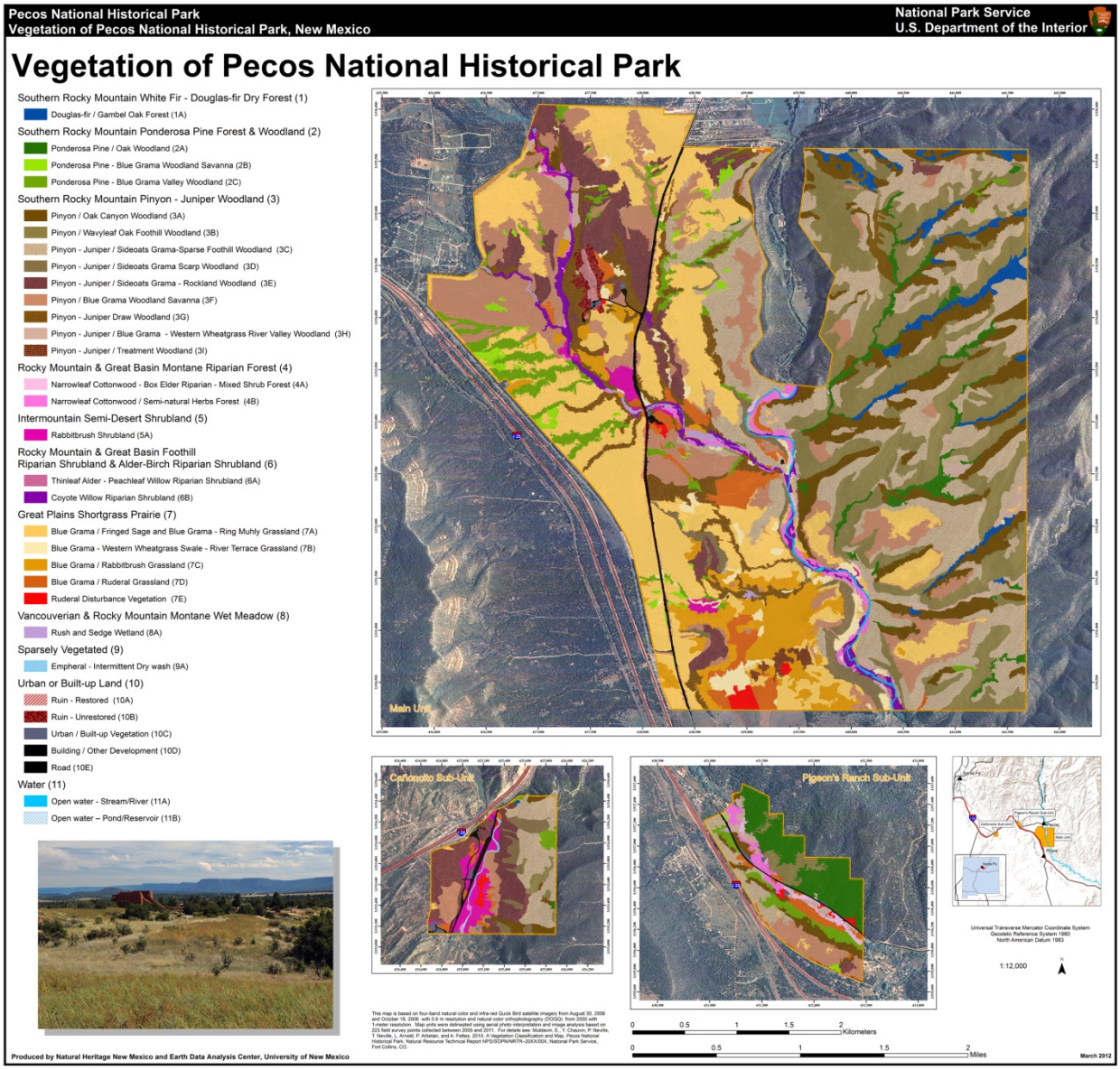

Figure 23. The vegetation map of Pecos National Historical Park portraying the Level 2 units (see table 5 and Appendix E for map unit definitions). A full-size 1:12,000 poster version is available at http://biology.usgs.gov/npsveg/products/peco/index.html.

Table 5. A hierarchical legend for the Pecos National Historical Park Vegetation Map composed of two nested levels, L1 and L2, along with component plant associations and their database codes that make up each map unit (see table 3). Under "Type," each association is designated either as a primary component (1), secondary component (2), or related inclusion (incl). The number of polygons representing the level 2 map unit is indicated, along with total area in hectares and acres.

Pecos National Historical Park Vegetation Map Legend

Map Unit 1	Map Unit 2	Map unit name / plant association	Code	Comp. Type	No. of Polys	Area (ha)	Area (ac)
1		**Southern Rocky Mountain White Fir - Douglas-fir Dry Forest**	**G226**				
	A	Douglas-fir / Gambel Oak Forest			23	39.1	96.5
		• *Pseudotsuga menziesii - Quercus gambelii* Forest	CEGL000452	1			
2		**Southern Rocky Mountain Ponderosa Pine Forest & Woodland**	**G228**				
	A	Ponderosa Pine / Oak Woodland			25	83.8	207.1
		• *Pinus ponderosa - Quercus gambelii* Woodland	CEGL000870	1			
		• *Pinus ponderosa - Quercus X pauciloba* Woodland	CEGL000874	2			
		• *Pinus ponderosa* / Sparse Understory Woodland	CEGL002384	incl			
	B	Ponderosa Pine - Blue Grama Woodland Savanna			30	16.7	41.3
		• *Pinus ponderosa / Bouteloua gracilis* Woodland	CEGL000848	1			
		• *Pinus ponderosa* / Sparse Understory Woodland	CEGL002384	incl			
	C	Ponderosa Pine - Blue Grama Valley Woodland			51	76.5	188.9
		• *Pinus ponderosa / Bouteloua gracilis* Woodland	CEGL000848	1			
		• *Pinus ponderosa / Schizachyrium scoparium* Woodland	CEGL000201	2			
		• *Pinus ponderosa / Poa fendleriana* Forest	GRCA_New6	incl			
		• *Pinus ponderosa* / Sparse Understory Woodland	CEGL002384	incl			
3		**Southern Rocky Mountain Pinyon - Juniper Woodland**	**G253**				
	A	Pinyon / Oak Canyon Woodland			68	192.8	476.5
		• *Pinus edulis - Juniperus* spp. / *Quercus gambelii* Woodland	CEGL000791	1			
		• *Pinus edulis - Juniperus monosperma / Quercus X pauciloba* Woodland	CEGL000793	1			
		• *Pinus edulis - Juniperus monosperma / Bouteloua curtipendula* Woodland	NHNM000570	incl			
	B	Pinyon / Wavyleaf Oak Foothill Woodland			47	378.4	934.9
		• *Pinus edulis - Juniperus monosperma / Quercus X pauciloba* Woodland	CEGL000793	1			
		• *Pinus edulis - Juniperus* spp. / *Cercocarpus montanus* - Mixed Shrubs Woodland	CEGL000780	2			
		• *Pinus edulis - Juniperus monosperma / Bouteloua curtipendula* Woodland	NHNM000570	incl			
		• Sparse Vegetation - Rockland	N/A	incl			
	C	Pinyon - Juniper / Sideoats Grama-Sparse Foothill Woodland			68	441.5	1090.5

Table 5. A hierarchical legend for the Pecos National Historical Park Vegetation Map, continued

Pecos National Historical Park Vegetation Map Legend							
Map Unit 1	**2**	**Map unit name / plant association**	**Code**	**Comp. Type**	**No. of Polys**	**Area (ha)**	**Area (ac)**
		• *Pinus edulis - Juniperus monosperma / Bouteloua curtipendula* Woodland	NHNM000570	1			
		• *Pinus edulis* / Sparse Understory Woodland	CEGL000795	1			
		• *Pinus edulis / Achnatherum scribneri* Woodland	NHNM000798	2			
		• *Pinus edulis - (Juniperus monosperma, Juniperus deppeana) / Bouteloua gracilis* Woodland	CEGL002151	incl			
		• *Pinus edulis - Juniperus monosperma / Muhlenbergia montana* Woodland	NHNM000572	incl			
		• Sparse Vegetation - Rockland		incl			
	D	Pinyon - Juniper / Sideoats Grama Scarp Woodland			14	42.6	105.2
		• *Pinus edulis - Juniperus monosperma / Bouteloua curtipendula* Woodland	NHNM000570	1			
		• *Pinus edulis - Juniperus scopulorum / Schizachyrium scoparium* Woodland	NHNM000578	2			
		• *Pinus edulis / Achnatherum scribneri* Woodland	CEGL000798	incl			
		• *Pinus edulis - Juniperus* spp. / *Cercocarpus montanus* - Mixed Shrubs Woodland	CEGL000780	incl			
		• Sparse Vegetation - Rockland		incl			
	E	Pinyon - Juniper / Sideoats Grama - Rockland Woodland			24	142.0	350.9
		• *Pinus edulis - Juniperus monosperma / Bouteloua curtipendula* Woodland	NHNM000570	1			
		• Sparse Vegetation - Rockland	N/A	2			
		• Sparse Vegetation - Bare Ground	N/A	2			
		• *Pinus edulis - (Juniperus monosperma, Juniperus deppeana) / Bouteloua gracilis* Woodland	CEGL002151	incl			
		• *Pinus edulis* / Sparse Understory Woodland	CEGL000795	incl			
	F	Pinyon / Blue Grama Woodland Savanna			105	287.9	711.3
		• *Pinus edulis - (Juniperus monosperma, Juniperus deppeana) / Bouteloua gracilis* Woodland	CEGL002151	1			
		• *Pinus edulis* / Sparse Understory Woodland	CEGL000795	2			
	G	Pinyon - Juniper Draw Woodland			42	93.3	230.6
		• *Pinus edulis - (Juniperus monosperma, Juniperus deppeana) / Bouteloua gracilis* Woodland	CEGL002151	1			
		• *Pinus edulis - Juniperus scopulorum / Pascopyrum smithii* Woodland	NHNM000576	2			
		• *Pinus edulis* / Sparse Understory Woodland	CEGL000795	incl			
		• *Pinus edulis - Juniperus monosperma / Bouteloua curtipendula* Woodland	NHNM000570	incl			
	H	Pinyon - Juniper / Blue Grama - Western Wheatgrass River Valley Woodland			35	35.3	87.1

Table 5. A hierarchical legend for the Pecos National Historical Park Vegetation Map, continued

Pecos National Historical Park Vegetation Map Legend							
Map Unit		**Map unit name / plant association**	**Code**	**Comp. Type**	**No. of Polys**	**Area (ha)**	**Area (ac)**
1	**2**						
		• *Pinus edulis - (Juniperus monosperma, Juniperus deppeana) / Bouteloua gracilis* Woodland	CEGL002151	1			
		• *Pinus edulis - Juniperus scopulorum / Pascopyrum smithii* Woodland	NHNM000576	2			
		• *Juniperus scopulorum / Rhus trilobata* Woodland	NHNM000474	2			
	I	Pinyon - Juniper / Treatment Woodland			4	6.2	15.3
		• *Pinus edulis - (Juniperus monosperma, Juniperus deppeana) / Bouteloua gracilis* Woodland, TreeTreatment Phase	CEGL002151	1			
4		**Rocky Mountain & Great Basin Montane Riparian Forest**	**G506**				
	A	Narrowleaf Cottonwood - Box Elder Riparian - Mixed Shrub Forest			12	6.3	15.7
		• *Populus angustifolia - Acer negundo* / *Poa pratensis* Woodland	CEGL005961	1			
		• *Populus angustifolia / Salix exigua* Woodland	CEGL000654	2			
	B	Narrowleaf Cottonwood / Semi-natural Herbs Forest			33	24.0	59.4
		• *Populus angustifolia* / Invasive Perennial Grasses Semi-natural Woodland	CEGL003749	1			
		• *Populus angustifolia / Salix exigua* Woodland	CEGL000654	2			
		• *Populus deltoides (*ssp. *wislizeni,* ssp. *monilifera) / Salix exigua* Woodland	CEGL002685	incl			
5		**Intermountain Semi-Desert Shrubland**	**G310**				
	A	Rabbitbrush Shrubland			24	26.1	64.4
		• *Ericameria nauseosa* Shrubland	CEGL002713	1			
		• *Ericameria nauseosa / Bouteloua gracilis* Shrub Herbaceous Vegetation	CEGL003495	2			
6		**Rocky Mountain & Great Basin Foothill Riparian Shrubland & Alder-Birch Riparian Shrubland**	**G526 & G504**				
	A	Thinleaf Alder - Peachleaf Willow Riparian Shrubland			2	0.7	1.8
		• *Alnus incana* ssp. *tenuifolia - Salix amygdaloides* Shrubland	NHNM000323	1			
	B	Coyote Willow Riparian Shrubland			29	30.8	76.1
		• *Salix exigua / Juncus arcticus* Shrubland	NHNMNew7	1			
		• *Salix exigua* / Invasive Perennial Grasses Semi-natural Shrubland	NHNM000856	1			
		• *Salix exigua / Eleocharis palustris* Shrubland	NHNM000779	2			
		• *Salix exigua - Ericameria nauseosa* Shrubland	NHNM000773	incl			
		• *Salix irrorata / Festuca arundinaceae* Shrubland	NHNM000789	incl			
7		**Great Plains Shortgrass Prairie**	**G144**				
	A	Blue Grama / Fringed Sage and Blue Grama - Ring Muhly Grassland			68	453.8	1121.5

Table 5. A hierarchical legend for the Pecos National Historical Park Vegetation Map, continued

Pecos National Historical Park Vegetation Map Legend							
Map Unit 1	**2**	**Map unit name / plant association**	**Code**	**Comp. Type**	**No. of Polys**	**Area (ha)**	**Area (ac)**
		• *Artemisia frigida* / *Bouteloua gracilis* Dwarf-shrubland	CEGL002782	1			
		• *Bouteloua gracilis - Muhlenbergia torreyi - Aristida purpurea* Herbaceous Vegetation	CEGL005389	2			
		• *Bouteloua gracilis - Bouteloua curtipendula* Herbaceous Vegetation, Tree Treatment Phase	CEGL001754	Incl			
		• *Bouteloua gracilis* / Ruderal Herbaceous Vegetation, Tree Treatment Phase	NPS_NM043	incl			
	B	Blue Grama - Western Wheatgrass Swale - River Terrace Grassland			46	34.4	85.0
		• *Pascopyrum smithii - Bouteloua gracilis* - Herbaceous Vegetation	CEGL001578	1			
		• *Pascopyrum smithii* / Ruderal Herbaceous Vegetation	NPS_NM045	2			
		• *Bouteloua gracilis* / Ruderal Herbaceous Vegetation	NPS_NM043	incl			
	C	Blue Grama / Rabbitbrush Grassland			45	100.1	247.3
		• *Ericameria nauseosa - Bouteloua gracilis* Shrub Herbaceous Vegetation	CEGL003495	1			
		• *Bouteloua gracilis* / Ruderal Herbaceous Vegetation	NPS_NM043	incl			
	D	Blue Grama / Ruderal Grassland			49	61.1	150.9
		• *Bouteloua gracilis* / Ruderal Herbaceous Vegetation	NPS_NM043	1			
		• *Psathyrostachys juncea* / Monotypic Herbaceous Vegetation	NHNM000236	2			
		• *Bouteloua gracilis* / Old Field Herbaceous Vegetation	NPS_NM042	incl			
	E	Ruderal Disturbance Vegetation			13	11.4	28.2
		• Ruderal Disturbance Vegetation	NPS_NM027	1			
		• *Bouteloua gracilis* / Ruderal Herbaceous Vegetation	NPS_NM043	2			
8		**Vancouverian & Rocky Mountain Montane Wet Meadow**	**G521**				
	A	Rush and Sedge Wetland			18	7.2	17.7
		• *Juncus balticus* Herbaceous Vegetation	CEGL001838	1			
		• J*uncus arcticus - Festuca arundinaceae* Semi-natural Herbaceous Vegetation	NHNM000183	2			
		• *Juncus arcticus* / *Anemopsis californica* Herbaceous Vegetation	NHNM000185	incl			
		• *Juncus arcticus* / *Typha latifolia* Herbaceous Vegetation	NHNM000186	incl			
		• *Typha (latifolia, angustifolia) Western Herbaceous Vegetation*	CEGL002010	incl			
		• *Carex nebrascensis - Eleocharis palustris Herbaceous Vegetation*	NHNM000186	incl			
		• *Juncus arcticus - Schoenoplectus pungens Herbaceous Vegetation*	NHNM000186	incl			
		• *Salix exigua* / *Juncus arcticus* Shrubland	NHNMNew7	incl			
		• *Salix exigua* / Invasive Perennial Grasses Semi-natural Shrubland	NHNM000856	incl			

Table 5. A hierarchical legend for the Pecos National Historical Park Vegetation Map, continued

Pecos National Historical Park Vegetation Map Legend							
Map Unit		**Map unit name / plant association**	**Code**	**Comp. Type**	**No. of Polys**	**Area (ha)**	**Area (ac)**
1	**2**						
9		**Sparsely Vegetated**					
	A	Empheral - Intermittent Dry wash			2	1.7	4.1
10		**Urban or Built-up Land**					
	A	Ruin - Restored			1	4.0	9.8
		• Ruderal Disturbance Vegetation	NPS_NM027	1			
		• *Bouteloua gracilis* / Ruderal Herbaceous Vegetation	NPS_NM043	2			
		• *Pascopyrum smithii* / Ruderal Herbaceous Vegetation	NPS_NM045	2			
	B	Ruin - Unrestored			4	7.8	19.2
		• Ruderal Disturbance Vegetation	NPS_NM027	1			
		• *Bouteloua gracilis* / Ruderal Herbaceous Vegetation	NPS_NM043	2			
		• *Pascopyrum smithii* / Ruderal Herbaceous Vegetation	NPS_NM045	2			
	C	Urban / Built-up Vegetation			13	3.4	8.3
		• Ruderal Disturbance Vegetation	NPS_NM027	1			
	D	Building / Other Development			5	0.8	1.9
		• Ruderal Disturbance Vegetation	NPS_NM027	1			
	E	Road			52	20.2	50.0
		• Ruderal Disturbance Vegetation	NPS_NM027	1			
		• *Bouteloua gracilis* / Ruderal Herbaceous Vegetation	NPS_NM043	2			
		• *Pascopyrum smithii* / Ruderal Herbaceous Vegetation	NPS_NM045	2			
11		**Water**					
	A	Open water - Stream/River			2	7.6	18.7
	B	Open water – Pond/Reservoir			10	0.7	1.8

Discussion

Mapping the grasslands and woodlands that dominate PECO presented challenges because of the subtle spectral differences among closely related types. Spectral signatures could overlap significantly among grass species and even shrubs. Therefore, our interpretation was also based on modeling landscape characteristics and soil signatures in relation to composition as sampled in the field. This was further compounded by a long and complex land-use history, both historic and prehistoric, that shapes much of the vegetation pattern, particularly in the grasslands. Landscapes are of course in constant flux with respect to vegetation, particularly where there is active resource management. This map initially represented a snapshot in time based on the 2006 imagery. Since that time, there have been active treatments for shrubs and trees at PECO, particularly west of the river and on ridge summits to the east. Luckily, given recent innovations for accessing imagery through on-line services such as Bing Imagery or Google Earth in a GIS, maps can be updated relatively easily using head's up digitizing as we did for this map to reflect some of the recent changes. These advances in combination with a well-defined and detailed legend will allow the park to continue to update polygons to reflect the ongoing change. Overall, the combination of the annotated legend (Appendix E) and the detailed floristic and site descriptions of individual plant associations (Appendix D) provide for a vegetation map that is ecologically rich in information and one that can serve multiple purposes in the management of the park and the broader network of parks.

Accuracy Assessment

The thematic accuracy of the PECO vegetation map was assessed following the USGS-NPS guidelines (Lea and Curtis 2010). Under these guidelines, the goal is to determine if overall and individual map unit accuracies exceed 80% from both producers' and users' perspectives. We tested both Level 1 (NVCS Group) and Level 2 of the legend hierarchy, and also scaled up to broad physiognomic classes of forest, woodland, shrubland, grassland, and riparian. We report the results here and make recommendations on the use of the map in the context of users' and producers' errors detected among the map units at various levels of the hierarchy.

With respect to positional accuracy, this is usually omitted from USGS-NPS National Vegetation Mapping Program products since vegetation seldom splits along discrete edges that can be positively located in the field. The subjectivity involved in this effort, plus the high resolution and accuracy of the ortho-photo imagery, usually allows for the assumption that all products derived from them are well within National Map Accuracy Standards for 1:12,000-scale maps (±30 feet). Further, since no additional funding was budgeted or available, the positional accuracy was not assessed (Cogan 2007).

Accuracy Assessment Methods

The USGS-NPS accuracy assessment (AA) methodology follows a point-based, minimum-mapping-unit design versus a polygon-based design. That is, to test the map, a set of points are distributed in a random systematic design such that each point represents a non-overlapping area of, in this case, 0.50 ha (the required minimum mapping unit polygon area for the project). Each point is attributed according to the map unit of the polygon that it falls in. The points are then randomly selected for field sampling, but stratified by map unit and as constrained by logistical considerations (primarily access and safety). While guidelines suggest using at least 30 sample points per map unit to support the error statistics in the subsequent contingency tables, resources limited sampling points to 339 or an average of about 15 per vegetation map unit. Ultimately, some units were underrepresented in the sample pool because of their limited extent (e.g., wetlands and riparian areas), while others were over represented somewhat, particularly among the most common units (the maximum was 37 for map unit 7A). Lastly, we minimized the sampling of miscellaneous land cover types that were conspicuous in the imagery such as water, buildings, roads, etc., (MUs 10 & 11).

Field data collection

To allocate sampling, we gridded the park into a set of 1-ha grid cells with a random sampling point in each. We then designed sampling tracks that a field person could reasonably cover in a single ten-hour day (including vehicle travel). The AA sampling was conducted during the summer of 2009. To support field sampling, paper maps were created at a 1:6,000-scale with target sample points and the underlying imagery and topography. These were used by the field crew as guidance in developing optimal sampling strategies with respect to map-unit targets and logistics, and for reconnoitering in the field. In the field, crews would navigate to the point location and determine if the point was representative of the surrounding vegetation as a whole. If not, crews were allowed to move the point to a representative area and provide a justification for the move. The key was to avoid sampling small patches or fragments of plant associations not typical of the target stand.

At the sample location, a validation plot was taken that included cover of the dominant species in each strata (trees, shrubs, subshrubs, grasses, and forbs), aspect (azimuth), slope (%), a brief description of the polygon landscape and composition relative to the sampling point, the GPS location (+/- 10 m precision), and four representative digital photos. A total of 339 validation plots were collected (Figure 24, 25, and 26).

The plot data were entered from the paper field sheets into the NHNM Plot Database (MS Access-based) and quality controlled with automated error routines and manual read-backs of the data. The digital photos were also databased and archived. Plant voucher specimens of unknowns were identified and those of high quality accessioned into the University of New Mexico Herbarium.

Analysis methods

Initially, each validation point was classified based on dominance and indicator species into a plant association following the PECO vegetation classification and dichotomous key (Table 3 and Appendix C). A validation point was then assigned to a map unit according to the plant association composition of the unit as reflected in the map unit descriptions (Table 5, Appendix E). In most cases, assignments were from either the primary or secondary components of the map units and, occasionally, related inclusions (<5%). Contrasting inclusions were considered errors.

Following the guidelines of Lea and Curtis (2010), two-way contingency tables were calculated with two accuracy measures for each map unit: a producers' and a users' accuracy. Producers' accuracy reflects how well the map-unit delineations represent that vegetation type on the ground and not some other vegetation type (e.g., that pinyon-juniper woodlands are mapped accurately based on the field-validation point locations). This provides the map maker with a measure of how well the mapping product meets specifications. In contrast, the users' accuracy demonstrates how well the map performs when used in the field. For example, when a juniper woodland encountered on the ground is mapped as such and not as some other map unit. This provides the user, regardless of training, a level of confidence that what one sees on the ground is actually the element indicated by the map. In addition, the 90% confidence interval was calculated by map unit for each type of error.

To quantify overall accuracy, we calculated both an overall accuracy and an estimate of Kappa (Kappa Index) for each of the three map unit levels in the legend. The overall accuracy is simply the total number of agreements between the map and the reference data. The estimate of Kappa is another measure of agreement or accuracy varying from 0 to 1, where higher values indicate better agreement. The Kappa statistic (KHAT) is used to measure the difference between the actual agreement between the reference data and the map and the chance agreement between the reference data and a random map. KHAT indicates the extent to which the percentage-correct values of an error matrix are due to "true" agreement versus "chance" agreement.

The results are presented as three contingency tables showing the producers' (Polygon Mapped As) and users' (Polygon Validated As) errors by map unit with associated 90% confidence intervals, and the overall accuracy and the Kappa estimate for each level. One addresses the general vegetation types of forests and woodlands, riparian and wetland vegetation, grasslands, and miscellaneous land cover elements taken together. The other two focus on the Level 1 and Level 2 map units, respectively.

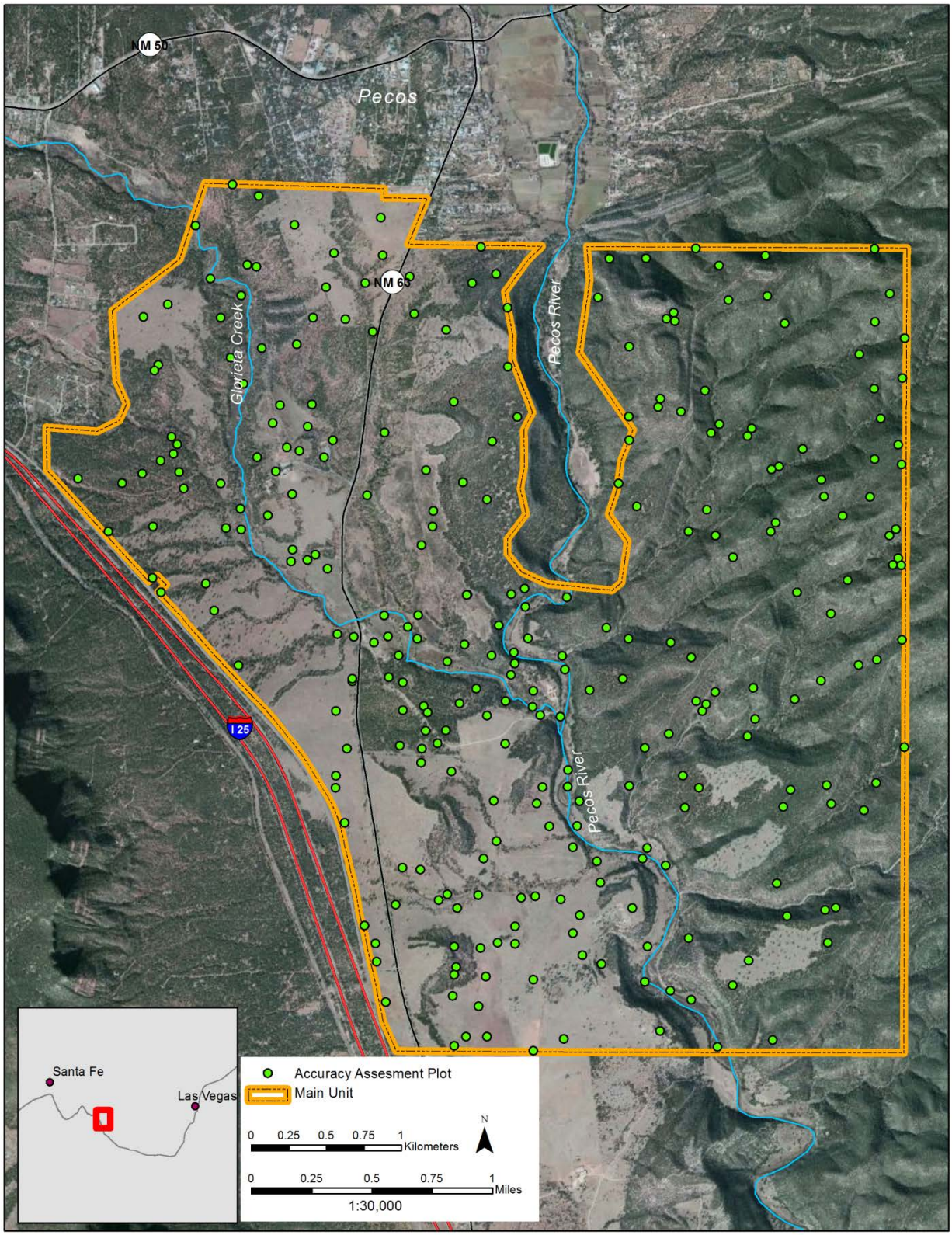

Figure 24. Distribution of accuracy assessment (AA) plots for the Pecos National Historical Park Main Unit.

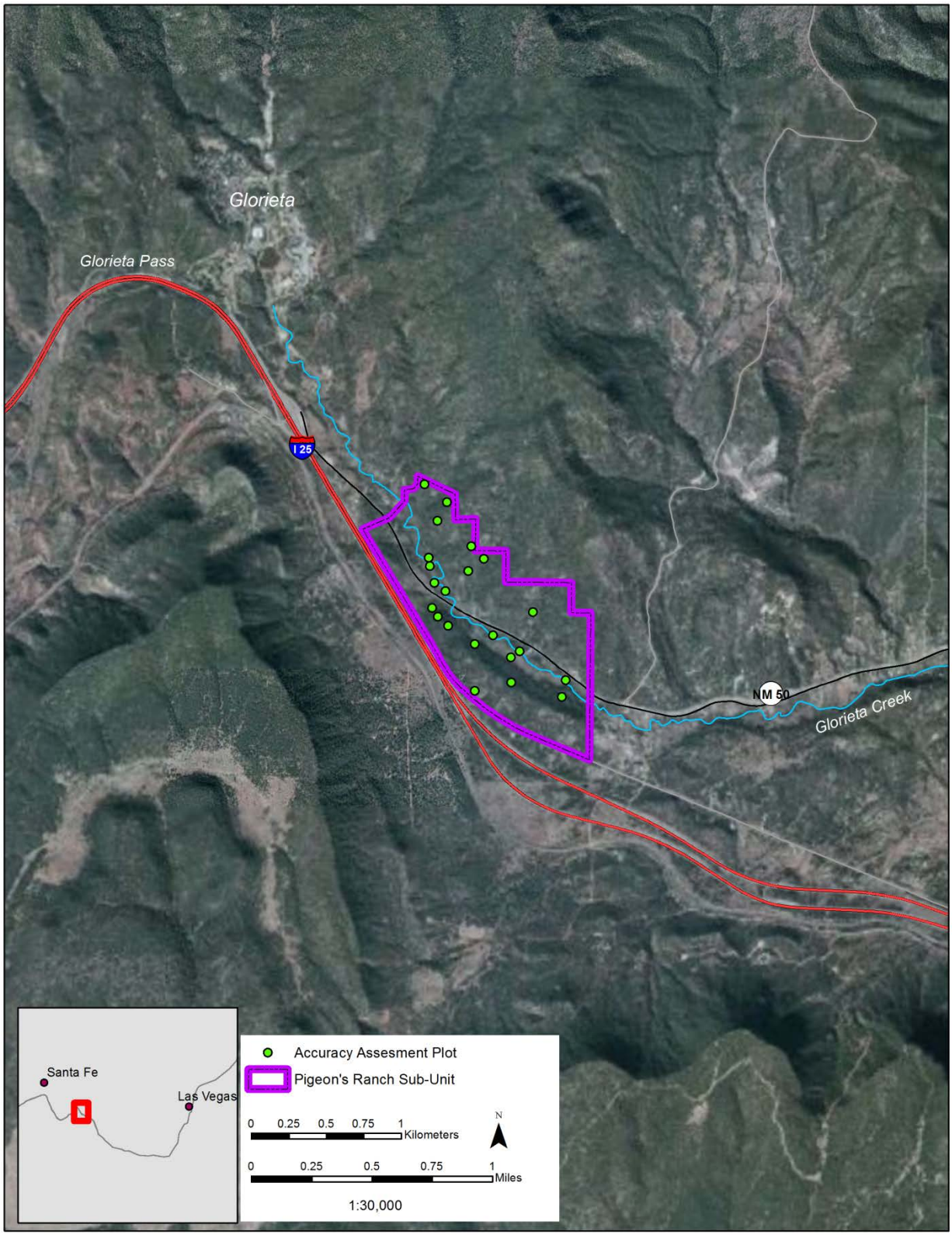

Figure 25. Distribution of accuracy assessment (AA) plots for the Pecos National Historical Park Pigeon's Ranch Sub-unit.

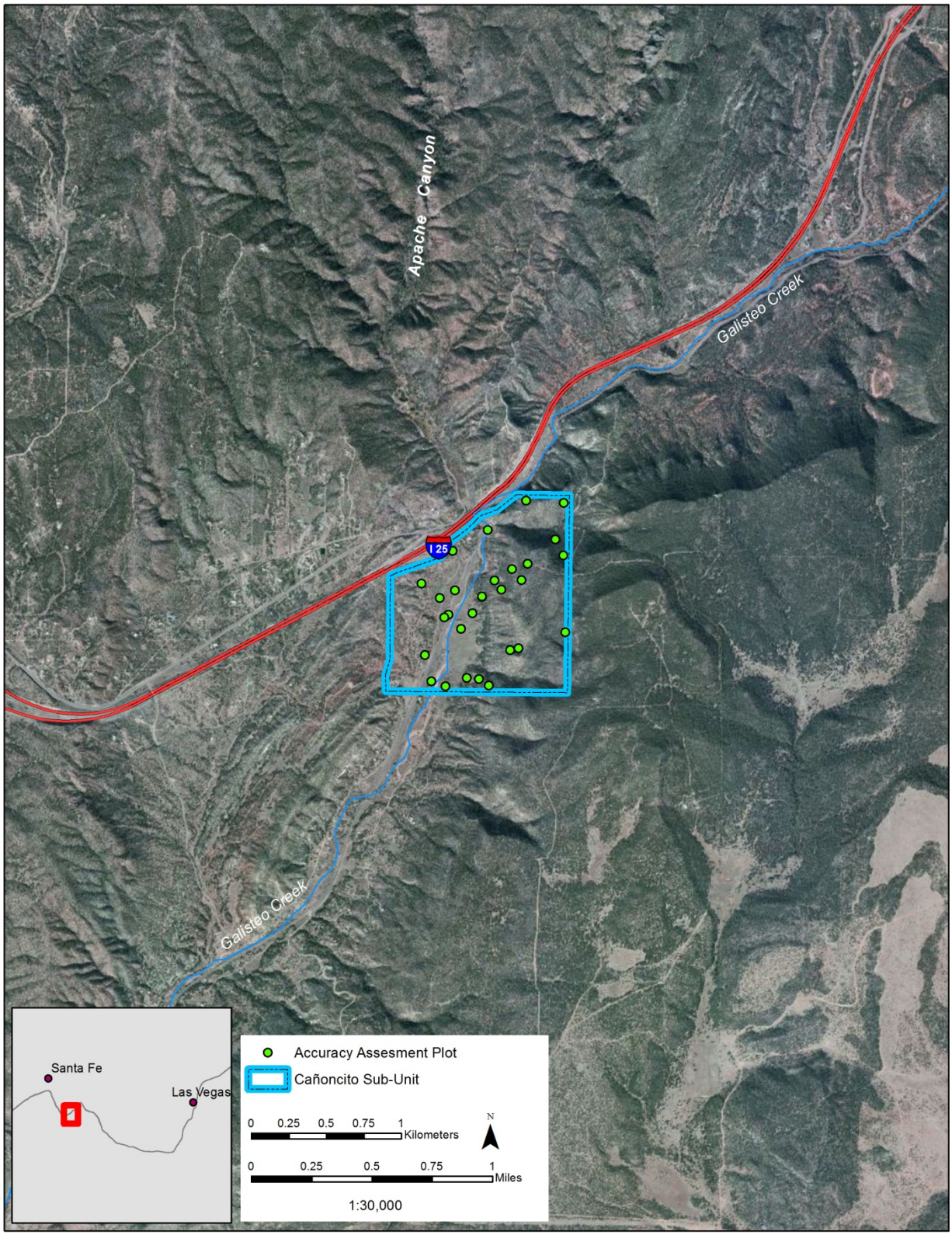

Figure 26. Distribution of accuracy assessment (AA) plots for the Pecos National Historical Park Cañoncito Sub-unit.

Accuracy Assessment Results

At the broadest scale of general vegetation types, overall accuracy was 98.5% (Table 6). The highest error rate was associated with riparian forests and herbaceous wetland. This is likely due to both the small size of the polygons (no minimum map unit was set for these units) and their narrow and linear delineation. Positional accuracy becomes a problem with these feature, particularly given the known geometric correction issues surrounding QuickBird satellite imagery in steep terrain.

At Level 1, the NVCS Group level of the legend hierarchy and the primary target of the accuracy assessment, overall accuracy was 95.3% (Table 7). Once again, much of the error is associated with riparian and wetland communities (MUs 4, 5, & 6). But there was significant user error among Douglas-fir forests where three out of the seven AA points were classified as either ponderosa or pinyon-dominated communities (MU 2 or 3). In these mixed conifer forests, Douglas-fir tends to form very open stands in conjunction with ponderosa and pinyon, so it is not surprising to see the cross classification. Telling the difference between Douglas-fir and ponderosa in the imagery was difficult, and the points associated with pinyon tended to be nearby areas or inclusions in sparse stands occupied by scattered tall conifers. Overall, we feel that the map performs well at Level 2 with respect to both users' and producer's accuracy.

At Level 2, overall accuracy drops to 80.5 % where, along with the cascading effect of Douglas-fir and riparian/wetland errors, there were issues separating some of the major grassland units (7A, 7B, 7C, and 7D) (Tables 8a and 8b). Unit 7B (Blue Grama - Western Wheatgrass Swale - River Terrace Grassland) occurs both in the riparian corridors and out on the rolling hills and plains where it is intermixed with 7C and 7D. It is in this latter context where we think most of the error occurred; the topographic gradient that was intended to separate the unit into swales was subtle across this portion of landscape. We have chosen to retain the unit because it potentially represents more productive sites than the surrounding areas, but refinements with future enhanced-imagery and digital-elevation models may increase confidence. User errors for 7C (Blue Grama / Rabbitbrush Grassland) mostly reflect low- and high-end cover values for rubber rabbitbrush in the plots, and the map unit assignment of plots often could have gone either way. In addition, these were often large polygons where rabbitbrush densities varied, and there were often relatively large inclusions of sparse rabbitbrush areas. With respect to 7D (Blue Grama / Ruderal Grassland), almost all the grassland areas of PECO have been disturbed by either past land use practices or current management objectives. That is, these grasslands were subject to either dryland agriculture or type conversion of pinyon-juniper and ponderosa woodlands to grassland where trees were removed either by chaining or logging. The legacy of these practices is the often abundant cover of ruderal, weedy species. Where grassland cover is highly diminished and replaced by annual and perennial forbs, we mapped the site as 7E (Ruderal Disturbance Vegetation). As might be expected, some of the 7D AA plots fell into this class (although only marginally). In contrast some fell into 7A, but the majority of 7A was also disturbed in some fashion. Yet, 7D also contains known old-field areas and is retained for this purpose in particular.

Among the pinyon-juniper units, most errors revolved around detecting significant oak and mountain mahogany cover in the imagery and minor thematic errors. For example, in 3A (Pinyon / Oak Canyon Woodland) plots cross-classified 3C (Pinyon - Juniper / Sideoats Grama-Sparse Foothill Woodland) because they lacked a significant (>5%) component of oaks—an image

interpretive error. In contrast, they also cross-classified with 3B (Pinyon / Wavyleaf Oak Foothill Woodland) because we left out the *Pinus edulis - Juniperus* spp. / *Cercocarpus montanus* - Mixed Shrubs Woodland plant association as an inclusion in 7A—a thematic error. If the thematic error alone was corrected, user accuracy would rise from 63% to 78%. Similarly, errors associated with 3C itself reflect mostly not detecting the shrubs (cross-classifications with 3A and 3B). Regardless, we feel the units remain viable and useful, and likely can be improved at a later date with enhanced imagery where oaks are easily detected.

Accuracy Assessment Discussion

This accuracy assessment suggests confidence in the broad physiognomic level of woodlands, shrublands etc., at Level 1, representing the Group level of NVCS. Overall, for much natural resource planning and evaluation, Level 1 units will likely be sufficient and most appropriate. At Level 2, many of the units are differentiated based on shrub versus grass cover as well as species differences that are not necessarily reflected at Level 1, and these may be important from a management perspective. Accordingly, while there are errors, most are explainable to the degree that the units can be used at least provisionally with caution and with an understanding that higher resolution mapping may be required at a later date. Lastly, the accuracy assessment was affected by significant vegetation manipulations that occurred at the park in the past few years that lead to full type conversions from woodlands and shrublands to grasslands and, hence, make AA plot calls problematic on the ground. While we compensated somewhat with recent imagery, we recommend that new high-resolution imagery be acquired at scales approaching six-inch so that structural differences among shrub and grass species can be detected and used in combination with spectral differences to improve and update the map across all classes as active management proceeds.

Table 6. Accuracy assessment contingency table for the Pecos National Historical Park vegetation map at broadest scale of the physiognomic classes of woodland, riparian/wetland, grassland, and miscellaneous land cover classes such as ruins and roads. We provide the Producers' and Users' accuracies with 10% confidence intervals where n = number of sampling points per class used to calculate "% Correct" by class. Also presented is the overall accuracy based on the total n, and the associated Kappa (KHAT) index.

		Polygon as Validated in Field				**User's Total**	**User's Accuracy**	**90% CI-**	**90% CI+**
		Forest & Woodlands	**Riparian/ Wetlands**	**Grasslands**	**MISC**				
Polygon as Mapped	Forest & Woodlands	208	1			209	99.5%	98.5%	100.0%
	Riparian/Wetlands	1	33			34	97.1%	90.8%	100.0%
	Grasslands		3	86		89	96.6%	92.9%	100.0%
	MISC				6	6	100.0%	91.7%	100.0%
	Producer's Total	209	37	86	6	338			
	Producer's Accuracy	99.5%	89.2%	100.0%	100.0%				
	90% CI-	98.5%	79.4%	99.4%	91.7%				
	90% CI+	100.0%	98.9%	100.0%	100.0%				
					Overall Accuracy	98.5%	Kappa Accuracy		96.6%
					90% CI-	97.3%	90% CI-		94.8%
					90% CI+	99.7%	90% CI+		98.3%

Table 7. Accuracy assessment contingency table for the Pecos National Historical Park vegetation map at Level 1. We provide the Producers' and Users' accuracies with 10% confidence intervals where n = number of sampling points per class used to calculate "% Correct" by class. Also presented is the overall accuracy based on the total n, and the associated Kappa (KHAT) index. Refer to Table 5 for map unit names that correspond to the MU numbers

		Polygon as Validated in Field										User's Total	User's Accuracy	90% CI-	90% CI+
	Leve 1 MU	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**				
Polygon as Mapped	1	4	1	2								7	57.1%	19.2%	95.1%
	2		23	3								26	88.5%	76.2%	100.0%
	3		1	174	1							176	98.9%	97.3%	100.0%
	4			1	11		1					13	84.6%	64.3%	100.0%
	5				1	7		2				10	70.0%	41.2%	98.8%
	6						10					10	100.0%	95.0%	100.0%
	7					2		86	1			89	96.6%	92.9%	100.0%
	8								1			1	100.0%	50.0%	100.0%
	9									1		1	100.0%	50.0%	100.0%
	10										5	5	100.0%	90.0%	100.0%
	Producer's Total	4	25	180	13	9	11	88	2	1	5	338			
	Producer's Accuracy	100.0%	92.0%	96.7%	84.6%	77.8%	90.9%	97.7%	50.0%	100.0%	100.0%				
	90% CI-	87.5%	81.1%	94.2%	64.3%	49.4%	72.1%	94.5%	0.0%	50.0%	90.0%				
	90% CI+	100.0%	100.0%	99.1%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%				
											Overall Accuracy	95.3%		Kappa Accuracy	92.7%
											90% CI-	93.2%		90% CI-	90.2%
											90% CI+	97.3%		90% CI+	95.1%

Table 8a. Accuracy assessment contingency table for the Pecos National Historical Park vegetation map at Level 2 (part 1). We provide the Producers' and Users' accuracies with 10% confidence intervals where n = number of sampling points per class used to calculate "% Correct" by class. Also presented is the overall accuracy based on the total n, and the associated Kappa (KHAT) index. Refer to Table 5 for map unit names that correspond to the MU numbers

	Polygon as Validated in Field															User's Total	User's Accuracy	90% CI-	90% CI+
	Level 2 MU	**1A**	**2A**	**2B**	**2C**	**3A**	**3B**	**3C**	**3D**	**3E**	**3F**	**3G**	**3H**	**4A**	**4B**				
Polygon as Mapped	1A	4	1			1		1								7	57.1%	19.2%	95.1%
	2A		11			1			1							13	84.6%	64.3%	100.0%
	2B			2												2	100.0%	75.0%	100.0%
	2C				10			1								11	90.9%	72.1%	100.0%
	3A					17	4	6								27	63.0%	45.8%	80.1%
	3B						27	5								32	84.4%	72.3%	96.5%
	3C						5	36								41	87.8%	78.2%	97.4%
	3D								7							7	100.0%	92.9%	100.0%
	3E								2	9	1					12	75.0%	50.3%	99.7%
	3F							4			35					39	89.7%	80.5%	99.0%
	3G		1									10				11	90.9%	72.1%	100.0%
	3H							1					5		1	7	71.4%	36.2%	100.0%
	4A													1	2	3	33.3%	0.0%	94.8%
	4B												1	1	7	10	70.0%	41.2%	98.8%
	5A														1	10	70.0%	41.2%	98.8%
	6B															10	100.0%	95.0%	100.0%
	7A															41	90.2%	81.4%	99.1%
	7B															12	66.7%	40.1%	93.2%
	7C															18	61.1%	39.4%	82.8%
	7D															15	53.3%	28.8%	77.9%
	7E															3	100.0%	83.3%	100.0%
	8A															1	100.0%	50.0%	100.0%
	9A															1	100.0%	50.0%	100.0%
	10A															1	100.0%	50.0%	100.0%
	10B															3	100.0%	83.3%	100.0%
	10C															2	100.0%	50.0%	100.0%
Producer's Total		4	13	2	10	19	36	54	10	9	36	10	6	2	11	339.00			
Producer's Accuracy		100.0%	84.6%	100.0%	100.0%	89.5%	75.0%	66.7%	70.0%	100.0%	97.2%	100.0%	83.3%	50.0%	63.6%				
90% CI-		87.5%	64.3%	75.0%	95.0%	75.3%	61.7%	55.2%	41.2%	94.4%	91.3%	95.0%	50.0%	0.0%	35.2%				
90% CI+		100.0%	100.0%	100.0%	100.0%	100.0%	88.3%	78.1%	98.8%	100.0%	100.0%	100.0%	100.0%	100.0%	92.0%				
														Overall Accuracy		80.5%	Kappa Accuracy		78.9%
														90% CI-		76.8%	90% CI-		75.1%
														90% CI+		84.2%	90% CI+		82.7%

Table 8b. Accuracy assessment contingency table for the Pecos National Historical Park vegetation map at Level 2 (part 2). We provide the Producers' and Users' accuracies with 10% confidence intervals where n = number of sampling points per class used to calculate "% Correct" by class. Also presented is the overall accuracy based on the total n, and the associated Kappa (KHAT) index. Refer to Table 5 for map unit names that correspond to the MU numbers

	Polygon as Validated in Field													User's Total	User's Accuracy	90% CI-	90% CI+
Polygon as Mapped	**Level 2 MU**	**5A**	**6B**	**7A**	**7B**	**7C**	**7D**	**7E**	**8A**	**9A**	**10A**	**10B**	**10C**				
	1A													7	57.1%	19.2%	95.1%
	2A													13	84.6%	64.3%	100.0%
	2B													2	100.0%	75.0%	100.0%
	2C													11	90.9%	72.1%	100.0%
	3A													27	63.0%	45.8%	80.1%
	3B													32	84.4%	72.3%	96.5%
	3C													41	87.8%	78.2%	97.4%
	3D													7	100.0%	92.9%	100.0%
	3E													12	75.0%	50.3%	99.7%
	3F													39	89.7%	80.5%	99.0%
	3G													11	90.9%	72.1%	100.0%
	3H													7	71.4%	36.2%	100.0%
	4A													3	33.3%	0.0%	94.8%
	4B		1											10	70.0%	41.2%	98.8%
	5A	7			1		1							10	70.0%	41.2%	98.8%
	6B		10											10	100.0%	95.0%	100.0%
	7A			37	3		1							41	90.2%	81.4%	99.1%
	7B				8	1	2		1					12	66.7%	40.1%	93.2%
	7C	2		4		11	1							18	61.1%	39.4%	82.8%
	7D			4			8	3						15	53.3%	28.8%	77.9%
	7E							3						3	100.0%	83.3%	100.0%
	8A								1					1	100.0%	50.0%	100.0%
	9A									1				1	100.0%	50.0%	100.0%
	10A										1			1	100.0%	50.0%	100.0%
	10B											3		3	100.0%	83.3%	100.0%
	10C												2	2	100.0%	50.0%	100.0%
Producer's Total		9	11	45	12	12	13	6	2	1	1	3	2	339.00			
Producer's Accuracy		77.8%	90.9%	82.2%	66.7%	91.7%	61.5%	50.0%	50.0%	100.0%	100.0%	100.0%	100.0%				
90% CI-		49.4%	72.1%	71.7%	40.1%	74.4%	35.5%	8.1%	0.0%	50.0%	50.0%	83.3%	50.0%				
90% CI+		100.0%	100.0%	92.7%	93.2%	100.0%	87.6%	91.9%	100.0%	100.0%	100.0%	100.0%	100.0%				

Overall Accuracy	80.5%	Kappa Accuracy	78.9%
90% CI-	76.8%	90% CI-	75.1%
90% CI+	84.2%	90% CI+	82.7%

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Appendix A. Field Handbook and Field Datasheets

This appendix contains the Natural Heritage New Mexico Vegetation Survey Handbook that was the guiding document for all vegetation plot data taken during the course of the Pecos National Historical Park mapping project. The handbook and associated datasheets follow. While this is the 2008 version, there were no significant changes made to the protocol during the life of the project.

VEGETATION SURVEY HANDBOOK

NATURAL HERITAGE NEW MEXICO

DEPARTMENT OF BIOLOGY

UNIVERSITY OF NEW MEXICO

Natural Heritage New Mexico

2008

The University of New Mexico

Natural Heritage New Mexico Vegetation Survey Protocols

Plot Establishment Guidelines and Techniques (May 2002)

Locating a plot: How plots are located varies with the survey/experimental design. For mapping/classification purposes where the intent is to place a plot in a stand of homogeneous vegetation, aerial photos and/or field reconnaissance generally determine where a plot is going to be established. Plots should be allocated to cover the range of variation in a study area (with the help of soils/geology and topographic maps, i.e. gradsect sampling), but for logistical purposes this usually still entails landscape cluster sampling by a team usually in a small target watershed with a variety of habitats and vegetation types (but clusters should be widely separated). Where a map/photo is available, plot locations can be determined beforehand with prescribed UTM locations (often used in map validation) and navigated to with a GPS.

Plot size and design: NHNM standard plots (STP) are typically 400 sq m and either circular with an 11.3-m radius or square and 20 m on a side. These are the typical dimensions for a forest or closed woodland. They can vary in dimension depending on the vegetation type. For riparian types, long and narrow (10 x 40 m) plots, fitted into the linear structure of a river bar or terrace is a common design. In large, open savanna or grassland types, the plots may need to be larger (50 x 50 m or more) to capture tree numbers successfully and sub-sampled to determine shrub/herbaceous cover. This sub-sampling is done with a series of 40, 1-m quadrat frames or a set of 3 to 5, 10 x 10-m quadrats in which species covers are estimated and then averaged. For small patch communities, i.e. vegetation around a spring or a cryptogam community, the plot size may be as small as a 10 x 10 by itself or even a single quadrat frame in the latter case. A cloth tape or a self winding "Spencer" tape is used to measure the boundaries.

Plot Types:

Releve plots (RP) are established in the same way as standard plots, but the species list includes species from the surrounding stand (homogeneous area). Both standard and releve plots include an in-depth floristic analysis that not only allows for community classification, but also provides species richness and diversity.

Quick plots (QP) are generally used for vegetation mapping ground control or rapid assessment. They are the same size as standard plots but only the dominant and most common species are recorded in each strata along with their abundance and total cover for the strata to ensure proper identification of the type to plant association level. Site information includes as a minimum the GPS location, one photo showing the general character of the site, along with a brief site description. Other attributes may be included depending on the project.

Observation points (OPT) contain mostly qualitative data on an occurrence, including location and community type, which may or may not include photos. These points are generally used as supplemental points for vegetation mapping or to record the location of other element occurrences.

Monitoring plots are variable, but the general design is two, parallel 30-m transects spaced 5 m apart within a 13.3 x 30-m macroplot (400 sq m). One-meter quadrat frames are placed at every third meter, cover is estimated to the nearest 1% class, and the median height measured to the nearest 1 cm. Since the exact spot is re-measured over time, the tapes must be drawn tight, through shrubs (not around), and as near the ground as possible. The quads should be aligned along one side of the tape with the inside of the corner of the frame at the position mark on the tape. Precision is key to good data in monitoring, particularly in grasslands.

Along each line, 150 point intercepts are read for basal cover (intercept at ground level) every 20 cm, starting from a different random location on the line for each monitoring session.

Quadrat framing and point intercept are the most precise methods and other ocular estimates of cover must be calibrated to them (plot cover estimated using scalars).

Monumenting a plot: Typically, the plot will be monumented in the center of a circular or square plot, or sometimes at the corners of square or rectangular plots. If there are transects, such as in a monitoring plot, this may occur at each end of it. Monuments are usually 3/8" rebar driven 0.5 m or more into the ground to ensure stability. They can extend anywhere from 5 cm to 1 m above the surface depending on the circumstances. Where aesthetics is not an issue and for ease of relocation, the rebar should be covered with ½" PVC pipe that can act as visible extensions of the rebar. The rebar should be tagged with permanent steel tags that are wired near the base with bailing or similar gauge wire. Where possible, have the tag flush with the ground.

Photo points: The intensity of photo documentation varies with the purpose of the project. At a minimum, there should be a single photo taken from above the center monument stake in a direction that best encompasses the character of the plot. Additional photos can be taken at 90-degree angles from each other around the central monument or, in the case of transects, from either end looking back along the line. **Record the azimuth/direction of the photo and the focal length of the lens being used.** Photos taken off monuments back at the plot or at elements of special interest are not normally considered for repeat photography. For analysis, it helps to have a photo taken from off of the plot looking back to get an overview of the composition and structure.

Instructions and Forms

General Plot Description:
(General Plot Desc. Form 2 or Standard Form - Page 1)

PLOT ID: Seven-character alphanumeric code. **[Required]**
This is the master NMNHP record identification number for all sampling at the site. All subsequent sampling or other independent data at the site will be tied to this number. It must be unique and is formatted as follows:

Record in order: the year (two digits), the first and second initial of lead surveyor as designated under the Surveyors field (two characters) or the assignment as designated for the project (two characters), and the plot ascension number (three digits).

Example (lead surveyor): The 33rd plot sampled in 1991 by Hank Gleason would be entered as 91HG033.

Example (project assignment): The 54th plot sampled in 2003 at Bandelier would be entered as 03BD054.

Monitoring data are assigned sub-record monitoring numbers under the PLOT ID, as are any quadrat sample numbers.

PLOT TYPE: [**Required]**

RP = Releve or Reconnaissance plot. Full species list of both plot and stand and their abundance estimated. May also include Element Quality Ranking using the ranking form.

STP = Standard plot where all species within the plot and their abundance are estimated, along with enough site information to provisionally rank the quality of the occurrence.

QP = Quick plot where only the dominant and most common species with their abundance to ensure proper identification of the type, and enough site information to provisionally rank the quality of the occurrence.

OPT = Observation point with mostly qualitative data on an occurrence, including: dominant species with their abundance, location, community type and size, and at least one photo.

AP = Analytical plot. Full species list of both plot and stand with sub-sampling of abundance (usually quadrat based). May include Element Quality Ranking using the ranking form.

OVP = Observation video plot; community type or size is interpreted from either video or aerial photography.

OSP = Observation scope plot is used for surveys of plants growing on steep cliff faces that are otherwise inaccessible.

FSP = Floristic survey plot used for general plant inventories when site information is not required and location encompasses an area greater than a standard size plot. Quantitative data is not recorded.

PROJECT: Project code. Example: LANL98. If no code is available, enter temporary project designation. **[Required]**

SUBPROJECT: Subproject code, if applicable

MO DATE YEAR: Two-digit month, day, and year numbers. **[Required]**

EO/PA: Plant Association (community type) to which vegetation data refers to. Use six- (seven) letter species acronyms. For example: PINPON/QUEGAM. Whoever makes the plant association determination must date and initial the designation. Refer to the NMNHP vegetation classification for current types and acronyms. If the type does not appear to match any on the list, assign a temporary name and indicate your reasoning in the **PA COMMENT** field. If you are uncertain, enter **UNCLASS**.

EO/PA Comment: Comments on plant-association designation. Indicate whether it was assigned in the field or in the office, if a vegetation key was used, an analysis of the quantitative data, etc. If you assigned a new acronym, indicate your reasons for the designation and any specific decision rules you have developed. If CT is questionable, make notes concerning the problem.

FIELD POINT ID: Alphanumeric code for GPS point assigned on field maps from GIS for plot location target (this is an approximate location based on imagery and should be evaluated for stand consistency prior to plot placement).

SURVEY SITE: Name assigned to the plot site at the time it is sampled, or the name of the site on a Survey Site form if it had been previously surveyed.

Naming guidelines:
1. Do not use element names in the site name.
2. Use local place names when available or features on topographic maps.
3. Avoid names that are too generalized such as "Spring Site" or "Flat Top Mountain."
   Good examples: "Lower Big Gyp Mountain East" or "Animas Canyon Main Spring."
4. Avoid using temporary GIS-based designations such as "Site 6b" or "polygon 41."

SURVEYORS: Last name and initial of first name of sampling personnel**, led by the person responsible for botanical determinations**.

LOCATION/ DIRECTIONS: Provide a brief description or place name that further defines where the survey site is located, so that a person reading the plot does not have to reference a map to know approximately where the site is, e.g., "the upper north slope of Freelove Canyon." Give directions as necessary to ensure that the plot can be relocated with ease, as needed. Directions to remote areas can be given as arrow-marked routes on a topo map, or by a sketch on the back of the form. Indicate if the route is marked on the back or on a topo map.

COUNTY and STATE: Abbreviations. NMNHP code for the county assigned when entered into Natural Heritage Database.

MAP NAME: Map used to locate and mark plot, usually the USGS 7.5' topographic quadrangle map name. If duplicate maps are used, indicate by adding 1, 2, 3 etc. at end of map name.

MARGNUM: Margin number on the field map associated with the mapped plot position. Each plot position within the map is marked with a dot and associated margin number. The margin number for the plot is also placed along the margin of the topographic map. Associated with each margin number is a margin note indicating the PlotID, CT acronym and, in parentheses, the 10,10 (described below).

10,10: The 10,10 is an imaginary grid over the topo map, (10 cells across and 10 cells down) to facilitate locating the dot at a later time on the map. For example, (5,6) indicates 5 cells across from left to right and 6 cells down from top to bottom. This would be almost half way across the map, and more than half way down.

GPS Unit: Write name and number of GPS unit used, such as: Garmin 1, 2, 3, etc. or Trimble 221230 (UNM Number).

GPS File: List the name of the file, either default point assigned by unit or name designated by user.

UTM: Enter **Easting** and **Northing** UTM coordinates and **Zone**. Datum as either **NAD27** or **WGS84**. If something else was used, please indicate such in the comment field.

PREC (PRECISION): +/- meters from GPS unit:

MONUMENT: If plot is permanently marked, indicate what was used (rebar, PVC, etc.), where it is located (such as center of plot), and height of marker (note whether in ft or m). Indicate if it was used as a photo point.

PHOTO PT.: Check off if there are plot photos. Indicate if there is a permanent photo point established and describe its location, e.g., "over the plot monument" or elsewhere and how it is monumented for repeat photography. Indicate the height of the camera (**CAM Ht)** from the surface of the ground to the mid-point of the lens.

LOG #: Indicate name or number assigned to the photo log. Check box for either digital or film pictures (D☐ / F☐**)**.

PHOTOGRAPHER: Record the initials of the photographer.

PP1 – PP8: Photo points: Indicate each photo taken of, or from, the plot, with indication of direction (**AZM**), focal length (**FocLen)** and subject (**Notes)**, e.g., "looking N across entire plot" or "looking to the western horizon towards the Tularosa Basin." Photos should have plot numbers, date, and project name on a chalk board, flip pad or something similar, and a reference to show scale, but preferably not people (at least not in the center of the picture). High precision repeat photo points should be done on a tripod and the height indicated along with the focal length of the shot.

OTHER SITE PHOTOS: Indicate if other photos were taken of the PA and surrounding landscape.

ELEV: Elevation *in feet,* unless otherwise noted.

SLOPE %: Enter the angle of the slope on which the plot occurs in *percent slope.*

ASPECT: Enter the *azimuth (0-360 degrees)* of the slope aspect on which the plot occurs.

SLOPE SHAPE: Enter one of the following codes to indicate the vertical shape of the slope on which the plot lies:

S - straight or even
R - rounded or convex
D - depression or concave
P - patterned (micro-relief of hummocks and swales)
U - undulating pattern of low ridges or knolls and draws
X – other - explain in landform comments section.

LANDFORM: Six-number code**.** Enter the landform name (or describe it as best you can in the comments field below) and the **code** as classified in the **NMNHP Landform Classification Handout**.

LANDFORM/GEOLOGY/SOIL COMMENTS: Additional comments on landforms and rock types in the EO and surrounding landscape and comments on soils including soil texture by feel using standard SCS techniques and the soil triangle and/or evidence of dune formation and/or erosion.

SITE /VEG SUMMARY: A description (a "word picture") of the site and community sampled. Indicate stand dominants, the structure and physiognomy of the community along with a landscape position and site features narrative (including geomorphology, soils and geology). Indicate successional status, if known (e.g., climax (old growth); young, second growth). Reserve other condition comments for Condition section below. Use clear, complete sentences and avoid extraneous personal comments that do not belong in a scientific database (no jokes, please, or comments in bad taste; these plots are long-term records that will be read again and again in the future).
Adjacent Communities: Indicate surrounding plant associations and the spatial relationships (e.g., the occurrence is a matrix community with other smaller patch communities within it, or vice versa). Indicate the width and nature of ecotones to other communities.
Disease/exotics: Examples are dwarf mistletoe damage (give a rating of average percent and extent of spread within and among trees); insect damage (e.g., spruce budworm); fungal rot and rusts.
Animal use evidence: Wildlife browse damage, sightings and sign (bird calls, tracks, scat and animal disturbances such as beaver dens, gopher holes, etc., and remember the insects).
Condition (Disturbance, Fragmentation, Erosion): Describe disturbances both natural and otherwise, their extent, intensity, and time frame: livestock grazing and impacts; roads, number and distance from; logging and fuelwood cutting; buildings and obstructions; and fires, floods, landslides, significant recent erosion features, etc. Estimate frequency and degree of disturbance (light, moderate, heavy, etc.). Indicate degree of element fragmentation, e.g., reduced patch size and corridors, and other watershed - level impacts (dams, parking lots, settlements).
Distance: If relevant, note the distance in kilometers to the nearest human disturbance such as roads, dams, clearcut, housing, mine, dump, etc.).

On the Standard Data Form the summary description is condensed space-wise, but should include the above information from Site/Veg Summary to Distance.

SURFACE ROCK TYPE: Enter the code for the dominant surface rock type:

Igneous
ANDE - andesite
BASA - basalt (including obsidian)
DIGA - diorite to gabbro
GRBG - granite and biotite granite
IFAL - igneous felsic(acid) alluvium
IGTU - igneous type unknown
IMAL - igneous mafic(basic) alluvium
LATI - latite
MIIG - mixed igneous
PUMI - pumice
QUMO - quartz monzonite
RHYO - rhyolite
SCOR - scoria (porcelanite), clinker
TRSY - trachyte and syenite
WETU - welded tuff (tufa)

Metamorphic
ARGI - argilliate
BISC - biotite schist
CAAR - calcareous argillite
GNBG - gneiss and biotite gneiss
MEAL - metamorphic alluvium
METU - type unknown
MIME - mixed metamorphic
MISC - mica schist
PHYL - phyllite
QUAR - quartzite
SCHI - schist
SILI - siltite
SLAT - slate

Sedimentary
CACO – calcareous conglomerate
CASA - calcareous sandstone
CASH – calcareous shale
CASI - calcareous siltstone
CLAY – claystone
CONG - conglomerate
DOLO - dolomite
LIME - limestone
MISE - mixed sedimentary
MUDS - mudstone
RESH - red shale
SAND - sandstone
SCAL – sedimentary calcareous alluvium
SETU - type unknown
SHAL - shale
SILT - siltstone
SNCA – sedimentary non-calcareous alluvium

Miscellaneous
ASHT - ash (of any origin)
CLAL - clayey alluvium
DUNE - sand dunes
GLTI - glacial till, mixed origin
GRAL - gravelly alluvium
GYPS - gypsum
LOES - loess
MIAL - mixed alluvium (full range of textures)
MIRT - mix of two or more rock types
NONE – no surface rocks
NORE – not recorded
SAAL - sandy alluvium
SIAL - silty alluvium

PLOTDIM(m): Plot size and shape entered in meters.

L/R: Enter plot **radius** (for circular plots) or **length** (for rectangular plots). Indicate units of measurement. Note: a 400-m-square plot has a radius of 11.3 m (37.1 ft); a 100-m-square plot has a radius of 5.6 m (18.5 ft).

PLOT W: Enter **width** if a rectangular plot shape is used. Enter 0 (numeric) if a circular plot shape is used. Indicate units of measurement.

OCC SIZE: (hectares/acres). Occurrence or total stand size surrounding the plot. Indicate if the area was estimated on the ground or from a map. This information is very important for accurate mapping.

EO/PA MAPPED: Indicate whether or not the EO boundaries were mapped on an aerial photo, topo map, or sketched on the back of the form. **List number(s) of aerial photos used**. Use sketch maps to help explain relationship among stands and plots in the area as necessary. A **solid** line indicates an actual boundary and a **dashed** line indicates a boundary of unknown extent.

MANAGEMENT/CONSERVATION/ OTHER COMMENTS: Comment on any stewardship (new or additional) needed to ensure continued existence of the community occurrence, and chances (and means) of bringing it about. Any other pertinent comments go here as well, e.g., "clearing of competing vegetation has been tried in the past but without success." Comment on the conservation attributes of the occurrence, long-term viability, and threats. Also, add miscellaneous comments from all sections. Again, no jokes, please, or comments in bad taste.

FORMS CHECKOFF: please indicate if other forms were used besides those given.
Forms: ☐ Floristics ☐ Trees ☐ Soils ☐ Quadrats ☐ Point/Line Intercept ☐ EO Assessment ☐ Site Evaluation

Floristic Inventory (Form 3)

PLOT ID: Seven-character alphanumeric code**.** NMNHP standard record tracking number (see general description, Form 2).
BOTANIST: Name of person responsible for assessing the botany.

DATE: Date of vegetation inventory. Two-digit month, day, and year numbers.

GROUND SURFACE: Enter percent-cover fraction for each of the following types of cover as they occur over the surface of the plot (must add up to 100%).

S - exposed soil: particles < 1/16-in. (2-mm) dia..
G – gravel: particles 1/16 to 3-in. (2-mm to 7.5-cm) dia..
R - rock as composed of cobbles, stones and bed rock: particles > 3-in. (>7.5-cm) dia.
L - litter and duff. Litter includes dead and detached vegetation, freshly fallen leaves, needles, twigs < 2 in. (5cm), bark, fruits, seeds; duff is decomposed litter (fermentation layer and humus layer).
HCC – herbaceous canopy cover is the total combined canopy cover of forbs and graminoids, including attached litter and current year's standing dead annuals, and does not include overlapping cover where canopies interlock.
WO – woody, downed debris: > 2-in. (5-cm) dia.

M - microphytic (cryptogams) crust cover; mosses, lichens and algae on soil surface (excludes cover found on logs, rocks and tree bases).
WA – water, standing pools of water, or streams if within the plot.

VEGETATION COMPOSITION AND ABUNDANCE CONVENTIONS: All species within the plot **and/or** in the stand, depending on plot type, are listed by Strata/lifeform categories (See the NMNHP species list for lifeform classification of individual species).

SPECIES NAME: Use the accepted acronyms from the current NMNHP species list or spell out the species scientific name. **Do not use common names**. If the species is not on the list, spell it out.

Tree species can occur in several height strata and should be listed separately under different acronyms representing different operating taxonomic units (OTU's). A number is attached to the end of the acronym to indicate which strata the OTU is from. For example: PINPON0 represents *Pinus ponderosa* seedlings of the forb layer, PINPON1 represents saplings < 1-in. dia. of the dwarf shrub layer, PINPON2 are saplings 1-in. to 2-in. dia. of the shrub layer, and PINPON3 are mature trees of the tree layer.

If you do not know the name of a species, but know the genus or family, enter those acronyms or **spell out the name**. Otherwise indicate unknowns with the code UNIDT for unknown trees; UNIDS for unknown shrubs; UNIDDS for dwarf shrub, etc. for each different unknown species with in the different lifeforms. The species ID number will differentiate them.

SPECIES ID NUMBER: Each species that is listed has a line number on the form associated with it by strata/lifeform (T1, S3, G10, F20, etc.). Blank species number lines are available on the forb side of the form for additions: grasses, shrubs, and trees. **Circle the species number when a voucher has been taken for that species**.

Ht: Modal height of each species to the nearest *meter* for trees, nearest *half meter* for shrubs, and *decimeter* for grasses and forbs, but measured in meters. For example a 3 dm high grass would be recorded on the data sheet as 0.3 m.

P: Phenology. Use "*****" for flowering, "**@**" for fruiting, "**X**" for a dead annual; and leave blank if vegetative.

VOUCHERS: When a **voucher specimen** is taken for species identification, the species ID number **MUST BE CIRCLED** on the plot sheet, and the plot number and species number put on the plant tag or collection sheet of the voucher.

Voucher Tag Format:

Plot ID	05YC001
Date	3/30/05
Species ID #	G5
Project	BAND-Val

If an unknown species from a previous data form is referred to on the current data sheet, **be sure the plot and species ID numbers** that the plant refers to are recorded on the current data sheet and the species ID number is **circled**. For example if you're at plot 05YC001 and you collect UNIDG5 (G5 should be circled on this plot form), then at plot 05YC004 you have the same unknown grass that is the

second grass on this data form, **circle G2** and write **05YC001-G5** after the species ID number. If you **know the genus or family, enter those acronyms** or **spell out the name** before the plot ID number.

Data sheet from 05YC004:

```
|G1_MUHMON_____________________|_@|_20_|__.4||___ _____________________________|__|____|____||
|G2_BROMUS - 05YC001-G5________|__|___5|__.2||___ _____________________________|__|____|____||
|G3_____________________________|__|____|____||___ _____________________________|__|____|____||
```

Circle G2

TREES: Usually single bole with lateral branches, and with the potential to grow over 5 m tall (some may be less than 5 m such as various *Juniperus* spp.). See NMNHP species list lifeform classifications for verification.

SHRUBS: Usually multi-stemmed woody species, spiny rosettes or succulents (cacti, yuccas, agave, etc.) less than 5 m and greater than 0.5 m.

DWARF SHRUBS: Usually multi-stemmed woody species, spiny rosettes and succulents (cacti, yuccas, agave, etc.) less than 0.5 m. Small suffrutescent species that are only woody at or near the base or at the root-crown are usually considered forbs, e.g., *Eriogonum*. See the NMNHP species list for lifeform classification.

GRAMINOIDS: Grasses and grass-like plants such as sedges and rushes, but not showy flowering monocots such as iris, lily, or dayflower (Iridaceae, Liliaceae or Commelineceae).

FORBS: Non-woody perennial and annual species that are not grass-like (includes monocots of the Iridaceae, Liliaceae, Commelineceae).

TOTAL COV. (BY STRATA): Percent aerial cover for tree, shrub, dwarf shrub, graminoid and forb layers. This is the total canopy cover of a strata as projected over the surface, regardless of species, and does not include overlapping cover where canopies interlock within a strata. ***Note: cover cannot exceed 100%.** For graminoids an additional category is added for **% green** which includes the current year's growth (green or tawny), but disregards the standing dead litter (grey).

COV.: Percent cover for each species <u>within</u> the plot, estimated by either directly using the precision guidelines below, *or* the Modified Domin-Krajina scale in Table 1 (both are at the bottom of Floristics-Form 3 and Standard Data Form). **Be sure to check box on data sheet to indicate which cover type is used.**

Percent Cover Estimation Precision Guidelines:

+0 – species outside the plot, but within the stand
+ – for < .05% (trace <0.2m^2/400m^2)
0.1% – for .05 - < 0.5% (>0.2m^2 - <2.0 m^2 /400m^2)
0.5% – For .5 - < 1% (>2.0 m^2 - <4.0 m^2 /400m^2)
1-10% to the nearest 1% (each % equals 4m^2/400m^2)
10-30% to the nearest 5%
30-100% to nearest 10%

Table 1. Cover Scale - Domin-Krajina cover-abundance scale.

Scalar	Cover Range	Concept	Midpoint Value	Data Value	m^2 / 400m^2
+0	N/A	Outside quadrat	0.001	.001	
+	<0.05%	Solitary or very few	0.025	.025	<.2m^2
1	0.05- 0.124%	very scattered	0.0875	0.1	0.2m^2 - <.5m^2
2	0.125- 0.99%	scattered	0.56	0.5	.5 m^2 - <4 m^2
3	1.0 - 4.9%	common	3.0	3.0	4m^2 - <20m^2
4	5.0 - 9.9%	well-represented	7.5	7.5	20m^2 - <40m^2
5	10.0- 24.9%		17.5	17.5	40m^2 - <100m^2
6	25.0- 32.9%	abundant	29.0	29.0	100m^2 - <132m^2
7	33.0 - 49.9%		41.5	41.5	132m^2 - <200m^2
8	50.0 -74.9%	luxuriant	62.5	62.5	200m^2 - < 300m^2
9	75.0 - 94.9%		85.0	85.0	300m^2 - <380m^2
10	95.0 -100.0%	full cover	97.5	97.5	380m^2 - 400m^2

STANDARD DATA FORM
The Standard Data Form is a combination of the General Plot Description (Form 2) and the Floristic Inventory (Form 3) on a single page, with the data fields in the same order as the previous forms. This form can be used for Standard Plots, Quick Plots, and Observation Points.

STANDARD DATA FORM – Page 2 is a continuation of the floristic inventory portion of the data form when more space is needed for additional species.

QUICK PLOT/OBSERVATION POINT FORM
This form is a condensed version of the Standard Data Form and has three observation points per page.

TREE INVENTORY FORM
In forested plots, the total number of trees is counted by species and size class. For each species and size class the count would be done using a dot/line matrix:

. .
. . One dot is used as each of the four corners and represents one tree.
Lines are then used to connect the dots and cross from corner to corner.
☒ Each line also represents one tree. A complete box equals 10 trees.

For each species, the size class is divided into three categories. The upper box is a count of the live trees in the stand. The two lower boxes are divided into stumps (which are trees that have been cut) and snags (which are standing dead trees).

Element Occurrence Condition Evaluation

The ranking of a plant community element occurrence (EO) within a site focuses on three sets of factors: condition, landscape, and size. These are based on concepts originally developed by the Natural Heritage Network and The Nature Conservancy, and derived from protocols developed by Natural Heritage New Mexico as part of its statewide wetland/riparian assessment project. All factors are weighted based on their importance for evaluating ecosystem function and biodiversity value. These weights vary depending on the type of ecosystem being considered, e.g., riparian communities are weighted strongly on hydrological regime, whereas upland communities may receive more emphasis on fire regime. For the pilot project, weighting specifications were developed for upland plant community occurrences. Where information is lacking for any given variable it is not considered in the ranking process. The overall intent is to create a set of consistent criteria for each element that can be used universally to compare occurrences not just at the local level, but the regional and national as well.

Condition Factors

There are nine condition factors that relate directly to the status of a given element occurrence (Table 1); these factors are usually based on direct field measurements of representative stands within a site. Exotic encroachments are considered to be very important indicators of ecosystem health in riparian systems (10 weight) and moderate indicators in uplands (5 weight). There are separate categories for exotics in the canopy versus the understory because of their differing effects on ecosystem structure and function. Structural diversity and cover reflect changes to the expected natural expression of a community as a function of utilization, e.g., logging and fuelwood removals, grazing, etc. Similarly, species richness is a measure of departure from the norm as a result of disturbance. The measurement of fuel loads speaks to the possibility that a given EO might be adversely affected or catastrophically removed due to human-induced fire hazards (e.g., fuel loads might be weighted higher in a non-fire-adapted riparian system than in a fire-adapted upland one). Erosion, although a natural process, can also be accelerated as a function of disturbance, but the effect of disturbance will vary from community to community. Streambank conditions apply to wetland/riparian occurrence only. Contaminants can potentially range from excess nitrogen from sewage outfalls to radioactive dumps. Lastly, parasites and infestations (insect, fungal or microbial) are perhaps some of the best measures of ecosystem health.

Landscape Context Factors

Beyond immediate impacts, an element occurrence is also subject to landscape-level processes that affect its condition and perhaps more importantly its long-term sustainability. Accordingly, there are seven landscape-level parameters considered in the ranking process that can be evaluated through a combination of field studies, historical inquiry and GIS-based map analysis. The first three center on the hydrologic regime and pertain primarily to wetland/riparian community assessment. Stream flow changes, lateral stream movement, and channel condition are best addressed through analysis of historical records, monitoring, and field assessment. Analogously, fire patch size and fire frequency can be addressed by a reconstruction

of the past record through tree-ring fire-scar evidence and historical photography, as well as current stand structures as they might reflect fire history.

The last two parameters, landscape impact/fragmentation and landscape community diversity and function, can be evaluated to some degree through field studies. However, GIS-based map analysis can be a powerful evaluation tool because it can reveal the pattern and underlying structure of a site and the relationship of any given element to the landscape. This type of analysis requires detailed and accurate spatial information, e.g., good vegetation maps, road and impact coverages, high-resolution digital elevation models, etc.

Size Factor

Because of its importance in ecological assessment, size is considered independently of condition and landscape context. Greater size implies greater buffering against impacts and hence greater stability and long-term viability within the context of the natural dynamics of the ecosystem.

NHNM VEGETATION SURVEY - Standard Data Form – 2008

PLOT ID_____**PLOT TYPE**_____**PROJECT**_____**Subproject** _____ **MO**___**DAY**___**YEAR**_____
EO/PA_____
EO/PA Comment_____
FIELD POINT ID_____**MONUMENT** ☐
_____**MU**_____
SURVEY SITE_____ **SURVEYORS**_____
COUNTY_____ **NM/**____ **MAP NAME**_____ **- __ MARGNUM___ 10,10 __,__**
DIRECTIONS_____
GPS Unit_____ **GPS File**_____ **PREC**____**m UTM:EASTING** __ __ __ __ __ __ **NORTHING** __ __ __ __ __ __ __
Zone_____ **Datum: NAD83** ☐ **/ NAD27** ☐**; Other**_____**; Log#**_____D☐ / F☐ **Photographer**_____
PP1:Exp____**AZM**____**FocL**___ **Notes**_____ **PP3:Exp**____**AZM**____**FocL**___ **Notes**_____
PP2:Exp____**AZM**____**FocL**___ **Notes**_____ **PP4:Exp**____**AZM**____**FocL**___ **Notes**_____
Other Site Photos:_____
ELEV _____**ft., SLOPE** ____**%, ASPECT**____**, SLOPE SHAPE**_____/___**, Surface Rock Type**_____/_____
LANDFORM:_____/ __ __ __ __ __ __
Lndfrm/Geol/Soil Notes:_____
SUMMARY DESCRIPTION: ☐**Site** ☐**Veg** ☐**Adjacent Com** ☐**Disturb/Frag** ☐**Animals** ☐**Disease** ☐**Management** ☐**Condition**
_____
_____
_____
_____
_____
_____
_____
_____
PLOTDIM(M)L/R ____**W** ____ **EO Size**_____**Ha**__**/Ac**__ **Est** ☐**MAP** ☐**EO Condition**____ Landscape
Comments:_____
Ground Surface Cover (%) Soil_____ Grav_____ Rock_____ Litter_____ HCC_____ Wood_____ Micro_____ Water_____=100%
Botanist:_____ ***CIRCLE YOUR VOUCHER NUMBERS***
Phenology: * = Flowering; @ = fruiting; X = dead annual ☐ Cover Scale or ☐ Percent Cover

TREES Total Cov____%	P	Cov	Ht(m)	GRAMINOIDS Tot Cov____%; Green____%	P	Cov	Ht(m)
T1				G1			
T2				G2			
T3				G3			
T4				G4			
T5				G5			
SHRUBS >.5m Total Cov____ %	P	Cov	Ht(m)	G6			
S1				G7			
S2				G8			
S3				FORBS Total Cover____%	P	Cov	Ht(m)
S4				F1			
S5				F2			
S6				F3			
S7				F4			
S8				F5			
DWARF SHRUBS < .5m Tot.Cov____ %	P	Cov	Ht(m)	F6			
DS1				F7			
DS2				F8			
DS3				F9			
DS4				F10			
DS5				F11			
DS6				F12			
DS7				F13			

Ht= species modal height (trees nearest m, shrubs nearest .5m, grasses & forbs nearest dm), recorded in meters____

Cover: +0=outside plot,in stand **2**=scattered, <1% (.5m^2 & <4m^2) **5**=10-<25%(40m^2 & <100m^2) **8**=50-<75%

Scale +=solitary/very few(<0.2m^2/400m^2) **3**=1-<5% (>4m^2 & <20m^2) **6**=25-<33%(100m^2 & <132m^2) **9**=75-<95%

1=very scattered (0.2m^2 -<.5m/400m^2) **4**=5-<10%(>20m^2 & <40m^2) **7**=33-<50% **10**=95-100%____

Percent: +0=outside plot,in stand **0.5%**= scattered, <1% (.5m^2 & <4m^2) **30-100%** to nearest 10%

Scale +=solitary/very few(<0.2m^2/400m^2) **1-10%** to the nearest 1% (each % equals 4m^2/400m^2)

0.1%=very scattered (0.2m^2 -<.5m/400m^2) **10-30%** to the nearest 5%

☐ **Trees** ☐ **Soils** ☐ **Quadrats** ☐ **Point/Line Intercept** ☐ **EO Assessment Form** ☐ **Site Evaluation**

NHNM VEGETATION SURVEY—GENERAL PLOT DESCRIPTION FORM 2 (2008)

PLOT ID_____**PLOT TYPE**_____**PROJECT**_____**Subproject** _____ **MO**___**DAY**___**YEAR**_____
EO/PA_____
EO/PA Comment_____
FIELD POINT ID_____**MU**_____
SURVEY SITE_____ **SURVEYORS**_____
LOCATION/DIRECTIONS_____
_____
COUNTY_____ **NM/**_____ **MAP NAME**_____ - __
MARGNUM___ **10,10** __,__
GPS Unit_____ **GPS File**_____ **UTM: EASTING** _ _ _ _ _ _ **NORTHING** _ _ _ _ _ _ _
PREC_____ **Zone**_____ **Datum: NAD83** ☐ **/ NAD27** ☐**;**
Other_____
☐ **Monument/:**_____
☐ **Photo Pt:**_____**/Cam Ht**_____ **Log#**____D☐ / F☐ **Photographer**_____
PP1:AZM____**FocL**____**Exp**___**Notes**_____**PP5:AZM**____**FocL**____**Exp**___**Notes**_____
PP2:AZM____**FocL**____**Exp**___**Notes**_____**PP6:AZM**____**FocL**____**Exp**___**Notes**_____
PP3:AZM____**FocL**____**Exp**___**Notes**_____**PP7:AZM**____**FocL**____**Exp**___**Notes**_____
PP4:AZM____**FocL**____**Exp**___**Notes**_____**PP8:AZM**____**FocL**____**Exp**___**Notes**_____
Other Site Photos/com:_____
_____
ELEV _____ **ft. SLOPE** _____**% ASPECT**_____ **SLOPE SHAPE**_____/_____
LANDFORM:_____/ __ __ __ __ __ __
Landform/Geology/Soil Comment_____
_____
SURFACE ROCK TYPE_____/_____
SITE / VEG SUMMARY:_____
_____
_____
_____
_____
_____
_____
_____
Adjacent Communities:_____
_____
_____
_____
Disease:_____
_____
Animal Use Evidence:_____
_____
Condition (Disturbance, Fragmentation, Erosion):_____
_____
_____
_____
_____
Distance in km to nearest human disturbance (roads, dam, clearcut, housing, mine, dump, etc.):_____**km**
Comments:_____
_____

PLOTDIM (m) L/R ____W ____ Comments:_____
_____OCC Size ☐HA ☐AC, ☐ Ground Estimate ☐ Mapped Estimate Comments:_____
_____
☐ EO/PA Mapped:_____
Management/Conservation/Other Comments:_____
_____
Forms: ☐ Floristics ☐ Trees ☐ Soils ☐ Quadrats ☐ Point/Line Intercept ☐ EO Assessment ☐ Site Evaluation

TREE INVENTORY FORM – NHNM 2006

Plot ID:_____ Project_____ Subproject:_____

Surveyors:_____ Date:_____ - _____ - 200__

PLOTDIM (m) L/R ____W ____

Species Code	0-2" <4.5'	0-2" >4.5'	2-4"	4-6"	6-8"	8-10"	10-12"	12-14"	14-16"	16-18"	18-20"	>20"	DRC___ DBH___
													DRC___ DBH___
													DRC___ DBH___
Stump →													DRC___ DBH___
													DRC___ DBH___
													DRC___ DBH___
													DRC___ DBH___
													DRC___ DBH___
													DRC___ DBH___
													DRC___ DBH___
													DRC___ DBH___
													DRC___ DBH___
													DRC___ DBH___

Tree Species	DBH (in)	DCH (in)	Core Age	Tree Height (ft)	Comment		Tree Species	DBH (in)	DCH (in)	Core Age	Tree Height (ft)	Comment

DRC = diameter root crown; DBH = diameter breast height; DCH = diameter core height; measure trees > 20”

Appendix B. Plant Species List

A list of plant species recorded on vegetation plots Pecos National Historical Park as part of the vegetation mapping project between 2006 and 2011. Plant voucher specimens were collected to confirm field identifications as necessary and are housed at the University of New Mexico Herbarium. Specimens were identified by NHNM botanist Yvonne Chauvin to lowest level possible given the material at hand and names assigned according to the PLANTS database (USDA-NRCS 2002) and the Integrated Taxonomic Information System (ITIS). Suitable quality specimens were accessioned with both UNM accession numbers and NPS record numbers tied to the Herbarium and NPS databases. Table B.1 provides the list ordered by lifeform code (LFC) and scientific name and Table B.2 is ordered by lifeform and common name. NHNM Acronym refers to the Natural Heritage New Mexico database code for the species; PLANTS symbol is database code from the USDA PLANTS database. Whether a voucher collection was made for the species is indicated in the last column.

Table B-1. Plant species arranged by life form and alphabetically by scientific name followed by the common name and plant family; PLANT symbol is database code for the USDA PLANTS database; NHNM Acronym refers to the Natural Heritage New Mexico database code for the species. Whether a voucher collection was made for the species is indicated in the last column.

Life Form Code	Life Form	Scientific Name	Common Name	Family	PLANTS Symbol	NHNM Acronym	Collected
1	Tree	*Acer negundo*	box elder	Aceraceae	ACNE2	ACENEG	Yes
1	Tree	*Alnus incana ssp. tenuifolia*	thinleaf alder	Betulaceae	ALINT	ALNINCT	Yes
1	Tree	*Elaeagnus angustifolia*	Russian olive	Elaeagnaceae	ELAN	ELAANG	Yes
1	Tree	*Fraxinus pennsylvanica*	green ash	Oleaceae	FRPE	FRAPEN	No
1	Tree	*Juniperus monosperma*	oneseed juniper	Cupressaceae	JUMO	JUNMON	No
1	Tree	*Juniperus scopulorum*	Rocky Mountain juniper	Cupressaceae	JUSC2	JUNSCO	Yes
1	Tree	*Malus pumila*	apple	Rosaceae	MAPU	MALPUM	No
1	Tree	*Pinus edulis*	pinyon pine	Pinaceae	PIED	PINEDU	No
1	Tree	*Pinus ponderosa*	ponderosa pine	Pinaceae	PIPO	PINPON	No
1	Tree	*Populus angustifolia*	narrowleaf cottonwood	Salicaceae	POAN3	POPANG	Yes
1	Tree	*Populus deltoides ssp. wislizeni*	Rio Grande cottonwood	Salicaceae	PODEW	POPDELW	No
1	Tree	*Populus x acuminata*	lanceleaf cottonwood	Salicaceae	POAC5	POPACU	No
1	Tree	*Prunus virginiana*	common chokecherry	Rosaceae	PRVI	PRUVIR	Yes
1	Tree	*Pseudotsuga menziesii*	Douglas-fir	Pinaceae	PSME	PSEMEN	No
1	Tree	*Quercus gambelii*	Gambel's oak	Fagaceae	QUGA	QUEGAM	No
1	Tree	*Salix amygdaloides*	peachleaf willow	Salicaceae	SAAM2	SALAMY	Yes
1	Tree	*Salix gooddingii*	Goodding's willow	Salicaceae	SAGO	SALGOO	Yes
1	Tree	*Ulmus pumila*	Siberian elm	Ulmaceae	ULPU	ULMPUM	No
2	Shrub	*Atriplex canescens*	fourwing saltbush	Chenopodiaceae	ATCA2	ATRCAN	No
2	Shrub	*Berberis fendleri*	Colorado barberry	Berberidaceae	BEFE	BERFEN	No
2	Shrub	*Cercocarpus montanus*	mountain mahogany	Rosaceae	CEMO2	CERMON	Yes
2	Shrub	*Clematis columbiana var.columbiana*	rock clematis	Ranunculaceae	CLCOC2	CLECOLC	Yes
2	Shrub	*Clematis ligusticifolia*	western white clematis	Ranunculaceae	CLLI2	CLELIG	Yes
2	Shrub	*Cylindropuntia imbricata*	tree cholla	Cactaceae	CYIM2	CYLIMB	No
2	Shrub	*Ericameria nauseosa*	rubber rabbitbrush	Asteraceae	ERNA10	ERINAU	No
2	Shrub	*Ericameria nauseosa var. bigelovii*	rubber rabbitbrush	Asteraceae	ERNAB2	ERINAUB	Yes
2	Shrub	*Ericameria nauseosa var. latisquamea*	rubber rabbitbrush	Asteraceae	CHNAL2	ERINAUL	Yes
2	Shrub	*Eriogonum microthecum var. simpsonii*	Simpson's buckwheat	Polygonaceae	ERMIS2	ERIMICS	Yes
2	Shrub	*Fallugia paradoxa*	Apacheplume	Rosaceae	FAPA	FALPAR	No
2	Shrub	*Forestiera pubescens var. pubescens*	New Mexico olive	Oleaceae	FOPUP	FORPUBP	No
2	Shrub	*Holodiscus dumosus*	rockspirea	Rosaceae	HODU	HOLDUM	No
2	Shrub	*Krascheninnikovia lanata*	winterfat	Chenopodiaceae	KRLA2	KRALAN2	No

Life Form Code	Life Form	Scientific Name	Common Name	Family	PLANTS Symbol	NHNM Acronym	Collected
2	Shrub	*Lycium pallidum*	pale wolfberry	Solanaceae	LYPA	LYCPAL	No
2	Shrub	*Parthenocissus vitacea*	thicket creeper	Vitaceae	PAVI5	PARVIT	Yes
2	Shrub	*Philadelphus microphyllus*	littleleaf mockorange	Hydrangeaceae	PHMI4	PHIMIC	Yes
2	Shrub	*Physocarpus monogynus*	mountain ninebark	Rosaceae	PHMO4	PHYMON	Yes
2	Shrub	*Quercus ×pauciloba*	wavyleaf oak	Fagaceae	QUPA4	QUEPAU	No
2	Shrub	*Rhus trilobata*	skunkbush sumac	Anacardiaceae	RHTR	RHUTRI	No
2	Shrub	*Ribes aureum*	golden currant	Grossulariaceae	RIAU	RIBAUR	Yes
2	Shrub	*Ribes cereum*	wax currant	Grossulariaceae	RICE	RIBCER	Yes
2	Shrub	*Rosa woodsii*	Woods' rose	Rosaceae	ROWO	ROSWOO	No
2	Shrub	*Salix exigua*	coyote willow	Salicaceae	SAEX	SALEXI	Yes
2	Shrub	*Salix irrorata*	bluestem willow	Salicaceae	SAIR	SALIRR	Yes
2	Shrub	*Salix ligulifolia*	strapleaf willow	Salicaceae	SALI	SALLIG	Yes
2	Shrub	*Tamarix chinensis*	saltcedar	Tamaricaceae	TACH2	TAMCHI	No
2	Shrub	*Yucca baccata*	banana yucca	Agavaceae	YUBA	YUCBAC	No
2	Shrub	*Yucca intermedia*	intermediate yucca	Agavaceae	YUIN	YUCINT	Yes
2.5	Sub-shrub	*Ageratina herbacea*	fragrant snakeroot	Asteraceae	AGHE5	AGEHER	Yes
2.5	Sub-shrub	*Artemisia frigida*	fringed sagewort	Asteraceae	ARFR4	ARTFRI	Yes
2.5	Sub-shrub	*Brickellia eupatorioides var. chlorolepis*	false boneset	Asteraceae	BREUC2	BRIEUPC	Yes
2.5	Sub-shrub	*Brickelliastrum fendleri*	Fendler's brickellbush	Asteraceae	BRFE2	BRIFEN2	Yes
2.5	Sub-shrub	*Dalea formosa*	featherplume	Fabaceae	DAFO	DALFOR	Yes
2.5	Sub-shrub	*Desmanthus cooleyi*	Cooley's bundleflower	Fabaceae	DECO2	DESCOO	Yes
2.5	Sub-shrub	*Echinocereus coccineus*	scarlet hedgehog cactus	Cactaceae	ECCO5	ECHCOC	No
2.5	Sub-shrub	*Echinocereus dasyacanthus*	rainbow cactus	Cactaceae	ECDA	ECHDAS	No
2.5	Sub-shrub	*Echinocereus fendleri*	pinkflower hedgehog cactus	Cactaceae	ECFE	ECHFEN	No
2.5	Sub-shrub	*Echinocereus fendleri var. fendleri*	Fendler's hedgehog cactus	Cactaceae	ECFEF2	ECHFENF	No
2.5	Sub-shrub	*Echinocereus viridiflorus*	nylon hedgehog cactus	Cactaceae	ECVI2	ECHVIR	No
2.5	Sub-shrub	*Escobaria vivipara*	spinystar	Cactaceae	ESVI2	ESCVIV	No
2.5	Sub-shrub	*Gutierrezia sarothrae*	broom snakeweed	Asteraceae	GUSA2	GUTSAR	Yes
2.5	Sub-shrub	*Menodora scabra*	rough menodora	Oleaceae	MESC	MENSCA	Yes
2.5	Sub-shrub	*Opuntia phaeacantha*	tulip pricklypear	Cactaceae	OPPH	OPUPHA	No
2.5	Sub-shrub	*Opuntia polyacantha*	plains pricklypear	Cactaceae	OPPO	OPUPOL	No
2.5	Sub-shrub	*Paxistima myrsinites*	myrtle boxleaf	Celastraceae	PAMY	PAXMYR	Yes
2.5	Sub-shrub	*Petrophyton caespitosum*	mat rockspirea	Rosaceae	PECA12	PETCAE	Yes

Life Form Code	Life Form	Scientific Name	Common Name	Family	PLANTS Symbol	NHNM Acronym	Collected
2.5	Sub-shrub	*Phoradendron juniperinum*	juniper mistletoe	Viscaceae	PHJU	PHOJUN	Yes
3	Grass	*Achnatherum hymenoides*	Indian ricegrass	Poaceae	ACHY	ACHHYM	No
3	Grass	*Achnatherum robustum*	sleepygrass	Poaceae	ACRO7	ACHROB	Yes
3	Grass	*Achnatherum scribneri*	Scribner's needlegrass	Poaceae	ACSC11	ACHSCR	Yes
3	Grass	*Agropyron desertorum*	desert wheatgrass	Poaceae	AGDE2	AGRDES	Yes
3	Grass	*Agrostis gigantea*	redtop	Poaceae	AGGI2	AGRGIG	Yes
3	Grass	*Agrostis stolonifera*	creeping bentgrass	Poaceae	AGST2	AGRSTO	Yes
3	Grass	*Andropogon gerardii*	big bluestem	Poaceae	ANGE	ANDGER	Yes
3	Grass	*Aristida arizonica*	Arizona threeawn	Poaceae	ARAR6	ARIARI	Yes
3	Grass	*Aristida divaricata*	poverty threeawn	Poaceae	ARDI5	ARIDIV	No
3	Grass	*Aristida purpurea*	purple threeawn	Poaceae	ARPU9	ARIPUR	No
3	Grass	*Aristida purpurea var. longiseta*	red threeawn	Poaceae	ARPUL	ARIPURL	No
3	Grass	*Aristida purpurea var. nealleyi*	Nealley's threeawn	Poaceae	ARPUN	ARIPURN	Yes
3	Grass	*Blepharoneuron tricholepis*	pine dropseed	Poaceae	BLTR	BLETRI	Yes
3	Grass	*Bouteloua curtipendula*	sideoats grama	Poaceae	BOCU	BOUCUR	Yes
3	Grass	*Bouteloua gracilis*	blue grama	Poaceae	BOGR2	BOUGRA	Yes
3	Grass	*Bouteloua hirsuta*	hairy grama	Poaceae	BOHI2	BOUHIR	Yes
3	Grass	*Bromus anomalus*	nodding brome	Poaceae	BRAN	BROANO	No
3	Grass	*Bromus catharticus*	rescuegrass	Poaceae	BRCA6	BROCAT	No
3	Grass	*Bromus inermis*	smooth brome	Poaceae	BRIN2	BROINE	Yes
3	Grass	*Bromus japonicus*	Japanese brome	Poaceae	BRJA	BROJAP	No
3	Grass	*Bromus lanatipes*	woolly brome	Poaceae	BRLA6	BROLAN	Yes
3	Grass	*Bromus tectorum*	cheatgrass	Poaceae	BRTE	BROTEC	No
3	Grass	*Carex hystericina*	porcupine sedge	Cyperaceae	CAHY4	CARHYS	Yes
3	Grass	*Carex inops ssp. heliophila*	sun sedge	Cyperaceae	CAINH2	CARINOH	Yes
3	Grass	*Carex microdonta*	littletooth sedge	Cyperaceae	CAMI5	CARMIC	No
3	Grass	*Carex nebrascensis*	Nebraska sedge	Cyperaceae	CANE2	CARNEB	Yes
3	Grass	*Carex occidentalis*	western sedge	Cyperaceae	CAOC2	CAROCC	Yes
3	Grass	*Carex pellita*	woolly sedge	Cyperaceae	CAPE42	CARPEL	Yes
3	Grass	*Carex praegracilis*	clustered field sedge	Cyperaceae	CAPR5	CARPRA	Yes
3	Grass	*Carex stipata*	owlfruit sedge	Cyperaceae	CAST5	CARSTI	Yes
3	Grass	*Carex vulpinoidea*	fox sedge	Cyperaceae	CAVU2	CARVUL	Yes
3	Grass	*Cyperus fendlerianus*	Fendler's flatsedge	Cyperaceae	CYFE2	CYPFEN	Yes
3	Grass	*Dactylis glomerata*	orchardgrass	Poaceae	DAGL	DACGLO	Yes
3	Grass	*Distichlis spicata*	inland saltgrass	Poaceae	DISP	DISSPI	Yes
3	Grass	*Eleocharis palustris*	common spikerush	Cyperaceae	ELPA3	ELEPAL	Yes
3	Grass	*Eleocharis parishii*	Parish's spikerush	Cyperaceae	ELPA4	ELEPAR	Yes
3	Grass	*Elymus canadensis*	Canada wildrye	Poaceae	ELCA4	ELYCAN	Yes
3	Grass	*Elymus elymoides*	bottlebrush squirreltail	Poaceae	ELEL5	ELYELY	Yes

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3	Grass	*Elymus lanceolatus*	streambank wheatgrass	Poaceae	ELLA3	ELYLAN	Yes
3	Grass	*Elymus repens*	quackgrass	Poaceae	ELRE4	ELYREP	No
3	Grass	*Elymus trachycaulus ssp. trachycaulus*	slender wheatgrass	Poaceae	ELTRT	ELYTRAT	Yes
3	Grass	*Elymus x pseudorepens*	false quackgrass	Poaceae	ELPS	ELYPSE	Yes
3	Grass	*Festuca arundinacea*	tall fescue	Poaceae	FEAR3	FESARU	Yes
3	Grass	*Festuca rubra*	red fescue	Poaceae	FERU2	FESRUB	Yes
3	Grass	*Glyceria grandis*	American mannagrass	Poaceae	GLGR	GLYGRA	Yes
3	Grass	*Hesperostipa comata*	needle-and-thread grass	Poaceae	HECO26	HESCOM	No
3	Grass	*Hesperostipa comata ssp. comata*	needle-and-thread grass	Poaceae	HECOC8	HESCOMC	No
3	Grass	*Hesperostipa neomexicana*	New Mexico needlegrass	Poaceae	HENE5	HESNEO	No
3	Grass	*Hordeum jubatum*	foxtail barley	Poaceae	HOJU	HORJUB	No
3	Grass	*Hordeum jubatum var. jubatum*	foxtail barley	Poaceae	HOJUJ	HORJUBJ	Yes
3	Grass	*Juncus arcticus*	arctic rush	Juncaceae	JUAR2	JUNARC	No
3	Grass	*Juncus arcticus var. balticus*	Baltic rush	Juncaceae	JUARB5	JUNARCB	Yes
3	Grass	*Juncus articulatus*	jointleaf rush	Juncaceae	JUAR4	JUNART	Yes
3	Grass	*Juncus dudleyi*	slender rush	Juncaceae	JUDU2	JUNDUD	Yes
3	Grass	*Juncus longistylis*	longstyle rush	Juncaceae	JULO	JUNLON	Yes
3	Grass	*Juncus torreyi*	Torrey's rush	Juncaceae	JUTO	JUNTOR	Yes
3	Grass	*Koeleria macrantha*	prairie junegrass	Poaceae	KOMA	KOEMAC	Yes
3	Grass	*Lycurus setosus*	bristly wolfstail	Poaceae	LYSE3	LYCSET	Yes
3	Grass	*Muhlenbergia asperifolia*	alkali muhly	Poaceae	MUAS	MUHASP	Yes
3	Grass	*Muhlenbergia montana*	mountain muhly	Poaceae	MUMO	MUHMON	Yes
3	Grass	*Muhlenbergia pauciflora*	New Mexico muhly	Poaceae	MUPA2	MUHPAU	Yes
3	Grass	*Muhlenbergia repens*	creeping muhly	Poaceae	MURE	MUHREP	Yes
3	Grass	*Muhlenbergia richardsonis*	Mat muhly	Poaceae	MURI	MUHRIC	No
3	Grass	*Muhlenbergia torreyi*	ring muhly	Poaceae	MUTO2	MUHTOR	Yes
3	Grass	*Muhlenbergia wrightii*	spike muhly	Poaceae	MUWR	MUHWRI	Yes
3	Grass	*Panicum bulbosum*	bulb panicgrass	Poaceae	PABU	PANBUL	Yes
3	Grass	*Panicum obtusum*	vine mesquite	Poaceae	PAOB	PANOBT	No
3	Grass	*Pascopyrum smithii*	western wheatgrass	Poaceae	PASM	PASSMI	Yes
3	Grass	*Phalaris arundinacea*	reed canarygrass	Poaceae	PHAR3	PHAARU	Yes
3	Grass	*Phleum pratense*	timothy	Poaceae	PHPR3	PHLPRA	Yes
3	Grass	*Piptatherum micranthum*	littleseed ricegrass	Poaceae	PIMI7	PIPMIC	Yes
3	Grass	*Pleuraphis jamesii*	galleta	Poaceae	PLJA	PLEJAM	Yes
3	Grass	*Poa bigelovii*	Bigelow's bluegrass	Poaceae	POBI	POABIG	Yes
3	Grass	*Poa compressa*	Canada bluegrass	Poaceae	POCO	POACOM	Yes
3	Grass	*Poa fendleriana*	muttongrass	Poaceae	POFE	POAFEN	No
3	Grass	*Poa pratensis*	Kentucky bluegrass	Poaceae	POPR	POAPRA	Yes

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3	Grass	*Psathyrostachys juncea*	Russian wildrye	Poaceae	PSJU3	PSAJUN	Yes
3	Grass	*Schedonnardus paniculatus*	tumblegrass	Poaceae	SCPA	SCHPAN	Yes
3	Grass	*Schizachyrium scoparium*	little bluestem	Poaceae	SCSC	SCHSCO	Yes
3	Grass	*Schoenoplectus acutus*	hardstem bulrush	Cyperaceae	SCAC3	SCHACU	No
3	Grass	*Schoenoplectus pungens*	common threesquare	Cyperaceae	SCPU10	SCHPUN	Yes
3	Grass	*Schoenoplectus tabernaemontani*	softstem bulrush	Cyperaceae	SCTA2	SCHTAB	Yes
3	Grass	*Sporobolus airoides*	alkali sacaton	Poaceae	SPAI	SPOAIR	No
3	Grass	*Sporobolus cryptandrus*	sand dropseed	Poaceae	SPCR	SPOCRY	No
3	Grass	*Vulpia octoflora*	sixweeks fescue	Poaceae	VUOC	VULOCT	No
4	Forb	*Achillea millefolium*	common yarrow	Asteraceae	ACMI2	ACHMIL	No
4	Forb	*Aletes filifolius*	TransPecos Indian parsley	Apiaceae	ALFI3	ALEFIL	Yes
4	Forb	*Allium cernuum*	nodding onion	Liliaceae	ALCE2	ALLCER	No
4	Forb	*Alyssum simplex*	alyssum	Brassicaceae	ALSI8	ALYSIM	Yes
4	Forb	*Ambrosia artemisiifolia*	annual ragweed	Asteraceae	AMAR2	AMBART	No
4	Forb	*Ambrosia confertiflora*	weakleaf bur ragweed	Asteraceae	AMCO3	AMBCON	No
4	Forb	*Ambrosia psilostachya*	Cuman ragweed	Asteraceae	AMPS	AMBPSI	No
4	Forb	*Androsace septentrionalis*	pygmyflower rockjasmine	Primulaceae	ANSE4	ANDSEP	Yes
4	Forb	*Anemopsis californica*	yerba mansa	Saururaceae	ANCA10	ANECAL	No
4	Forb	*Antennaria parvifolia*	smallleaf pussytoes	Asteraceae	ANPA4	ANTPAR	No
4	Forb	*Apocynum cannabinum*	Indianhemp	Apocynaceae	APCA	APOCAN	No
4	Forb	*Argentina anserina*	silverweed cinquefoil	Rosaceae	ARAN7	ARGANS	Yes
4	Forb	*Artemisia campestris*	field sagewort	Asteraceae	ARCA12	ARTCAM	Yes
4	Forb	*Artemisia carruthii*	Carruth's sagewort	Asteraceae	ARCA14	ARTCAR	Yes
4	Forb	*Artemisia dracunculus*	tarragon	Asteraceae	ARDR4	ARTDRA	Yes
4	Forb	*Artemisia ludoviciana*	white sagebrush	Asteraceae	ARLU	ARTLUD	Yes
4	Forb	*Asclepias involucrata*	dwarf milkweed	Asclepiadaceae	ASIN14	ASCINV	Yes
4	Forb	*Asclepias speciosa*	showy milkweed	Asclepiadaceae	ASSP	ASCSPE	No
4	Forb	*Asclepias subverticillata*	whorled milkweed	Asclepiadaceae	ASSU2	ASCSUB	No
4	Forb	*Asparagus officinalis*	garden asparagus	Liliaceae	ASOF	ASPOFF	No
4	Forb	*Astragalus humistratus var. humistratus*	groundcover milkvetch	Fabaceae	ASHUH3	ASTHUMH	Yes
4	Forb	*Astragalus lonchocarpus*	rushy milkvetch	Fabaceae	ASLO3	ASTLON	Yes
4	Forb	*Astragalus lotiflorus*	lotus milkvetch	Fabaceae	ASLO4	ASTLOT	Yes
4	Forb	*Astragalus missouriensis*	Missouri milkvetch	Fabaceae	ASMI10	ASTMIS	Yes
4	Forb	*Astragalus mollissimus*	woolly milkvetch	Fabaceae	ASMO7	ASTMOL	Yes
4	Forb	*Astragalus praelongus*	stinking milkvetch	Fabaceae	ASPR5	ASTPRA	Yes

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4	Forb	*Bahia dissecta*	ragleaf bahia	Asteraceae	BADI	BAHDIS	Yes
4	Forb	*Barbarea vulgaris*	garden yellowrocket	Brassicaceae	BAVU	BARVUL	Yes
4	Forb	*Besseya plantaginea*	White River coraldrops	Scrophulariaceae	BEPL	BESPLA	Yes
4	Forb	*Boechera fendleri*	Fendler's rockcress	Brassicaceae	BOFE	BOEFEN	Yes
4	Forb	*Brickellia brachyphylla*	plumed brickellbush	Asteraceae	BRBR2	BRIBRA	Yes
4	Forb	*Calylophus hartwegii*	Hartweg's sundrops	Onagraceae	CAHA14	CALHAR	No
4	Forb	*Camelina microcarpa*	littlepod false flax	Brassicaceae	CAMI2	CAMMIC	Yes
4	Forb	*Cardaria draba*	hoary cress	Brassicaceae	CADR	CARDRA	Yes
4	Forb	*Castilleja integra*	wholeleaf Indian paintbrush	Scrophulariaceae	CAIN14	CASINT	Yes
4	Forb	*Chaetopappa ericoides*	rose heath	Asteraceae	CHER2	CHAERI	Yes
4	Forb	*Chamaesyce fendleri*	Fendler's sandmat	Euphorbiaceae	CHFE3	CHAFEN	Yes
4	Forb	*Cheilanthes fendleri*	Fendler's lipfern	Pteridaceae	CHFE2	CHEFEN	Yes
4	Forb	*Chenopodium album*	lambsquarters	Chenopodiaceae	CHAL7	CHEALB	Yes
4	Forb	*Chenopodium graveolens*	fetid goosefoot	Chenopodiaceae	CHGR2	CHEGRA	No
4	Forb	*Chenopodium incanum*	mealy goosefoot	Chenopodiaceae	CHIN2	CHEINC	Yes
4	Forb	*Chenopodium leptophyllum*	narrowleaf goosefoot	Chenopodiaceae	CHLE4	CHELEP	Yes
4	Forb	*Chenopodium pratericola*	desert goosefoot	Chenopodiaceae	CHPR5	CHEPRA	Yes
4	Forb	*Chenopodium watsonii*	Watson's goosefoot	Chenopodiaceae	CHWA	CHEWAT	Yes
4	Forb	*Chorispora tenella*	crossflower	Brassicaceae	CHTE2	CHOTEN	No
4	Forb	*Cicuta maculata*	spotted water hemlock	Apiaceae	CIMA2	CICMAC	Yes
4	Forb	*Cirsium arvense*	Canada thistle	Asteraceae	CIAR4	CIRARV	Yes
4	Forb	*Cirsium ochrocentrum*	yellowspine thistle	Asteraceae	CIOC2	CIROCH	Yes
4	Forb	*Cirsium undulatum*	wavyleaf thistle	Asteraceae	CIUN	CIRUND	No
4	Forb	*Cirsium vulgare*	bull thistle	Asteraceae	CIVU	CIRVUL	Yes
4	Forb	*Commelina dianthifolia*	birdbill dayflower	Commelinaceae	CODI4	COMDIA	Yes
4	Forb	*Conium maculatum*	poison hemlock	Apiaceae	COMA2	CONMAC	Yes
4	Forb	*Conopholis alpina var. mexicana*	Mexican cancer-root	Orobanchaceae	COALM	CONALPM	Yes
4	Forb	*Convolvulus arvensis*	field bindweed	Convolvulaceae	COAR4	CONARV	No
4	Forb	*Conyza canadensis*	Canadian horseweed	Asteraceae	COCA5	CONCAN	Yes
4	Forb	*Cordylanthus wrightii*	Wright's birdbeak	Scrophulariaceae	COWR2	CORWRI	Yes
4	Forb	*Croton texensis*	Texas croton	Euphorbiaceae	CRTE4	CROTEX	Yes
4	Forb	*Cryptantha cinerea*	James' catseye	Boraginaceae	CRCI3	CRYCIN	No
4	Forb	*Cryptantha cinerea var. cinerea*	James' catseye	Boraginaceae	CRCIC	CRYCINC	Yes
4	Forb	*Cucurbita foetidissima*	buffalo gourd	Cucurbitaceae	CUFO	CUCFOE	No
4	Forb	*Dalea candida*	slender white prairieclover	Fabaceae	DACA7	DALCAN	Yes
4	Forb	*Dalea jamesii*	James' prairieclover	Fabaceae	DAJA	DALJAM	Yes
4	Forb	*Descurainia obtusa ssp. obtusa*	blunt tansymustard	Brassicaceae	DEOBO	DESOBTO	Yes
4	Forb	*Descurainia sophia*	herb sophia	Brassicaceae	DESO2	DESSOP	No

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4	Forb	*Desmanthus obtusus*	bluntpod bundleflower	Fabaceae	DEOB2	DESOBT	No
4	Forb	*Dieteria canescens*	hoary aster	Asteraceae	MACA2	DIECAN	No
4	Forb	*Dieteria canescens var. glabra*	hoary tansyaster	Asteraceae	MACAG	DIECANG	Yes
4	Forb	*Dipsacus fullonum*	Fuller's teasel	Dipsacaceae	DIFU2	DIPFUL	Yes
4	Forb	*Draba cuneifolia*	wedgeleaf draba	Brassicaceae	DRCU	DRACUN	No
4	Forb	*Draba helleriana*	Heller's draba	Brassicaceae	DRHE	DRAHEL	Yes
4	Forb	*Equisetum arvense*	field horsetail	Equisetaceae	EQAR	EQUARV	No
4	Forb	*Equisetum laevigatum*	smooth horsetail	Equisetaceae	EQLA	EQULAE	Yes
4	Forb	*Erigeron canus*	hoary fleabane	Asteraceae	ERCA4	ERICAN	Yes
4	Forb	*Erigeron divergens*	spreading fleabane	Asteraceae	ERDI4	ERIDIV	Yes
4	Forb	*Erigeron eximius*	sprucefir fleabane	Asteraceae	EREX4	ERIEXI	No
4	Forb	*Erigeron flagellaris*	trailing fleabane	Asteraceae	ERFL	ERIFLA	Yes
4	Forb	*Erigeron formosissimus*	beautiful fleabane	Asteraceae	ERFO3	ERIFOR	Yes
4	Forb	*Erigeron formosissimus var. viscidus*	beautiful fleabane	Asteraceae	ERFOV	ERIFORV	Yes
4	Forb	*Erigeron philadelphicus*	Philadelphia fleabane	Asteraceae	ERPH	ERIPHI	Yes
4	Forb	*Erigeron speciosus*	aspen fleabane	Asteraceae	ERSP4	ERISPE	No
4	Forb	*Eriogonum alatum*	winged buckwheat	Polygonaceae	ERAL4	ERIALA	Yes
4	Forb	*Eriogonum jamesii*	James' buckwheat	Polygonaceae	ERJA	ERIJAM	No
4	Forb	*Eriogonum jamesii var. jamesii*	James' buckwheat	Polygonaceae	ERJAJ	ERIJAMJ	Yes
4	Forb	*Erodium cicutarium*	redstem stork's bill	Geraniaceae	ERCI6	EROCIC	Yes
4	Forb	*Erodium texanum*	Texas filaree	Geraniaceae	ERTE13	EROTEX	No
4	Forb	*Erysimum inconspicuum*	shy wallflower	Brassicaceae	ERIN7	ERYINC	Yes
4	Forb	*Euphorbia brachycera*	horned spurge	Euphorbiaceae	EUBR	EUPBRA	Yes
4	Forb	*Euphorbia davidii*	David's spurge	Euphorbiaceae	EUDA5	EUPDAV	Yes
4	Forb	*Gaillardia aristata*	common blanketflower	Asteraceae	GAAR	GAIARI	No
4	Forb	*Gaillardia pinnatifida*	red dome blanketflower	Asteraceae	GAPI	GAIPIN	Yes
4	Forb	*Gaillardia pulchella*	firewheel	Asteraceae	GAPU	GAIPUL	Yes
4	Forb	*Gaura coccinea*	scarlet beeblossom	Onagraceae	GACO5	GAUCOC	No
4	Forb	*Gaura mollis*	velvetweed	Onagraceae	GAMO5	GAUMOL	No
4	Forb	*Geranium caespitosum*	pineywoods geranium	Geraniaceae	GECA3	GERCAE	No
4	Forb	*Glandularia bipinnatifida*	Dakota mock vervain	Verbenaceae	GLBI2	GLABIP	Yes
4	Forb	*Glycyrrhiza lepidota*	American licorice	Fabaceae	GLLE3	GLYLEP	No
4	Forb	*Grindelia squarrosa*	curlycup gumweed	Asteraceae	GRSQ	GRISQU	Yes
4	Forb	*Hackelia besseyi*	Bessey's stickseed	Boraginaceae	HABE3	HACBES	Yes
4	Forb	*Hedeoma drummondii*	Drummond's false pennyroyal	Lamiaceae	HEDR	HEDDRU	Yes
4	Forb	*Helianthus annuus*	common sunflower	Asteraceae	HEAN3	HELANN	Yes
4	Forb	*Helianthus ciliaris*	Texas blueweed	Asteraceae	HECI	HELCIL	Yes
4	Forb	*Helianthus petiolaris*	prairie sunflower	Asteraceae	HEPE	HELPET	Yes

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4	Forb	*Heterotheca fulcrata*	rockyscree falsegoldenaster	Asteraceae	HEFU3	HETFUL	No
4	Forb	*Heterotheca villosa*	hairy goldenaster	Asteraceae	HEVI4	HETVIL	No
4	Forb	*Heterotheca villosa var. minor*	hairy false goldenaster	Asteraceae	HEVIM3	HETVILM	Yes
4	Forb	*Heuchera parvifolia*	littleleaf alumroot	Saxifragaceae	HEPA11	HEUPAR	Yes
4	Forb	*Hymenopappus filifolius*	fineleaf hymenopappus	Asteraceae	HYFI	HYMFIL	No
4	Forb	*Hymenopappus filifolius var. cinereus*	fineleaf hymenopappus	Asteraceae	HYFIC	HYMFILC	Yes
4	Forb	*Hymenoxys richardsonii*	pingue hymenoxys	Asteraceae	HYRI	HYMRIC	No
4	Forb	*Hymenoxys richardsonii var. floribunda*	Colorado rubberweed	Asteraceae	HYRIF	HYMRICF	Yes
4	Forb	*Ipomopsis aggregata*	skyrocket gilia	Polemoniaceae	IPAG	IPOAGG	No
4	Forb	*Ipomopsis longiflora*	flaxflowered gilia	Polemoniaceae	IPLO2	IPOLON	Yes
4	Forb	*Iris missouriensis*	Rocky Mountain iris	Iridaceae	IRMI	IRIMIS	No
4	Forb	*Kochia scoparia*	common kochia	Chenopodiaceae	KOSC	KOCSCO	No
4	Forb	*Lactuca serriola*	prickly lettuce	Asteraceae	LASE	LACSER	Yes
4	Forb	*Lappula occidentalis*	flatspine stickseed	Boraginaceae	LAOC3	LAPOCC	No
4	Forb	*Lathyrus eucosmus*	bush peavine	Fabaceae	LAEU	LATEUC	Yes
4	Forb	*Lathyrus latifolius*	perennial pea	Fabaceae	LALA4	LATLAT	Yes
4	Forb	*Lepidium densiflorum*	common pepperweed	Brassicaceae	LEDE	LEPDEN	Yes
4	Forb	*Leucanthemum vulgare*	oxeye daisy	Asteraceae	LEVU	LEUVUL	Yes
4	Forb	*Linum lewisii*	prairie flax	Linaceae	LILE3	LINLEW	No
4	Forb	*Linum puberulum*	plains flax	Linaceae	LIPU4	LINPUB	Yes
4	Forb	*Lithospermum multiflorum*	manyflowered gromwell	Boraginaceae	LIMU3	LITMUL	Yes
4	Forb	*Lupinus kingii*	King's lupine	Fabaceae	LUKI	LUPKIN	Yes
4	Forb	*Machaeranthera tanacetifolia*	tanseyleaf aster	Asteraceae	MATA2	MACTAN	Yes
4	Forb	*Marrubium vulgare*	horehound	Lamiaceae	MAVU	MARVUL	No
4	Forb	*Medicago lupulina*	black medick	Fabaceae	MELU	MEDLUP	Yes
4	Forb	*Medicago sativa*	alfalfa	Fabaceae	MESA	MEDSAT	Yes
4	Forb	*Melampodium leucanthum*	plains blackfoot	Asteraceae	MELE2	MELLEU	No
4	Forb	*Melilotus indicus*	annual yellow sweetclover	Fabaceae	MEIN2	MELIND	No
4	Forb	*Melilotus officinalis*	yellow sweetclover	Fabaceae	MEOF	MELOFF	No
4	Forb	*Mentha arvensis*	wild mint	Lamiaceae	MEAR4	MENARV	Yes
4	Forb	*Mentzelia albicaulis*	whitestem blazingstar	Loasaceae	MEAL6	MENALB	No
4	Forb	*Mentzelia multiflora*	manyflowered mentzelia	Loasaceae	MEMU3	MENMUL	No
4	Forb	*Mentzelia multiflora var. multiflora*	Adonis blazingstar	Loasaceae	MEMUM2	MENMULM	Yes
4	Forb	*Mirabilis linearis*	narrowleaf four o'clock	Nyctaginaceae	MILI3	MIRLIN	Yes
4	Forb	*Mirabilis multiflora*	Colorado four o'clock	Nyctaginaceae	MIMU	MIRMUL	No
4	Forb	*Mirabilis oxybaphoides*	smooth spreading four o'clock	Nyctaginaceae	MIOX	MIROXY	No
4	Forb	*Monarda pectinata*	pony beebalm	Lamiaceae	MOPE	MONPEC	Yes

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4	Forb	*Nasturtium officinale*	watercress	Brassicaceae	NAOF	NASOFF	Yes
4	Forb	*Nepeta cataria*	catnip	Lamiaceae	NECA2	NEPCAT	No
4	Forb	*Noccaea montanum*	alpine pennycress	Brassicaceae	NOMO2	NOCMON	Yes
4	Forb	*Oenothera coronopifolia*	crownleaf evening-primrose	Onagraceae	OECO2	OENCOR	Yes
4	Forb	*Oenothera pallida*	pale eveningprimrose	Onagraceae	OEPA	OENPAL	No
4	Forb	*Onopordum acanthium*	Scotch thistle	Asteraceae	ONAC	ONOACA	Yes
4	Forb	*Orobanche ludoviciana ssp. multiflora*	manyflowered broomrape	Orobanchaceae	ORLUM	OROLUDM	Yes
4	Forb	*Oxalis alpina*	alpine woodsorrel	Oxalidaceae	OXAL2	OXAALP	No
4	Forb	*Oxytropis lambertii*	Lambert's crazyweed	Fabaceae	OXLA3	OXYLAM	No
4	Forb	*Oxytropis sericea*	silvery lupine	Fabaceae	OXSE	OXYSER	No
4	Forb	*Packera fendleri*	Fendler's ragwort	Asteraceae	PAFE4	PACFEN	Yes
4	Forb	*Packera pseudaurea var. flavula*	falsegold groundsel	Asteraceae	PAPSF	PACPSEF	Yes
4	Forb	*Pennellia micrantha*	mountain mock thelypody	Brassicaceae	PEMI7	PENMIC	No
4	Forb	*Penstemon barbatus*	beardlip penstemon	Scrophulariaceae	PEBA2	PENBAR	Yes
4	Forb	*Penstemon jamesii*	James' beardtongue	Scrophulariaceae	PEJA	PENJAM	Yes
4	Forb	*Penstemon virgatus*	upright blue beardtongue	Scrophulariaceae	PEVI4	PENVIR	Yes
4	Forb	*Penstemon whippleanus*	Whipple's penstemon	Scrophulariaceae	PEWH	PENWHI	No
4	Forb	*Persicaria lapathifolia*	curlytop knotweed	Polygonaceae	PELA22	PERLAP	Yes
4	Forb	*Phemeranthus brevicaulis*	dwarf fameflower	Portulacaceae	PHBR15	PHEBRE	Yes
4	Forb	*Phemeranthus parviflorus*	sunbright	Portulacaceae	PHPA29	PHEPAR	Yes
4	Forb	*Phlox nana*	Santa Fe phlox	Polemoniaceae	PHNA2	PHLNAN	Yes
4	Forb	*Physalis hederifolia var. fendleri*	Fendler's groundcherry	Solanaceae	PHHEF	PHYHEDF	Yes
4	Forb	*Physalis longifolia var. longifolia*	longleaf groundcherry	Solanaceae	PHLOL3	PHYLONL	Yes
4	Forb	*Physaria rectipes*	straight bladderpod	Brassicaceae	LERE3	PHYREC	Yes
4	Forb	*Picradeniopsis oppositifolia*	oppositeleaf bahia	Asteraceae	PIOP	PICOPP	Yes
4	Forb	*Plantago argyrea*	saltmeadow plantain	Plantaginaceae	PLAR9	PLAARG	No
4	Forb	*Plantago lanceolata*	english plantain	Plantaginaceae	PLLA	PLALAN	No
4	Forb	*Plantago major*	common plantain	Plantaginaceae	PLMA2	PLAMAJ	No
4	Forb	*Plantago patagonica*	woolly plantain	Plantaginaceae	PLPA2	PLAPAT	Yes
4	Forb	*Platanthera huronensis*	Huron green orchid	Orchidaceae	PLHU2	PLAHUR	Yes
4	Forb	*Polygonum douglasii*	Douglas' knotweed	Polygonaceae	PODO4	POLDOU	Yes
4	Forb	*Portulaca oleracea*	common purslane	Portulacaceae	POOL	POROLE	No
4	Forb	*Potentilla hippiana*	woolly cinquefoil	Rosaceae	POHI6	POTHIP	No
4	Forb	*Potentilla pensylvanica*	Pennsylvania cinquefoil	Rosaceae	POPE8	POTPEN	Yes
4	Forb	*Prunella vulgaris*	common selfheal	Lamiaceae	PRVU	PRUVUL	No
4	Forb	*Psilostrophe tagetina*	woolly paperflower	Asteraceae	PSTA	PSITAG	No
4	Forb	*Psoralidium tenuiflorum*	slimflower scurfpea	Fabaceae	PSTE5	PSOTEN	Yes

Life Form Code	Life Form	Scientific Name	Common Name	Family	PLANTS Symbol	NHNM Acronym	Collected
4	Forb	*Ranunculus cymbalaria*	alkali buttercup	Ranunculaceae	RACY	RANCYM	Yes
4	Forb	*Ranunculus macounii*	Macoun's buttercup	Ranunculaceae	RAMA2	RANMAC	Yes
4	Forb	*Ratibida columnifera*	upright prairie coneflower	Asteraceae	RACO3	RATCOL	Yes
4	Forb	*Ratibida tagetes*	green prairie coneflower	Asteraceae	RATA	RATTAG	Yes
4	Forb	*Rorippa sylvestris*	creeping yellowcress	Brassicaceae	ROSY	RORSYL	Yes
4	Forb	*Rudbeckia laciniata*	cutleaf coneflower	Asteraceae	RULA3	RUDLAC	No
4	Forb	*Rudbeckia laciniata var. ampla*	cutleaf coneflower	Asteraceae	RULAA	RUDLACA	Yes
4	Forb	*Rumex crispus*	curly dock	Polygonaceae	RUCR	RUMCRI	No
4	Forb	*Salsola tragus*	prickly Russian thistle	Chenopodiaceae	SATR12	SALTRA	Yes
4	Forb	*Schkuhria multiflora*	manyflower false threadleaf	Asteraceae	SCMU6	SCHMUL	Yes
4	Forb	*Schoenocrambe linearifolia*	slimleaf plainsmustard	Brassicaceae	SCLI12	SCHLIN	Yes
4	Forb	*Scorzonera laciniata*	cutleaf vipergrass	Asteraceae	SCLA6	SCOLAC	Yes
4	Forb	*Sedum cockerellii*	Cockerell's stonecrop	Crassulaceae	SECO	SEDCOC	Yes
4	Forb	*Selaginella mutica*	bluntleaf spikemoss	Selaginellaceae	SEMU	SELMUT	Yes
4	Forb	*Senecio flaccidus var. flaccidus*	threadleaf ragwort	Asteraceae	SEFLF	SENFLAF	No
4	Forb	*Senecio spartioides*	broom groundsel	Asteraceae	SESP3	SENSPA	Yes
4	Forb	*Sidalcea candida*	white checkermallow	Malvaceae	SICA3	SIDCAN	Yes
4	Forb	*Sisymbrium altissimum*	tall tumblemustard	Brassicaceae	SIAL2	SISALT	Yes
4	Forb	*Sisyrinchium demissum*	dwarf blue-eyed grass	Iridaceae	SIDE4	SISDEM	Yes
4	Forb	*Solidago canadensis*	Canada goldenrod	Asteraceae	SOCA6	SOLCAN	No
4	Forb	*Solidago canadensis var. glivocanescens*	shorthair goldenrod	Asteraceae	SOCAG	SOLCANG	No
4	Forb	*Solidago simplex ssp. simplex var. simplex*	Mt. Albert goldenrod	Asteraceae	SOSIS3	SOLSIMS	Yes
4	Forb	*Solidago wrightii*	Wright's goldenrod	Asteraceae	SOWR	SOLWRI	No
4	Forb	*Solidago wrightii var. wrightii*	Wright's goldenrod	Asteraceae	SOWRW	SOLWRIW	Yes
4	Forb	*Sonchus asper*	spiny sowthistle	Asteraceae	SOAS	SONASP	No
4	Forb	*Sphaeralcea coccinea*	scarlet globemallow	Malvaceae	SPCO	SPHCOC	No
4	Forb	*Sphaeralcea fendleri*	Fendler's globemallow	Malvaceae	SPFE	SPHFEN	Yes
4	Forb	*Sphaeralcea hastulata*	spear globemallow	Malvaceae	SPHA	SPHHAS	No
4	Forb	*Stephanomeria pauciflora*	brownplume wirelettuce	Asteraceae	STPA4	STEPAU	Yes
4	Forb	*Symphyotrichum falcatum var. commutatum*	cluster aster	Asteraceae	SYFAC	SYMFALC	Yes
4	Forb	*Taraxacum officinale*	common dandelion	Asteraceae	TAOF	TAROFF	No
4	Forb	*Tetraneuris acaulis*	stemless hymenoxys	Asteraceae	TEAC	TETACA	No
4	Forb	*Tetraneuris argentea*	perkysue	Asteraceae	TEAR4	TETARG	Yes
4	Forb	*Tetraneuris scaposa*	stemmy four-nerve daisy	Asteraceae	TESC2	TETSCA	Yes
4	Forb	*Thalictrum fendleri*	Fendler's meadowrue	Ranunculaceae	THFE	THAFEN	No
4	Forb	*Thelesperma filifolium*	stiff greenthread	Asteraceae	THFI	THEFIL	Yes

Life Form Code	Life Form	Scientific Name	Common Name	Family	PLANTS Symbol	NHNM Acronym	Collected
4	Forb	*Thelesperma longipes*	longstalk greenthread	Asteraceae	THLO	THELON	No
4	Forb	*Thelesperma megapotamicum*	Hopi tea greenthread	Asteraceae	THME	THEMEG	Yes
4	Forb	*Thelypodium wrightii*	Wright's thelypody	Brassicaceae	THWR	THEWRI	No
4	Forb	*Thlaspi arvense*	field pennycress	Brassicaceae	THAR5	THLARV	Yes
4	Forb	*Townsendia annua*	annual townsend daisy	Asteraceae	TOAN	TOWANN	No
4	Forb	*Townsendia eximia*	tall townsendia	Asteraceae	TOEX	TOWEXI	Yes
4	Forb	*Townsendia exscapa*	stemless townsendia	Asteraceae	TOEX2	TOWEXS	Yes
4	Forb	*Tragia ramosa*	branched noseburn	Euphorbiaceae	TRRA5	TRARAM	No
4	Forb	*Tragopogon dubius*	yellow salsify	Asteraceae	TRDU	TRADUB	No
4	Forb	*Tragopogon pratensis*	meadow salsify	Asteraceae	TRPR	TRAPRA	Yes
4	Forb	*Trifolium pratense*	red clover	Fabaceae	TRPR2	TRIPRA	Yes
4	Forb	*Trifolium repens*	white clover	Fabaceae	TRRE3	TRIREP	No
4	Forb	*Typha domingensis*	southern cattail	Typhaceae	TYDO	TYPDOM	Yes
4	Forb	*Typha latifolia*	broadleaf cattail	Typhaceae	TYLA	TYPLAT	No
4	Forb	*Verbascum thapsus*	common mullein	Scrophulariaceae	VETH	VERTHA	No
4	Forb	*Verbena macdougalii*	MacDougal verbena	Verbenaceae	VEMA	VERMAC	Yes
4	Forb	*Verbesina encelioides*	golden crownbeard	Asteraceae	VEEN	VERENC	No
4	Forb	*Veronica americana*	American speedwell	Scrophulariaceae	VEAM2	VERAME	Yes
4	Forb	*Veronica peregrina ssp. xalapensis*	hairy purslane speedwell	Scrophulariaceae	VEPEX2	VERPERX	Yes
4	Forb	*Vicia americana*	American vetch	Fabaceae	VIAM	VICAME	Yes
4	Forb	*Woodsia neomexicana*	New Mexico cliff fern	Dryopteridaceae	WONE	WOONEO	Yes
4	Forb	*Xanthisma spinulosum*	lacy tansyaster	Asteraceae	MAPI	XANSPI2	Yes
4	Forb	*Xanthium strumarium*	rough cocklebur	Asteraceae	XAST	XANSTR	No
4	Forb	*Zinnia grandiflora*	Rocky Mountain zinnia	Asteraceae	ZIGR	ZINGRA	No

Table B-2. Plant species arranged by life form and alphabetically by common name followed by the scientific name and plant family; PLANT symbol is database code for the USDA PLANTS database; NHNM Acronym refers to the Natural Heritage New Mexico database code for the species. Whether a voucher collection was made for the species is indicated in the last column.

Life Form Code	Life Form	Common Name	*Scientific Name*	Family	PLANTS Symbol	NHNM Acronym	Collected
1	Tree	alligator juniper	*Juniperus deppeana*	Cupressaceae	JUDE2	JUNDEP	No
1	Tree	apple	*Malus pumila*	Rosaceae	MAPU	MALPUM	No
1	Tree	box elder	*Acer negundo*	Aceraceae	ACNE2	ACENEG	Yes
1	Tree	common chokecherry	*Prunus virginiana*	Rosaceae	PRVI	PRUVIR	Yes
1	Tree	Douglas-fir	*Pseudotsuga menziesii*	Pinaceae	PSME	PSEMEN	No
1	Tree	Gambel's oak	*Quercus gambelii*	Fagaceae	QUGA	QUEGAM	No
1	Tree	Goodding's willow	*Salix gooddingii*	Salicaceae	SAGO	SALGOO	Yes
1	Tree	green ash	*Fraxinus pennsylvanica*	Oleaceae	FRPE	FRAPEN	No
1	Tree	lanceleaf cottonwood	*Populus x acuminata*	Salicaceae	POAC5	POPACU	No
1	Tree	narrowleaf cottonwood	*Populus angustifolia*	Salicaceae	POAN3	POPANG	Yes
1	Tree	oneseed juniper	*Juniperus monosperma*	Cupressaceae	JUMO	JUNMON	No
1	Tree	peachleaf willow	*Salix amygdaloides*	Salicaceae	SAAM2	SALAMY	Yes
1	Tree	pinyon pine	*Pinus edulis*	Pinaceae	PIED	PINEDU	No
1	Tree	ponderosa pine	*Pinus ponderosa*	Pinaceae	PIPO	PINPON	No
1	Tree	Rio Grande cottonwood	*Populus deltoides ssp. wislizeni*	Salicaceae	PODEW	POPDELW	No
1	Tree	Rocky Mountain juniper	*Juniperus scopulorum*	Cupressaceae	JUSC2	JUNSCO	Yes
1	Tree	Russian olive	*Elaeagnus angustifolia*	Elaeagnaceae	ELAN	ELAANG	Yes
1	Tree	Siberian elm	*Ulmus pumila*	Ulmaceae	ULPU	ULMPUM	No
1	Tree	thinleaf alder	*Alnus incana ssp. tenuifolia*	Betulaceae	ALINT	ALNINCT	Yes
2	Shrub	Apacheplume	*Fallugia paradoxa*	Rosaceae	FAPA	FALPAR	No
2	Shrub	banana yucca	*Yucca baccata*	Agavaceae	YUBA	YUCBAC	No
2	Shrub	bluestem willow	*Salix irrorata*	Salicaceae	SAIR	SALIRR	Yes
2	Shrub	Colorado barberry	*Berberis fendleri*	Berberidaceae	BEFE	BERFEN	No
2	Shrub	coyote willow	*Salix exigua*	Salicaceae	SAEX	SALEXI	Yes
2	Shrub	fourwing saltbush	*Atriplex canescens*	Chenopodiaceae	ATCA2	ATRCAN	No
2	Shrub	golden currant	*Ribes aureum*	Grossulariaceae	RIAU	RIBAUR	Yes
2	Shrub	intermediate yucca	*Yucca intermedia*	Agavaceae	YUIN	YUCINT	Yes
2	Shrub	littleleaf mockorange	*Philadelphus microphyllus*	Hydrangeaceae	PHMI4	PHIMIC	Yes
2	Shrub	mountain mahogany	*Cercocarpus montanus*	Rosaceae	CEMO2	CERMON	Yes
2	Shrub	mountain ninebark	*Physocarpus monogynus*	Rosaceae	PHMO4	PHYMON	Yes
2	Shrub	New Mexico olive	*Forestiera pubescens var. pubescens*	Oleaceae	FOPUP	FORPUBP	No
2	Shrub	pale wolfberry	*Lycium pallidum*	Solanaceae	LYPA	LYCPAL	No
2	Shrub	rock clematis	*Clematis columbiana var.columbiana*	Ranunculaceae	CLCOC2	CLECOLC	Yes
2	Shrub	rockspirea	*Holodiscus dumosus*	Rosaceae	HODU	HOLDUM	No

Life Form Code	Life Form	Common Name	*Scientific Name*	Family	PLANTS Symbol	NHNM Acronym	Collected
2	Shrub	rubber rabbitbrush	*Ericameria nauseosa*	Asteraceae	ERNA10	ERINAU	No
2	Shrub	rubber rabbitbrush	*Ericameria nauseosa var. bigelovii*	Asteraceae	ERNAB2	ERINAUB	Yes
2	Shrub	rubber rabbitbrush	*Ericameria nauseosa var. latisquamea*	Asteraceae	CHNAL2	ERINAUL	Yes
2	Shrub	saltcedar	*Tamarix chinensis*	Tamaricaceae	TACH2	TAMCHI	No
2	Shrub	Simpson's buckwheat	*Eriogonum microthecum var. simpsonii*	Polygonaceae	ERMIS2	ERIMICS	Yes
2	Shrub	skunkbush sumac	*Rhus trilobata*	Anacardiaceae	RHTR	RHUTRI	No
2	Shrub	strapleaf willow	*Salix ligulifolia*	Salicaceae	SALI	SALLIG	Yes
2	Shrub	thicket creeper	*Parthenocissus vitacea*	Vitaceae	PAVI5	PARVIT	Yes
2	Shrub	tree cholla	*Cylindropuntia imbricata*	Cactaceae	CYIM2	CYLIMB	No
2	Shrub	wavyleaf oak	*Quercus ×pauciloba*	Fagaceae	QUPA4	QUEPAU	No
2	Shrub	wax currant	*Ribes cereum*	Grossulariaceae	RICE	RIBCER	Yes
2	Shrub	western white clematis	*Clematis ligusticifolia*	Ranunculaceae	CLLI2	CLELIG	Yes
2	Shrub	winterfat	*Krascheninnikovia lanata*	Chenopodiaceae	KRLA2	KRALAN2	No
2	Shrub	Woods' rose	*Rosa woodsii*	Rosaceae	ROWO	ROSWOO	No
2.5	Sub-shrub	broom snakeweed	*Gutierrezia sarothrae*	Asteraceae	GUSA2	GUTSAR	Yes
2.5	Sub-shrub	Cooley's bundleflower	*Desmanthus cooleyi*	Fabaceae	DECO2	DESCOO	Yes
2.5	Sub-shrub	false boneset	*Brickellia eupatorioides var. chlorolepis*	Asteraceae	BREUC2	BRIEUPC	Yes
2.5	Sub-shrub	featherplume	*Dalea formosa*	Fabaceae	DAFO	DALFOR	Yes
2.5	Sub-shrub	Fendler's brickellbush	*Brickelliastrum fendleri*	Asteraceae	BRFE2	BRIFEN2	Yes
2.5	Sub-shrub	Fendler's hedgehog cactus	*Echinocereus fendleri var. fendleri*	Cactaceae	ECFEF2	ECHFENF	No
2.5	Sub-shrub	fragrant snakeroot	*Ageratina herbacea*	Asteraceae	AGHE5	AGEHER	Yes
2.5	Sub-shrub	fringed sagewort	*Artemisia frigida*	Asteraceae	ARFR4	ARTFRI	Yes
2.5	Sub-shrub	juniper mistletoe	*Phoradendron juniperinum*	Viscaceae	PHJU	PHOJUN	Yes
2.5	Sub-shrub	mat rockspirea	*Petrophyton caespitosum*	Rosaceae	PECA12	PETCAE	Yes
2.5	Sub-shrub	myrtle boxleaf	*Paxistima myrsinites*	Celastraceae	PAMY	PAXMYR	Yes
2.5	Sub-shrub	nylon hedgehog cactus	*Echinocereus viridiflorus*	Cactaceae	ECVI2	ECHVIR	No
2.5	Sub-shrub	pinkflower hedgehog cactus	*Echinocereus fendleri*	Cactaceae	ECFE	ECHFEN	No
2.5	Sub-shrub	plains pricklypear	*Opuntia polyacantha*	Cactaceae	OPPO	OPUPOL	No
2.5	Sub-shrub	rainbow cactus	*Echinocereus dasyacanthus*	Cactaceae	ECDA	ECHDAS	No
2.5	Sub-shrub	rough menodora	*Menodora scabra*	Oleaceae	MESC	MENSCA	Yes
2.5	Sub-shrub	scarlet hedgehog cactus	*Echinocereus coccineus*	Cactaceae	ECCO5	ECHCOC	No

Life Form Code	Life Form	Common Name	*Scientific Name*	Family	PLANTS Symbol	NHNM Acronym	Collected
2.5	Sub-shrub	spinystar	*Escobaria vivipara*	Cactaceae	ESVI2	ESCVIV	No
2.5	Sub-shrub	tulip pricklypear	*Opuntia phaeacantha*	Cactaceae	OPPH	OPUPHA	No
3	Grass	alkali muhly	*Muhlenbergia asperifolia*	Poaceae	MUAS	MUHASP	Yes
3	Grass	alkali sacaton	*Sporobolus airoides*	Poaceae	SPAI	SPOAIR	No
3	Grass	American mannagrass	*Glyceria grandis*	Poaceae	GLGR	GLYGRA	Yes
3	Grass	arctic rush	*Juncus arcticus*	Juncaceae	JUAR2	JUNARC	No
3	Grass	Arizona threeawn	*Aristida arizonica*	Poaceae	ARAR6	ARIARI	Yes
3	Grass	Baltic rush	*Juncus arcticus var. balticus*	Juncaceae	JUARB5	JUNARCB	Yes
3	Grass	big bluestem	*Andropogon gerardii*	Poaceae	ANGE	ANDGER	Yes
3	Grass	Bigelow's bluegrass	*Poa bigelovii*	Poaceae	POBI	POABIG	Yes
3	Grass	blue grama	*Bouteloua gracilis*	Poaceae	BOGR2	BOUGRA	Yes
3	Grass	bottlebrush squirreltail	*Elymus elymoides*	Poaceae	ELEL5	ELYELY	Yes
3	Grass	bristly wolfstail	*Lycurus setosus*	Poaceae	LYSE3	LYCSET	Yes
3	Grass	bulb panicgrass	*Panicum bulbosum*	Poaceae	PABU	PANBUL	Yes
3	Grass	Canada bluegrass	*Poa compressa*	Poaceae	POCO	POACOM	Yes
3	Grass	Canada wildrye	*Elymus canadensis*	Poaceae	ELCA4	ELYCAN	Yes
3	Grass	cheatgrass	*Bromus tectorum*	Poaceae	BRTE	BROTEC	No
3	Grass	clustered field sedge	*Carex praegracilis*	Cyperaceae	CAPR5	CARPRA	Yes
3	Grass	common spikerush	*Eleocharis palustris*	Cyperaceae	ELPA3	ELEPAL	Yes
3	Grass	common threesquare	*Schoenoplectus pungens*	Cyperaceae	SCPU10	SCHPUN	Yes
3	Grass	creeping bentgrass	*Agrostis stolonifera*	Poaceae	AGST2	AGRSTO	Yes
3	Grass	creeping muhly	*Muhlenbergia repens*	Poaceae	MURE	MUHREP	Yes
3	Grass	desert wheatgrass	*Agropyron desertorum*	Poaceae	AGDE2	AGRDES	Yes
3	Grass	false quackgrass	*Elymus x pseudorepens*	Poaceae	ELPS	ELYPSE	Yes
3	Grass	Fendler's flatsedge	*Cyperus fendlerianus*	Cyperaceae	CYFE2	CYPFEN	Yes
3	Grass	fox sedge	*Carex vulpinoidea*	Cyperaceae	CAVU2	CARVUL	Yes
3	Grass	foxtail barley	*Hordeum jubatum*	Poaceae	HOJU	HORJUB	No
3	Grass	foxtail barley	*Hordeum jubatum var. jubatum*	Poaceae	HOJUJ	HORJUBJ	Yes
3	Grass	galleta	*Pleuraphis jamesii*	Poaceae	PLJA	PLEJAM	Yes
3	Grass	hairy grama	*Bouteloua hirsuta*	Poaceae	BOHI2	BOUHIR	Yes
3	Grass	hardstem bulrush	*Schoenoplectus acutus*	Cyperaceae	SCAC3	SCHACU	No
3	Grass	Indian ricegrass	*Achnatherum hymenoides*	Poaceae	ACHY	ACHHYM	No
3	Grass	inland saltgrass	*Distichlis spicata*	Poaceae	DISP	DISSPI	Yes
3	Grass	Japanese brome	*Bromus japonicus*	Poaceae	BRJA	BROJAP	No
3	Grass	jointleaf rush	*Juncus articulatus*	Juncaceae	JUAR4	JUNART	Yes
3	Grass	Kentucky bluegrass	*Poa pratensis*	Poaceae	POPR	POAPRA	Yes
3	Grass	little bluestem	*Schizachyrium scoparium*	Poaceae	SCSC	SCHSCO	Yes
3	Grass	littleseed ricegrass	*Piptatherum micranthum*	Poaceae	PIMI7	PIPMIC	Yes

Life Form Code	Life Form	Common Name	*Scientific Name*	Family	PLANTS Symbol	NHNM Acronym	Collected
3	Grass	littletooth sedge	*Carex microdonta*	Cyperaceae	CAMI5	CARMIC	No
3	Grass	longstyle rush	*Juncus longistylis*	Juncaceae	JULO	JUNLON	Yes
3	Grass	Mat muhly	*Muhlenbergia richardsonis*	Poaceae	MURI	MUHRIC	No
3	Grass	mountain muhly	*Muhlenbergia montana*	Poaceae	MUMO	MUHMON	Yes
3	Grass	muttongrass	*Poa fendleriana*	Poaceae	POFE	POAFEN	No
3	Grass	Nealley's threeawn	*Aristida purpurea var. nealleyi*	Poaceae	ARPUN	ARIPURN	Yes
3	Grass	Nebraska sedge	*Carex nebrascensis*	Cyperaceae	CANE2	CARNEB	Yes
3	Grass	needle-and-thread grass	*Hesperostipa comata*	Poaceae	HECO26	HESCOM	No
3	Grass	needle-and-thread grass	*Hesperostipa comata ssp. comata*	Poaceae	HECOC8	HESCOMC	No
3	Grass	New Mexico muhly	*Muhlenbergia pauciflora*	Poaceae	MUPA2	MUHPAU	Yes
3	Grass	New Mexico needlegrass	*Hesperostipa neomexicana*	Poaceae	HENE5	HESNEO	No
3	Grass	nodding brome	*Bromus anomalus*	Poaceae	BRAN	BROANO	No
3	Grass	orchardgrass	*Dactylis glomerata*	Poaceae	DAGL	DACGLO	Yes
3	Grass	owlfruit sedge	*Carex stipata*	Cyperaceae	CAST5	CARSTI	Yes
3	Grass	Parish's spikerush	*Eleocharis parishii*	Cyperaceae	ELPA4	ELEPAR	Yes
3	Grass	pine dropseed	*Blepharoneuron tricholepis*	Poaceae	BLTR	BLETRI	Yes
3	Grass	porcupine sedge	*Carex hystericina*	Cyperaceae	CAHY4	CARHYS	Yes
3	Grass	poverty threeawn	*Aristida divaricata*	Poaceae	ARDI5	ARIDIV	No
3	Grass	prairie junegrass	*Koeleria macrantha*	Poaceae	KOMA	KOEMAC	Yes
3	Grass	purple threeawn	*Aristida purpurea*	Poaceae	ARPU9	ARIPUR	No
3	Grass	quackgrass	*Elymus repens*	Poaceae	ELRE4	ELYREP	No
3	Grass	red fescue	*Festuca rubra*	Poaceae	FERU2	FESRUB	Yes
3	Grass	red threeawn	*Aristida purpurea var. longiseta*	Poaceae	ARPUL	ARIPURL	No
3	Grass	redtop	*Agrostis gigantea*	Poaceae	AGGI2	AGRGIG	Yes
3	Grass	reed canarygrass	*Phalaris arundinacea*	Poaceae	PHAR3	PHAARU	Yes
3	Grass	rescuegrass	*Bromus catharticus*	Poaceae	BRCA6	BROCAT	No
3	Grass	ring muhly	*Muhlenbergia torreyi*	Poaceae	MUTO2	MUHTOR	Yes
3	Grass	Russian wildrye	*Psathyrostachys juncea*	Poaceae	PSJU3	PSAJUN	Yes
3	Grass	sand dropseed	*Sporobolus cryptandrus*	Poaceae	SPCR	SPOCRY	No
3	Grass	Scribner's needlegrass	*Achnatherum scribneri*	Poaceae	ACSC11	ACHSCR	Yes
3	Grass	sideoats grama	*Bouteloua curtipendula*	Poaceae	BOCU	BOUCUR	Yes
3	Grass	sixweeks fescue	*Vulpia octoflora*	Poaceae	VUOC	VULOCT	No
3	Grass	sleepygrass	*Achnatherum robustum*	Poaceae	ACRO7	ACHROB	Yes
3	Grass	slender rush	*Juncus dudleyi*	Juncaceae	JUDU2	JUNDUD	Yes
3	Grass	slender wheatgrass	*Elymus trachycaulus ssp. trachycaulus*	Poaceae	ELTRT	ELYTRAT	Yes
3	Grass	smooth brome	*Bromus inermis*	Poaceae	BRIN2	BROINE	Yes
3	Grass	softstem bulrush	*Schoenoplectus tabernaemontani*	Cyperaceae	SCTA2	SCHTAB	Yes

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3	Grass	spike muhly	*Muhlenbergia wrightii*	Poaceae	MUWR	MUHWRI	Yes
3	Grass	streambank wheatgrass	*Elymus lanceolatus*	Poaceae	ELLA3	ELYLAN	Yes
3	Grass	sun sedge	*Carex inops ssp. heliophila*	Cyperaceae	CAINH2	CARINOH	Yes
3	Grass	tall fescue	*Festuca arundinacea*	Poaceae	FEAR3	FESARU	Yes
3	Grass	timothy	*Phleum pratense*	Poaceae	PHPR3	PHLPRA	Yes
3	Grass	Torrey's rush	*Juncus torreyi*	Juncaceae	JUTO	JUNTOR	Yes
3	Grass	tumblegrass	*Schedonnardus paniculatus*	Poaceae	SCPA	SCHPAN	Yes
3	Grass	vine mesquite	*Panicum obtusum*	Poaceae	PAOB	PANOBT	No
3	Grass	western sedge	*Carex occidentalis*	Cyperaceae	CAOC2	CAROCC	Yes
3	Grass	western wheatgrass	*Pascopyrum smithii*	Poaceae	PASM	PASSMI	Yes
3	Grass	woolly brome	*Bromus lanatipes*	Poaceae	BRLA6	BROLAN	Yes
3	Grass	woolly sedge	*Carex pellita*	Cyperaceae	CAPE42	CARPEL	Yes
4	Forb	Adonis blazingstar	*Mentzelia multiflora var. multiflora*	Loasaceae	MEMUM2	MENMULM	Yes
4	Forb	alfalfa	*Medicago sativa*	Fabaceae	MESA	MEDSAT	Yes
4	Forb	alkali buttercup	*Ranunculus cymbalaria*	Ranunculaceae	RACY	RANCYM	Yes
4	Forb	alpine pennycress	*Noccaea montanum*	Brassicaceae	NOMO2	NOCMON	Yes
4	Forb	alpine woodsorrel	*Oxalis alpina*	Oxalidaceae	OXAL2	OXAALP	No
4	Forb	alyssum	*Alyssum simplex*	Brassicaceae	ALSI8	ALYSIM	Yes
4	Forb	American licorice	*Glycyrrhiza lepidota*	Fabaceae	GLLE3	GLYLEP	No
4	Forb	American speedwell	*Veronica americana*	Scrophulariaceae	VEAM2	VERAME	Yes
4	Forb	American vetch	*Vicia americana*	Fabaceae	VIAM	VICAME	Yes
4	Forb	annual ragweed	*Ambrosia artemisiifolia*	Asteraceae	AMAR2	AMBART	No
4	Forb	annual townsend daisy	*Townsendia annua*	Asteraceae	TOAN	TOWANN	No
4	Forb	annual yellow sweetclover	*Melilotus indicus*	Fabaceae	MEIN2	MELIND	No
4	Forb	aspen fleabane	*Erigeron speciosus*	Asteraceae	ERSP4	ERISPE	No
4	Forb	beardlip penstemon	*Penstemon barbatus*	Scrophulariaceae	PEBA2	PENBAR	Yes
4	Forb	beautiful fleabane	*Erigeron formosissimus*	Asteraceae	ERFO3	ERIFOR	Yes
4	Forb	beautiful fleabane	*Erigeron formosissimus var. viscidus*	Asteraceae	ERFOV	ERIFORV	Yes
4	Forb	Bessey's stickseed	*Hackelia besseyi*	Boraginaceae	HABE3	HACBES	Yes
4	Forb	birdbill dayflower	*Commelina dianthifolia*	Commelinaceae	CODI4	COMDIA	Yes
4	Forb	black medick	*Medicago lupulina*	Fabaceae	MELU	MEDLUP	Yes
4	Forb	blunt tansymustard	*Descurainia obtusa ssp. obtusa*	Brassicaceae	DEOBO	DESOBTO	Yes
4	Forb	bluntleaf spikemoss	*Selaginella mutica*	Selaginellaceae	SEMU	SELMUT	Yes
4	Forb	bluntpod bundleflower	*Desmanthus obtusus*	Fabaceae	DEOB2	DESOBT	No
4	Forb	branched noseburn	*Tragia ramosa*	Euphorbiaceae	TRRA5	TRARAM	No
4	Forb	broadleaf cattail	*Typha latifolia*	Typhaceae	TYLA	TYPLAT	No
4	Forb	broom groundsel	*Senecio spartioides*	Asteraceae	SESP3	SENSPA	Yes
4	Forb	brownplume wirelettuce	*Stephanomeria pauciflora*	Asteraceae	STPA4	STEPAU	Yes

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4	Forb	buffalo gourd	*Cucurbita foetidissima*	Cucurbitaceae	CUFO	CUCFOE	No
4	Forb	bull thistle	*Cirsium vulgare*	Asteraceae	CIVU	CIRVUL	Yes
4	Forb	bush peavine	*Lathyrus eucosmus*	Fabaceae	LAEU	LATEUC	Yes
4	Forb	Canada goldenrod	*Solidago canadensis*	Asteraceae	SOCA6	SOLCAN	No
4	Forb	Canada thistle	*Cirsium arvense*	Asteraceae	CIAR4	CIRARV	Yes
4	Forb	Canadian horseweed	*Conyza canadensis*	Asteraceae	COCA5	CONCAN	Yes
4	Forb	Carruth's sagewort	*Artemisia carruthii*	Asteraceae	ARCA14	ARTCAR	Yes
4	Forb	catnip	*Nepeta cataria*	Lamiaceae	NECA2	NEPCAT	No
4	Forb	cluster aster	*Symphyotrichum falcatum var. commutatum*	Asteraceae	SYFAC	SYMFALC	Yes
4	Forb	Cockerell's stonecrop	*Sedum cockerellii*	Crassulaceae	SECO	SEDCOC	Yes
4	Forb	Colorado four o'clock	*Mirabilis multiflora*	Nyctaginaceae	MIMU	MIRMUL	No
4	Forb	Colorado rubberweed	*Hymenoxys richardsonii var. floribunda*	Asteraceae	HYRIF	HYMRICF	Yes
4	Forb	common blanketflower	*Gaillardia aristata*	Asteraceae	GAAR	GAIARI	No
4	Forb	common dandelion	*Taraxacum officinale*	Asteraceae	TAOF	TAROFF	No
4	Forb	common kochia	*Kochia scoparia*	Chenopodiaceae	KOSC	KOCSCO	No
4	Forb	common mullein	*Verbascum thapsus*	Scrophulariaceae	VETH	VERTHA	No
4	Forb	common pepperweed	*Lepidium densiflorum*	Brassicaceae	LEDE	LEPDEN	Yes
4	Forb	common plantain	*Plantago major*	Plantaginaceae	PLMA2	PLAMAJ	No
4	Forb	common purslane	*Portulaca oleracea*	Portulacaceae	POOL	POROLE	No
4	Forb	common selfheal	*Prunella vulgaris*	Lamiaceae	PRVU	PRUVUL	No
4	Forb	common sunflower	*Helianthus annuus*	Asteraceae	HEAN3	HELANN	Yes
4	Forb	common yarrow	*Achillea millefolium*	Asteraceae	ACMI2	ACHMIL	No
4	Forb	creeping yellowcress	*Rorippa sylvestris*	Brassicaceae	ROSY	RORSYL	Yes
4	Forb	crossflower	*Chorispora tenella*	Brassicaceae	CHTE2	CHOTEN	No
4	Forb	crownleaf evening-primrose	*Oenothera coronopifolia*	Onagraceae	OECO2	OENCOR	Yes
4	Forb	Cuman ragweed	*Ambrosia psilostachya*	Asteraceae	AMPS	AMBPSI	No
4	Forb	curly dock	*Rumex crispus*	Polygonaceae	RUCR	RUMCRI	No
4	Forb	curlycup gumweed	*Grindelia squarrosa*	Asteraceae	GRSQ	GRISQU	Yes
4	Forb	curlytop knotweed	*Persicaria lapathifolia*	Polygonaceae	PELA22	PERLAP	Yes
4	Forb	cutleaf coneflower	*Rudbeckia laciniata*	Asteraceae	RULA3	RUDLAC	No
4	Forb	cutleaf coneflower	*Rudbeckia laciniata var. ampla*	Asteraceae	RULAA	RUDLACA	Yes
4	Forb	cutleaf vipergrass	*Scorzonera laciniata*	Asteraceae	SCLA6	SCOLAC	Yes
4	Forb	Dakota mock vervain	*Glandularia bipinnatifida*	Verbenaceae	GLBI2	GLABIP	Yes
4	Forb	David's spurge	*Euphorbia davidii*	Euphorbiaceae	EUDA5	EUPDAV	Yes
4	Forb	desert goosefoot	*Chenopodium pratericola*	Chenopodiaceae	CHPR5	CHEPRA	Yes
4	Forb	Douglas' knotweed	*Polygonum douglasii*	Polygonaceae	PODO4	POLDOU	Yes
4	Forb	Drummond's false pennyroyal	*Hedeoma drummondii*	Lamiaceae	HEDR	HEDDRU	Yes
4	Forb	dwarf blue-eyed grass	*Sisyrinchium demissum*	Iridaceae	SIDE4	SISDEM	Yes

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4	Forb	dwarf fameflower	*Phemeranthus brevicaulis*	Portulacaceae	PHBR15	PHEBRE	Yes
4	Forb	dwarf milkweed	*Asclepias involucrata*	Asclepiadaceae	ASIN14	ASCINV	Yes
4	Forb	english plantain	*Plantago lanceolata*	Plantaginaceae	PLLA	PLALAN	No
4	Forb	falsegold groundsel	*Packera pseudaurea var. flavula*	Asteraceae	PAPSF	PACPSEF	Yes
4	Forb	Fendler's globemallow	*Sphaeralcea fendleri*	Malvaceae	SPFE	SPHFEN	Yes
4	Forb	Fendler's groundcherry	*Physalis hederifolia var. fendleri*	Solanaceae	PHHEF	PHYHEDF	Yes
4	Forb	Fendler's lipfern	*Cheilanthes fendleri*	Pteridaceae	CHFE2	CHEFEN	Yes
4	Forb	Fendler's meadowrue	*Thalictrum fendleri*	Ranunculaceae	THFE	THAFEN	No
4	Forb	Fendler's ragwort	*Packera fendleri*	Asteraceae	PAFE4	PACFEN	Yes
4	Forb	Fendler's rockcress	*Boechera fendleri*	Brassicaceae	BOFE	BOEFEN	Yes
4	Forb	Fendler's sandmat	*Chamaesyce fendleri*	Euphorbiaceae	CHFE3	CHAFEN	Yes
4	Forb	fetid goosefoot	*Chenopodium graveolens*	Chenopodiaceae	CHGR2	CHEGRA	No
4	Forb	field bindweed	*Convolvulus arvensis*	Convolvulaceae	COAR4	CONARV	No
4	Forb	field horsetail	*Equisetum arvense*	Equisetaceae	EQAR	EQUARV	No
4	Forb	field pennycress	*Thlaspi arvense*	Brassicaceae	THAR5	THLARV	Yes
4	Forb	field sagewort	*Artemisia campestris*	Asteraceae	ARCA12	ARTCAM	Yes
4	Forb	fineleaf hymenopappus	*Hymenopappus filifolius*	Asteraceae	HYFI	HYMFIL	No
4	Forb	fineleaf hymenopappus	*Hymenopappus filifolius var. cinereus*	Asteraceae	HYFIC	HYMFILC	Yes
4	Forb	firewheel	*Gaillardia pulchella*	Asteraceae	GAPU	GAIPUL	Yes
4	Forb	flatspine stickseed	*Lappula occidentalis*	Boraginaceae	LAOC3	LAPOCC	No
4	Forb	flaxflowered gilia	*Ipomopsis longiflora*	Polemoniaceae	IPLO2	IPOLON	Yes
4	Forb	Fuller's teasel	*Dipsacus fullonum*	Dipsacaceae	DIFU2	DIPFUL	Yes
4	Forb	garden asparagus	*Asparagus officinalis*	Liliaceae	ASOF	ASPOFF	No
4	Forb	garden yellowrocket	*Barbarea vulgaris*	Brassicaceae	BAVU	BARVUL	Yes
4	Forb	golden crownbeard	*Verbesina encelioides*	Asteraceae	VEEN	VERENC	No
4	Forb	green prairie coneflower	*Ratibida tagetes*	Asteraceae	RATA	RATTAG	Yes
4	Forb	groundcover milkvetch	*Astragalus humistratus var. humistratus*	Fabaceae	ASHUH3	ASTHUMH	Yes
4	Forb	hairy false goldenaster	*Heterotheca villosa var. minor*	Asteraceae	HEVIM3	HETVILM	Yes
4	Forb	hairy goldenaster	*Heterotheca villosa*	Asteraceae	HEVI4	HETVIL	No
4	Forb	hairy purslane speedwell	*Veronica peregrina ssp. xalapensis*	Scrophulariaceae	VEPEX2	VERPERX	Yes
4	Forb	Hartweg's sundrops	*Calylophus hartwegii*	Onagraceae	CAHA14	CALHAR	No
4	Forb	Heller's draba	*Draba helleriana*	Brassicaceae	DRHE	DRAHEL	Yes
4	Forb	herb sophia	*Descurainia sophia*	Brassicaceae	DESO2	DESSOP	No
4	Forb	hoary aster	*Dieteria canescens*	Asteraceae	MACA2	DIECAN	No
4	Forb	hoary cress	*Cardaria draba*	Brassicaceae	CADR	CARDRA	Yes
4	Forb	hoary fleabane	*Erigeron canus*	Asteraceae	ERCA4	ERICAN	Yes
4	Forb	hoary tansyaster	*Dieteria canescens var. glabra*	Asteraceae	MACAG	DIECANG	Yes
4	Forb	Hopi tea greenthread	*Thelesperma megapotamicum*	Asteraceae	THME	THEMEG	Yes

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4	Forb	horehound	*Marrubium vulgare*	Lamiaceae	MAVU	MARVUL	No
4	Forb	horned spurge	*Euphorbia brachycera*	Euphorbiaceae	EUBR	EUPBRA	Yes
4	Forb	Huron green orchid	*Platanthera huronensis*	Orchidaceae	PLHU2	PLAHUR	Yes
4	Forb	Indianhemp	*Apocynum cannabinum*	Apocynaceae	APCA	APOCAN	No
4	Forb	James' beardtongue	*Penstemon jamesii*	Scrophulariaceae	PEJA	PENJAM	Yes
4	Forb	James' buckwheat	*Eriogonum jamesii*	Polygonaceae	ERJA	ERIJAM	No
4	Forb	James' buckwheat	*Eriogonum jamesii var. jamesii*	Polygonaceae	ERJAJ	ERIJAMJ	Yes
4	Forb	James' catseye	*Cryptantha cinerea*	Boraginaceae	CRCI3	CRYCIN	No
4	Forb	James' catseye	*Cryptantha cinerea var. cinerea*	Boraginaceae	CRCIC	CRYCINC	Yes
4	Forb	James' prairieclover	*Dalea jamesii*	Fabaceae	DAJA	DALJAM	Yes
4	Forb	King's lupine	*Lupinus kingii*	Fabaceae	LUKI	LUPKIN	Yes
4	Forb	lacy tansyaster	*Xanthisma spinulosum*	Asteraceae	MAPI	XANSPI2	Yes
4	Forb	Lambert's crazyweed	*Oxytropis lambertii*	Fabaceae	OXLA3	OXYLAM	No
4	Forb	lambsquarters	*Chenopodium album*	Chenopodiaceae	CHAL7	CHEALB	Yes
4	Forb	littleleaf alumroot	*Heuchera parvifolia*	Saxifragaceae	HEPA11	HEUPAR	Yes
4	Forb	littlepod false flax	*Camelina microcarpa*	Brassicaceae	CAMI2	CAMMIC	Yes
4	Forb	longleaf groundcherry	*Physalis longifolia var. longifolia*	Solanaceae	PHLOL3	PHYLONL	Yes
4	Forb	longstalk greenthread	*Thelesperma longipes*	Asteraceae	THLO	THELON	No
4	Forb	lotus milkvetch	*Astragalus lotiflorus*	Fabaceae	ASLO4	ASTLOT	Yes
4	Forb	MacDougal verbena	*Verbena macdougalii*	Verbenaceae	VEMA	VERMAC	Yes
4	Forb	Macoun's buttercup	*Ranunculus macounii*	Ranunculaceae	RAMA2	RANMAC	Yes
4	Forb	manyflower false threadleaf	*Schkuhria multiflora*	Asteraceae	SCMU6	SCHMUL	Yes
4	Forb	manyflowered broomrape	*Orobanche ludoviciana ssp. multiflora*	Orobanchaceae	ORLUM	OROLUDM	Yes
4	Forb	manyflowered gromwell	*Lithospermum multiflorum*	Boraginaceae	LIMU3	LITMUL	Yes
4	Forb	manyflowered mentzelia	*Mentzelia multiflora*	Loasaceae	MEMU3	MENMUL	No
4	Forb	meadow salsify	*Tragopogon pratensis*	Asteraceae	TRPR	TRAPRA	Yes
4	Forb	mealy goosefoot	*Chenopodium incanum*	Chenopodiaceae	CHIN2	CHEINC	Yes
4	Forb	Mexican cancer-root	*Conopholis alpina var. mexicana*	Orobanchaceae	COALM	CONALPM	Yes
4	Forb	Missouri milkvetch	*Astragalus missouriensis*	Fabaceae	ASMI10	ASTMIS	Yes
4	Forb	mountain mock thelypody	*Pennellia micrantha*	Brassicaceae	PEMI7	PENMIC	No
4	Forb	Mt. Albert goldenrod	*Solidago simplex ssp. simplex var. simplex*	Asteraceae	SOSIS3	SOLSIMS	Yes
4	Forb	narrowleaf four o'clock	*Mirabilis linearis*	Nyctaginaceae	MILI3	MIRLIN	Yes
4	Forb	narrowleaf goosefoot	*Chenopodium leptophyllum*	Chenopodiaceae	CHLE4	CHELEP	Yes
4	Forb	New Mexico cliff fern	*Woodsia neomexicana*	Dryopteridaceae	WONE	WOONEO	Yes
4	Forb	nodding onion	*Allium cernuum*	Liliaceae	ALCE2	ALLCER	No

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4	Forb	oppositeleaf bahia	*Picradeniopsis oppositifolia*	Asteraceae	PIOP	PICOPP	Yes
4	Forb	oxeye daisy	*Leucanthemum vulgare*	Asteraceae	LEVU	LEUVUL	Yes
4	Forb	pale eveningprimrose	*Oenothera pallida*	Onagraceae	OEPA	OENPAL	No
4	Forb	Pennsylvania cinquefoil	*Potentilla pensylvanica*	Rosaceae	POPE8	POTPEN	Yes
4	Forb	perennial pea	*Lathyrus latifolius*	Fabaceae	LALA4	LATLAT	Yes
4	Forb	perkysue	*Tetraneuris argentea*	Asteraceae	TEAR4	TETARG	Yes
4	Forb	Philadelphia fleabane	*Erigeron philadelphicus*	Asteraceae	ERPH	ERIPHI	Yes
4	Forb	pineywoods geranium	*Geranium caespitosum*	Geraniaceae	GECA3	GERCAE	No
4	Forb	pingue hymenoxys	*Hymenoxys richardsonii*	Asteraceae	HYRI	HYMRIC	No
4	Forb	plains blackfoot	*Melampodium leucanthum*	Asteraceae	MELE2	MELLEU	No
4	Forb	plains flax	*Linum puberulum*	Linaceae	LIPU4	LINPUB	Yes
4	Forb	plumed brickellbush	*Brickellia brachyphylla*	Asteraceae	BRBR2	BRIBRA	Yes
4	Forb	poison hemlock	*Conium maculatum*	Apiaceae	COMA2	CONMAC	Yes
4	Forb	pony beebalm	*Monarda pectinata*	Lamiaceae	MOPE	MONPEC	Yes
4	Forb	prairie flax	*Linum lewisii*	Linaceae	LILE3	LINLEW	No
4	Forb	prairie sunflower	*Helianthus petiolaris*	Asteraceae	HEPE	HELPET	Yes
4	Forb	prickly lettuce	*Lactuca serriola*	Asteraceae	LASE	LACSER	Yes
4	Forb	prickly Russian thistle	*Salsola tragus*	Chenopodiaceae	SATR12	SALTRA	Yes
4	Forb	pygmyflower rockjasmine	*Androsace septentrionalis*	Primulaceae	ANSE4	ANDSEP	Yes
4	Forb	ragleaf bahia	*Bahia dissecta*	Asteraceae	BADI	BAHDIS	Yes
4	Forb	red clover	*Trifolium pratense*	Fabaceae	TRPR2	TRIPRA	Yes
4	Forb	red dome blanketflower	*Gaillardia pinnatifida*	Asteraceae	GAPI	GAIPIN	Yes
4	Forb	redstem stork's bill	*Erodium cicutarium*	Geraniaceae	ERCI6	EROCIC	Yes
4	Forb	Rocky Mountain iris	*Iris missouriensis*	Iridaceae	IRMI	IRIMIS	No
4	Forb	Rocky Mountain zinnia	*Zinnia grandiflora*	Asteraceae	ZIGR	ZINGRA	No
4	Forb	rockyscree falsegoldenaster	*Heterotheca fulcrata*	Asteraceae	HEFU3	HETFUL	No
4	Forb	rose heath	*Chaetopappa ericoides*	Asteraceae	CHER2	CHAERI	Yes
4	Forb	rough cocklebur	*Xanthium strumarium*	Asteraceae	XAST	XANSTR	No
4	Forb	rushy milkvetch	*Astragalus lonchocarpus*	Fabaceae	ASLO3	ASTLON	Yes
4	Forb	saltmeadow plantain	*Plantago argyrea*	Plantaginaceae	PLAR9	PLAARG	No
4	Forb	Santa Fe phlox	*Phlox nana*	Polemoniaceae	PHNA2	PHLNAN	Yes
4	Forb	scarlet beeblossom	*Gaura coccinea*	Onagraceae	GACO5	GAUCOC	No
4	Forb	scarlet globemallow	*Sphaeralcea coccinea*	Malvaceae	SPCO	SPHCOC	No
4	Forb	Scotch thistle	*Onopordum acanthium*	Asteraceae	ONAC	ONOACA	Yes
4	Forb	shorthair goldenrod	*Solidago canadensis var. glivocanescens*	Asteraceae	SOCAG	SOLCANG	No
4	Forb	showy milkweed	*Asclepias speciosa*	Asclepiadaceae	ASSP	ASCSPE	No
4	Forb	shy wallflower	*Erysimum inconspicuum*	Brassicaceae	ERIN7	ERYINC	Yes

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4	Forb	silverweed cinquefoil	*Argentina anserina*	Rosaceae	ARAN7	ARGANS	Yes
4	Forb	silvery lupine	*Oxytropis sericea*	Fabaceae	OXSE	OXYSER	No
4	Forb	skyrocket gilia	*Ipomopsis aggregata*	Polemoniaceae	IPAG	IPOAGG	No
4	Forb	slender white prairieclover	*Dalea candida*	Fabaceae	DACA7	DALCAN	Yes
4	Forb	slimflower scurfpea	*Psoralidium tenuiflorum*	Fabaceae	PSTE5	PSOTEN	Yes
4	Forb	slimleaf plainsmustard	*Schoenocrambe linearifolia*	Brassicaceae	SCLI12	SCHLIN	Yes
4	Forb	smallleaf pussytoes	*Antennaria parvifolia*	Asteraceae	ANPA4	ANTPAR	No
4	Forb	smooth horsetail	*Equisetum laevigatum*	Equisetaceae	EQLA	EQULAE	Yes
4	Forb	smooth spreading four o'clock	*Mirabilis oxybaphoides*	Nyctaginaceae	MIOX	MIROXY	No
4	Forb	southern cattail	*Typha domingensis*	Typhaceae	TYDO	TYPDOM	Yes
4	Forb	spear globemallow	*Sphaeralcea hastulata*	Malvaceae	SPHA	SPHHAS	No
4	Forb	spiny sowthistle	*Sonchus asper*	Asteraceae	SOAS	SONASP	No
4	Forb	spotted water hemlock	*Cicuta maculata*	Apiaceae	CIMA2	CICMAC	Yes
4	Forb	spreading fleabane	*Erigeron divergens*	Asteraceae	ERDI4	ERIDIV	Yes
4	Forb	sprucefir fleabane	*Erigeron eximius*	Asteraceae	EREX4	ERIEXI	No
4	Forb	stemless hymenoxys	*Tetraneuris acaulis*	Asteraceae	TEAC	TETACA	No
4	Forb	stemless townsendia	*Townsendia exscapa*	Asteraceae	TOEX2	TOWEXS	Yes
4	Forb	stemmy four-nerve daisy	*Tetraneuris scaposa*	Asteraceae	TESC2	TETSCA	Yes
4	Forb	stiff greenthread	*Thelesperma filifolium*	Asteraceae	THFI	THEFIL	Yes
4	Forb	stinking milkvetch	*Astragalus praelongus*	Fabaceae	ASPR5	ASTPRA	Yes
4	Forb	straight bladderpod	*Physaria rectipes*	Brassicaceae	LERE3	PHYREC	Yes
4	Forb	sunbright	*Phemeranthus parviflorus*	Portulacaceae	PHPA29	PHEPAR	Yes
4	Forb	tall townsendia	*Townsendia eximia*	Asteraceae	TOEX	TOWEXI	Yes
4	Forb	tall tumblemustard	*Sisymbrium altissimum*	Brassicaceae	SIAL2	SISALT	Yes
4	Forb	tanseyleaf aster	*Machaeranthera tanacetifolia*	Asteraceae	MATA2	MACTAN	Yes
4	Forb	tarragon	*Artemisia dracunculus*	Asteraceae	ARDR4	ARTDRA	Yes
4	Forb	Texas blueweed	*Helianthus ciliaris*	Asteraceae	HECI	HELCIL	Yes
4	Forb	Texas croton	*Croton texensis*	Euphorbiaceae	CRTE4	CROTEX	Yes
4	Forb	Texas filaree	*Erodium texanum*	Geraniaceae	ERTE13	EROTEX	No
4	Forb	threadleaf ragwort	*Senecio flaccidus var. flaccidus*	Asteraceae	SEFLF	SENFLAF	No
4	Forb	trailing fleabane	*Erigeron flagellaris*	Asteraceae	ERFL	ERIFLA	Yes
4	Forb	TransPecos Indian parsley	*Aletes filifolius*	Apiaceae	ALFI3	ALEFIL	Yes
4	Forb	upright blue beardtongue	*Penstemon virgatus*	Scrophulariaceae	PEVI4	PENVIR	Yes
4	Forb	upright prairie coneflower	*Ratibida columnifera*	Asteraceae	RACO3	RATCOL	Yes
4	Forb	velvetweed	*Gaura mollis*	Onagraceae	GAMO5	GAUMOL	No
4	Forb	watercress	*Nasturtium officinale*	Brassicaceae	NAOF	NASOFF	Yes
4	Forb	Watson's goosefoot	*Chenopodium watsonii*	Chenopodiaceae	CHWA	CHEWAT	Yes

Life Form Code	Life Form	Common Name	*Scientific Name*	Family	PLANTS Symbol	NHNM Acronym	Collected
4	Forb	wavyleaf thistle	*Cirsium undulatum*	Asteraceae	CIUN	CIRUND	No
4	Forb	weakleaf bur ragweed	*Ambrosia confertiflora*	Asteraceae	AMCO3	AMBCON	No
4	Forb	wedgeleaf draba	*Draba cuneifolia*	Brassicaceae	DRCU	DRACUN	No
4	Forb	Whipple's penstemon	*Penstemon whippleanus*	Scrophulariaceae	PEWH	PENWHI	No
4	Forb	white checkermallow	*Sidalcea candida*	Malvaceae	SICA3	SIDCAN	Yes
4	Forb	white clover	*Trifolium repens*	Fabaceae	TRRE3	TRIREP	No
4	Forb	White River coraldrops	*Besseya plantaginea*	Scrophulariaceae	BEPL	BESPLA	Yes
4	Forb	white sagebrush	*Artemisia ludoviciana*	Asteraceae	ARLU	ARTLUD	Yes
4	Forb	whitestem blazingstar	*Mentzelia albicaulis*	Loasaceae	MEAL6	MENALB	No
4	Forb	wholeleaf Indian paintbrush	*Castilleja integra*	Scrophulariaceae	CAIN14	CASINT	Yes
4	Forb	whorled milkweed	*Asclepias subverticillata*	Asclepiadaceae	ASSU2	ASCSUB	No
4	Forb	wild mint	*Mentha arvensis*	Lamiaceae	MEAR4	MENARV	Yes
4	Forb	winged buckwheat	*Eriogonum alatum*	Polygonaceae	ERAL4	ERIALA	Yes
4	Forb	woolly cinquefoil	*Potentilla hippiana*	Rosaceae	POHI6	POTHIP	No
4	Forb	woolly milkvetch	*Astragalus mollissimus*	Fabaceae	ASMO7	ASTMOL	Yes
4	Forb	woolly paperflower	*Psilostrophe tagetina*	Asteraceae	PSTA	PSITAG	No
4	Forb	woolly plantain	*Plantago patagonica*	Plantaginaceae	PLPA2	PLAPAT	Yes
4	Forb	Wright's birdbeak	*Cordylanthus wrightii*	Scrophulariaceae	COWR2	CORWRI	Yes
4	Forb	Wright's goldenrod	*Solidago wrightii*	Asteraceae	SOWR	SOLWRI	No
4	Forb	Wright's goldenrod	*Solidago wrightii var. wrightii*	Asteraceae	SOWRW	SOLWRIW	Yes
4	Forb	Wright's thelypody	*Thelypodium wrightii*	Brassicaceae	THWR	THEWRI	No
4	Forb	yellow salsify	*Tragopogon dubius*	Asteraceae	TRDU	TRADUB	No
4	Forb	yellow sweetclover	*Melilotus officinalis*	Fabaceae	MEOF	MELOFF	No
4	Forb	yellowspine thistle	*Cirsium ochrocentrum*	Asteraceae	CIOC2	CIROCH	Yes
4	Forb	yerba mansa	*Anemopsis californica*	Saururaceae	ANCA10	ANECAL	No

Appendix C. Keys to Plant Associations

A dichotomous key to the major plant associations of Pecos National Historic Park follows. The key uses either explicitly specified cover values for indicator species as part of the decision rules in each step or specific adjectives that relate to species canopy cover as shown in Table A-1. There are separate keys for the major classes (e.g., forests and woodlands, shrublands, etc.) as specified in the first key. There are also three forest sub-keys that are specified under the Forest and Woodlands key (Key 1). Descriptions for each association can be found in below.

Table C-1. Text descriptors for canopy cover and density with associated quantitative range definitions

Descriptor	Definition
Absent	Individuals are not found in stand.
Present	Individuals found in stand.
Accidental	Individuals very infrequent, occasional, or limited to special microsites.
Scarce/Scattered (uncommon)	Canopy coverage < 1%.
Common	Canopy coverage > 1%.
Poorly Represented	Canopy coverage < 5%.
Well Represented	Canopy coverage >5%, but less than 10%.
Abundant	Canopy coverage >10%, but less than 25%.
Very Abundant	Canopy coverage > 25%, but less than 50%.
Luxuriant	Canopy coverage > 50%.
Dominant	Cover is greater than any other species of the same life form.
Codominant	Cover is as great as any other species of the same life form.
Regeneration	Understory trees represented by established seedlings and/or saplings.

Key to the major classes:

A. Trees dominant, at least 10% canopy cover: **KEY 1 - Forests and Woodlands** (PG. 1)
A. Trees <10%, clearly not predominant: (B)

B. Shrubs >25% or dominant over herbaceous cover: **KEY 2 - Shrublands** (PG. 5)
B. Shrubs <25%, herbs clearly the dominant and/or characteristic growth-form:
KEY 3 - Herbaceous Vegetation (PG. 6)

KEY 1 – Forests and Woodlands

1. *Pseudotsuga menziesii* dominant:
    Pseudotsuga menziesii / *Quercus gambelii* Forest
1. *Pseudotsuga menziesii* subdominant or absent: (2)

2. *Pinus ponderosa* dominant:
    Forest Sub - key I. *Pinus ponderosa* Forest Alliance (Appendix C-2)
2. *Pinus ponderosa* subdominant or absent: (3)

3. Riparian species dominant: **Forest Sub - key II. Riparian Forests** (Appendix C-2)
3. Tall conifers and riparian species poorly represented or absent:
    Forest Sub - key III. *Pinus edulis* and *Juniperus* sp. Woodlands (Appendix C-3)

Forest Sub - key I. *Pinus ponderosa* Forest Alliance

1. Shrubs well-represented, dominant over herbs: (2)
1. Shrubs poorly represented: (3)

2 (1). *Quercus* ×*pauciloba* well-represented:
    Pinus ponderosa / *Quercus* ×*pauciloba* Woodland
2. *Quercus* ×*pauciloba* poorly represented or absent; *Quercus gambelii* well-represented:
    Pinus ponderosa / *Quercus gambelii* Woodland

3 (1). *Bouteloua gracilis* common and dominant or codominant:
    Pinus ponderosa / *Bouteloua gracilis* Woodland
3. *Bouteloua gracilis* uncommon or absent: (4)

4 (3). *Poa fendleriana* common, dominant:
    Pinus ponderosa / *Poa fendleriana* Woodland
4. *Poa fendleriana* uncommon: (5)

5 (4). *Pascopyrum smithii* well represented, dominant:
    Pinus ponderosa / *Pascopyrum smithii* Woodland
5. *Pascopyrum smithii* poorly represented: (6)

6 (5). *Schizachyrium scoparium* common, dominant:
    Pinus ponderosa / *Schizachyrium scoparium* Wooded Herbaceous Vegetation
6. *Schizachyrium scoparium* uncommon or absent:
    Pinus ponderosa / Sparse Understory Woodland [Provisional]

Forest Sub - key II. Riparian Forests

1. *Populus angustifolia* dominant: (2)
1. *Populus angustifolia* poorly represented or absent: (5)

2 (1). *Acer negundo* dominant in the understory:
    Populus angustifolia - Acer negundo / *Poa pratensis* Woodland
2. *Acer negundo* poorly represented or absent: (3)

3 (2). *Salix exigua* well represented:

Populus angustifolia / *Salix exigua* Woodland
3. *Salix exigua* poorly represented: (4)

4 (3). *Bromus inermis* common:
Populus angustifolia / Invasive Perennial Grasses Semi-natural Woodland
4. *Bromus inermis* uncommon, *Poa pratensis* or other invasive perennial grasses common, dominant:
Populus angustifolia / Invasive Perennial Grasses Semi-natural Woodland

5 (1). *Populus deltoides* dominant:
Populus deltoides (*ssp. wislizeni, ssp. monilifera*) / *Salix exigua* Woodland
5. *Populus deltoides* absent: (6)

6 (5). *Alnus incana ssp. tenuifolia* abundant, dominant:
Alnus incana ssp. tenuifolia - Salix amygdaloides Shrubland
6. *Alnus incana ssp. tenuifolia* and other riparian tree species absent:
See: Forest Sub - key III. *Pinus edulis* and *Juniperus* sp. Woodlands

Forest Sub - key III. *Pinus edulis* and *Juniperus* sp. Woodlands

1. *Rhus trilobata* well represented:
Juniperus scopulorum / *Rhus trilobata* Woodland
1. *Rhus trilobata* absent, scarce, or poorly represented: (2)

2 (1). Shrubs dominant over herbs: (3)
2. Herbs dominant, tall shrubs poorly represented: (6)

3 (2). *Quercus gambelii* well represented to abundant:
Pinus edulis - Juniperus spp. / *Quercus gambelii* Woodland
3. *Quercus gambelii* poorly represented or absent: (4)

4 (3). *Quercus ×pauciloba* common, dominant or co-dominant
Pinus edulis - Juniperus monosperma / *Quercus ×pauciloba* Woodland
4. *Quercus ×pauciloba* uncommon or sub-dominant (5)

5 (4) *Cercocarpus montanus* common to well-represented, dominant:
Pinus edulis - Juniperus spp. / *Cercocarpus montanus* - Mixed Shrubs Woodland

6 (2). *Muhlenbergia montana* well represented:
Pinus edulis - Juniperus monosperma / *Muhlenbergia montana* Woodland
6. *Muhlenbergia montana* poorly represented or absent: (7)

7 (6). *Pascopyrum smithii* well represented, dominant:
Pinus edulis - Juniperus scopulorum / *Pascopyrum smithii* Woodland
7. *Pascopyrum smithii* poorly represented: (8)

8 (7). *Schizachyrium scoparium* well represented:
Pinus edulis - Juniperus scopulorum / *Schizachyrium scoparium* Woodland
8. *Schizachyrium scoparium* poorly represented: (9)

9 (8). *Bouteloua gracilis* dominant:

Pinus edulis - (*Juniperus monosperma, J. deppeana, J scopulorum*) / *Bouteloua gracilis* Woodland

9. *Bouteloua gracilis* not dominant: (10)

10 (9). *Achnatherum scribneri* common:
Pinus edulis / *Achnatherum scribneri* Woodland

10. *Achnatherum scribneri* uncommon or absent: (11)

11 (10). *Bouteloua curtipendula* dominant
Pinus edulis - *Juniperus monosperma* / *Bouteloua curtipendula* Woodland

11. *Bouteloua curtipendula* not dominant:
Pinus edulis / Sparse Understory Woodland

KEY 2 - Shrublands

1. *Ericameria nauseosus* dominant
Ericameria nauseosus Shrubland

1. *Ericameria nauseosus* not dominant (2)

2(1) *Salix irrorata* dominant:
Salix irrorata / *Festuca arundinaceae* Shrubland

2. *Salix exigua dominant*: (3)

3(2) *Ericameria nauseosus* well represented:
Salix exigua - *Ericameria nauseosus* Shrubland

3. *Ericameria nauseosus* poorly represented or absent: (4)

4(3) *Agrostis gigantea* or *Festuca arundinacea* or *Poa pratensis* or *Bromus inermis* dominant:
Salix exigua / Invasive Perennial Grasses Semi-natural Shrubland

4. *Agrostis gigantea* or *Festuca arundinacea* or *Poa pratensis* or *Bromus inermis* poorly represented or absent: (5)

5(4) *Eleocharis palustris* abundant:
Salix exigua / *Eleocharis palustris* Shrubland

5. *Eleocharis palustris* poorly represented or absent: (6)

6(5) *Juncus arcticus* well represented, dominant or co-dominant:
Salix exigua / *Juncus arcticus* Shrubland

6. **Shrubs** poorly represented or absent:
See: (KEY 3 - Herbaceous Vegetation)

KEY 3 - Herbaceous Vegetation

1. Forbs dominant over graminoids: (2)
1. Graminoids dominant over or codominant with forbs: (3)

2 (1). *Pascopyrum smithii* well represented:
Pascopyrum smithii / Ruderal Herbaceous Vegetation

2. *Pascopyrum smithii* poorly represented:
Ruderal Disturbance Vegetation

3 (1). *Bouteloua gracilis* common, dominant or codominant: (4)
3. *Bouteloua gracilis* poorly represented or absent: (11)

4 (3). Tall shrubs and dwarf shrubs well represented: (5)
4. Tall shrubs and dwarf shrubs poorly represented: (6)

5 (4). *Ericameria nauseosus* well represented:
Ericameria nauseosa / *Bouteloua gracilis* Shrub Herbaceous Vegetation
5. *Ericameria nauseosus* poorly represented or absent:
Artemisia frigida / *Bouteloua gracilis* Dwarf-shrubland

6 (4). *Pascopyrum smithii* well represented:
Pascopyrum smithii- Bouteloua gracilis Herbaceous Vegetation
6. *Pascopyrum smithii* poorly represented or absent: (7)

7 (6). *Pleuraphis jamesii* well represented:
Bouteloua gracilis - Pleuraphis jamesii Herbaceous Vegetation
7. *Pleuraphis jamesii* poorly represented or absent: (8)

8 (7). *Bouteloua curtipendula* well represented:
Bouteloua gracilis - Bouteloua curtipendula Herbaceous Vegetation
8. *Bouteloua curtipendula* poorly represented or absent: (9)

9 (8). *Muhlenbergia torreyi* common:
Bouteloua gracilis - Muhlenbergia torreyi - Aristida purpurea Herbaceous Vegetation
9. *Muhlenbergia torreyi* uncommon or absent: (10)

10(9) *Psathyrostachys juncea* well represented:
Bouteloua gracilis / Old Field Herbaceous Vegetation

10. Other grasses poorly represented, forbs common to well represented
Bouteloua gracilis / Ruderal Herbaceous Vegetation

11 (3). *Psathyrostachys juncea* monotypically dominant:
Psathyrostachys juncea / Monotypic Herbaceous Vegetation
11. *Psathyrostachys juncea* codominant or absent: (12)

12 (11). *Juncus arcticus* abundant: (13)
12. *Juncus arcticus* not abundant: (17)

13 (12). *Typha latifolia* well represented:
Juncus arcticus / *Typha latifolia* Herbaceous Vegetation
13. *Typha latifolia* poorly represented or absent: (14)

14 (13). *Schoenoplectus pungens* abundant:
Juncus arcticus - Schoenoplectus pungens Herbaceous Vegetation
14. *Schoenoplectus pungens* not abundant: (15)

15 (14). *Festuca arundinaceae* abundant:
Juncus arcticus - Festuca arundinaceae Semi - natural Herbaceous Vegetation

15. *Festuca arundinaceae* not abundant: (16)

16 (15). *Anemopsis californica* well represented:
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17 (12). *Carex nebrascensis* abundant:
Carex nebrascensis - *Eleocharis palustris* Herbaceous Vegetation
17. *Carex nebrascensis* not abundant: (18)

18 (17). *Typha latifolia* abundant:
Typha (*latifolia*, *angustifolia*) Western Herbaceous Vegetation

Appendix D. Local Plant Association Descriptions for Pecos National Historic Park

As part of the Pecos National Historic Park (PECO) vegetation classification and mapping project, local plant association descriptions were written for 46 plant associations (PAs) identified for the park during the classification and mapping phase of the project (plant associations detected during the accuracy assessment phase are included). Local descriptions provide information on the park-level distribution, level of acceptable physiognomic and compositional variation, and the key ecological process and environmental/abiotic factors that are associated with a type (Grossman et al. 1998).

At this time, the PECO descriptions have not been integrated into the national database maintained by NatureServe, but where a given association is recognized in the National Vegetation Classification, the NatureServe database code (codes beginning "CEGL") has been provided which can be used to query NatureServe's Explorer website for additional information at a global level (http://www.natureserve.org/explorer). In this appendix, the arrangement of the plant associations follows the new hierarchy per FGDC (2008) and table 3 of the main report. Certain text descriptors have specific meaning as shown in Table D-1.

Table D-1. Text descriptors for canopy cover and density with associated quantitative range definitions.

Descriptor	Definition
Absent	Individuals are not found in stand.
Present	Individuals found in stand.
Accidental	Individuals very infrequent, occasional, or limited to special microsites.
Scarce/Scattered (uncommon)	Canopy coverage < 1%.
Common	Canopy coverage > 1%.
Poorly Represented	Canopy coverage < 5%.
Well Represented	Canopy coverage >5%, but less than 10%.
Abundant	Canopy coverage >10%, but less than 25%.
Very Abundant	Canopy coverage > 25%, but less than 50%.
Luxuriant	Canopy coverage > 50%.
Dominant	Cover is greater than any other species of the same life form.
Codominant	Cover is as great as any other species of the same life form.
Regeneration	Understory trees represented by established seedlings and/or saplings.

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1. Forest & Woodland (Mesomorphic Tree Vegetation)

1.C. Temperate Forest

1.C.2. Cool Temperate Forest

1.C.2.b. Western North American Cool Temperate Forest

M022. Southern Rocky Mountain Lower Montane Forest

G228. Southern Rocky Mountain Ponderosa Pine Forest & Woodland Group

Pinus ponderosa / *Poa fendleriana* Forest

Ponderosa Pine / Fendler's Muttongrass Forest
Identifier: GRCA_New6

NVC CLASSIFICATION

Division	Western North American Cool Temperate Forest (1.C.2.Nb)
Macrogroup	Southern Rocky Mountain Lower Montane Forest (M022)
Group	Southern Rocky Mountain Ponderosa Pine Forest & Woodland Group (G228)
Association	*Pinus ponderosa* / *Poa fendleriana* Forest

DISTRIBUTION

Pecos National Historic Park
This association is known from the Cañoncito Subunit (Glorieta Unit); likely in the eastern portion of the Main Unit.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park
This association occurs at around 2,250 m (7,400 ft) on northwesterly and southeasterly aspects. Stands are known from steep slopes in the heads of drainages to upper slopes and ridge summits. Soils are derived from sandstone. The ground surface is characterized mostly by leaf litter and woody debris (80% on average) and rock (7.5%) with scattered patches of gravel and soil (5%), and forbs and grasses (7.5% in sum).

VEGETATION DESCRIPTION

Pecos National Historic Park
This Southern Rocky Mountain Woodland is dominated by *Pinus ponderosa* with *Pinus edulis* and *Juniperus scopulorum* as sub-canopy associates. Shrubs are uncommon in the association, and the understory is characterized by scattered graminoids with *Poa fendleriana* the most abundant and *Achnatherum scribneri, Koeleria macrantha,* and *Elymus elymoides* often present. Forbs are scattered and variable and may include *Androsace septentrionalis, Cheilanthes fendleri*, and *Heterotheca villosa.*

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus ponderosa*, *Pinus edulis*
Herb (field)	Graminoid	*Poa fendleriana*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park
New Mexico state-listed noxious weeds: (Class C) *Bromus tectorum*

CLASSIFICATION COMMENTS

Pecos National Historic Park
Data are not available.

CLASSIFICATION CONFIDENCE:

ELEMENT SOURCES
Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 07PP031 and 07PP028.
Local Description Authors: A. Fettes, E. H. Muldavin

Pinus ponderosa / *Quercus gambelii* Woodland

Ponderosa Pine - Gambel Oak Forest
Identifier: CEGL000870

NVC CLASSIFICATION

Division	Western North American Cool Temperate Forest (1.C.2.Nb)
Macrogroup	Southern Rocky Mountain Lower Montane Forest (M022)
Group	Southern Rocky Mountain Ponderosa Pine Forest & Woodland Group (G228)
Association	*Pinus ponderosa* - *Quercus gambelii* Woodland

DISTRIBUTION

Pecos National Historic Park
This association is known from upland areas in the eastern half of the main park unit and the Pigeon's Ranch Subunit of the Glorieta Unit.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park
This association occurs from 2,020 - 2,230 m (6,630 - 7,320 ft), typically on cool north-facing aspects of mid-to-lower slopes along canyon drainages. Soils are derived from limestone or sandstone. The ground surface is characterized mostly by leaf litter (90% on average) and with scattered rocks, patches of gravel and soil, and scattered forbs and grasses (10% in sum).

VEGETATION DESCRIPTION

Pecos National Historic Park
This Southern Rocky Mountain Woodland is dominated by *Pinus ponderosa* with *Quercus gambelii* as a well represented to abundant sub-canopy and as a shrub. *Pinus edulis* and *Juniperus scopulorum* may both be abundant in the sub-canopy. Overall, the herbaceous layer is poorly represented (2% maximum cover). Herbs are scattered and variable in composition with *Achnatherum scribneri, Carex inops* ssp. *heliophila,* and *Schizachyrium scoparium* the most frequent graminoid representatives.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus ponderosa*
Tree canopy	Broad-leaved deciduous tree	*Quercus gambelii*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park
Data are not available.

CLASSIFICATION COMMENTS

Pecos National Historic Park
Data are not available.

CLASSIFICATION CONFIDENCE: 1

ELEMENT SOURCES

Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 05PP030 and 06PP025.
Local Description Authors: A. Fettes; E. H. Muldavin

Pinus ponderosa / *Quercus ×pauciloba* Woodland

Ponderosa Pine / Wavyleaf Oak Forest
Identifier: CEGL000874

NVC CLASSIFICATION

Division	Western North American Cool Temperate Forest (1.C.2.Nb)
Macrogroup	Southern Rocky Mountain Lower Montane Forest (M022)
Group	Southern Rocky Mountain Ponderosa Pine Forest & Woodland Group (G228)
Association	*Pinus ponderosa* / *Quercus ×pauciloba* Woodland

DISTRIBUTION

Pecos National Historic Park
This association is known from upland areas east of the Pecos River in the main park unit and from the Pigeon's Ranch and Cañoncito Subunits of the Glorieta Unit.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park
This association occurs from 2,170 to 2,230 m (7,120 to 7,320 ft) on northerly to southeasterly aspects of gentle-to-moderately steep (5 - 25%) canyon slopes; stands may extend as stringers down along canyon bottoms. Soils are derived from sandstone and the mixed alluvium of the canyon bottom drainages. The ground surface is characterized mostly by leaf litter (75% on average) and rocks (15%) with patches of gravel and soil, and scattered forbs and grasses (10%).

VEGETATION DESCRIPTION

Pecos National Historic Park
This Southern Rocky Mountain Woodland is characterized by a moderate canopy (55%) of *Pinus ponderos*a with *Pinus edulis*, *Juniperus scopulorum*, and *Juniperus monosperma* common to abundant in the sub-canopy. The understory is shrubby with *Quercus ×pauciloba* as the dominant that can reach 30% canopy cover. Overall, the herbaceous layer is poorly represented with scattered graminoids such as *Bouteloua gracilis*, *Carex inops* ssp. *heliophila*, and *Schizachyrium scoparium* common but total cover seldom exceeding 2%. Forbs are scattered and variable in composition. Among the 29 species reported, *Tetraneuris argentea*, *Lithospermum multiflorum*, *Bahia dissecta*, and *Schoenocrambe linearifolia* are most frequent.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus ponderosa*, *Pinus edulis*, *Juniperus monosperma*, *Juniperus scopulorum*
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Quercus ×pauciloba*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park
Data are not available.

CLASSIFICATION COMMENTS

Pecos National Historic Park
Data are not available.

CLASSIFICATION CONFIDENCE: 1

ELEMENT SOURCES

Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 05PP015, 06PP035, 07PP036.
Local Description Authors: A. Fettes; E. H. Muldavin

Pinus ponderosa / Sparse Understory Woodland

Ponderosa Pine / Sparse Understory Woodland
Identifier: CEGL002384

NVC CLASSIFICATION

Division	Western North American Cool Temperate Forest (1.C.2.Nb)
Macrogroup	Southern Rocky Mountain Lower Montane Forest (M022)
Group	Southern Rocky Mountain Ponderosa Pine Forest & Woodland Group (G228)
Association	*Pinus ponderosa* / Sparse Understory Woodland

DISTRIBUTION

Pecos National Historic Park
This association is known from central and eastern portions of the main park unit.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park
This association occurs from 2,110 to 2,160 m (6,920 to 7,100 ft) in elevation on northwesterly to northeasterly aspects of gentle-to-moderately steep (10 to 35%) canyon slopes. Sites vary from rocky canyon slopes to rolling hills and plains. Soils are derived from limestone or sandstone. The ground surface is characterized mostly by leaf litter (90% on average) with patches of gravel, soil, and rock (10%), and scattered plants (<1%).

VEGETATION DESCRIPTION

Pecos National Historic Park
This Southern Rocky Mountain Woodland is characterized by a moderate canopy (50%) of *Pinus ponderos*a with *Pinus edulis*, *Juniperus scopulorum*, and *Juniperus monosperma* common to abundant in the sub-canopy. The understory is sparse with little vegetative cover. Of the 17 herbaceous species reported, none exceeded 1% cover. Among graminoids, there can be scattered individuals of *Bouteloua curtipendula, Bouteloua gracilis, Carex inops* ssp. *heliophila*, and *Schizachyrium scoparium.*

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus ponderosa*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park
Data are not available.

CLASSIFICATION COMMENTS

Pecos National Historic Park
Data are not available.

CLASSIFICATION CONFIDENCE: 3

ELEMENT SOURCES

Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 05PP006, 06PP017, 05PP037.
Local Description Authors: A. Fettes; E. H. Muldavin

G229. Southern Rocky Mountain Ponderosa Pine Savanna Group

Pinus ponderosa / *Bouteloua gracilis* Woodland
Ponderosa Pine / Blue Grama Forest
Identifier: CEGL000848

NVC CLASSIFICATION

Division	Western North American Cool Temperate Forest (1.C.2.Nb)
Macrogroup	Southern Rocky Mountain Lower Montane Forest (M022)
Group	Southern Rocky Mountain Ponderosa Pine Savanna Group (G229)
Association	*Pinus ponderosa* / *Bouteloua gracilis* Woodland

DISTRIBUTION
Pecos National Historic Park
This association is known from the western half of the main park unit.

ENVIRONMENTAL DESCRIPTION
Pecos National Historic Park
This association occurs from 2,088 to 2,134 m (6,850 to 7,000 ft) in elevation over a terrain of mesa tops and shallow drainages. Stands typically occur on gentle slopes of draws or along the bottoms or out on the mesa tabletops. Soils are derived from sandstone or mixed alluvium. The ground surface is characterized mostly by patches of grasses (20% on average), leaf litter (60%), and bare soil along with scattered gravel and rock (20%).

VEGETATION DESCRIPTION
Pecos National Historic Park
This woodland savanna association is characterized by a moderately open to open canopy (20% to 60% cover) dominated by *Pinus ponderosa* with scattered *Juniperus scopulorum*, *Juniperus monosperma*, and *Pinus edulis* in the sub-canopy. Shrubs species are poorly represented or absent except for scattered individuals of pine and juniper regeneration. The herbaceous layer is characteristically grassy (as high as 30% cover) and dominated by *Bouteloua gracilis* with *Bouteloua curtipendula* a frequent associate. Forbs are diverse and variable with over 40 species recorded for this association; *Astragalus lonchocarpus*, *Tetraneuris argentea*, *Melilotus officinalis*, *Eriogonum jamesii*, and *Erigeron flagellaris* are the most frequent representatives.

MOST ABUNDANT SPECIES
Pecos National Historic Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus ponderosa*
Herb (field)	Graminoid	*Bouteloua gracilis*

OTHER NOTEWORTHY SPECIES
Pecos National Historic Park
New Mexico state-listed noxious weeds: (Class C) *Bromus tectorum*

CLASSIFICATION COMMENTS
Pecos National Historic Park
Data are not available.

CLASSIFICATION CONFIDENCE:

ELEMENT SOURCES
Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 06PP015, 06PP018, 05PP036, 07PP052, 07PP053, 06PP019, 06PP031, and 07PP054.
Local Description Authors: A. Fettes; E. H. Muldavin

Pinus ponderosa / *Schizachyrium scoparium* Woodland

Ponderosa Pine / Little Bluestem Wooded Herbaceous Vegetation
Identifier: CEGL000201

NVC CLASSIFICATION

Division	Western North American Cool Temperate Forest (1.C.2.Nb)
Macrogroup	Southern Rocky Mountain Lower Montane Forest (MG022)
Group	Southern Rocky Mountain Ponderosa Pine Savanna Group (G229)
Association	*Pinus ponderosa* / *Schizachyrium scoparium* Woodland Vegetation

DISTRIBUTION

Pecos National Historic Park
This association is known from scattered occurrences throughout the main park unit.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park
This woodland herbaceous association occurs from 2,070 - 2,170 m (6,800 - 7,120 ft) in elevation on northwest to northeast-facing slopes of shallow draws and along drainages. Slopes are gentle to moderately steep (10-30%). Soils are derived from limestone or sandstone. The ground surface is characterized mostly by patches of grasses (11% on average) and leaf litter and woody debris (77%), with limited bare soil, gravel or rock (<12% in sum).

VEGETATION DESCRIPTION

Pecos National Historic Park
This woodland is characterized by a moderate canopy (40-60% cover) of *Pinus ponderosa* with *Juniperus scopulorum*, *Juniperus monosperma,* and *Pinus edulis* in the sub-canopy. Shrubs are poorly represented or absent except for scattered individuals of pine and juniper regeneration. The herbaceous layer is characteristically grassy and dominated by *Schizachyrium scoparium* with *Bouteloua curtipendula* common. Forbs are variable in composition and typically low in total cover (<3%). Among the 20 species reported, *Tetraneuris argentea* and *Hymenoxys richardsonii* are the most frequent.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus ponderosa*, *Pinus edulis*, *Juniperus monosperma*
Herb (field)	Graminoid	*Schizachyrium scoparium*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park
Data are not available.

CLASSIFICATION COMMENTS

Pecos National Historic Park
Data are not available.

CLASSIFICATION CONFIDENCE: 1

ELEMENT SOURCES

Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 07PP035 and 05PP001.
Local Description Authors: A. Fettes; E. H. Muldavin

G226. Southern Rocky Mountain White Fir - Douglas-fir Dry Forest Group

Pseudotsuga menziesii / *Quercus gambelii* Forest
Douglas-fir / Gambel Oak Forest
Identifier: CEGL000452

NVC CLASSIFICATION

Division	Western North American Cool Temperate Forest (1.C.2.Nb)
Macrogroup	Southern Rocky Mountain Lower Montane Forest (M022)
Group	Southern Rocky Mountain White Fir - Douglas-fir Dry Forest Group (G226)
Association	*Pseudotsuga menziesii* / *Quercus gambelii* Forest

DISTRIBUTION

Pecos National Historic Park
This association is limited to the foothills east of the Pecos River in the main park unit, and an isolated stand in the Cañoncito Subunit of the Glorieta Unit.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park
This association occurs from 2,130 to 2,180 m (7,000 to 7,150 ft) in elevation on relatively cool northwestern and northeastern aspects. Stands occur along steep (30 to 50%) lower slopes of higher-elevation canyons and as stringers along drainages. Soils are derived from limestone. The ground surface is characterized mostly by patches of grasses (5% on average), and leaf litter and woody debris (85%), with limited bare soil, gravel or rock (<10% in sum).

VEGETATION DESCRIPTION

Pecos National Historic Park
This closed-canopy mixed-conifer forest is dominated by *Pseudotsuga menziesii* with deciduous *Quercus gambelii* well represented as a sub-canopy tree or shrub. The canopy cover often exceeds 75% cover with *Pinus edulis*, *Juniperus scopulorum*, and *Pinus ponderosa* as common conifer associates. Herbs are scattered and variable in composition with *Achnatherum scribneri*, *Carex inops* ssp. *heliophila*, and *Piptatherum micranthum* the most frequent graminoid representatives; *Aletes filifolius*, *Allium cernuum*, and *Artemisia ludoviciana* are the most common forbs.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pseudotsuga menziesii, Juniperus scopulorum, Pinus edulis*
Tree canopy	Broad-leaved deciduous tree	*Quercus gambelii*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park
Data are not available.

CLASSIFICATION COMMENTS

Pecos National Historic Park
Data are not available.

CLASSIFICATION CONFIDENCE: 1

ELEMENT SOURCES

Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 05PP012, 06PP022, 06PP014, 07PP041.
Local Description Authors: A. Fettes; E. H. Muldavin

1.C.2. c. Western North American Cool Temperate Scrub Woodland & Shrubland

M027. Rocky Mountain Two-needle Pinyon - Juniper Woodland

G253. Southern Rocky Mountain Pinyon - Juniper Woodland Group

Juniperus scopulorum / *Rhus trilobata* Woodland

Rocky Mountain Juniper / Skunkbush Sumac Woodland
Identifier: NHNM000474

NVC CLASSIFICATION

Division	Western North American Cool Temperate Scrub Woodland & Shrubland (1.C.2.Nc)
Macrogroup	Rocky Mountain Two-needle Pinyon - Juniper Woodland (M027)
Group	Southern Rocky Mountain Pinyon - Juniper Woodland Group (G253)
Association	*Juniperus scopulorum* / *Rhus trilobata* Woodland

DISTRIBUTION

Pecos National Historic Park
This association is limited to the Pecos River riparian corridor in the main park unit.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park
This woodland association occurs at about 2,060 m (6,750 ft) in elevation on floodplain terraces. Soils are derived from mixed alluvium. The ground surface is characterized mostly by abundant herbaceous cover (>50% on average), plus leaf litter and woody debris (33%) and areas of bare soil and gravel (<17% in sum).

VEGETATION DESCRIPTION

Pecos National Historic Park
This short-statured semi-riparian woodland is dominated by *Juniperus scopulorum* with *Juniperus monosperma* and *Acer negundo* as common associates. Average canopy cover is 30%. The understory is characteristically shrubby with *Rhus trilobata* well represented. *Berberis fendleri* and *Salix exigua* may be common shrub associates. The herbaceous layer is typically luxurious in cover with 12 graminoid species and 48 forb species recorded for this association. Grasses are dominant, with *Bouteloua gracilis* as high as 40% cover and *Poa pratensis* and *Elymus* spp. as well represented associates. Among the forbs, *Erigeron divergens*, *Melilotus officinalis*, *Glandularia bipinnatifida*, and *Geranium caespitosum* are the most common.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	Juni*perus scopulorum*
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Rhus trilobata*
Herb (field)	Graminoid	*Bouteloua gracilis*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park
New Mexico state-listed noxious weeds: (Class C) *Bromus tectorum*

CLASSIFICATION COMMENTS

Pecos National Historic Park
Data are not available.

CLASSIFICATION CONFIDENCE:

ELEMENT SOURCES

Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 91EM007 and 07PP001.
Local Description Authors: A. Fettes; E. H. Muldavin

Pinus edulis - (*Juniperus monosperma, Juniperus deppeana*) / *Bouteloua gracilis* Woodland

Two-needle Pinyon - (One-seed Juniper, Alligator Juniper) / Blue Grama Woodland
Identifier: CEGL002151

NVC CLASSIFICATION

Division	Western North American Cool Temperate Scrub Woodland & Shrubland (1.C.2.Nc)
Macrogroup	Rocky Mountain Two-needle Pinyon - Juniper Woodland (M027)
Group	Southern Rocky Mountain Pinyon - Juniper Woodland Group (G253)
Association	*Pinus edulis* - (*Juniperus monosperma, Juniperus deppeana*) / Bouteloua gracilis Woodland

DISTRIBUTION

Pecos National Historic Park

A widespread association known from areas throughout the main park unit (with the exception of the Pecos River riparian corridor) and in the Cañoncito Subunit.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park

This woodland association occurs from 2,060 to 2,130 m (6,760 to 6,980 ft) in elevation among rolling hills, mesa tops, and shallow drainages. Slopes are gentle (4 to 10%). Soils are derived from limestone, sandstone, or mixed alluvium. The ground surface is characterized mostly by patches of grasses (22% on average), leaf litter (40%), and bare soil and scatterd gravel and rock (38%).

VEGETATION DESCRIPTION

Pecos National Historic Park

This short-statured woodland savanna association is dominated by *Pinus edulis* with *Juniperus monosperma* and *Juniperus scopulorum* as co-dominants. Total canopy cover can range from 15 to 70%. Shrubs are few, but the herbaceous layer is quite diverse and is characteristically grassy (>20% cover). *Bouteloua gracilis* is the dominant, with *Bouteloua curtipendula*, *Poa fendleriana*, and *Schizachyrium scoparium* common associates among the 36 grass species recorded. Forbs, while diverse (over 87 species recorded in this association) are highly variable in composition and generally low in cover. *Eriogonum jamesii*, *Hymenoxys richardsonii*, *Astragalus mollissimus*, and *Tetraneuris argentea* were the most frequent.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus edulis, Juniperus monosperma, Juniperus scopulorum*
Herb (field)	Graminoid	*Bouteloua gracilis*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park

New Mexico state-listed noxious weeds: (Class C) *Ulmus pumila, Bromus tectorum*

CLASSIFICATION COMMENTS

Pecos National Historic Park

Data are not available.

CLASSIFICATION CONFIDENCE: 3

ELEMENT SOURCES

Pecos National Historic Park

Inventory Notes: Data are not available.

Pecos National Historic Park: NHNM plots 06PP010, 06PP016, 06PP008, 06PP039, 06PP002, 07PP007, 05PP020, 05PP003, 06PP001, 05PP028, 07PP048, 05PP016, 06PP004, 05PP010, 05PP009, 07PP046, 06PP032, 07PP005.

Local Description Authors: A. Fettes; E. H. Muldavin

Pinus edulis - Juniperus monosperma / *Bouteloua curtipendula* Woodland

Pinyon Pine - Rocky Mountain Juniper / Sideoats Grama Woodland
Identifier: NHNM000570

NVC CLASSIFICATION

Division	Western North American Cool Temperate Scrub Woodland & Shrubland (1.C.2.Nc)
Macrogroup	Rocky Mountain Two-needle Pinyon - Juniper Woodland (M027)
Group	Southern Rocky Mountain Pinyon - Juniper Woodland Group (G253)
Association	*Pinus edulis* to *Juniperus monosperma* / *Bouteloua curtipendula* Woodland

DISTRIBUTION

Pecos National Historic Park
Common throughout the main park unit and at the Cañoncito Subunit.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park
This woodland association occurs from 2,080 to 2,170 m (6,810 to 7,130 ft) in elevation on flat mesa tops or plains, eroded rolling hills, and the slopes of canyons and draws. Soils are derived from limestone or sandstone. The ground surface is often rocky and or gravelly with extensive exposed soils (50% in sum), with scattered bunch grasses (10% on average) and leaf litter and woody debris (40%) in a matrix.

VEGETATION DESCRIPTION

Pecos National Historic Park
This short-statured woodland is dominated by *Pinus edulis* with *Juniperus monosperma* as a co-dominant. Total canopy cover can range from 20 to 60%. The understory is characterized by scattered patches of *Bouteloua curtipendula,* and *Bouteloua gracilis* may be common, but total grass cover seldom exceeds 5%. Forbs are low in cover and variable (36 forb species recorded). *Tetraneuris argentea, Astragalus lonchocarpus, Dalea candida*, and *Eriogonum jamesii* var. *jamesii* were the most frequent representatives.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus edulis, Juniperus monosperma*
Herb (field)	Graminoid	*Bouteloua curtipendula*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park
Data are not available.

CLASSIFICATION COMMENTS

Pecos National Historic Park
Data are not available.

CLASSIFICATION CONFIDENCE: 3

ELEMENT SOURCES

Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 06PP027, 06PP023, 07PP034, 06PP012, 07PP047, 05PP008, 05PP007, 07PP009, 05PP025, 07PP049, and 07PP018.
Local Description Authors: A. Fettes; E. H. Muldavin

Pinus edulis - Juniperus monosperma / *Muhlenbergia montana* Woodland

Pinyon Pine - Rocky Mountain Juniper / Mountain Muhly Woodland
Identifier: NHNM000572

NVC CLASSIFICATION

Division	Western North American Cool Temperate Scrub Woodland & Shrubland (1.C.2.Nc)
Macrogroup	Rocky Mountain Two-needle Pinyon - Juniper Woodland (M027)
Group	Southern Rocky Mountain Pinyon - Juniper Woodland Group (G253)
Association	*Pinus edulis – Juniperus monosperma* / *Muhlenbergia montana* Woodland

DISTRIBUTION

Pecos National Historic Park
This association is known from the Cañoncito Subunit (Glorieta Unit); and observed in the northeast sector of the main unit.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park
This woodland association known from a stand at 2,270 m (7,450 ft) in elevation on a gentle slope (8%) with a west-northwestern aspect. Soil is derived from sandstone. The ground surface is characterized mostly by patches of grasses (35%), leaf litter and woody debris (47%) among rocks (12%) and bare soil (6%).

VEGETATION DESCRIPTION

Pecos National Historic Park
This short-statured, open woodland (<25% canopy cover) is dominated by *Pinus edulis* with *Juniperus monosperma* as a co-dominant. The understory is characteristically grassy with *Muhlenbergia montana* well represented and diagnostic, with *Achnatherum scribneri, Bouteloua gracilis, Poa fendleriana,* and *Carex inops* ssp. *heliophila* as common associates. Total grass cover can be 25% or more. Forbs are relatively abundant (20% cover) with *Bahia dissecta, Artemisia ludoviciana, Erigeron flagellaris, Erigeron divergens,* and *Heterotheca villosa* common.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus edulis, Juniperus monosperma*
Herb (field)	Graminoid	*Muhlenbergia montana*
Herb (field)	Forb	*Bahia dissecta*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park
New Mexico state-listed noxious weeds: (Class C) *Bromus tectorum*

CLASSIFICATION COMMENTS

Pecos National Historic Park
Data are not available.

CLASSIFICATION CONFIDENCE:

ELEMENT SOURCES

Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 05PP039.
Local Description Authors: A. Fettes

Pinus edulis - Juniperus monosperma / *Quercus ×pauciloba* Woodland
Two-needle Pinyon - One-seed Juniper / Wavyleaf Oak Woodland
Identifier: CEGL000793

NVC CLASSIFICATION

Division	Western North American Cool Temperate Scrub Woodland & Shrubland (1.C.2.Nc)
Macrogroup	Rocky Mountain Two-needle Pinyon - Juniper Woodland (M027)
Group	Southern Rocky Mountain Pinyon - Juniper Woodland Group (G253)
Association	*Pinus edulis - Juniperus monosperma* / *Quercus ×pauciloba* Woodland

DISTRIBUTION

Pecos National Historic Park

This association is common east of the Pecos River in the main park unit, and it also occurs in the Pigeon's Ranch and Cañoncito Subunits.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park

This woodland association occurs from 2,080 to 2,246 m (6,840 to 7,370 ft) in elevation on southerly aspects. Sites are typically on gentle-to-steep (5 to 50%) canyon slopes, and may extend as stringers along canyon bottoms. Soils are derived from sandstone or limestone. The ground surface is usually rocky and gravelly (30% on average) with areas of exposed soil (10%); the remainder is primarily leaf litter and woody debris (45% on average) with scattered forbs and grasses (10%).

VEGETATION DESCRIPTION

Pecos National Historic Park

This short-statured, open woodland (25% to 60% canopy cover) is dominated by *Pinus edulis* with *Juniperus monosperma* and *J. scopulorum* as common co-dominants. The understory is characteristically shrubby and dominated by the semi-deciduous *Quercus ×pauciloba*, which can reach 40% cover. *Cercocarpus montanus* and *Rhus trilobata* are common associates in addition to scattered pine and juniper regeneration. Total herbaceous cover is low and variable in composition (<5% cover). *Bouteloua curtipendula, Achnatherum scribneri, Carex inops* ssp. *heliophila*, and *Schizachyrium scoparium* may be common among graminoids while *Tetraneuris argentea, Eriogonum jamesii, Chamaesyce fendleri, Brickellia brachyphylla*, and *Hymenopappus filifolius* are the most frequent forbs.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus edulis, Juniperus monosperma*
Shrub/sapling (tall & short)	Broad-leaved tree	*Quercus ×pauciloba*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park

Data are not available.

CLASSIFICATION COMMENTS

Pecos National Historic Park

Data are not available.

CLASSIFICATION CONFIDENCE: 2

ELEMENT SOURCES

Pecos National Historic Park

Inventory Notes: Data are not available.

Pecos National Historic Park: NHNM plots 06PP020, 07PP033, 06PP013, 06PP024, 06PP011, 07PP032, 05PP037, 07PP030, 05PP013, 05PP014, and 05PP024

Local Description Authors: A. Fettes; E. H. Muldavin

Pinus edulis - Juniperus scopulorum / *Pascopyrum smithii* Woodland

Pinyon Pine - Rocky Mountain Juniper / Western Wheatgrass Woodland
Identifier: NHNM000576

NVC CLASSIFICATION

Division	Western North American Cool Temperate Scrub Woodland & Shrubland (1.C.2.Nc)
Macrogroup	Rocky Mountain Two-needle Pinyon - Juniper Woodland (M027)
Group	Southern Rocky Mountain Pinyon - Juniper Woodland Group (G253)
Association	*Pinus edulis - Juniperus scopulorum* / *Pascopyrum smithii* Woodland

DISTRIBUTION

Pecos National Historic Park
This minor association is known from a few occurrences west of the Pecos River in the main park unit.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park
This woodland association occurs from 2,070 to 2,090 m (6,870 to 6,790 ft) in drainage bottoms alluvial deposits. The ground surface is usually dominated by grass cover (75% on average), litter (15%), and exposed alluvial deposits (10%); rock and gravel are minimal.

VEGETATION DESCRIPTION

Pecos National Historic Park
This short-statured, open woodland (> 25% canopy cover) is dominated by *Pinus edulis* with *Juniperus monosperma* and *J. scopulorum* as common co-dominants. The understory is characteristically grassy and strongly dominated by *Pascopyrum smithii*. Herbaceous cover can be as high as 80% with 16 graminoid and 29 forb species represented in this association. Introduced species such as *Onopordum acanthium, Melilotus officinalis, Bromus japonicus,* and *Poa pratensis* are also common. Shrubs and dwarf-shrubs are usually poorly represented, but riparian species such as *Salix exigua* may occasionally be present.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus edulis, Juniperus scopulorum, Juniperus monosperma*
Herb (field)	Graminoid	*Pascopyrum smithii*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park
New Mexico state-listed noxious weeds: (Class A) *Onopordum acanthium, Cardaria draba*; (Class C) *Ulmus pumila, Bromus tectorum*

CLASSIFICATION COMMENTS

Pecos National Historic Park
Data are not available.

CLASSIFICATION CONFIDENCE: 3

ELEMENT SOURCES

Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 07PP050 and 07PP011.
Local Description Authors: A. Fettes; E. H. Muldavin

Pinus edulis - Juniperus scopulorum / *Schizachyrium scoparium* Woodland

Pinyon Pine – Rocky Mountain Juniper / Little Bluestem Woodland
Identifier: NHNM000578

NVC CLASSIFICATION

Division	Western North American Cool Temperate Scrub Woodland & Shrubland (1.C.2.Nc)
Macrogroup	Rocky Mountain Two-needle Pinyon - Juniper Woodland (M027)
Group	Southern Rocky Mountain Pinyon - Juniper Woodland Group (G253)
Association	*Pinus edulis - Juniperus monosperma* / *Schizachyrium scoparium* Woodland

DISTRIBUTION

Pecos National Historic Park
This minor association is known from the eastern half of the main park unit.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park
This woodland association is known from a stand at about 2,050 m (6,720 ft) in elevation on a moderate canyon slope with a north-northeasterly aspect. The soil is derived from limestone. The ground surface is dominated by grass bunches (15% on average) and litter (55%), but gravel, rock and exposed soil can account for 25% of the area.

VEGETATION DESCRIPTION

Pecos National Historic Park
This short-statured, open woodland (60% canopy cover) is dominated by *Pinus edulis* with *Juniperus monosperma* and *J. scopulorum* as common co-dominants. The understory is characteristically grassy (15% cover) and strongly dominated by *Schizachyrium scoparium* with *Andropogon gerardii* and *Bouteloua curtipendula* as common graminoid associates. Forbs are low in cover (<1%) with *Dalea candida* and *Tetraneuris argentea* the most abundant representatives.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus edulis, Juniperus scopulorum, Juniperus monosperma*
Herb (field)	Graminoid	*Schizachyrium scoparium*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park
Data are not available.

CLASSIFICATION COMMENTS

Pecos National Historic Park
Data are not available.

CLASSIFICATION CONFIDENCE: 3

ELEMENT SOURCES

Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 07PP022.
Local Description Authors: A. Fettes; E. H. Muldavin

Pinus edulis - *Juniperus* spp. / *Cercocarpus montanus* - Mixed Shrubs Woodland

Two-needle Pinyon - Juniper species / Alderleaf Mountain-mahogany - Mixed Shrubs Woodland
Identifier: CEGL000780

NVC CLASSIFICATION

Division	Western North American Cool Temperate Scrub Woodland & Shrubland (1.C.2.Nc)
Macrogroup	Rocky Mountain Two-needle Pinyon - Juniper Woodland (M027)
Group	Southern Rocky Mountain Pinyon - Juniper Woodland Group (G253)
Association	*Pinus edulis* - *Juniperus* spp. / *Cercocarpus montanus* - Mixed Shrubs Woodland

DISTRIBUTION

Pecos National Historic Park
This association is known from upland areas throughout the eastern half of the main park unit and from the Cañoncito Subunit.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park
This association occurs from 2,110 to 2,190 m (6,780 to 7,190 ft) in elevation on moderate to steep escarpments and canyon slopes of southerly aspects. Soils are derived from limestone or sandstone. The ground surface is usually rocky and gravelly (40% on average) with areas of exposed soil (10%); the remainder is primarily leaf litter and woody debris (45% on average) with scattered forbs and grasses (5%).

VEGETATION DESCRIPTION

Pecos National Historic Park
This short-statured, open woodland (30 to 50% canopy cover) is dominated by *Pinus edulis* with *Juniperus monosperma* and *J. scopulorum* as common co-dominants. The understory is characteristically shrubby and dominated by the semi-deciduous *Cercocarpus montanus* (coverage can be as high as 40%). *Quercus ×pauciloba* is poorly presented. The herbaceous layer is typically low in cover, however, *Bouteloua curtipendula* and *Schizachyrium scoparium* may be common. Forbs are low in cover (<1%) with *Eriogonum jamesii* and *Tetraneuris argentea* the most abundant representatives.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus edulis, Juniperus monosperma*
Shrub/sapling (tall & short)	Broad-leaved evergreen shrub	*Cercocarpus montanus*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park
Data are not available.

CLASSIFICATION COMMENTS

Pecos National Historic Park
Data are not available.

CLASSIFICATION CONFIDENCE:

ELEMENT SOURCES

Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 07PP038, 05PP005, 06PP005 and 07PP008.
Local Description Authors: A. Fettes

Pinus edulis - Juniperus spp. / Quercus gambelii Woodland
Two-needle Pinyon - Juniper species / Gambel Oak Woodland
Identifier: CEGL000791

NVC CLASSIFICATION

Division	Western North American Cool Temperate Scrub Woodland & Shrubland (1.C.2.Nc)
Macrogroup	Rocky Mountain Two-needle Pinyon - Juniper Woodland (M027)
Group	Southern Rocky Mountain Pinyon - Juniper Woodland Group (G253)
Association	*Pinus edulis – Juniperus* spp. / *Quercus gambelii* Woodland

DISTRIBUTION

Pecos National Historic Park
This association is uncommon east of the Pecos River in the main park unit.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park
This woodland association occurs from 2,130 to 2,220 m (6,860 to 7,280 ft) in elevation on steep, north-facing, mid-to-lower canyon slopes. Soils are derived from sandstone or limestone. The ground surface is usually rocky and gravelly (20% on average) with areas of exposed soil (5%); the remainder is primarily leaf litter and woody debris (70% on average) with scattered forbs and grasses (5%).

VEGETATION DESCRIPTION

Pecos National Historic Park
This short-statured, closed-canopied woodland (> 60% canopy cover) is dominated by *Pinus edulis* with *Juniperus monosperma* and *J. scopulorum* as common co-dominants. The understory is characteristically shrubby and dominated by the deciduous *Quercus gambelii*, which can reach 40% cover. Other shrubs such as *Cercocarpus montanus* and *Rhus trilobata* are scattered and limited in cover (<1%). Total herbaceous cover is low and variable in composition (<5% cover). *Achnatherum scribneri, Carex inops* ssp. *heliophila*, and *Schizachyrium scoparium* may be common among graminoids while *Tetraneuris argentea* and *Eriogonum jamesii* are the most frequent forbs.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus edulis, Juniperus monosperma*
Shrub/sapling (tall & short)	Broad-leaved tree	*Quercus gambelii*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park
Data are not available.

CLASSIFICATION COMMENTS

Pecos National Historic Park
Data are not available.

CLASSIFICATION CONFIDENCE:

ELEMENT SOURCES

Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 05PP023, 05PP027, 07PP042, 06PP026
Local Description Authors: A. Fettes; E. H. Muldavin

Pinus edulis / *Achnatherum scribneri* Woodland

Pinyon Pine / Scribner's Needlegrass Woodland
Identifier: CEGL000798

NVC CLASSIFICATION

Division	Western North American Cool Temperate Scrub Woodland & Shrubland (1.C.2.Nc)
Macrogroup	Rocky Mountain Two-needle Pinyon - Juniper Woodland (M027)
Group	Southern Rocky Mountain Pinyon - Juniper Woodland Group (G253)
Association	*Pinus edulis* / *Achnatherum scribneri* Woodland

DISTRIBUTION

Pecos National Historic Park
This limited association is known from upland areas east of the Pecos River in the main park unit and from the Cañoncito Subunit.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park
This woodland association occurs from 2,060 to 2,280 m (6,760 to 7,480 ft) in elevation on steep, north-facing, mid-to-upper canyon slopes and summits. Soils are derived from sandstone or limestone. The ground surface is usually rocky and gravelly (20% on average) with areas of exposed soil (10%); the remainder is primarily leaf litter and woody debris (60% on average) with patches of bunch grasses (10%).

VEGETATION DESCRIPTION

Pecos National Historic Park
This short-statured, closed-canopied woodland (> 60% canopy cover) is dominated by *Pinus edulis* with *Juniperus monosperma* and *J. scopulorum* as common co-dominants. The understory is characteristically grassy (10% cover) and strongly dominated by *Achnatherum scribneri*. Among the other 13 graminoid species *Bouteloua curtipendula* and *B. gracilis* are the most common. Forbs are high in overall diversity (41 forb species recorded) but variable in composition and cover. *Bahia dissecta, Heterotheca villosa, Erigeron flagellaris,* and *Tetraneuris argentea* are the most frequent.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus edulis, Juniperus monosperma*
Herb (field)	Graminoid	*Achnatherum scribneri*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park
New Mexico state-listed noxious weeds: (Class C) *Bromus tectorum*

CLASSIFICATION COMMENTS

Pecos National Historic Park
Data are not available.

CLASSIFICATION CONFIDENCE: 1

ELEMENT SOURCES

Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 07PP029, 05PP011, 06PP021, 07PP027, 07PP026, 05PP022, 07PP003, 07PP017, 07PP025.
Local Description Authors: A. Fettes; E. H. Muldavin

Pinus edulis / Sparse Understory Woodland

Pinyon Pine / Sparse Undergrowth Woodland
Identifier: CEGL000795

NVC CLASSIFICATION

Division	Western North American Cool Temperate Scrub Woodland & Shrubland (1.C.2.Nc)
Macrogroup	Rocky Mountain Two-needle Pinyon - Juniper Woodland (M027)
Group	Southern Rocky Mountain Pinyon - Juniper Woodland Group (G253)
Association	*Pinus edulis* / Sparse Understory Woodland

DISTRIBUTION

Pecos National Historic Park
This common association is known throughout the main park unit and from the Cañoncito Subunit.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park
This association occurs from 2,082 to 2,126 m (6,830 to 6,975 ft) in elevation on a variety of sites that include steep slopes and flat summits, rolling hills and tablelands. Aspects are generally northerly and slopes range between 5 and 20%. Soils are derived from limestone and sandstone. The ground surface is characterized mostly by leaf litter (50% on average) but sites can be rocky and gravelly with exposed soils (45% in sum); herbaceous ground cover is usually less than 1%.

VEGETATION DESCRIPTION

Pecos National Historic Park
This short-statured, closed-canopied woodland (> 60% canopy cover) is dominated by *Pinus edulis* with *Juniperus monosperma* and *J. scopulorum* as common co-dominants. Tall and dwarf shrub species are accidental or absent except for scattered individuals of pine and juniper regeneration. Total herbaceous cover is low (3% maximum cover) with scattered individuals of *Bouteloua gracilis*, *Bouteloua hirsuta* and *Carex inops* ssp. *heliophila* present; however, other grasses and forbs are highly variable in composition and cover and seldom exceed 0.5% cover.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Tree canopy	Needle-leaved tree	*Pinus edulis, Juniperus monosperma*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park
Data are not available.

CLASSIFICATION COMMENTS

Pecos National Historic Park
Data are not available.

CLASSIFICATION CONFIDENCE: 1

ELEMENT SOURCES

Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 07PP024, 05PP032, 05PP002, 07PP040, 07PP039.
Local Description Authors: A. Fettes; E. H. Muldavin

1.C.3. Temperate Flooded & Swamp Forest

1.C.3.c. Western North American Flooded & Swamp Forest

M034. Rocky Mountain and Great Basin Flooded & Swamp Forest

G503. Rocky Mountain & Great Basin Lowland & Foothill Riparian Forest Group

Populus deltoides (ssp. *wislizeni,* ssp. *monilifera*) / *Salix exigua* Woodland

Rio Grande / Plains Cottonwood / Coyote Willow Forest
Identifier: CEGL002685

NVC CLASSIFICATION

Division	Western North American Flooded & Swamp Forest (1.C.3.Nc)
Macrogroup	Rocky Mountain and Great Basin Flooded & Swamp Forest (M034)
Group	Rocky Mountain & Great Basin Lowland & Foothill Riparian Forest Group (G503)
Association	*Populus deltoides* (ssp. *wislizeni*, ssp. *monilifera*) / *Salix exigua* Woodland

DISTRIBUTION

Pecos National Historic Park
This association is known from the Glorieta Creek riparian corridor in the main park unit.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park
This association occurs from 2,075 to 2,090 m (6,800 to 6,860 ft) in elevation on terraces within a perennial stream riparian corridor. The ground surface is characterized mostly by abundant grass cover (50% on average) plus leaf litter and woody debris (45%), and little exposed bare soil, gravel, or rock (<5%).

VEGETATION DESCRIPTION

Pecos National Historic Park
This forested wetland community is characterized by open to closed canopy (60 to 80% cover) of *Populus deltoides* ssp. *wislizeni* with a shrubby understory dominated by *Salix exigua*. *Salix irrorata* and *Ericameria nauseosa* may be common shrub associates. Herbaceous cover is characteristically grassy and dominated by exotics (*Festuca arundinacea*, *Agrostis gigantea*), but natives can also be prevalent (*Elymus Canadensis*, *E.* x *pseudorepens*, *Juncus arcticus* var. *balticus*, and *Muhlenbergia asperifoliai*). Forbs, while well represented, are variable in composition. Among the 22 species reported, *Melilotus officinalis*, *Symphyotrichum* spp., *Heterotheca villosa* and *Ratibida tagetes* were the most frequent and abundant.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Populus deltoides* ssp. *Wislizeni*
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Salix exigua*
Herb (field)	Graminoid	*Festuca arundinacea*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park
Obligate wetland (OBL) indicator species: *Salix exigua, Muhlenbergia asperifolia, Juncus arcticus* var. *balticus, Salix gooddingii*
Facultative wetland (FACW) indicator species: *Agrostis gigantea*, *Salix irrorata, Populus angustifolia, Elaeagnus angustifolia, Tamarix chinensis*
New Mexico state-listed noxious weeds: (Class A) *Onopordum acanthium*; (Class C) *Bromus tectorum*, *Elaeagnus angustifolia, Tamarix chinensis, Ulmus pumila*

CLASSIFICATION COMMENTS

Pecos National Historic Park
Data are not available.

CLASSIFICATION CONFIDENCE: 1

ELEMENT SOURCES
Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 06PP046, 06PP050.
Local Description Authors: A. Fettes; E. H. Muldavin

G506. Rocky Mountain & Great Basin Montane Riparian Forest Group

Populus angustifolia - Acer negundo / *Poa pratensis* Woodland
Narrowleaf Cottonwood - Boxelder / Kentucky Bluegrass Woodland
Identifier: CEGL005961

NVC CLASSIFICATION

Division	Western North American Flooded & Swamp Forest (1.C.3.Nc)
Macrogroup	Rocky Mountain and Great Basin Flooded & Swamp Forest (M034)
Group	Rocky Mountain & Great Basin Montane Riparian Forest Group (G506)
Association	*Populus angustifolia - Acer negundo* / *Poa pratensis* Woodland

DISTRIBUTION

Pecos National Historic Park

This association is known from the Pecos River riparian corridor in the main park unit and from the Glorieta Creek riparian corridor at the Pigeon's Ranch Subunit (Glorieta unit).

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park

This wetland association occurs from 2,055 to 2,075 m (6,750 to 7,140 ft) in elevation along open floodplain terraces and river bars. The ground surface is characterized mostly by abundant grass cover plus leaf litter and woody debris and little exposed bare soil, gravel, or rock.

VEGETATION DESCRIPTION

Pecos National Historic Park

This forested wetland community is characterized by open to closed canopy (40 to 80% cover) *Populus angustifolia* and *Acer negundo*. *Juniperus scopulorum* and the introduced species *Fraxinus pennsylvanica* are common canopy associates. Shrubs are typically abundant and represented by *Rosa woodsii* with *Salix irrorata, Clematis columbiana* var. *columbiana,* and *Berberis fendleri* common. Grasses can be high (25-50%) and are dominated by the exotic *Poa pratensis* and other introduced cool-season species such as *Elymus repens,* and *Bromus inermis* can be well represented.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Populus angustifolia, Acer negundo*
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Rosa woodsii*
Herb (field)	Graminoid	*Poa pratensis*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park

Obligate wetland (OBL) indicator species: *Salix exigua, Juncus arcticus* var. *balticus, Veronica americana, Conium maculatum, Nasturtium officinale*

Facultative wetland (FACW) indicator species: *Agrostis gigantea, Salix irrorata, Populus angustifolia, Populus x acuminata, Acer negundo, Epilobium* spp., *Equisetum laevigatum, Rumex crispus*

New Mexico state-listed noxious weeds: (Class B) *Conium maculatum*

CLASSIFICATION COMMENTS

Pecos National Historic Park

Data are not available.

CLASSIFICATION CONFIDENCE:

ELEMENT SOURCES

Pecos National Historic Park

Inventory Notes: Data are not available.

Pecos National Historic Park: NHNM plots 06PP036, 91EM004, 91EM005, 91EM008, 06PP057.

Local Description Authors: A. Fettes; E. H. Muldavin

Populus angustifolia / Invasive Perennial Grasses Semi-natural Woodland

Narrowleaf Cottonwood / Invasive Perennial Grasses Semi-natural Woodland
Identifier: CEGL003749

NVC CLASSIFICATION

Division	Western North American Flooded & Swamp Forest (1.C.3.Nc)
Macrogroup	Rocky Mountain and Great Basin Flooded & Swamp Forest (M034)
Group	Rocky Mountain & Great Basin Montane Riparian Forest Group (G506)
Association	*Populus angustifolia* / Invasive Perennial Grasses Semi-natural Woodland

DISTRIBUTION

Pecos National Historic Park
This association is known from the Pecos River and Glorieta Creek riparian corridor in the Main Unit, along Glorieta Creek in the Pigeon's Ranch Subunit and along the channel in the Cañoncito subunit of the Glorieta Unit.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park
This association occurs from 2,045 to 2,115 m (6,710 to 6,935 ft) along open floodplain terraces and river bars. The ground surface is characterized mostly by grass cover plus leaf litter and woody debris and little exposed bare soil, gravel, or rock.

VEGETATION DESCRIPTION

Pecos National Historic Park
This riparian woodland is characterized by an open to closed (40 to 80% cover) tree canopy dominated by *Populus angustifolia* with *Juniperus scopulorum* and *Juniperus monosperma* prevalent in the sub-canopy. *Acer negundo* is poorly represented or absent. Shrubs are scattered or absent. The herbaceous layer is characteristically grassy (as high as 70% cover) and dominated by the introduced species such as *Bromus inermis*, *Elymus repens*, *Poa pratensis*, and *Festuca arundinacea*. Forbs, while well represented, are variable in composition with both natives and exotics. Among the 71 species reported, *Melilotus officinalis, Taraxacum officinale, Erigeron flagellaris, Verbascum thapsus, Geranium caespitosum, Cirsium* spp., and *Equisetum arvense* are the most frequent and abundant.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Populus angustifolia*
Tree canopy	Needle-leaved tree	*Juniperus scopulorum, Juniperus monosperma*
Herb (field)	Graminoid	*Bromus inermis*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park
Obligate wetland (OBL) indicator species: *Salix exigua, Juncus arcticus* var. *balticus, Muhlenbergia asperifolia*
Facultative wetland (FACW) indicator species: *Agrostis gigantea, Populus angustifolia, Acer negundo, Equisetum laevigatum, Salix irrorata, Populus angustifolia, Elaeagnus angustifolia, Equisetum arvense, Acer negundo*
New Mexico state-listed noxious weeds: (Class A) *Onopordum acanthium*; (Class C) *Bromus tectorum, Elaeagnus angustifolia, Tamarix chinensis, Ulmus pumila*

CLASSIFICATION COMMENTS

Pecos National Historic Park
Data are not available.

CLASSIFICATION CONFIDENCE: 3

ELEMENT SOURCES

Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 91EM013,11EM231, 06PP055, 06PP052, 91EM023, 91EM009, 91EM018, 91EM024, 91EM025, 06PP042, 07PP015, and97RW002,
Local Description Authors: A. Fettes; E. H. Muldavin

Populus angustifolia / *Salix exigua* Woodland
Narrowleaf Cottonwood / Coyote Willow Woodland
Identifier: CEGL000654

NVC CLASSIFICATION

Division	Western North American Flooded & Swamp Forest (1.C.3.Nc)
Macrogroup	Rocky Mountain and Great Basin Flooded & Swamp Forest (M034)
Group	Rocky Mountain & Great Basin Montane Riparian Forest Group (G506)
Association	*Populus angustifolia* / *Salix exigua* Forest

DISTRIBUTION

Pecos National Historic Park

This association is known from the Pecos River and Glorieta Creek riparian corridors in the Main Unit and Pigeon's Ranch Subunit (Glorieta unit).

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park

This association occurs from 2,040 to 2,210 m (6,700 to 7,260 ft) in floodplain alluvial terraces and river bars. The ground surface is characterized mostly by abundant grass cover plus leaf litter and woody debris; out on river bars there can be significant exposed bare soil and gravel.

VEGETATION DESCRIPTION

Pecos National Historic Park

This riparian woodland is characterized by an open to closed (40 to 80% cover) tree canopy dominated by *Populus angustifolia*. The understory is shrubby and dominated by *Salix exigua* and/or *Salix irrorata.* The herbaceous layer is characteristically grassy (30 to 60% cover) and dominated by the introduced species such as *Poa pratensis, Festuca arundinacea,* and *Bromus inermis*. Forbs, while well represented, are variable in composition with both natives and exotics. Among the 44 species reported, *Melilotus officinalis* and *Geranium caespitosum* were the most frequent.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Populus angustifolia*
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Salix exigua*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park

Obligate wetland (OBL) indicator species: *Salix exigua, Juncus arcticus* var. *balticus, Typha latifolia, Schoenoplectus pungens, Conium maculatum*

Facultative wetland (FACW) indicator species: *Agrostis gigantea, Salix irrorata, Populus angustifolia, Elaeagnus angustifolia, Equisetum arvense, Salix amygdaloides, Rumex crispus*

New Mexico state-listed noxious weeds: (Class C) *Elaeagnus angustifolia*

CLASSIFICATION COMMENTS

Pecos National Historic Park

Data are not available.

CLASSIFICATION CONFIDENCE: 1

ELEMENT SOURCES

Pecos National Historic Park

Inventory Notes: Data are not available.

Pecos National Historic Park: NHNM plots 06PP034, 06PP044, 91EM021, 91EM017.

Local Description Authors: A. Fettes

2. Shrubland & Grassland (Mesomorphic Shrub & Herb Vegetation)

2.C. Temperate & Boreal Shrubland & Grassland

2.C.1. Temperate Grassland, Meadow & Shrubland

2.C.1.b. Great Plains Grassland & Shrubland

M053. Great Plains Shortgrass Prairie & Shrubland

G144. Great Plains Shortgrass Prairie Group

Artemisia frigida / *Bouteloua gracilis* Dwarf-shrubland [Provisional]

Fringed Sagewort / Blue Grama Grassland
Identifier: CEGL002782

NVC CLASSIFICATION

Division	Great Plains Grassland & Shrubland (2.C.1.Nb)
Macrogroup	Great Plains Shortgrass Prairie & Shrubland (M053)
Group	Great Plains Shortgrass Prairie Group (G144)
Association	*Artemisia frigida* / *Bouteloua gracilis* Dwarf-shrubland

DISTRIBUTION

Pecos National Historic Park

This common association is known from the western side of the main park unit and from the Pigeon's Ranch Subunit (Glorieta Unit).

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park

This grassland association occurs from 2,135 to 2,190 m (7,000 to 7,180 ft) in elevation on rolling, mesa-like plains with gentle slopes
(3 to 5%). Soils are derived from limestone or sandstone. The ground surface is characterized mostly by abundant grass cover (50% on average), leaf litter (7.5%), and bare soil and gravel (40%).

VEGETATION DESCRIPTION

Pecos National Historic Park

This grassland is dominated by the short grass *Bouteloua gracilis* with the dwarf-shrub *Artemisia frigida* as common to well-represented along with *Gutierrezia sarothrae*. Overall grass cover is abundant and can be as high as 50%. *Lycurus setosus, Muhlenbergia torreyi,* and *Elymus elymoides* are common graminoid associates. Forbs are well represented, but are variable in composition. *Thelesperma longipes*, *Artemisia carruthii*, *Hymenoxys richardsonii*, and *Penstemon jamesii* are the most frequent species. Trees and tall shrubs are generally scarce or absent, however, scattered individuals of *Juniperus monosperma* and *Pinus edulis* may be present.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Shrub/Sapling (tall & short)	Dwarf-shrub	*Artemisia frigida*
Herb (field)	Graminoid	*Bouteloua gracilis*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park

Data are not available.

CONSERVATION STATUS RANK

Global Rank & Reasons:

CLASSIFICATION COMMENTS

Pecos National Historic Park

Stands on PECO are typically treated pinyon-juniper woodlands.

CLASSIFICATION CONFIDENCE: 2

ELEMENT SOURCES
Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 06PP033, 06PP006.
Local Description Authors: A. Fettes

Bouteloua gracilis - Bouteloua curtipendula Herbaceous Vegetation

Blue Grama - Sideoats Grama Grassland
Identifier: CEGL001754

NVC CLASSIFICATION

Division	Great Plains Grassland & Shrubland (2.C.1.Nb)
Macrogroup	Great Plains Shortgrass Prairie & Shrubland (M053)
Group	Great Plains Shortgrass Prairie Group (G144)
Association	*Bouteloua gracilis - Bouteloua curtipendula* Herbaceous Vegetation

DISTRIBUTION

Pecos National Historic Park
This association is common west of the Pecos River in the main park unit.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park
This association occurs at around 2,100 to 2,110 m (6,890 to 6,930 ft) on rolling, mesa-like plains with gentle slopes (3 to 5%). Soils are derived from limestone or sandstone. The ground surface is characterized mostly by abundant grass cover (55% on average), leaf litter and woody debris (5%), and bare soil and gravel (40%).

VEGETATION DESCRIPTION

Pecos National Historic Park
This grassland is characterized by abundant *Bouteloua gracilis* with *Bouteloua curtipendula* the co-dominant. *Elymus elymoides, Aristida purpurea*, and *Bouteloua hirsuta* may be common associates with total graminoid cover often exceeding 40%. Forbs, while abundant, vary in composition and cover. Of the 39 species reported, *Heterotheca villosa, Erigeron flagellaris, Dalea candida*, and *Chamaesyce fendleri* are the most frequent and abundant representatives.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Bouteloua gracilis* , *Bouteloua curtipendula*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park
Data are not available.

CLASSIFICATION COMMENTS

Pecos National Historic Park
Stands on PECO are typically treated pinyon-juniper woodlands.

CLASSIFICATION CONFIDENCE: 1

ELEMENT SOURCES

Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 07PP051, 05PP038, 07PP043.
Local Description Authors: A. Fettes; E. H. Muldavin

Bouteloua gracilis - Muhlenbergia torreyi - Aristida purpurea Herbaceous Vegetation
Blue Grama – Ring Muhly – Purple Threeawn Grassland
Identifier: CEGL005389

NVC CLASSIFICATION

Division	Great Plains Grassland & Shrubland (2.C.1.Nb)
Macrogroup	Great Plains Shortgrass Prairie & Shrubland (M053)
Group	Great Plains Shortgrass Prairie Group (G144)
Association	*Bouteloua gracilis* -/ *Muhlenbergia torreyi* - *Aristida purpurea* Herbaceous Vegetation

DISTRIBUTION

Pecos National Historic Park
This association is known throughout areas west of the Pecos River and select locations southeast of the Pecos River in the main park unit.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park
This association occurs from 2,075 to 2,150 m (6,810 to 7,060 ft) in elevation on rolling, mesa-like plains with gentle slopes
(3 to 5%). Soils are derived from limestone or mixed alluvium. The ground surface is characterized mostly by abundant grass cover (50% on average), leaf litter and woody debris (15%), and bare soil with scattered gravel and rock (35%).

VEGETATION DESCRIPTION

Pecos National Historic Park
This grassland is characterized by abundant to luxuriant *Bouteloua gracilis* with *Muhlenbergia torreyi* as a common to well represented associate. *Bouteloua curtipendula*, *Elymus elymoides*, *Aristida purpurea*, and *Lycurus setosus* may all be common associates, with total graminoid cover often exceeding 50%. Forbs, while well represented, vary in composition and cover. Of the 51 species reported, *Chaetopappa ericoides, Sphaeralcea coccinea, Gaura coccinea, Hymenoxys richardsonii, Xanthisma spinulosum, Erigeron divergens, Plantago patagonica, Hymenopappus filifolius* var. *cinereus*, and *Glandularia bipinnatifida* are the most frequent and abundant representatives.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Bouteloua gracilis*
		Muhlenbergia torreyi

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park
Data are not available.

CLASSIFICATION COMMENTS

Pecos National Historic Park
Stands on PECO are typically treated pinyon-juniper woodlands.

CLASSIFICATION CONFIDENCE: 2

ELEMENT SOURCES

Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 05PP004, 06PP028, 05PP021, 06PP003, 06PP009, 05PP033, 91EM012.
Local Description Authors: A. Fettes; E. H. Muldavin

Pascopyrum smithii - Bouteloua gracilis Herbaceous Vegetation

Western Wheatgrass - Blue Grama Grassland
Identifier: CEGL001578

NVC CLASSIFICATION

Division	Great Plains Grassland & Shrubland (2.C.1.Nb)
Macrogroup	Great Plains Shortgrass Prairie & Shrubland (M053)
Group	Great Plains Shortgrass Prairie Group (G144)
Association	*Pascopyrum smithii - Bouteloua gracilis* Herbaceous Vegetation

DISTRIBUTION

Pecos National Historic Park
This association is known from the Pecos River corridor and western portion of the main park unit.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park
This association occurs from 2,055 to 2,115 m (6,750 to 6,940 ft) in elevation in swales or depressions within the mesa-like plains or on river terraces along the Pecos River. Soils are derived from limestone or mixed alluvium. The ground surface is characterized mostly by abundant grass cover (75% on average), leaf litter and woody debris (10%), and bare soil and gravel (15%).

VEGETATION DESCRIPTION

Pecos National Historic Park
This southwest plains grassland is dominated by *Pascopyrum smithii* and *Bouteloua gracilis*. Overall grass cover is luxuriant and can be as high as 80%. *Elymus elymoides, Glandularia bipinnatifida,* and *Achnatherum robustum* may be other common graminoids associates. Forbs, while well represented, vary in composition and cover. Of the 46 species recorded in this association,
Ratibida tagetes, Glandularia bipinnatifida, Tragopogon pratensis, Gaura coccinea, and *Lithospermum multiflorum* are the most frequent and abundant. Generally shrubs and dwarf-shrubs are poorly represented; however, scattered individuals of *Gutierrezia sarothrae* may be common.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Bouteloua gracilis, Pascopyrum smithii*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park
Facultative wetland (FACW) indicator species: *Iris missouriensis*
New Mexico state-listed noxious weeds: (Class A) *Onopordum acanthium*; (Class C) *Bromus tectorum*

CLASSIFICATION COMMENTS

Pecos National Historic Park
Stands on PECO are typically treated pinyon-juniper woodlands.

CLASSIFICATION CONFIDENCE: 1

ELEMENT SOURCES

Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 06PP029, 05PP019, 07PP004, 07PP020, 07PP013.
Local Description Authors: A. Fettes; E. H. Muldavin

GSW7. Southwest Plains-Mesa Ruderal Shrubland & Grassland [Provisional]

Bouteloua gracilis / Old Field Herbaceous Vegetation
Blue Grama – Old Agricultural Field Grassland
Identifier: NPS_NM042

NVC CLASSIFICATION

Division	Great Plains Grassland & Shrubland (2.C.1.Nb)
Macrogroup	Great Plains Shortgrass Prairie & Shrubland (M053)
Group	Southwest Plains-Mesa Ruderal Shrubland & Grassland (GSW7)
Association	*Bouteloua gracilis* / Old Field Herbaceous Vegetation

DISTRIBUTION
Pecos National Historic Park
This association is known from the Pecos River corridor and in the western portion of the main park unit.

ENVIRONMENTAL DESCRIPTION
Pecos National Historic Park
This grassland association occurs from 2,065 to 2,075 m (6,780 to 6,800 ft) in elevation on rolling, mesa-like plains that have been cultivated in the past. Soils are derived from limestone or mixed alluvium. The ground surface is characterized mostly by abundant grass cover (55% on average), some leaf litter and woody debris (3%), and extensive bare soil and gravel (40%).

VEGETATION DESCRIPTION
Pecos National Historic Park
This grassland is dominated by the short grass *Bouteloua gracilis* with the introduced cool-season grass *Psathyrostachys juncea* abundant throughout. While total grass cover can be as high as 70%, all other species (including shrubs, dwarf shrubs, and forbs) are scattered or accidental and seldom exceed1% cover.

MOST ABUNDANT SPECIES
Pecos National Historic Park

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Bouteloua gracilis*
		Psathyrostachys juncea

OTHER NOTEWORTHY SPECIES
Pecos National Historic Park
Data are not available.

CLASSIFICATION COMMENTS
Pecos National Historic Park

Stands on PECO may also be treated pinyon-juniper woodlands.

CLASSIFICATION CONFIDENCE:

ELEMENT SOURCES
Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 05PP034, 05PP029, 07PP056.
Local Description Authors: A. Fettes; E. H. Muldavin

Bouteloua gracilis / Ruderal Herbaceous Vegetation

Blue Grama / Weedy Herbaceous Vegetation Grassland
Identifier: NPS_NM043

NVC CLASSIFICATION

Division	Great Plains Grassland & Shrubland (2.C.1.Nb)
Macrogroup	Great Plains Shortgrass Prairie & Shrubland (M053)
Group	Southwest Plains-Mesa Ruderal Shrubland & Grassland (GSW7)
Association	*Bouteloua gracilis* / Ruderal Herbaceous Vegetation

DISTRIBUTION

Pecos National Historic Park
This association is common in the Pecos River corridor and in the western portion of the main park unit (including areas around the Pueblo Ruins).

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park
This grassland association occurs from 2,060 to 2,085 m (6,760 to 6,840 ft) in elevation on rolling, mesa-like plains with gentle slopes (3 to 10 %). Soils are derived from limestone or mixed alluvium. The ground surface is characterized mostly by abundant grass cover (75% on average), some leaf litter and woody debris (5%), and exposed bare soil and gravel (20%).

VEGETATION DESCRIPTION

Pecos National Historic Park
This grassland is dominated by *Bouteloua gracilis* and ruderal forbs that are common to abundant. Total graminoid cover can reach 50% with *Elymus elymoides* and *Pleuraphis jamesii* as common associates. Forbs are largely represented by annual and biennial ruderal (weedy) species with total cover at 30% or more. Of the 46 forbs reported, *Glandularia bipinnatifida*, *Onopordum acanthium*, *Lappula occidentalis*, *Monarda pectinata*, *Tragopogon pratensis,* and *Lactuca serriola* are the most frequent and generally the most abundant. *Kochia scoparia* was also reported in one stand at 85% cover.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Bouteloua gracilis*
Herb (field)	Forb	*Kochia scoparia*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park
New Mexico state-listed noxious weeds: (Class A) *Onopordum acanthium*

CLASSIFICATION COMMENTS

Pecos National Historic Park
Stands on PECO are typically treated pinyon-juniper woodlands.

CLASSIFICATION CONFIDENCE:

ELEMENT SOURCES

Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 07PP045, 07PP019, 07PP010, and 07PP006.
Local Description Authors: A. Fettes; E. H. Muldavin

Pascopyrum smithii / Ruderal Herbaceous Vegetation

Western Wheatgrass / Weedy Herbaceous Vegetation Grassland
Identifier: NPS_NM045

NVC CLASSIFICATION

Division	Great Plains Grassland & Shrubland (2.C.1.Nb)
Macrogroup	Great Plains Shortgrass Prairie & Shrubland (M053)
Group	Southwest Plains-Mesa Ruderal Shrubland & Grassland (GSW7)
Association	*Pascopyrum smithii* / Ruderal Herbaceous Vegetation

DISTRIBUTION

Pecos National Historic Park
This association is known from the western portion of the main park unit, particularly areas around the Pueblo Ruins near the Visitors Center in the main unit.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park
This association occurs at around 2,115 m (6,940 ft) over disturbed/unexcavated mounds of the Pueblo site and other disturbed low-lying sites on the mesa-top. Soils are derived from limestone or mixed alluvium. The ground surface is characterized mostly by abundant grass cover (60% on average), some leaf litter and woody debris (15%), and extensive exposed bare soil and gravel (25%).

VEGETATION DESCRIPTION

Pecos National Historic Park
This weedy herbaceous vegetation/grassland association is characterized by a mix of graminoids (*Pascopyrum smithii, Bouteloua gracilis,* and *Psathyrostachys juncea*) and the annual and introduced forbs, particularly *Kochia scoparia* along with *Lactuca serriola*
Sphaeralcea coccinea, Picradeniopsis oppositifolia, Ratibida tagetes, Asclepias subverticillata, Helianthus annuus, Melilotus officinalis, Polygonum douglasii, Tragopogon pratensis, Grindelia squarrosa, and *Euphorbia davidii.*

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Pascopyrum smithii*
Herb (field)	Forb	*Kochia scoparia*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park
Data are not available.

CLASSIFICATION COMMENTS

Pecos National Historic Park

CLASSIFICATION CONFIDENCE:

ELEMENT SOURCES

Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 05PP017, and 05PP031.
Local Description Authors: A. Fettes; E. H. Muldavin

Psathyrostachys juncea / Monotypic Herbaceous Vegetation

Russian Wildrye / Monotypic Stand Grassland
Identifier: NHNM000236

NVC CLASSIFICATION

Division	Great Plains Grassland & Shrubland (2.C.1.Nb)
Macrogroup	Great Plains Shortgrass Prairie & Shrubland (M053)
Group	Southwest Plains-Mesa Ruderal Shrubland & Grassland (GSW7)
Association	*Psathyrostachys juncea* / Monotypic Herbaceous Vegetation

DISTRIBUTION

Pecos National Historic Park
This association occurs near the Visitors Center in the main park unit.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park
This exotic grassland association is known from a single occurrence at 2,090 m (6,860 ft) in elevation in a depressional area on a rolling, mesa-like plain. Soils are derived from mixed alluvium. The ground surface is characterized mostly by abundant forb and grass cover (80% on average), some leaf litter and woody debris (5%), and extensive exposed bare soil and gravel (15%).

VEGETATION DESCRIPTION

Pecos National Historic Park
This grassland association is characterized by monotypic stands of the introduced, cool-season grass *Psathyrostachys juncea* with no other representative greater than 0.5% cover. Total cover can be as high as 80%.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Psathyrostachys juncea*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park
Data are not available.

CLASSIFICATION COMMENTS

Pecos National Historic Park
Data are not available.

CLASSIFICATION CONFIDENCE: 3

ELEMENT SOURCES

Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 05PP018.
Local Description Authors: A. Fettes; E. H. Muldavin

Ruderal Disturbance Vegetation
Weedy Disturbance Vegetation
Identifier: NPS_NM027

NVC CLASSIFICATION

Division	Great Plains Grassland & Shrubland (2.C.1.Nb)
Macrogroup	Great Plains Shortgrass Prairie & Shrubland (M053)
Group	Southwest Plains-Mesa Ruderal Shrubland & Grassland (GSW7)
Association	Ruderal Disturbance Vegetation

DISTRIBUTION

Pecos National Historic Park
This association is known from the western portion of the main park unit and from the Pigeon's Ranch and Cañoncito Subunits (Glorieta unit).

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park
This ruderal association occurs from around 2,070 to 2,200 m (6,790 to 7,240 ft) in elevation in open sites where soils have been significantly disturbed by human activities. The ground surface is characterized mostly by abundant forb cover (40% on average), leaf litter and woody debris (20%), and extensive exposed bare soil and gravel (40%).

VEGETATION DESCRIPTION

Pecos National Historic Park
This ruderal herbaceous association is dominated by an abundance of exotic and weedy/invasive species such as *Bromus tectorum*, *Chorispora tenella*, and *Kochia scoparia*. Native disturbance-related grasses and forbs may be common but are clearly subordinate to the introduced species.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Bromus tectorum*
Herb (field)	Forb	*Chorispora tenella, Kochia scoparia*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park
New Mexico state-listed noxious weeds: (Class C) *Bromus tectorum*

CLASSIFICATION COMMENTS

Pecos National Historic Park
Data are not available.

CLASSIFICATION CONFIDENCE: 3

ELEMENT SOURCES

Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 06PP040, 07PP023.
Local Description Authors: A. Fettes

2.C.5. Temperate & Boreal Freshwater Wet Meadow & Marsh

2.C.5.b. Western North American Freshwater Wet Meadow & Marsh

M073. Western North American Lowland Freshwater Wet Meadow, Marsh & Shrubland

G526. Rocky Mountain & Great Basin Lowland & Foothill Riparian & Seep Shrubland Group

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Salix exigua - Ericameria nauseosus Shrubland

Coyote Willow - Rubber Rabbitbrush Shrubland
Identifier: NHNM000773

NVC CLASSIFICATION

Division	Western North American Freshwater Wet Meadow & Marsh (2.C.5.Nb)
Macrogroup	Western North American Lowland Freshwater Wet Meadow, Marsh & Shrubland (M073)
Group	Rocky Mountain & Great Basin Lowland & Foothill Riparian & Seep Shrubland Group (G526)
Association	*Salix exigua - Ericameria nauseosa* Shrubland

DISTRIBUTION

Pecos National Historic Park
This association is known from the Pecos River riparian corridor in the main park unit.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park
This association is known from a stand that occurs at around 2,055 m (6,750 ft) in elevation on a floodplain point bar adjacent to the Pecos River. The site is likely flooded during spring runoff on at least a ten-year basis. (Muldavin1991and Muldavin et al 2000))

VEGETATION DESCRIPTION

Pecos National Historic Park
This wetland is characterized by stands dominated by the obligate wetland shrub *Salix exigua* along with *Ericameria nauseosa*, which is a species common both in uplands and along ephemeral dry washes as well as riparian zones. *Populus angustifolia* regeneration is present. Although found adjacent to the river, the herbaceous layer is largely dominated by upland species such as *Heterotheca fulcrata* and *Bouteloua gracilis*.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Salix exigua*
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Ericameria nauseosa*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park
Obligate wetland (OBL) indicator species: *Salix exigua*
Facultative wetland (FACW) indicator species: *Populus angustifolia*

CLASSIFICATION COMMENTS

Pecos National Historic Park
Data are not available.

CLASSIFICATION CONFIDENCE: 2

ELEMENT SOURCES

Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plot 91EM019.
Local Description Authors: A. Fettes; E. H. Muldavin

Salix exigua / *Eleocharis palustris* Shrubland
Coyote Willow / Common Spikerush Shrubland
Identifier: NHNM000779

NVC CLASSIFICATION

Division	Western North American Freshwater Wet Meadow & Marsh (2.C.5.Nb)
Macrogroup	Western North American Lowland Freshwater Wet Meadow, Marsh & Shrubland (M073)
Group	Rocky Mountain & Great Basin Lowland & Foothill Riparian & Seep Shrubland Group (G526)
Association	*Salix exigua* / *Eleocharis palustris* Shrubland

DISTRIBUTION

Pecos National Historic Park
This association is known from the Pecos River riparian corridor in the main park unit.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park
This wetland association occurs at around 2,050 m (6,720 ft) elevation on a floodplain point bar adjacent to the Pecos River. The site is likely flooded during spring runoff on at least a five-year basis. The ground surface is characterized mostly by abundant forb and graminoid cover (>82% on average) with the remainder composed of exposed bare soil, gravel, and rock (18% %).

VEGETATION DESCRIPTION

Pecos National Historic Park
This shrub wetland is characterized by open canopies (average 15% cover) of the obligate wetland indicator *Salix exigua* along with other scattered riparian trees and shrubs (e.g., *Salix amygdaloides, Alnus incana* ssp. *tenuifolia,* and *Populus angustifolia*). The undergrowth is dominated by the native and obligate wetland indicator *Eleocharis palustris* but exotic graminoids such as *Agrostis gigantea,* and *Festuca arundinacea* are well represented (along with the invasive *Phalaris arundinacea*). Total forb and graminoid cover reaches 85%. Several other native wetland indicators are present such as such as *Juncus arcticus* var. *balticus, Carex hystericina, Carex stipata, Carex pellita, Equisetum laevigatum, E. arvense, Mentha arvensis, Ranunculus macounii,* and *Ranunculus cymbalaria*.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	***Salix exigua***
Herb (field)	Graminoid	*Eleocharis palustris*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park
Obligate wetland (OBL) indicator species: *Eleocharis palustris, Salix exigua, Juncus arcticus* var. *balticus, Argentina anserine, Carex hystericina, Phalaris arundinacea, Schoenoplectus acutus, Schoenoplectus pungens, Glyceria grandis, Carex stipata, Carex pellita, Juncus articulatus, Nasturtium officinale, Cicuta maculata, Ranunculus cymbalaria, Persicaria lapathifolia*
New Mexico state-listed noxious weeds: (Class A) *Leucanthemum vulgare*, *Onopordum acanthium*; (Class C) *Bromus tectorum*

CLASSIFICATION COMMENTS

Pecos National Historic Park
Data are not available.

CLASSIFICATION CONFIDENCE: 2

ELEMENT SOURCES

Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plot 06PP056.
Local Description Authors: A. Fettes; E.H. Muldavin

Salix exigua / Invasive Perennial Grasses Semi-natural Shrubland

Coyote Willow / Invasive Perennial Grasses Semi-natural Shrubland
Identifier: NHNM000856

NVC CLASSIFICATION

Division	Western North American Freshwater Wet Meadow & Marsh (2.C.5.Nb)
Macrogroup	Western North American Lowland Freshwater Wet Meadow, Marsh & Shrubland (M073)
Group	Rocky Mountain & Great Basin Lowland & Foothill Riparian & Seep Shrubland (G526)
Association	*Salix exigua* / Invasive Perennial Grasses Semi-natural Shrubland

DISTRIBUTION

Pecos National Historic Park
This association is known from the Pecos River and Glorieta Creeks riparian corridors of the Main Unit.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park
This wetland association occurs from 2,040 to 2,065 m (6,700 to 6,780 ft) in floodplain back channels, seeps, and on point bars adjacent to stream and river channels. Sites are likely flooded during spring runoff on at least a five-year basis. The ground surface is characterized mostly by a mix of herbaceous cover (50% on average) and leaf and woody debris (25%) with the remainder composed of exposed bare soil, gravel, and rock (25%).

VEGETATION DESCRIPTION

Pecos National Historic Park
This shrub wetland is characterized by open to closed canopies (30 - 90% cover) of the obligate wetland indicator *Salix exigua* along with other scattered riparian trees and shrubs (e.g., *Salix amygdaloides, Alnus incana* ssp. *tenuifolia*, and *Populus angustifolia*).
The undergrowth is dominated by exotic graminoids that include *Bromus inermis, Poa pratensis, Agrostis gigantea,* and *Festuca arundinacea,* and the potentially invasive *Phalaris arundinacea*. Total graminoid can reach 80%. While exotic dominated, native wetland obligates such as *Equisetum laevigatum*, *E. arvense*, and *Juncus arcticus* var. *balticus* may be present in low amounts.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Salix exigua*
Herb (field)	Graminoid	*Bromus inermis*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park
Obligate wetland (OBL) indicator species: *Salix exigua, Juncus arcticus* var. *balticus, Carex hystericina, Phalaris arundinacea, Sisyrinchium demissum*
Facultative wetland (FACW) indicator species: *Salix irrorata, Populus angustifolia, Populus x acuminata, Equisetum arvense, Mentha arvensis, Plantago major, Salix amygdaloides, Equisetum laevigatum*
New Mexico state-listed noxious weeds: (Class A) *Leucanthemum vulgare*; (Class B) *Dipsacus fullonum*; (Class C) *Cirsium vulgare*

CLASSIFICATION COMMENTS

Pecos National Historic Park
Data are not available.

CLASSIFICATION CONFIDENCE: 3

ELEMENT SOURCES

Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 91EM006, 11EM234, 91EM022, 97RW003, 07PP014, 91EM015, 91EM027, 07PP002, 06PP038, and 91EM011
Local Description Authors: A. Fettes; E. H. Muldavin

Salix exigua / *Juncus arcticus* Shrubland

Coyote Willow / Arctic Rush Shrubland
Identifier: NHNMNew7

NVC CLASSIFICATION

Division	Western North American Freshwater Wet Meadow & Marsh (2.C.5.Nb)
Macrogroup	Western North American Lowland Freshwater Wet Meadow, Marsh & Shrubland (M073)
Group	Rocky Mountain & Great Basin Lowland & Foothill Riparian & Seep Shrubland Group (G526)
Association	*Salix exigua* / *Juncus arcticus* Shrubland

DISTRIBUTION

Pecos National Historic Park
This association is known from the Pecos River and Glorieta Creek riparian corridors in the main park unit.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park
This association occurs from 2,040 to 2,170 m (6,700 to 6,920 ft) in floodplain back channels, seeps, and on point bars adjacent to stream and river channels. Sites are likely flooded during spring runoff on at least a five-year basis. The ground surface is characterized mostly by a mix of herbaceous cover (45% on average) and leaf and woody debris (20%) with the remainder composed of exposed bare soil, gravel, and rock (35%).

VEGETATION DESCRIPTION

Pecos National Historic Park
This shrub wetland is characterized by open canopies (average 15% cover) of the obligate wetland indicator *Salix exigua* along with other scattered riparian trees and shrubs (e.g., *Salix amygdaloides, Alnus incana* ssp. *tenuifolia*, and *Populus angustifolia*). The
undergrowth is dominated by the native and obligate wetland indicator *Juncus arcticus* var. *balticus* along with 17 other native obligate and facultative wetland species (e.g. *Eleocharis palustris, Carex hystericina, Juncus articulates,* and *Carex vulpinoidea*). Exotics grasses such as *Agrostis gigantea* and *Festuca arundinacea* can also be prevalent , but not dominant. Overall, grasses and forbs can be quite luxuriant and reach as high as 75% total cover, with 26 graminoid and 47 forb species recorded for this association.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Salix exigua*
Herb (field)	Graminoid	*Juncus arcticus* var. *balticus*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park
Obligate wetland (OBL) indicator species: *Juncus arcticus* var. *balticus, Salix exigua, Eleocharis palustris, Sisyrinchium demissum, Schoenoplectus pungens, Schoenoplectus acutus, Muhlenbergia asperifolia, Typha latifolia, Ranunculus cymbalaria, Cicuta maculate, Phalaris arundinacea, Juncus articulatus, Eleocharis parishii, Argentina anserina, Carex vulpinoidea, Typha domingensis, Carex hystericina*
New Mexico state-listed noxious weeds: (Class A) *Cirsium arvense,* (Class C) *Ulmus pumila*

CLASSIFICATION COMMENTS

Pecos National Historic Park
Data are not available.

CLASSIFICATION CONFIDENCE: 2

ELEMENT SOURCES

Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 06PP045, 06PP051, 07PP016, 06PP054, 91EM020, 91EM026.
Local Description Authors: A. Fettes

Salix irrorata / *Festuca arundinaceae* Shrubland

Bluestem Willow / Tall Fescue Shrubland
Identifier: NHNM000789

NVC CLASSIFICATION

Division	Western North American Freshwater Wet Meadow & Marsh (2.C.5.Nb)
Macrogroup	Western North American Lowland Freshwater Wet Meadow, Marsh & Shrubland (M073)
Group	Rocky Mountain & Great Basin Lowland & Foothill Riparian & Seep Shrubland Group (G526)
Association	*Salix irrorata* / *Festuca arundinaceae* Shrubland

DISTRIBUTION

Pecos National Historic Park
This association is known from the Glorieta Creek riparian corridor in the main park unit.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park
This association is known from around 2,110 m (6,920 ft) on floodplain point bars adjacent to Glorieta Creek. Sites are likely flooded during spring runoff on at least a five-year basis. The ground surface is characterized mostly by a mix of herbaceous cover (40% on average) and leaf and woody debris (35%), with the remainder composed of exposed bare soil, gravel, and rock (25%).

VEGETATION DESCRIPTION

Pecos National Historic Park
This shrub wetland is characterized by a dense, luxuriant cover of *Salix irrorata*. *Salix exigua, Ericameria nauseosa*, and shrub-statured *Juniperus scopulorum* may be common associates. Total shrub canopy cover may be as high as 70%. Graminoids are abundant and dominated by the introduced cool-season grasses *Festuca arundinaceae* and *Bromus inermis*, but native grasses such as *Elymus Canadensis, E. trachycaulus* ssp. *trachycaulus,* and *Pascopyrum smithii* may be well-represented. Forbs are variable in composition and low in cover; *Geranium caespitosum* was common, but other species were less than 0.5% individual cover.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Salix irrorata*
Herb (field)	Graminoid	*Festuca arundinaceae, Elymus canadensis*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park
Obligate wetland (OBL) indicator species: *Juncus arcticus* var. *balticus, Salix exigua*
Facultative wetland (FACW) indicator species: *Salix irrorata, Rumex crispus*

CLASSIFICATION COMMENTS

Pecos National Historic Park
Data are not available.
CLASSIFICATION CONFIDENCE: 3

ELEMENT SOURCES

Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 06PP043.
Local Description Authors: A. Fettes; E. H. Muldavin

G518. Western North American Temperate Interior Freshwater Marsh Group

Juncus arcticus / *Typha latifolia* Herbaceous Vegetation
Arctic Rush / Broadleaf Cattail Herbaceous Vegetation
Identifier: NHNM000186

NVC CLASSIFICATION

Division	Western North American Freshwater Wet Meadow & Marsh (2.C.5.Nb)
Macrogroup	Western North American Lowland Freshwater Wet Meadow, Marsh & Shrubland (M073)
Group	Western North American Temperate Interior Freshwater Marsh Group (G518)
Association	*Juncus arcticus* / *Typha latifolia* Herbaceous Vegetation

DISTRIBUTION
Pecos National Historic Park
This association is known from floodplain areas along the Glorieta Creek corridor in the main park unit.

ENVIRONMENTAL DESCRIPTION
Pecos National Historic Park
This wetland association occurs at around 2,065 m (6,780 ft) in elevation adjacent to and within the Glorieta Creek channel. Sites are likely ponded or flooded during spring runoff on an annual basis. The ground surface is dominated by herbaceous cover (85% on average) and leaf and woody debris (5%) with the remainder composed of exposed bare soil, gravel, and rock (10%).

VEGETATION DESCRIPTION
Pecos National Historic Park
This herbaceous wetland association is dominated by *Juncus arcticus* var. *balticus* and *Typha latifolia* with exotic grasses such *Festuca arundinacea* and *Agrostis gigantea* well represented to abundant. Total herbaceous cover can be as high as 85%. Native obligate wetland species such as *Equisetum laevigatum*, *Carex nebrascensis*, *Eleocharis palustris*, and *Schoenoplectus pungens* may also be common. Scattered regeneration of *Populus angustifolia* along with *Salix exigua*, and *Salix irrorata* shrubs may be present.

MOST ABUNDANT SPECIES
Pecos National Historic Park

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Juncus arcticus* var. *balticus* *Festuca arundinacea*
Herb (field)	Forb	*Typha latifolia, Equisetum laevigatum*

OTHER NOTEWORTHY SPECIES
Pecos National Historic Park
Obligate wetland (OBL) indicator species: *Juncus arcticus* var. *balticus, Typha latifolia, Salix exigua, Eleocharis palustris, Carex nebrascensis, Schoenoplectus pungens*
Facultative wetland (FACW) indicator species: *Agrostis gigantean, Salix irrorata, Populus angustifolia, Equisetum arvense, Rumex crispus, Juncus longistylis, Plantago major, Equisetum laevigatum, Epilobium* spp.

CLASSIFICATION COMMENTS
Pecos National Historic Park
Data are not available.

CLASSIFICATION CONFIDENCE: 3

ELEMENT SOURCES
Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 06PP047.
Local Description Authors: A. Fettes; E. H. Muldavin

Typha (*latifolia, angustifolia*) Western Herbaceous Vegetation
Cattail / Monotypic Herbaceous Vegetation
Identifier: CEGL002010

NVC CLASSIFICATION

Division	Western North American Freshwater Wet Meadow & Marsh (2.C.5.Nb)
Macrogroup	Western North American Lowland Freshwater Wet Meadow, Marsh & Shrubland (M073)
Group	Western North American Temperate Interior Freshwater Marsh Group (G518)
Association	*Typha* (*latifolia, angustifolia*) Western Herbaceous Vegetation

DISTRIBUTION

Pecos National Historic Park

This association occurs in floodplain areas along the Glorieta Creek and Pecos River riparian corridors in the main park unit.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park

This wetland association occurs at around 2,050 m (6,720 ft) in elevation adjacent to and within the river and creek channels. Sites are likely ponded or flooded during spring runoff on an annual basis. The ground surface is dominated by herbaceous cover (30% on average) and leaf and woody debris (30%), with the remainder composed of exposed bare soil, gravel, and rock (40%).

VEGETATION DESCRIPTION

Pecos National Historic Park

This emergent wetland association is dominated by tall, open to dense stands of *Typha latifolia*. Additional native obligate wetland indicator species such as *Eleocharis* spp., *Juncus arcticus* var. *balticus, Carex nebrascensis, and Equisetum arvense* may be common to abundant associates. Total herbaceous cover often exceeds 50%. Trees and shrubs are generally absent; however, *Salix amygdaloides* and *S. exigua* can occur on the edges of this association.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Herb (field)	Forb	*Typha latifolia*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park

Obligate wetland (OBL) indicator species: *Typha latifolia, Juncus arcticus* var. *balticus, Carex nebrascensis, Salix exigua, Schoenoplectus pungens*

Facultative wetland (FACW) indicator species: *Equisetum arvense, Salix amygdaloides, Salix irrorata*

CLASSIFICATION COMMENTS

Pecos National Historic Park

CLASSIFICATION CONFIDENCE: 2

ELEMENT SOURCES

Pecos National Historic Park

Inventory Notes: Data are not available.

Pecos National Historic Park: NHNM plots 06PP048, 91EM016, and 97RW005

Local Description Authors: A. Fettes; E. H. Muldavin

M075. Western North American Montane Wet Meadow & Low Shrubland

G504. Rocky Mountain & Great Basin Montane Alder & Birch Riparian Shrubland Group

Alnus incana ssp. *tenuifolia* - *Salix amygdaloides* Shrubland

Thinleaf Alder – Peachleaf Willow Shrubland
Identifier: NHNM000323

NVC CLASSIFICATION

Division	Western North American Freshwater Wet Meadow & Marsh (2.C.5.Nb)
Macrogroup	Western North American Montane Wet Meadow & Low Shrubland (M075)
Group	Rocky Mountain & Great Basin Montane Alder & Birch Riparian Shrubland Group (G504)
Association	*Alnus incana* ssp. *tenuifolia* - *Salix amygdaloides* Shrubland

DISTRIBUTION

Pecos National Historic Park
This association is known from areas along the Pecos River riparian corridor in the main park unit.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park
This association occurs from 2,040 to 2,045 m (6,700 to 6,710 ft) in elevation on floodplain point bars adjacent to the Pecos River. Sites are likely flooded during spring runoff on an annual basis. The ground surface is characterized mostly by abundant forb and graminoid cover (>60% on average), with the remainder composed of exposed bare soil, gravel, and rock (40%).

VEGETATION DESCRIPTION

Pecos National Historic Park
This shrub wetland is characterized by a dense canopy of tall shrubs or small trees of *Alnus incana* ssp. *tenuifolia* and *Salix amygdaloides*. *Salix exigua, S. irrorata,* and *S. ligulifolia* are occasionally intermixed in the diverse shrub canopy, which can reach 70% total cover. The herbaceous layer is dominated by exotic grasses including *Festuca arundinacea, Agrostis stolonifera, Poa pratensis,* and *Bromus inermis.* Native wetland species such as *Juncus arcticus* var. *balticus, Equisetum arvense, E. laevigatum,* and *Ranunculus macounii* are common.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Tree canopy	Broad-leaved deciduous tree	*Alnus incana* ssp. *tenuifolia, Salix amygdaloides*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park
Obligate wetland (OBL) indicator species: *Salix exigua, Juncus arcticus* var. *balticus, Cicuta maculata, Argentina anserina*
Facultative wetland (FACW) indicator species: *Salix irrorata, Populus angustifolia, Ranunculus macounii, Equisetum arvense, Mentha arvensis, Plantago major, Salix amygdaloides, Equisetum laevigatum, Barbarea vulgaris*
New Mexico state-listed noxious weeds: (Class B) *Dipsacus fullonum*; (Class C) *Ulmus pumila, Cirsium vulgare*

CLASSIFICATION COMMENTS

Pecos National Historic Park
Data are not available.

CLASSIFICATION CONFIDENCE: 3

ELEMENT SOURCES

Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 91EM014, 07PP021, 06PP053.
Local Description Authors: A. Fettes

G521. Vancouverian & Rocky Mountain Montane Wet Meadow Group

Carex nebrascensis - Eleocharis palustris Herbaceous Vegetation
Nebraska Sedge - Common Spikerush Herbaceous Vegetation
Identifier: NHNM000135

NVC CLASSIFICATION

Division	Western North American Freshwater Wet Meadow & Marsh (2.C.5.Nb)
Macrogroup	Western North American Montane Wet Meadow & Low Shrubland (M075)
Group	Vancouverian & Rocky Mountain Montane Wet Meadow Group (G521)
Association	*Carex nebrascensis* - *Eleocharis palustris* Herbaceous Vegetation

DISTRIBUTION
Pecos National Historic Park
This association occurs in floodplain areas along the Pecos River corridor in the main park unit.

ENVIRONMENTAL DESCRIPTION
Pecos National Historic Park
This wetland association occurs at around 2,055 m (6,740 ft) in elevation in floodplain back channels and seeps, and seeps adjacent to the river channel. Sites are likely ponded or flooded during spring runoff on an annual basis.

VEGETATION DESCRIPTION
Pecos National Historic Park
This herbaceous wetland is dominated by the obligate wetland species *Carex nebrascensis* with *Eleocharis palustris* as the co-dominant, and *Juncus arcticus* var. *balticus* as a common associate. Total graminoid cover reaches 70% , but forbs are typically low in abundance with no representative greater than 0.1% cover.

MOST ABUNDANT SPECIES
Pecos National Historic Park

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Carex nebrascensis, Eleocharis palustris, Juncus arcticus* var. *balticus*

OTHER NOTEWORTHY SPECIES
Pecos National Historic Park
Obligate wetland (OBL) indicator species: *Carex nebrascensis, Eleocharis palustris, Juncus arcticus* var. *balticus*
Facultative wetland (FACW) indicator species: *Equisetum arvense*

CLASSIFICATION COMMENTS
Pecos National Historic Park
Data are not available.

CLASSIFICATION CONFIDENCE: 3

ELEMENT SOURCES
Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 91EM010.
Local Description Authors: A. Fettes; E. H. Muldavin

Juncus arcticus - *Festuca arundinaceae* Semi-natural Herbaceous Vegetation

Arctic Rush - Tall Fescue Semi-natural Herbaceous Vegetation
Identifier: NHNM000183

NVC CLASSIFICATION

Division	Western North American Freshwater Wet Meadow & Marsh (2.C.5.Nb)
Macrogroup	Western North American Montane Wet Meadow & Low Shrubland (M075)
Group	Vancouverian & Rocky Mountain Montane Wet Meadow Group (G521)
Association	*Juncus arcticus* - *Festuca arundinacea* Semi-natural Herbaceous Vegetation

DISTRIBUTION

Pecos National Historic Park
This association occurs in floodplain areas along the Glorieta Creek corridor in the main park unit.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park
This wetland association occurs at around 2,065 m (6,780 ft) in elevation adjacent to and within the Glorieta Creek channel. Sites are likely flooded during spring runoff on at least a five -year or less basis. The ground surface is dominated by herbaceous cover (95% on average) and leaf and woody debris (5%) with little exposed bare soil, gravel, and rock (10%).

VEGETATION DESCRIPTION

Pecos National Historic Park
This herbaceous wetland is characterized by the dominance of *Juncus arcticus* var. *balticus* with the exotic grass *Festuca arundinacea* as a co-dominant. Total gramioid cover in this association can be as high as 90%. *Eleocharis palustris*, *Anemopsis californica*, and *Schoenoplectus pungens* are all common obligate native wetland indicators. Scattered reproduction of *Populus angustifolia* may be present.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Juncus arcticus* var. *balticus Festuca arundinace Eleocharis palustris, Agrostis gigantea*
Herb (field)	Forb	*Anemopsis californica*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park
Obligate wetland (OBL) indicator species: *Juncus arcticus* var. *balticus, Schoenoplectus pungens, Salix exigua, Carex nebrascensis, Eleocharis palustris, Muhlenbergia asperifolia, Anemopsis californica*
Facultative wetland (FACW) indicator species: *Agrostis gigantea, Salix irrorata, Populus angustifolia, Equisetum laevigatum, Equisetum arvense, Plantago major*

CLASSIFICATION COMMENTS

Pecos National Historic Park
Data are not available.

CLASSIFICATION CONFIDENCE:

ELEMENT SOURCES

Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 06PP049.
Local Description Authors: A. Fettes

VEGETATION DESCRIPTION

Pecos National Historic Park

Juncus arcticus - Schoenoplectus pungens Herbaceous Vegetation

Arctic Rush –Threesquare Bulrush Herbaceous Vegetation
Identifier: NHNM000448

NVC CLASSIFICATION

Division	Western North American Freshwater Wet Meadow & Marsh (2.C.5.Nb)
Macrogroup	Western North American Montane Wet Meadow & Low Shrubland (M075)
Group	Vancouverian & Rocky Mountain Montane Wet Meadow Group (G521)
Association	*Juncus arcticus - Schoenoplectus pungens* Herbaceous Vegetation

DISTRIBUTION

Pecos National Historic Park
This association occurs in floodplain areas along the Glorieta Creek corridor in the main park unit.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park
This wetland association occurs at around 2,050 m (6,720 ft) in elevation adjacent to and within the Glorieta Creek channel. Sites are likely flooded during spring runoff on an annual basis. The ground surface is dominated by herbaceous cover (40% on average) and leaf and woody debris (50%) with little exposed bare soil, gravel, and rock (5%).

VEGETATION DESCRIPTION

Pecos National Historic Park
This herbaceous wetland is dominated by the obligate wetland indicators *Juncus arcticus* var. *balticus* and *Schoenoplectus pungens.* Total graminoid cover in this association can be as high as 85% and the exotic *Festuca arundinacea* can be well represented. Other native obligate wetland species include *Eleocharis palustris, Carex nebrascensisi, Schoenoplectus acutus,* and *Equisetum arvense.* Trees and shrubs are accidental or absent in this association, however *Salix exigua* may be present at the periphery of the stands.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Juncus arcticus* var. *balticus*
		Schoenoplectus pungens

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park
Obligate wetland (OBL) indicator species: *Juncus arcticus* var. *balticus, Schoenoplectus pungens, Schoenoplectus acutus, Salix exigua, Carex nebrascensis*
Facultative wetland (FACW) indicator species: *Salix irrorata, Populus angustifolia, Equisetum arvense*

CLASSIFICATION COMMENTS

Pecos National Historic Park
Data are not available.

CLASSIFICATION CONFIDENCE: 2

ELEMENT SOURCES

Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 97RW004.
Local Description Authors: A. Fettes; E. H. Muldavin

Juncus arcticus / *Anemopsis californica* Herbaceous Vegetation

Arctic Rush / Yerba Mansa Herbaceous Vegetation
Identifier: NHNM000185

NVC CLASSIFICATION

Division	Western North American Freshwater Wet Meadow & Marsh (2.C.5.Nb)
Macrogroup	Western North American Montane Wet Meadow & Low Shrubland (M075)
Group	Vancouverian & Rocky Mountain Montane Wet Meadow Group (G521)
Association	*Juncus arcticus* / *Anemopsis californica* Herbaceous Vegetation

DISTRIBUTION

Pecos National Historic Park
This association occurs in floodplain areas along the Glorieta Creek corridor in the main park unit.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park
This wetland association occurs at around 2,050 m (6,720 ft) in elevation adjacent to and within the Glorieta Creek channel. Sites are likely flooded during spring runoff on at least a five-year basis. The ground surface is dominated by herbaceous cover and leaf and woody debris (95% on average), with little exposed bare soil, gravel, and rock (5%).

VEGETATION DESCRIPTION

Pecos National Historic Park
This herbaceous wetland is dominated by the obligate wetland indicator *Juncus arcticus* var. *balticus* with the native forb *Anemopsis californica* as the co-dominant. Total herbaceous cover in this association can be as high as 90%. *Eleocharis palustris*, *Anemopsis californica*, and *Schoenoplectus pungens* are common obligate native wetland indicators. Scattered reproduction of *Populus angustifolia* may be present.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Juncus arcticus* var. *balticus*
Herb (field)	Forb	*Anemopsis californica*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park
Obligate wetland (OBL) indicator species: *Juncus arcticus* var. *balticus, Anemopsis californica, Argentina anserina*
Facultative wetland (FACW) indicator species: *Populus angustifolia, Equisetum arvense*

CLASSIFICATION COMMENTS

Pecos National Historic Park
Data are not available.

CLASSIFICATION CONFIDENCE: 2

ELEMENT SOURCES

Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 97RW001.
Local Description Authors: A. Fettes; E. H. Muldavin

Juncus balticus Herbaceous Vegetation

Arctic Rush Herbaceous Vegetation
Identifier: CEGL001838

NVC CLASSIFICATION

Division	Western North American Freshwater Wet Meadow & Marsh (2.C.5.Nb)
Macrogroup	Western North American Montane Wet Meadow & Low Shrubland (M075)
Group	Vancouverian & Rocky Mountain Montane Wet Meadow Group (G521)
Association	*Juncus arcticus* / Herbaceous Vegetation

DISTRIBUTION

Pecos National Historic Park
This association occurs in floodplain areas along Glorieta Creek and the Pecos River and tributary drainages within the main park unit.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park
This wetland association occurs at around 2,065 m (6,780 ft) in elevation adjacent to and within stream and river channels. Sites are likely flooded during spring runoff on at least a five-year basis. The ground surface is dominated by herbaceous cover and leaf and woody debris (95% on average), with little exposed bare soil, gravel, and rock (5%).

VEGETATION DESCRIPTION

Pecos National Historic Park
This wetland association is characterized by dense monotypic stands of the native obligate indicator *Juncus arcticus* var. *balticus* with coverage as high as 85 to 95%. Additional grasses and forbs such as *Muhlenbergia repens* and *Symphyotrichum* spp. may be common but are clearly subordinate. Trees are typically absent; however, scattered *Juniperus scopulorum* occur.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Herb (field)	Graminoid	*Juncus arcticus* var. *balticus*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park
Obligate wetland (OBL) indicator species: *Juncus arcticus* var. *balticus*

CLASSIFICATION COMMENTS

Pecos National Historic Park
Data are not available.

CLASSIFICATION CONFIDENCE: 2

ELEMENT SOURCES

Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 07PP012 and 07PP055.
Local Description Authors: A. Fettes; E. H. Muldavin

3. Semi-Desert (Xeromorphic Scrub & Herb Vegetation)

3.B. Cool Semi-Desert Scrub & Grassland

3.B.1. Cool Semi-Desert Scrub & Grassland

3.B.1.a. Western North American Cool Semi-Desert Scrub & Grassland

M171. Great Basin & Intermountain Dry Shrubland & Grassland

G310. Intermountain Semi-Desert Shrubland & Steppe Group

Ericameria nauseosa / *Bouteloua gracilis* Shrub Herbaceous Vegetation

Rubber Rabbitbrush / Blue Grama Shrub Herbaceous Vegetation
Identifier: CEGL003495

NVC CLASSIFICATION

Division	Western North American Cool Semi-Desert Scrub & Grassland (3.B.1.Ne)
Macrogroup	Great Basin & Intermountain Dry Shrubland & Grassland (M171)
Group	Intermountain Semi-Desert Shrubland & Steppe Group (G310)
Association	*Ericameria nauseosa* / *Bouteloua gracilis* Shrub Herbaceous Vegetation

DISTRIBUTION

Pecos National Historic Park

This association is known extensively from west of the Pecos River in the main unit of the park and along the railroad corridor at the Cañoncito Subunit (Glorieta Unit).

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park

This association occurs from 2,065 to 2,110 m (6,780 to 6,930 ft) in elevation on rolling, mesa-like plains with gentle slopes
(3 to 5%) and in wide valley bottoms. Soils are derived from limestone, sandstone, and mixed alluvium. The ground surface is characterized mostly by abundant grass cover (55% on average), leaf litter and woody debris (10%), and bare soil and gravel (35%).

VEGETATION DESCRIPTION

Pecos National Historic Park

This shrub-steppe association is dominated by *Bouteloua gracilis* and other graminoids such as *Muhlenbergia torreyi*, *Elymus elymoides*, *Pascopyrum smithii*, and *Sporobolus cryptandrus* with cover reaching up to 70%. Short-statured *Ericameria nauseosa* (including varieties *E. nauseosa* var. *latisquamea* and *E. nauseosa* var. *bigelovii*) is abundant in the shrub layer, but subordinate to grasses. *Gutierrezia sarothrae* may also be a common sub-shrub. Forbs, while well-represented, are variable in composition. Of the 36 species reported, *Xanthisma spinulosum, Artemisia carruthii, Thelesperma megapotamicum,* and *Hymenopappus filifolius* are the most frequent and abundant representatives.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Ericameria nauseosa*
Forb (field)	Graminoid	*Bouteloua gracilis*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park

New Mexico state-listed noxious weeds: (Class A) *Onopordum acanthium*; (Class C) *Ulmus pumila, Bromus tectorum*

CLASSIFICATION COMMENTS
Pecos National Historic Park
Data are not available.

CLASSIFICATION CONFIDENCE: 3

ELEMENT SOURCES
Pecos National Historic Park
Inventory Notes: Data are not available.
Pecos National Historic Park: NHNM plots 07PP044, 05PP035, 06PP030.
Local Description Authors: A. Fettes; E. H. Muldavin

Ericameria nauseosa Shrubland
Rubber Rabbitbrush Shrub Vegetation
Identifier: CEGL002713

NVC CLASSIFICATION

Division	Western North American Cool Semi-Desert Scrub & Grassland (3.B.1.Ne)
Macrogroup	Great Basin & Intermountain Dry Shrubland & Grassland (M171)
Group	Intermountain Semi-Desert Shrubland & Steppe Group (G310)
Association	*Ericameria nauseosa* Shrubland

DISTRIBUTION

Pecos National Historic Park

This association is known from drainages in the main park unit, and the Pigeon's Ranch and Cañoncito Subunits of the Glorieta Unit.

ENVIRONMENTAL DESCRIPTION

Pecos National Historic Park

This association occurs from 2,090 to 2,110 m (6,850 to 6,930 ft) in drainages and adjacent high alluvial terraces. The ground surface is characterized mostly by abundant grass cover (35% on average), leaf litter and woody debris (30%), and bare soil and gravel (35%).

VEGETATION DESCRIPTION

Pecos National Historic Park

This shrubland steppe association is dominated by *Ericameria nauseosa* (including varieties *E. nauseosa* var. *latisquamea* and *E. nauseosa* var. *bigelovii*) with cover that can reach 60% or more. The understory and intershrub spaces are typically grassy and dominated by *Bouteloua gracilis* (20% canopy cover on average) with *Pascopyrum smithii* and *Sporobolus cryptandrus* often common. Forbs, while well-represented, are variable in composition. Of the 46 species reported, *Sphaeralcea fendleri, Heterotheca villosa, Artemisia carruthii,* and *Gaura coccinea* are the most frequent and abundant representatives.

MOST ABUNDANT SPECIES

Pecos National Historic Park

Stratum	Lifeform	Species
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Ericameria nauseosa*
Forb (field)	Graminoid	*Bouteloua gracilis*

OTHER NOTEWORTHY SPECIES

Pecos National Historic Park

New Mexico state-listed noxious weeds: (Class A) *Onopordum acanthium*; (Class C) *Ulmus pumila*, *Bromus tectorum*

CLASSIFICATION COMMENTS

Pecos National Historic Park

Data are not available.

CLASSIFICATION CONFIDENCE: 3

ELEMENT SOURCES

Pecos National Historic Park

Inventory Notes: Data are not available.

Pecos National Historic Park: NHNM plots 07PP044, 05PP035, 06PP030.

Local Description Authors: A. Fettes; E. H. Muldavin

References

Muldavin, E. 1991. Riparian and Wetlands Survey: Pecos National Historical Park. University of New Mexico, Albuquerque

Muldavin, E., P. Durkin, and M. Bradley. 2000. Handbook of Wetland Vegetation Communities of New Mexico. Final Report to the New Mexico Environment Department, Santa Fe, NM, and the U.S. Environmental Protection Agency.

Appendix E. Annotated Vegetation Map Legend

Below is the annotated map legend for the vegetation map of Pecos National Historical Park based on Table 5 of the main report. For each Level 2 unit, we provide a description with the following:

A list of primary and secondary plant association components plus related and contrasting inclusions (see main report for definitions);

- Elevation range derived from the GIS;
- A summary of the distribution, environment, and floristic composition of the unit;
- One or two representative ground photographs;
- A distribution map of the unit with black polygons shown for each unit;
- An image map showing the delineation of a representative polygon(s) in the 2006 color aerial photography (Photo Map Detail);
- The total hectares and acres of the unit and number of polygons as derived from the GIS.

1	Southern Rocky Mountain White Fir - Douglas-fir Dry Forest
A	Douglas-fir / Gambel Oak Forest

Primary Component Associations:
- *Pseudotsuga menziesii - Quercus gambelii Forest*

Secondary Component Associations:

Inclusions:

Elev.: 6833 to 7522 ft (2083 to 2293 m)

Summary: Open mixed-conifer forests dominated by Douglas-fir with scattered ponderosa pine, pinyon pine, and Rocky Mountain juniper. The unit occurs along northeast-facing lower slopes in the upper portions of canyons. Sites tend to have rocky and steep slopes. Understories typically have a moderate to high cover of Gambel's oak or wavyleaf oak along with scattered graminoids such as littleseed ricegrass, Scribner's needlegrass, sideoats grama, and sun sedge. But some stands have very sparse understories with little or no shrub or herbaceous cover. Usually found adjacent to or in a mosaic with map units 2A or 3A.

Distribution

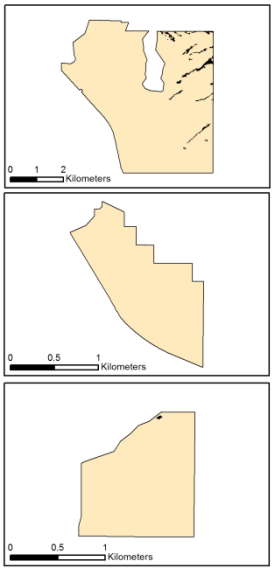
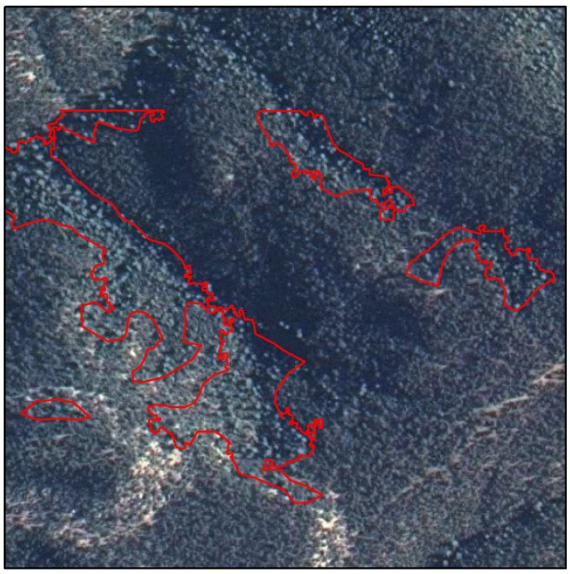


Photo Map Detail



Ha: 31.9	Acres: 96.5	Polygons: 23

2	Southern Rocky Mountain Ponderosa Pine Forest & Woodland
A	Ponderosa Pine/Oak Woodland

Primary Component Associations:
- *Pinus ponderosa - Quercus gambelii Woodland*

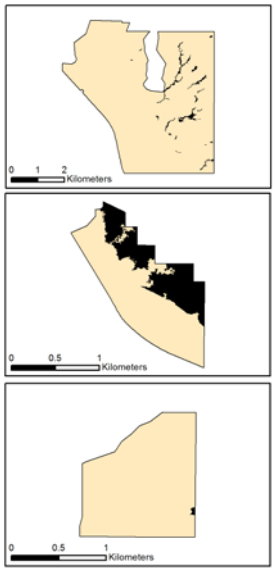
Secondary Component Associations:
- *Pinus ponderosa* - Quercus X pauciloba Woodland

Inclusions:
- *Pinus ponderosa* / Sparse Understory Woodland

Elev.: 6770 to 7590 ft (2064 to 2313 m)

Summary: Open forests dominated by ponderosa pine with pinyon pine, Rocky Mountain juniper, and oneseed juniper common sub-canopy trees. Douglas-fir is absent or accidental. The unit occurs along north-facing lower to upper slopes of steep canyons, extending as “stringers” down dry wash bottoms of the canyons. Sites tend to have rocky slopes. Understories have a moderate to high cover of Gambel’s oak or wavyleaf oak along with scattered graminoids such as little bluestem, Scribner's needlegrass, and sun sedge. Usually found adjacent to or in a mosaic with map units 1A or 3A.

Distribution



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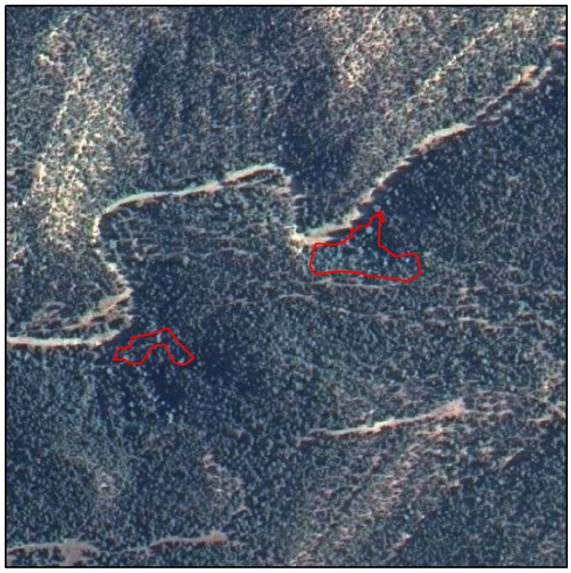


Ha: 83.8	Acres: 207.1	Polygons: 25

2	Southern Rocky Mountain Ponderosa Pine Forest & Woodland
B	Ponderosa Pine - Blue Grama Woodland Savanna

Primary Component Associations:
- *Pinus ponderosa / Bouteloua gracilis Woodland*

Secondary Component Associations:

Inclusions:
- *Pinus ponderosa* / Sparse Understory Woodland

Elev.: 6828 to 7318 ft (2081 to 2230 m)

Summary: Open, savanna-like woodlands dominated by ponderosa pine with pinyon pine, Rocky Mountain juniper, and oneseed juniper common sub-canopy trees. The unit occurs on rolling hills to nearly level plains. Understories are grassy and dominated by blue grama with sideoats grama, and western wheatgrass common associates. Most stands, but not all, have been mechanically thinned historically or recently to create the open stand structure. As a result, herbaceous composition can have a significant ruderal (weedy) element (e.g., yellow sweetclover, Canadian horseweed, rushy milkvetch, etc.). Usually found adjacent to or in a mosaic with map units 3F and 7A (when tree cover is <10% adjacent areas are mapped as 7A).

Distribution

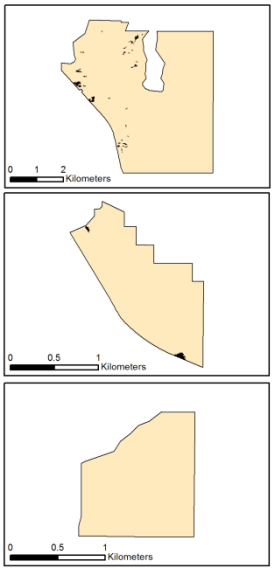


Photo Map Detail

Ha: 16.7	Acres: 41.3	Polygons: 30

2	Southern Rocky Mountain Ponderosa Pine Forest & Woodland
C	Ponderosa Pine - Blue Grama Valley Woodland

Primary Component Associations:
- *Pinus ponderosa / Bouteloua gracilis Woodland*

Secondary Component Associations:
- *Pinus ponderosa* / *Schizachyrium scoparium* Woodland

Inclusions:
- *Pinus ponderosa / Poa fendleriana Forest*
- *Pinus ponderosa* / Sparse Understory Woodland

Elev.: 6795 to 7536 ft (2071 to 2297 m)

Summary: Open forests dominated by ponderosa pine with pinyon pine, Rocky Mountain juniper, and oneseed juniper common sub-canopy trees. The unit occurs along shallow draws that dissect the rolling hills and plains of the main unit on the este side, and along drainage at Pigeon's Ranch Sub-unit and canyons of Cañoncito sub-unit. On south-facing short slopes within the drainages, canopies are more open and the understories on tend to be grassy and dominated by blue grama with sideoats grama, and little bluestem as common associates. North-facing slopes tend to have denser canopies and sparser understories where mutton bluegrass and sun sedge may be more prevalent. These stands *have not* been mechanically thinned. Usually found adjacent to or in a mosaic with map units 2B, 3F and 7A, and at the lower ends of the drainages, it often gives way to 3G.

Distribution

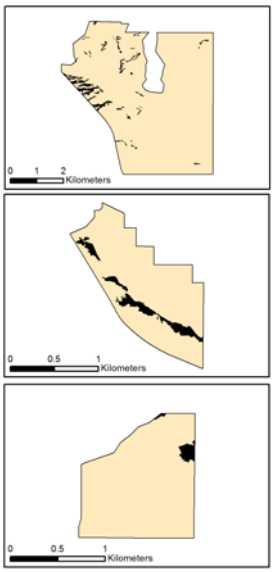
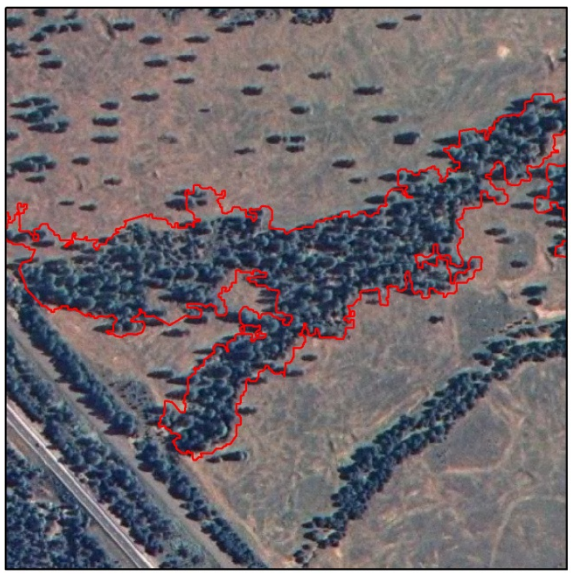


Photo Map Detail



Ha: 76.5	Acres: 188.9	Polygons: 51

3	Southern Rocky Mountain Pinyon - Juniper Woodland
A	Pinyon / Oak Canyon Woodland

Primary Component Associations:
Pinus edulis - Juniperus spp. / Quercus gambelii Woodland
Pinus edulis - Juniperus monosperma / Quercus X pauciloba Woodland

Secondary Component Associations:

Inclusions:
- *Pinus edulis - Juniperus monosperma* / *Bouteloua curtipendula* Woodland

Elev.: 6735 to 7563 ft (2053 to 2305 m)

Summary: Open woodlands dominated by pinyon pine with Rocky Mountain juniper and oneseed juniper as common co-dominants. The unit occurs along north-facing lower to upper slopes of steep canyons, extending as “stringers” down dry wash bottoms of the canyons. Sites tend to have rocky slopes. Understories have a moderate to high cover of Gambel’s oak or wavyleaf oak along with scattered graminoids such sideoats grama, little bluestem, hairy grama, littleseed ricegrass, blue grama, and muttongrass. Usually found adjacent to or in a mosaic with map units 1A or 2A.

Distribution

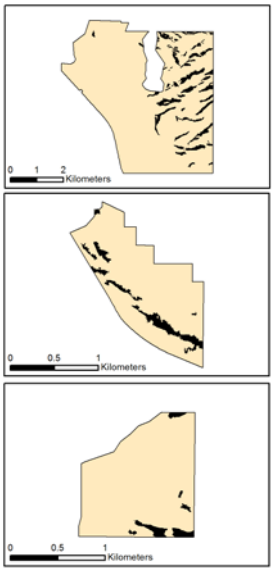
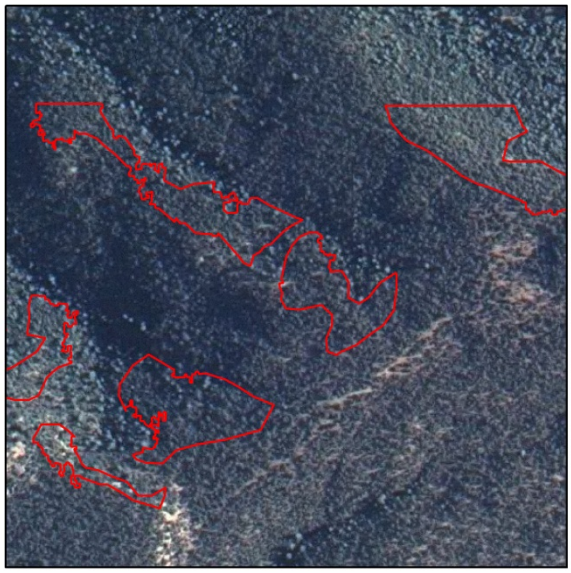


Photo Map Detail



Ha: 192.8	Acres: 476.5	Polygons: 68

3	Southern Rocky Mountain Pinyon - Juniper Woodland
B	Pinyon / Wavyleaf Oak Foothill Woodland

Primary Component Associations:
- *Pinus edulis - Juniperus monosperma / Quercus X pauciloba Woodland*

Secondary Component Associations:
- *Pinus edulis - Juniperus* spp. / *Cercocarpus montanus* - Mixed Shrubs Woodland

Inclusions:
- *Pinus edulis - Juniperus monosperma / Bouteloua curtipendula* Woodland
- Sparse Vegetation - Rockland

Elev.: 6732 to 7592 ft (2052 to 2314 m)

Summary: Woodlands with very open canopies dominated by pinyon pine with Rocky Mountain juniper and oneseed juniper as common co-dominants. The unit occurs along south -facing lower to upper slopes of steep canyons, extending up on to ridge summits and as “stringers” down dry wash bottoms of the canyons. Sites tend to have very rocky slopes. Understories have a moderate cover of wavyleaf oak and mountain mahogany along with pricklypear and broom snakeweed. Grasses are scattered graminoids such sideoats grama, little bluestem, hairy grama, littleseed ricegrass, blue grama, and muttongrass. Usually found adjacent to or in a mosaic with map units 3A or 3C.

Distribution

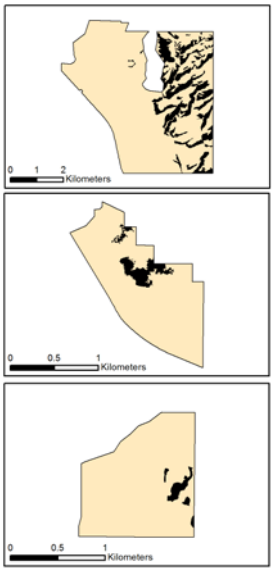


Photo Map Detail

Ha: 378.4	Acres: 934.9	Polygons: 47

3	Southern Rocky Mountain Pinyon-Juniper Woodland
C	Pinyon - Juniper / Sideoats Grama-Sparse Foothill Woodland

Primary Component Associations:

- *Pinus edulis - Juniperus monosperma / Bouteloua curtipendula* Woodland
- *Pinus edulis* / Sparse Understory Woodland

Secondary Component Associations:

- *Pinus edulis* / *Achnatherum scribneri* Woodland

Inclusions:

- *Pinus edulis* - (*Juniperus monosperma, Juniperus deppeana) / Bouteloua gracilis* Woodland
- *Pinus edulis - Juniperus monosperma* / *Muhlenbergia montana* Woodland
- Sparse Vegetation - Rockland

Elev.: 6732 to 7593 ft (2052 to 2314 m)

Summary: moderately open to closed-canopied woodlands dominated by pinyon pine with Rocky Mountain juniper and oneseed juniper as common co-dominants. The unit occurs along upper, north-facing slopes extending up on to ridge summits and down on south-facing slopes of steep canyons; it also occurs in the rolling hills and table-land terrains to the west of Pecos River. Sites vary from steep rocky slopes to flat ridge summits with mostly exposed soil. Understories lack significant shrub cover and the herbaceous layer ranges from very sparse to scattered grasses dominated in various combinations by sideoats grama, mountain muhly, Scribner's needlegrass, and blue grama. Other common grasses include hairy grama, galleta, littleseed ricegrass, prairie junegrass, and muttongrass. Usually found adjacent to or in a mosaic with map units 3B or 3F.

Distribution

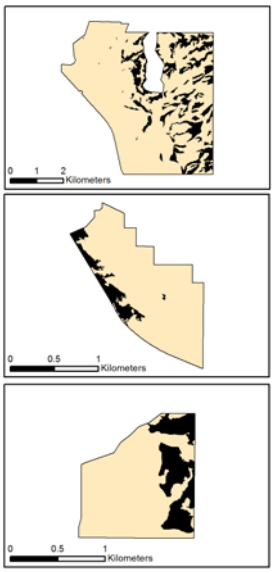


Photo Map Detail

Ha: 441.5	Acres: 1090.5	Polygons: 68

3	Southern Rocky Mountain Pinyon-Juniper Woodland
D	Pinyon - Juniper / Sideoats Grama Scarp Woodland

Primary Component Associations:

- *Pinus edulis - Juniperus monosperma / Bouteloua curtipendula Woodland*

Secondary Component Associations:

- *Pinus edulis - Juniperus scopulorum / Schizachyrium scoparium* Woodland

Inclusions:

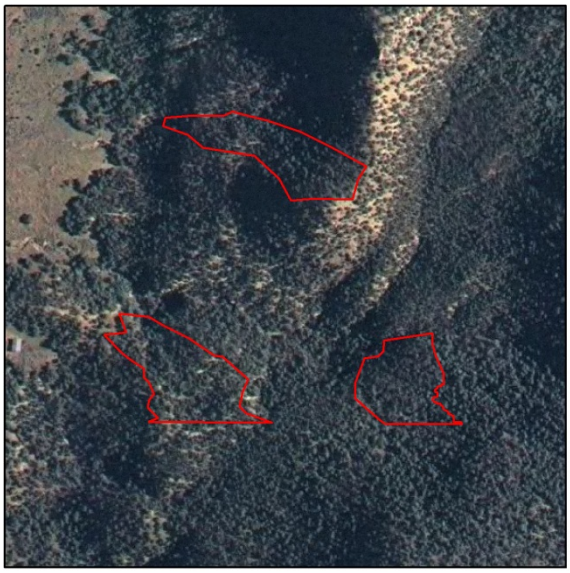
- *Pinus edulis / Achnatherum scribneri* Woodland
- *Pinus edulis - Juniperus* spp. / *Cercocarpus montanus* - Mixed Shrubs Woodland
- Sparse Vegetation - Rockland

Elev.: 6728 to7484 ft. (2051 to 2281 m)

Summary: moderately open to closed-canopied woodlands dominated by pinyon pine with Rocky Mountain juniper and oneseed juniper as common co-dominants. The unit occurs primarily on steep, rocky, north-facing escarpment slopes. Understories are characterized by scattered bunch grasses growing amongst rocks and boulders and typically include sideoats grama, little bluestem, or Scribner's needlegrass, Other common grasses include blue grama, hairy grama, prairie junegrass, and muttongrass. Among shrubs, mountain mahogany can prevalent on some slopes. Commonly found adjacent to or in a mosaic with map units 3C or 3E.

Distribution

Photo Map Detail



Ha: 42.6	Acres: 105.2	Polygons: 14

3	Southern Rocky Mountain Pinyon-Juniper Woodland
E	Pinyon - Juniper / Sideoats Grama - Rockland Woodland

Primary Component Associations:
- *Pinus edulis - Juniperus monosperma / Bouteloua curtipendula* Woodland

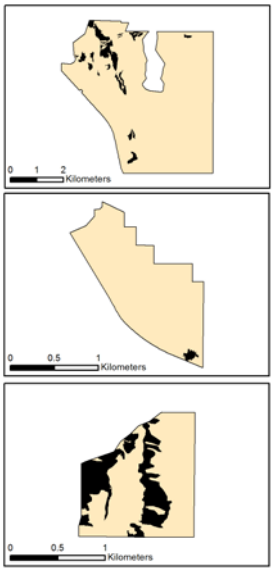
Secondary Component Associations:
- Sparse Vegetation – Rockland
- Sparse Vegetation - Bare Ground

Inclusions:
- *Pinus edulis* - (*Juniperus monosperma, Juniperus deppeana*) / *Bouteloua gracilis* Woodland
- *Pinus edulis* / Sparse Understory Woodland

Elev.: 6825 to 7454 ft (2080 to 2272 m)

Summary: open-canopied woodlands dominated by pinyon pine with Rocky Mountain juniper and oneseed juniper as common co-dominants. The unit occurs on rocky and eroded hills and escarpment slopes. Sites typically have significant areas of exposed soil and rock with only scattered patches of herbaceous cover dominated by bunch grasses such as sideoats grama, Scribner's needlegrass, and blue grama. Shrubs are few and scattered. Commonly found adjacent to or in a mosaic with map unit 3F.

Distribution



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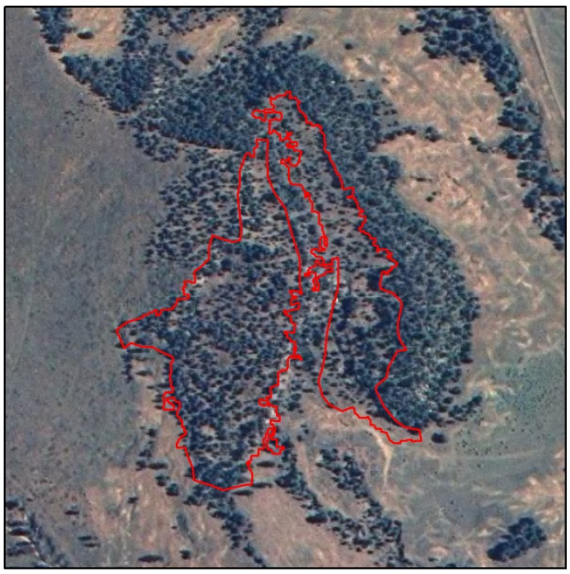


Ha: 142.0	Acres: 350.9	Polygons: 24

3	Southern Rocky Mountain Pinyon-Juniper Woodland
F	Pinyon / Blue Grama Woodland Savanna

Primary Component Associations:

- *Pinus edulis - (Juniperus monosperma, Juniperus deppeana) / Bouteloua gracilis* Woodland

Secondary Component Associations:

- *Pinus edulis* / Sparse Understory Woodland

Inclusions:

Elev.: 6740 to 7477 ft (2055 to 2279 m)

Summary: moderately open to closed-canopied woodlands dominated by pinyon pine and oneseed juniper. The unit occurs in gently sloping the rolling hills and table-land terrains, flat ridge summits, and occasionally valley bottoms. Understories lack significant shrub cover and the herbaceous layer ranges from very sparse to grassy and dominated by blue grama with sideoats grama, sun sedge, and purple threeawn as common associates. Usually found adjacent to or in a mosaic with map units 3C, 3D, 7A, or 7C (7A and 7C often represents cleared versions of 3F).

Distribution

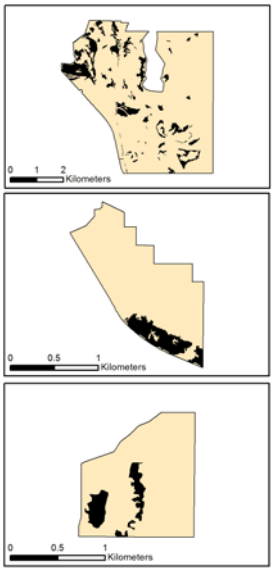


Photo Map Detail

Ha: 287.9	Acres: 711.3	Polygons: 105

3	Southern Rocky Mountain Pinyon-Juniper Woodland
G	Pinyon - Juniper Draw Woodland

Primary Component Associations:

- *Pinus edulis - (Juniperus monosperma, Juniperus deppeana) / Bouteloua gracilis* Woodland

Secondary Component Associations:

- *Pinus edulis - Juniperus scopulorum / Pascopyrum smithii* Woodland

Inclusions:

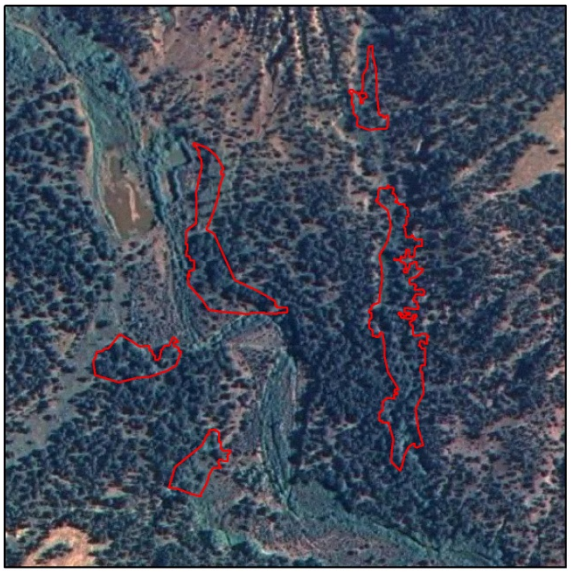
- *Pinus edulis* / Sparse Understory Woodland
- *Pinus edulis - Juniperus monosperma / Bouteloua curtipendula* Woodland

Elev.: 6771 to 7050 ft (2064 to 2149 m)

Summary: moderately open to closed-canopied woodlands dominated by pinyon pine and with oneseed juniper and Rocky Mountain juniper as co-dominants. The unit occurs along shallow drainages that cut through the rolling hills and table-lands of the western side of the park main unit. These draws are subject high-flow ephemeral flood events during summer storms; perennial water is generally absent but sites may occur adjacent to wetlands. While understories lack significant shrub cover grasses can be abundant and are dominated by blue grama and western wheatgrass. Other common grasses include sideoats grama, little bluestem, Kentucky bluegrass, creeping muhly, and littleseed ricegrass. This unit can grade to 2C upstream.

Distribution

Photo Map Detail



Ha: 93.3	Acres: 230.6	Polygons: 42

3	Southern Rocky Mountain Pinyon-Juniper Woodland
H	Pinyon - Juniper / Blue Grama - Western Wheatgrass River Valley Woodland

Primary Component Associations:

- *Pinus edulis - (Juniperus monosperma, Juniperus deppeana) / Bouteloua gracilis* Woodland

Secondary Component Associations:

- *Pinus edulis - Juniperus scopulorum* / *Pascopyrum smithii* Woodland
- *Juniperus scopulorum* / *Rhus trilobata* Woodland

Inclusions:

Elev.: 6716 to 7356 ft (2047 to 2242 m)

Summary: moderately open to closed-canopied woodlands dominated by pinyon pine and with oneseed juniper and Rocky Mountain juniper as co-dominants. The unit occurs on upper alluvial terraces along the Glorieta Creek and the Pecos River, and canyon bottoms of ephemeral drainages. Stands can have a significant cover of mesic shrubs such as skunkbush sumac, coyote willow, and Colorado barberry along abundant grass cover dominated by blue grama and western wheatgrass. Mesic forbs can also be abundant such as pineywoods geranium and showy milkweed.

Distribution

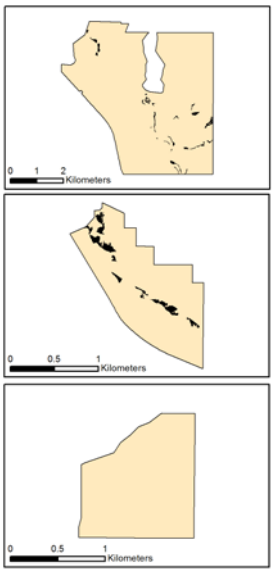
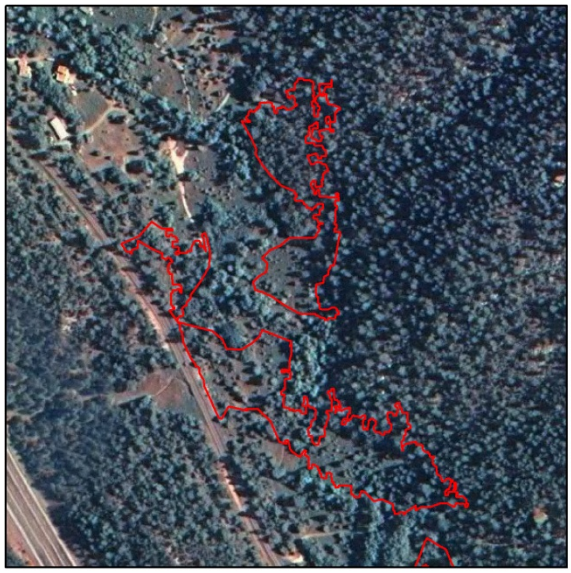


Photo Map Detail



Ha: 35.3	Acres: 87.1	Polygons: 35	

3	Southern Rocky Mountain Pinyon-Juniper Woodland
I	Pinyon - Juniper / Treatment Woodland

Primary Component Associations:

- *Pinus edulis - (Juniperus monosperma, Juniperus deppeana) / Bouteloua gracilis* Woodland, TreeTreatment Phase Woodland

Secondary Component Associations:

Inclusions:

Elev.: 6795 to 6885 ft (2071 to 2099 m)

Summary: open-canopied woodlands dominated by pinyon pine and oneseed juniper. Stands have been treated by the removal of both junipers and pinyons by various methods overtime. The unit occurs in gently sloping the rolling hills and table-land terrains, flat ridge summits, and occasionally valley bottoms. Understories lack significant shrub cover and the herbaceous layer ranges from very sparse to grassy and dominated by blue grama with sideoats grama, sun sedge, and purple threeawn as common associates. Found adjacent to or in a mosaic with map units 3F or 7E (3F represents most often the untreated version of 3I; 7E often represents the fully cleared version of both).

Distribution

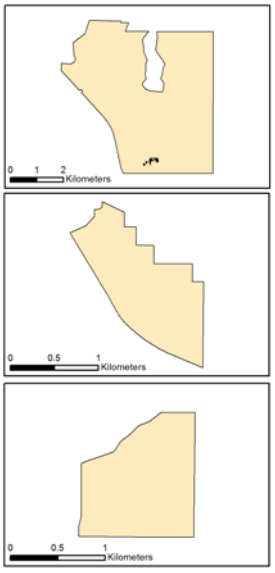


Photo Map Detail

Ha: 6.2	Acres: 15.3	Polygons: 4	

4	Rocky Mountain & Great Basin Montane Riparian Forest
A	Narrowleaf Cottonwood - Box Elder Riparian - Mixed Shrub Forest

Primary Component Associations:

- *Populus angustifolia - Acer negundo / Poa pratensis* Woodland

Secondary Component Associations:

- *Populus angustifolia / Salix exigua Woodland*

Inclusions:

Elev.: 6723 to 7324 ft (2049 to 2232 m)

Summary: these riparian forests occur on alluvial terraces and point bars with the active floodplain perennial streams and rivers. They are dominated by broadleaf deciduous box elder and narrowleaf cottonwood in the overstory with Rocky Mountain juniper in the subcanopy. The understory can be shrubby and include bluestem willow, coyote willow, Colorado barberry, Woods' rose, skunkbush sumac, and golden currant. The herbaceous layer is rich and diverse and may include facultative and obligate wetland species such as smooth horsetail, Baltic rush, poison hemlock, willowherb, and American speedwell. Mesic exotics are also prevalent and may include smooth brome, redtop, tall fescue, Kentucky bluegrass, rough cocklebur and yellow sweetclover, among others

Distribution

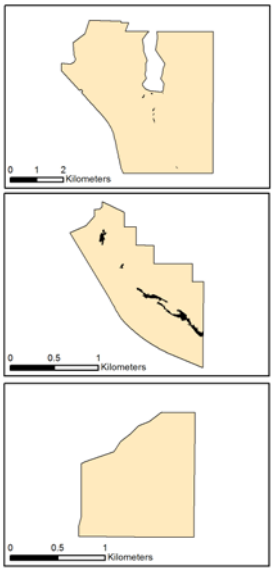


Photo Map Detail

Ha: 6.3	Acres: 15.7	Polygons: 12

4	Rocky Mountain & Great Basin Montane Riparian Forest
B	Narrowleaf Cottonwood / Semi-natural Herbs Forest

Primary Component Associations:

- *Populus angustifolia* / Invasive Perennial Grasses Semi-natural Woodland

Secondary Component Associations:

- *Populus angustifolia* / *Salix exigua* Woodland

Inclusions:

- *Populus deltoides* (ssp. *wislizeni,* ssp. *monilifera)* / *Salix exigua* Woodland

Elev.: 6723 to 7313 ft (2049 to 2229 m)

Summary: These riparian forests occur on alluvial terraces and point bars with the active floodplain perennial streams and rivers. They are dominated in the canopy by broadleaf deciduous narrowleaf cottonwood, occasional individuals of Rio Grande cottonwood, and the hybrid between the two, lanceleaf cottonwood along with Rocky Mountain and oneseed junipers in the subcanopy. Box elder is uncommon. The understory can be shrubby and include bluestem willow, coyote willow, common chokecherry, Woods' rose, Colorado barberry, skunkbush sumac, and golden currant. The herbaceous layer is typically dominated by invasive graminoids such as smooth brome, redtop, tall fescue, Kentucky bluegrass, and quackgrass. Native facultative and obligate wetland species can still be common and include smooth horsetail, Baltic rush,common threesquare, poison hemlock, and broadleaf cattail. Mesic exotics forbs are also prevalent and may include rough cocklebur and yellow sweetclover, curly dock, common mullein, among others

Distribution

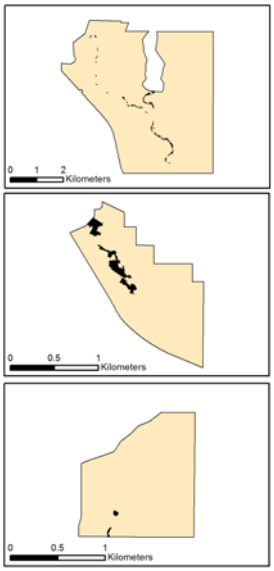
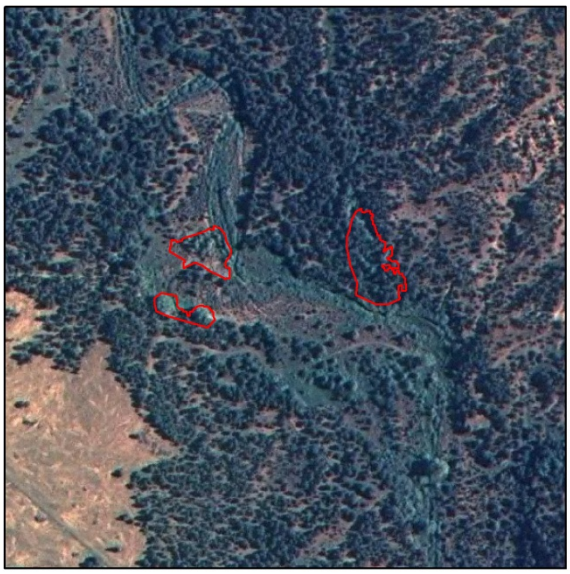


Photo Map Detail



Ha: 24.0	Acres: 59.4	Polygons: 33

5	Intermountain Semi-Desert Shrubland
A	Rabbitbrush Shrubland

Primary Component Associations:
- Ericameria nauseosa Shrubland

Secondary Component Associations:
- *Ericameria nauseosa / Bouteloua gracilis* Shrub Herbaceous Vegetation

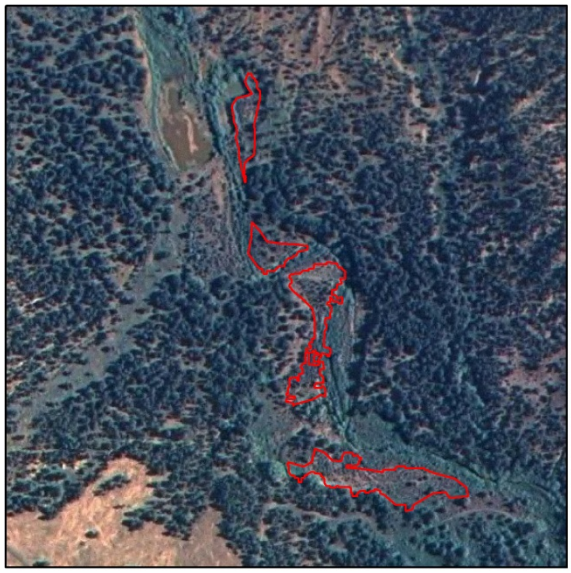
Inclusions:

Elev.: 6742 to 7005 ft (2055 to 2135 m)

Summary: These dry-wash riparian shrublands occur along upper alluvial terraces along intermittent or ephemeral stream reaches. They are dominated rubber rabbitbrush with grassy inter-shrub spaces are dominated by upland species such as blue grama, western wheatgrass, and sand dropseed. Forbs, can be well-represented by upland species such as ,James' catseye, hoary aster, common kochia (exotic), flatspine stickseed, manyflowered gromwell, green prairie coneflower, yellowspine thistle, Fendler's globemallow, hairy goldenaster, Carruth's sagewort, and scarlet beeblossom.

Distribution

Photo Map Detail



Ha: 26.1	Acres: 64.4	Polygons: 24

6	Rocky Mountain & Great Basin Foothill Riparian Shrubland & Alder-Birch Riparian Shrubland
A	Thinleaf Alder - Peachleaf Willow Riparian Shrubland

Primary Component Associations:

- *Alnus incana* ssp. *tenuifolia* - *Salix amygdaloides* Shrubland

Secondary Component Associations:

Inclusions:

Elev.: 6712 to 6735 ft (2046 to 2053 m)

Summary: These riparian shrublands occur on floodplain point bars adjacent to the Pecos River. Sites are likely flooded during spring runoff on an annual basis. They are characterized by a dense canopy of tall, broadleaf deciduous shrubs or small trees of thinleaf alder and peachleaf willow. Coyote willow, bluestem willow, and strapleaf willow are occasionally intermixed in the diverse shrub canopy, which can reach 70% total cover. The herbaceous layer is dominated by exotic grasses including smooth brome, redtop, tall fescue, Kentucky bluegrass, and creeping bentgrass. Native wetland species include Baltic rush, field horsetail, smooth horsetail, and Macoun's buttercup.

Distribution

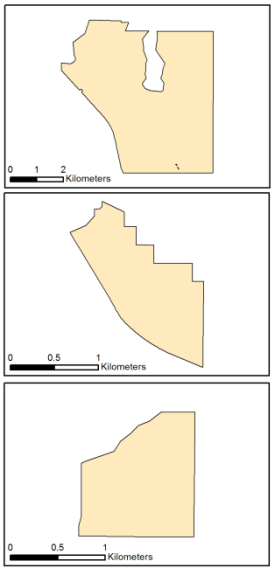


Photo Map Detail

Ha: 0.7	Acres: 1.8	Polygons: 2	

6	**Rocky Mountain & Great Basin Foothill Riparian Shrubland & Alder-Birch Riparian Shrubland**
B	**Coyote Willow Riparian Shrubland**

Primary Component Associations:
- *Salix exigua / Juncus arcticus* Shrubland
- *Salix exigua* / Invasive Perennial Grasses Semi-natural Shrubland

Secondary Component Associations:
- *Salix exigua / Eleocharis palustris* Shrubland

Inclusions:
- *Salix exigua - Ericameria nauseosa* Shrubland
- *Salix irrorata / Festuca arundinaceae* Shrubland

Elev.: 6705 to 6982 ft (2044 to 2128 m)

Summary: These riparian shrublands occur on floodplain point bars adjacent to the Pecos River and in Cañoncito. Sites are likely flooded during spring runoff on an annual basis. They are obligate wetland shrubs coyote willow and bluestem willow can form a sense shrub canopy. The herbaceous layer is dominated by mesic exotic grasses including smooth brome, redtop, tall fescue, Kentucky bluegrass, and creeping bentgrass. Native wetland species can be prevalent and include Baltic rush, common spikerush, field horsetail, smooth horsetail, and dwarf blue-eyed grass. There are inclusions of drier, more elevated bar sites within the floodplain where rubber rabbitbrush is a codominant with coyote willow and the mesic graminoids and forbs decline in abundance.

Distribution

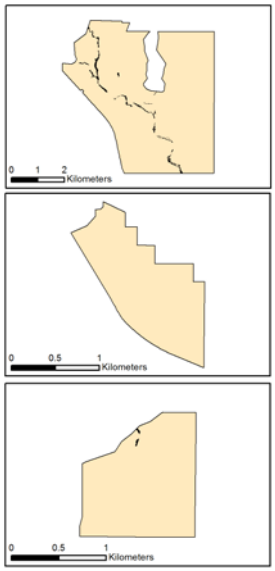
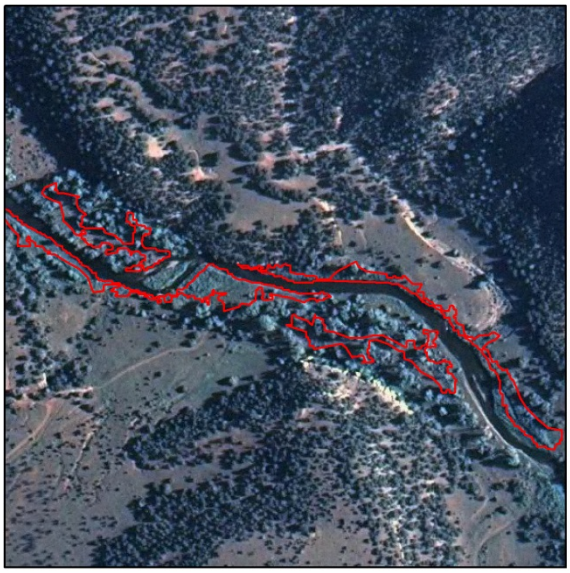


Photo Map Detail



Ha: 30.8	**Acres: 76.1**	**Polygons: 29**

7	Great Plains Shortgrass Prairie
A	Blue Grama / Fringed Sage and Blue Grama - Ring Muhly Grassland

Primary Component Associations:
- *Artemisia frigida* / *Bouteloua gracilis* Dwarf-shrubland

Secondary Component Associations:
- *Bouteloua gracilis - Muhlenbergia torreyi - Aristida purpurea* Herbaceous Vegetation

Inclusions:
- *Bouteloua gracilis - Bouteloua curtipendula* Herbaceous Vegetation, Tree Treatment Phase
- *Bouteloua gracilis* / Ruderal Herbaceous Vegetation, Tree Treatment Phase

Elev.: 6726 to 7353 ft (2050 to 2241 m)

Summary: grasslands that occur in gently sloping the rolling hills and table-land terrains, flat ridge summits, and occasionally valley bottoms. The herbaceous layer is dominated by blue grama with ring muhly, sideoats grama, and purple threeawn as common associates. Fringed sage, a forb-like low-lying subshrub, can be prevalent along with other subshrubs and succulents such as broom snakeweed, plains pricklypear, and intermediate yucca. Most sites are in cleared woodland areas, but some undisturbed meadows (vegas) still occur intermixed among the woodlands.

Distribution

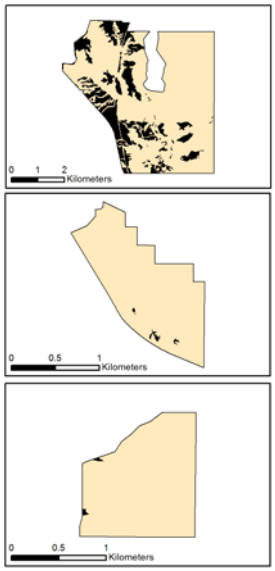
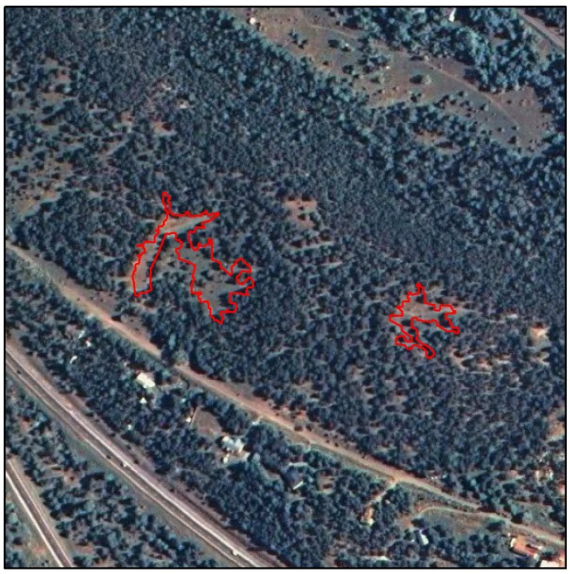


Photo Map Detail



Ha: 453.8	Acres: 1121.5	Polygons: 68

7	Great Plains Shortgrass Prairie
B	Blue Grama - Western Wheatgrass Swale - River Terrace Grassland

Primary Component Associations:
- *Pascopyrum smithii - Bouteloua gracilis* Herbaceous Vegetation

Secondary Component Associations:
- *Pascopyrum smithii* / Ruderal Herbaceous Vegetation

Inclusions:
- *Bouteloua gracilis* / Ruderal Herbaceous Vegetation

Elev.: 6707 to 7057 ft (2044 to 2151 m)

Summary: grasslands that occur in low-lying areas among rolling hills and table-land terrains, and on river terrace valley bottoms. The herbaceous layer is dominated by blue grama and western wheatgrass with sleepygrass, ring muhly, and purple threeawn sometimes prevalent. Shrubs and subshrubs are minor or absent. Most sites are in cleared woodland areas, but some undisturbed meadows (vegas) still occur intermixed among the woodlands. In some areas, this has resulted in an increase in weedy forbs and grasses (e.g., weakleaf bur ragweed, Indianhemp, Carruth's sagewort, tarragon, yellowspine thistle, wavyleaf thistle, and Canadian horseweed.

Distribution

Photo Map Detail

Ha: 34.4	Acres: 85.0	Polygons: 46

7	Great Plains Shortgrass Prairie
C	Blue Grama / Rabbitbrush Grassland

Primary Component Associations:

- *Ericameria nauseosa - Bouteloua gracilis* Shrub Herbaceous Vegetation

Secondary Component Associations:

Inclusions:

- *Bouteloua gracilis* / Ruderal Herbaceous Vegetation

Elev.: 6717 to 7309 ft (2047 to 2228 m)

Summary: grasslands that occur among rolling hills and table-land terrains. The herbaceous layer is dominated by blue grama with ring muhly, sideoats grama, and purple threeawn as common associates. Rubber rabbitbrush is common to abundant mostly as a subshrub along with other subshrubs and succulents such as broom snakeweed and plains pricklypear. Most sites are associated with cleared woodlands, while may reflect past intensive livestock use.

Distribution

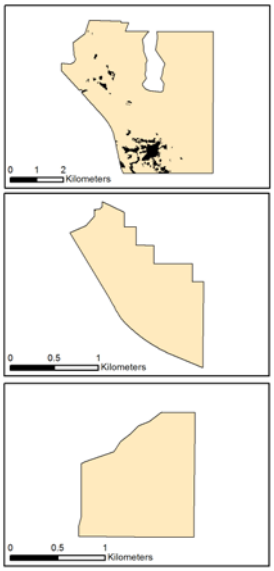
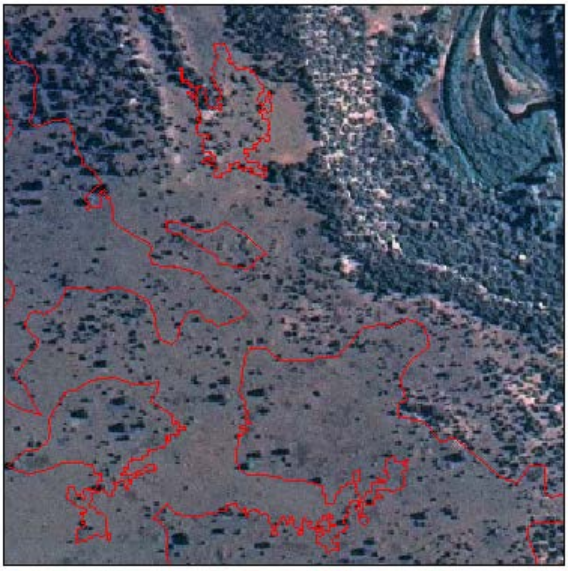


Photo Map Detail



Ha: 100.1	Acres: 247.3	Polygons: 45

7	Great Plains Shortgrass Prairie
D	Blue Grama / Ruderal Grassland

Primary Component Associations:

- *Bouteloua gracilis* / Ruderal Herbaceous Vegetation

Secondary Component Associations:

- Psathyrostachys juncea / Monotypic Herbaceous Vegetation

Inclusions:

- *Bouteloua gracilis* / Old Field Herbaceous Vegetation

Elev.: 6746 to 7335 ft (2056 to 2236 m)

Summary: grasslands that occur in gently sloping the rolling hills and table-land terrains, and along valley bottoms. The herbaceous layer is dominated by blue grama with a mixture of weedy grasses and forbs, which can include exotics such as Russian wildrye, Japanese brome, and field bindweed along with natives such as weakleaf bur ragweed, Carruth's sagewort, tarragon, and narrowleaf goosefoot, among others. Shrubs and subshrubs are scattered or absent. Most sites are associated with cleared woodland areas or old, abandoned agricultural fields.

Distribution

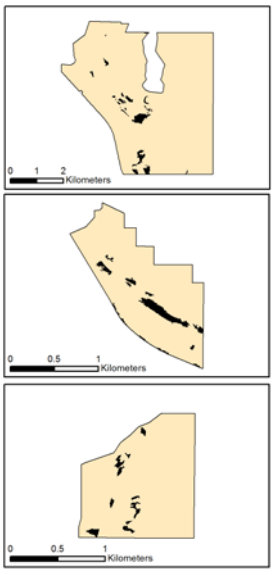


Photo Map Detail

Ha: 61.1	Acres: 150.9	Polygons: 49

7	Great Plains Shortgrass Prairie
E	Ruderal Disturbance Vegetation

Primary Component Associations:
- Ruderal Disturbance Vegetation

Secondary Component Associations:
- *Bouteloua gracilis* / Ruderal Herbaceous Vegetation

Inclusions:

Elev.: 6786 to 7285 ft (2068 to 2220 m)

Summary: Weedy, primarily herbaceous vegetation associated with areas heavily disturbed by humans, both historically and prehistorically. While some native grasses and shrubs may be present, the vegetation is often dominated annual and short-lived forbs, many of them exotic. Native examples include flatspine stickseed, tanseyleaf aster, lacy tansyaster, and woolly paperflowera; common exotics are crossflower, tall tumblemustard, meadow salsify, common mullein, and common Kochia. .

Distribution

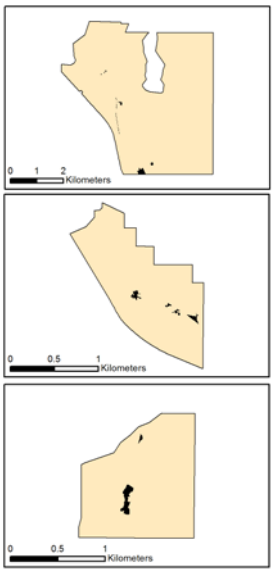
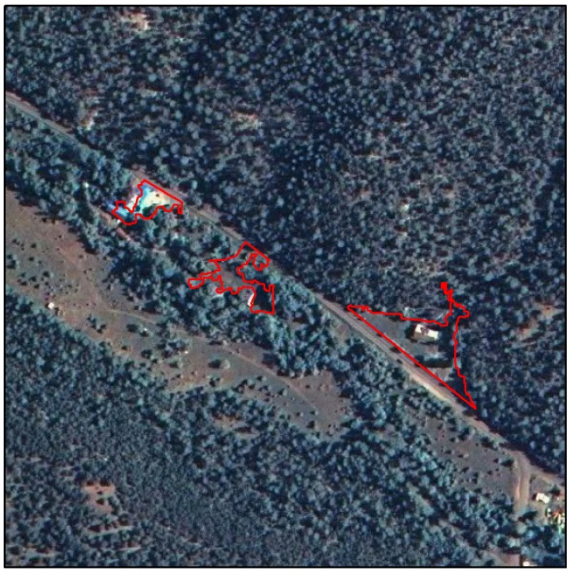


Photo Map Detail



Ha: 11.4	Acres: 28.2	Polygons: 13

8	Vancouverian & Rocky Mountain Montane Wet Meadow
A	Rush and Sedge Wetland

Primary Component Associations:
- *Juncus balticus* Herbaceous Vegetation

Secondary Component Associations:
- *Juncus arcticus - Festuca arundinaceae* Semi-natural Herbaceous Vegetation

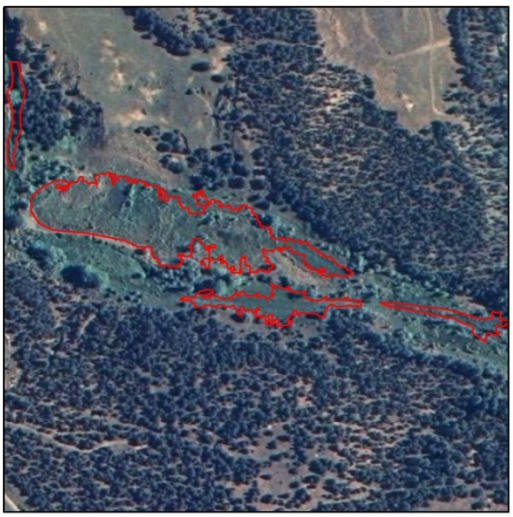
Inclusions:
- *Juncus arcticus / Anemopsis californica* Herbaceous Vegetation
- *Juncus arcticus / Typha latifolia* Herbaceous Vegetation
- *Typha* (*latifolia, angustifolia*) Western Herbaceous Vegetation
- *Carex nebrascensis - Eleocharis palustris* Herbaceous Vegetation
- *Juncus arcticus - Schoenoplectus pungens* Herbaceous Vegetation
- *Salix exigua / Juncus arcticus* Shrubland
- *Salix exigua* / Invasive Perennial Grasses Semi-natural Shrubland

Elev.: 6715 to 7319 ft (2047 to 2231 m)

Summary: These montane emergent wetlands are associated with side channels, low-lying point bars within perennial stream channels. They are dominated by an admixture of facultative or obligate native wetland species such as Baltic sedge, softstem bulrush, common spikerush, slender rush, common threesquare, yerba mansa, field horsetail, and smooth horsetail. Exotic mesic grasses may be abundant but are subordinate to the native wetland graminoids. They may include smooth brome, redtop, tall fescue, Kentucky bluegrass, and creeping bentgrass.

Distribution

Photo Map Detail



Ha: 7.2	Acres: 17.7	Polygons: 18

9	Sparsely Vegetated
A	Ephemeral - Intermittent Dry wash

Primary Component Associations: none

Secondary Component Associations:

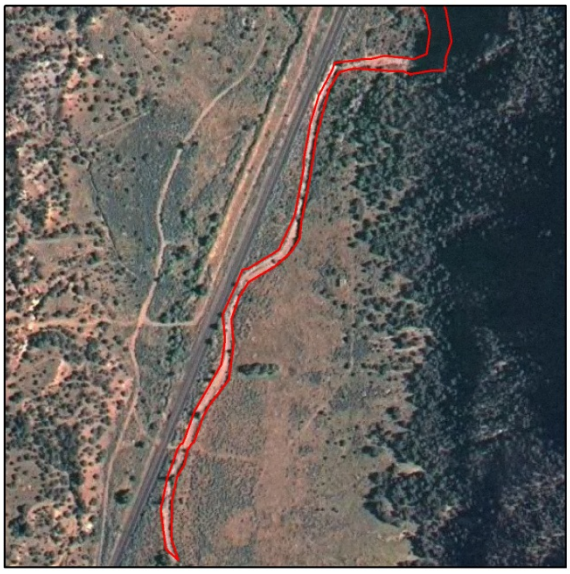
Inclusions:

Elev.: 6870 to 6972 ft (2094 to 2125 m)

Summary: Sparsely vegetated ephemeral washes subjected to annual inundation during storm events. Exposed cobble, gravel, and soil predominate but they may be lined by shrubs such as rubber rabbitbrush and apache plume.

Distribution

Photo Map Detail



Ha: 1.7	Acres: 4.1	Polygons: 2

10	Urban or Built-up Land
A	Ruin - Restored

Primary Component Associations:
- Ruderal Disturbance Vegetation

Secondary Component Associations:
- *Bouteloua gracilis* / Ruderal Herbaceous Vegetation
- *Pascopyrum smithii* / Ruderal Herbaceous Vegetation

Inclusions:

Elev.: 6923 to 6973 ft (2110 to 2125 m)

Summary: Built-up land includes vegetation in and surrounding archeological sites that have restored or modified in some way (include walkways and associated public buildings). May include weedy grasslands and areas of weedy dominated by annual and perennial forbs (see 7D, 7E, and 10B)

Distribution

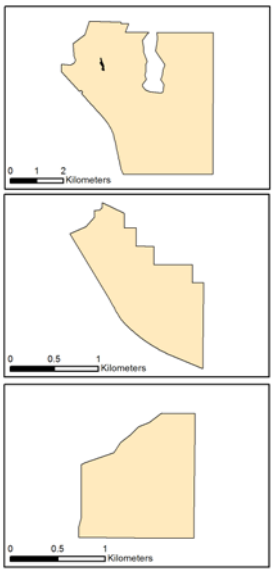


Photo Map Detail

Ha: 4.0	Acres: 9.8	Polygons: 1	

10	Urban or Built-up Land
B	Ruin - Unrestored

Primary Component Associations:
- Ruderal Disturbance Vegetation

Secondary Component Associations:
- *Bouteloua gracilis* / Ruderal Herbaceous Vegetation
- *Pascopyrum smithii* / Ruderal Herbaceous Vegetation

Inclusions:

Elev.: 6903 to 6975 ft (2104 to 2126 m)

Summary: unexcavated ruins, which often have weedy, herbaceous vegetation associated with them. While some native grasses and shrubs may be present, the vegetation is often dominated annual and short-lived forbs, many of them exotic. Native examples include flatspine stickseed, tanseyleaf aster, lacy tansyaster, and woolly paperflower; common exotics are crossflower, tall tumblemustard, meadow salsify, common mullein, and common Kochia. Similar to 7E

Distribution

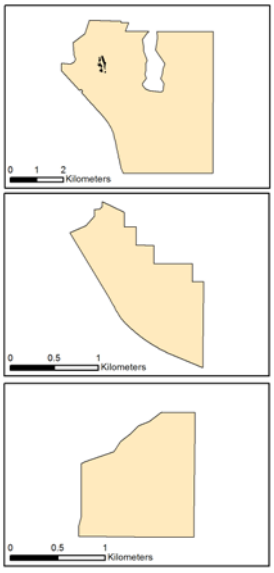


Photo Map Detail

Ha: 7.8	Acres: 19.2	Polygons: 4

10	Urban or Built-up Land
C	Urban / Built-up Vegetation

Primary Component Associations:
- Ruderal Disturbance Vegetation

Secondary Component Associations:

Inclusions:

Elev.: 6843 to 7302 ft (2086 to 2226 m)

Summary: Built-up land includes vegetation in and around recreation and residential areas, and public buildings.

Distribution

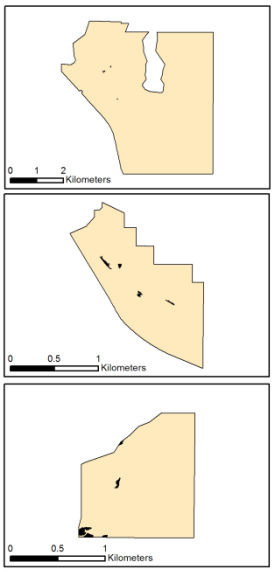


Photo Map Detail

Ha: 3.4	Acres: 8.3	Polygons: 13	

10	Urban or Built-up Land
D	Building / Other Development

Primary Component Associations:
- Ruderal Disturbance Vegetation

Secondary Component Associations:

Inclusions:

Elev.: 6815 to 6935 ft (2077 to 2114 m)

Summary: Built-up areas that include park headquarters, other administrative building, and residential areas.

Distribution

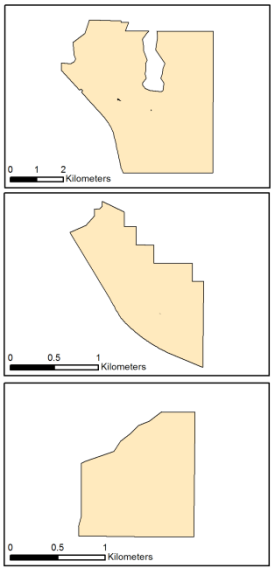


Photo Map Detail

Ha: 0.8	Acres: 1.9	Polygons: 5	

10	Urban or Built-up Land
E	Road

Primary Component Associations:
- Ruderal Disturbance Vegetation

Secondary Component Associations:
- *Bouteloua gracilis* / Ruderal Herbaceous Vegetation
- *Pascopyrum smithii* / Ruderal Herbaceous Vegetation

Inclusions:

Elev.: 6834 to 7330 ft (2083 to 2234 m)

Summary: Built-up areas that include paved and dirt roads. May include weedy grasslands and areas of weedy dominated by annual and perennial forbs (see 7D, 7E, and 10B)

Distribution

Photo Map Detail

Ha: 20.2	Acres: 49.9	Polygons: 52	

11	Water
A	Open water - Stream/River

Primary Component Associations:

Secondary Component Associations:

Inclusions:

Elev.: 6703 to 6844 ft (2043 to 2086 m)

Summary: Open water associated with the Pecos River, Glorieta Creek, and Cañoncito.

Distribution

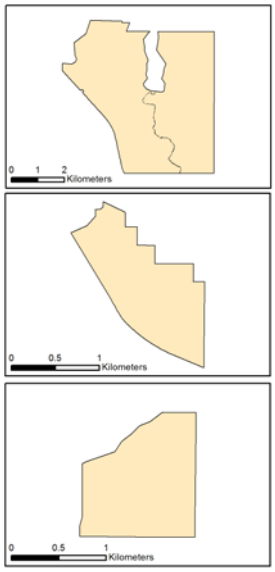


Photo Map Detail

Ha: 7.6	Acres: 18.7	Polygons: 2

11	Water
B	Open water – Pond/Reservoir

Primary Component Associations:

Secondary Component Associations:

Inclusions:

Elev.: 6791 to 6947 ft (2070 to 2117 m)

Summary: Open water associated with small natural impoundments along Glorieta Creek.

Distribution

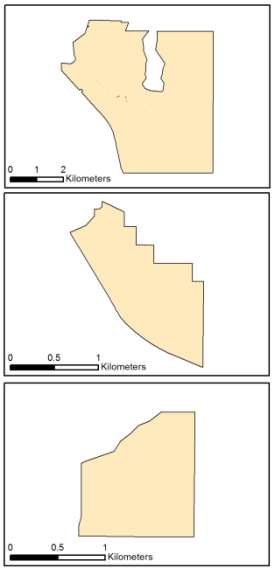


Photo Map Detail

Ha: 0.7	Acres: 1.8	Polygons: 10

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 430/115830, July 2012

National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science
1201 Oakridge Drive, Suite 150
Fort Collins, CO 80525

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