National Park Service
U.S. Department of the Interior

Natural Resource Stewardship and Science

A Vegetation Classification and Map

Fort Davis National Historic Site

Natural Resource Technical Report NPS/CHDN/NRTR—2012/639

ON THE COVER

Fort Davis National Historic Site looking southeast with desert foothill grasslands on the south-facing slopes of the North Ridge, Madrean woodlands and shrublands among the boulder cliffs on the north face of Sleeping Lion, and semi-riparian woodlands and grasslands in the valley bottom.
Photograph by Paul Neville

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Data in this report were collected and analyzed using methods based on established peer-reviewed protocols and were analyzed and interpreted within the guidelines of the protocols. This report received informal review by subject-matter experts who were not directly involved in the collection, analysis, or reporting of the data.

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Executive Summary

We developed a vegetation classification and high-resolution vegetation map for Fort Davis National Historic Site, Texas, as part of the USGS Vegetation Characterization Program, a cooperative effort by the U.S. Geological Survey (USGS) and the National Park Service Inventory & Monitoring - Vegetation Mapping Program to classify, describe, and map vegetation communities in more than 280 national park units across the United States. The classification and map followed the guidelines and requirements of the national program, and were based on data collected from 65 field plots between 2007 and 2011. We identified 33 plant associations following the guidelines of the National Vegetation Classification Standard (NVCS).

Using the classification as a foundation, we constructed a vegetation map of the site including the new 2011 western addition using a combination of image analysis and photo interpretation of high-resolution (0.6 m) color and color infrared aerial ortho-photography along with satellite imagery (DigitalGlobe QuickBird). The map was designed to facilitate ecologically based natural resources management at a 1:5,000 scale with 0.25-ha minimum map unit size and has an overall modified accuracy of 83.5%. The map legend was hierarchically structured with an upper Level 1 of eight map units corresponding more or less to the Group Level of the NVCS and a Level 2 composed of 22 nested map units defined by the plant associations from the vegetation classification. Level 1 units will likely be sufficient and most appropriate for many natural resource plans and evaluations, while Level 2 units provide added fine-scale information within major ecological groups. To support the map as a management tool, we provide an annotated map legend along with local descriptions of each plant association, a corresponding diagnostic key, field forms, and a plant species list. The map was delivered in both printed form and as digital Geographic Information System (GIS) map files.

The vegetation pattern of Fort Davis National Historic Site (NHS) has an intricate pattern that reflects its history as an active garrison in two periods between 1854 and 1891. Evergreen oak-dominated woodlands occur on north-facing ridges and in canyons. Chihuahuan foothill semi-desert grasslands dominated by grama grasses are found on the southerly slopes intermixed with desert shrublands (often-dense catclaw mimosa, whitethorn acacia, and beebrush). The flats of the eastern foreground area and along the bottom of Hospital Canyon were also dominated by grama grasslands, but these may have a weedy herbaceous component or have been invaded by honey mesquite. This ruderal aspect is likely a legacy of grazing and agricultural practices during the fort's heyday and subsequent private ownership up until Fort Davis NHS establishment in 1961. The core historic site itself currently has actively manicured, cultural vegetation that includes mowed grasslands and a relic cottonwood grove once used as a picnic ground. Hospital Canyon also supports a remnant dry riparian zone dominated by oaks and netleaf hackberry. The expansion area to the west acquired in 2011 is predominately foothill grasslands along with scattered shrublands and woodlands, but a fire that swept through this portion of the park in spring 2011 may have significantly reduced tree cover. Hence, the vegetation of Fort Davis NHS is dynamic, but the GIS format that we have provided provides flexibility to update the map as new information becomes available or as major vegetation changes such as those caused by fire, disease, drought, or other impacts occur.

Acknowledgments

This project was funded by the USGS-NPS National Vegetation Mapping Program and the Chihuahuan Desert Network (CHDN). The Natural Heritage New Mexico (NHNM) technicians Connor Flynn, Hugh Hulse, Katie Carrillo, and Matt Wilder provided fieldwork and data entry support. Rebecca Keeshen provided management support and editorial review. In addition, we thank John Heiner and Bill Manhart at Fort Davis National Historic Site for guidance and logistical support. Kirsten Gallo, CHDN Coordinator, provided support for the project through agreements with the CHDN and the Colorado Plateau Cooperative Ecosystems Studies Unit and Tom Richie, data manager for the CHDN. Tom Forsyth and Lynelle Wright (both retired) formerly with the NPS Intermountain Region assisted with development of cooperative agreements. From the USGS-NPS Vegetation Mapping Program national office, important guidance and review was provided by Karl Brown, Tammy Cook, and Chris Lea (retired). Additional review was provided by Hildy Reiser, Cathryn Hoyt, and John Karges. Formatting and technical editor support was provided by Nina Chambers.

Acronyms and Abbreviations

CHDN	Chihuahuan Desert Network
DOQQ	Digital Ortho-photo Quarter Quad
DRG	Digital Raster Graphics
ESA	Ecological Society of America
ESRI	Environmental Systems Research Institute
FGDC	Federal Geographic Data Committee
FODA	Fort Davis National Historic Site
GIS	Geographic Information System
GPS	Global Positioning System
I&M	Inventory and Monitoring Program
ITIS	Integrated Taxonomic Information System
MMU	Minimum Mapping Unit
NAD	North American Datum
NAIP	National Agricultural Imagery Program
NDVI	Normalized Difference Vegetation Index
NGO	Non-governmental Organization
NHS	National Historic Site
NHNM	Natural Heritage New Mexico
NPS	National Park Service
NRCS	Natural Resource Conservation Service
NVC	National Vegetation Classification
NVCS	National Vegetation Classification Standard
OP	Observation Points
PA	Plant Association
ROA	Resource Opportunity Area
USDA	United States Department of Agriculture
USGS	United States Geological Survey
UNM	University of New Mexico
UTM	Universal Transverse Mercator

Chapter 1 Introduction

1.1 Background, Scope, and Products

Fort Davis, established as a military post in 1854, is nestled in the foothills of the Davis Mountains in the Trans-Pecos region of west Texas (Figure 1). It lies at the mouth of a small canyon with steep sidewalls and faces east to the open grasslands of west Texas, the northeastern extension of the Marfa Plains grassland. In this strategically protective setting, the fort guarded roads and trails, protected the nearby town, and served as a focal point for settlement (including being a strategic location in the Indian campaigns) until its abandonment in 1891. Seventy years later, the Fort Davis National Historic Site (NHS) was established to preserve and protect what remained of the fort and the immediate natural landscape surrounding it (474 acres; 192 ha). While the historic structures, including the remaining and rebuilt barracks, corrals, and agricultural areas are the main attractions, the National Park Service (NPS) has sought to manage the surrounding natural landscape with the same care and attention as that given to the cultural values. Accordingly, along with comprehensive biological inventories and monitoring, a key to effective natural resources management is the development of a high-resolution vegetation map that can support such activities as flora and fauna habitat management, recreation planning, fire management, ecological research, and broad-scale facilities planning.

To meet this objective, the U.S. Geological Survey (USGS)-National Park Service Vegetation Mapping Program and the NPS Chihuahuan Desert Network (CHDN), in cooperation with Natural Heritage New Mexico (NHNM)[1], and the staff at Fort Davis NHS, set out to develop a vegetation map that meets or exceeds USGS-NPS standards[2] (1:24,000 scale and 0.5-ha minimum map unit size). The map was to be based on high-resolution aerial photography, satellite imagery, and extensive ground sampling. The project was initiated in September 2007 with field surveys of the vegetation communities beginning that fall. In 2011, 20 ha (50 ac) were added to the park and these were surveyed in 2011 and added to the project. 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[3]. A vegetation map was then generated from the vegetation classification and associated ground control points at the 1:6,000 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 uses for fire and recreation, plus cultural resource management.

We provide here: (1) the details on how the map was constructed; (2) an overview of the classification and ecology of the vegetation communities of the park; (3) the vegetation map with associated map unit descriptions; (4) plant community descriptions and a diagnostic key; and (5) a vouchered species list. The map was presented in both printed form and as digital Geographic Information System (GIS) map files. In addition, all field data were compiled into a relational database, and all data and reports elements have been made ready for web-based applications. Finally, we provide a review of an accuracy assessment of the map conducted by Van Loh and Cogan (in-press).

1.2 The USGS-NPS Vegetation Characterization and 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

1 A division of the Museum of Southwestern Biology at the University of New Mexico.

2 See http://biology.usgs.gov/npsveg/standards.html.

3 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/.

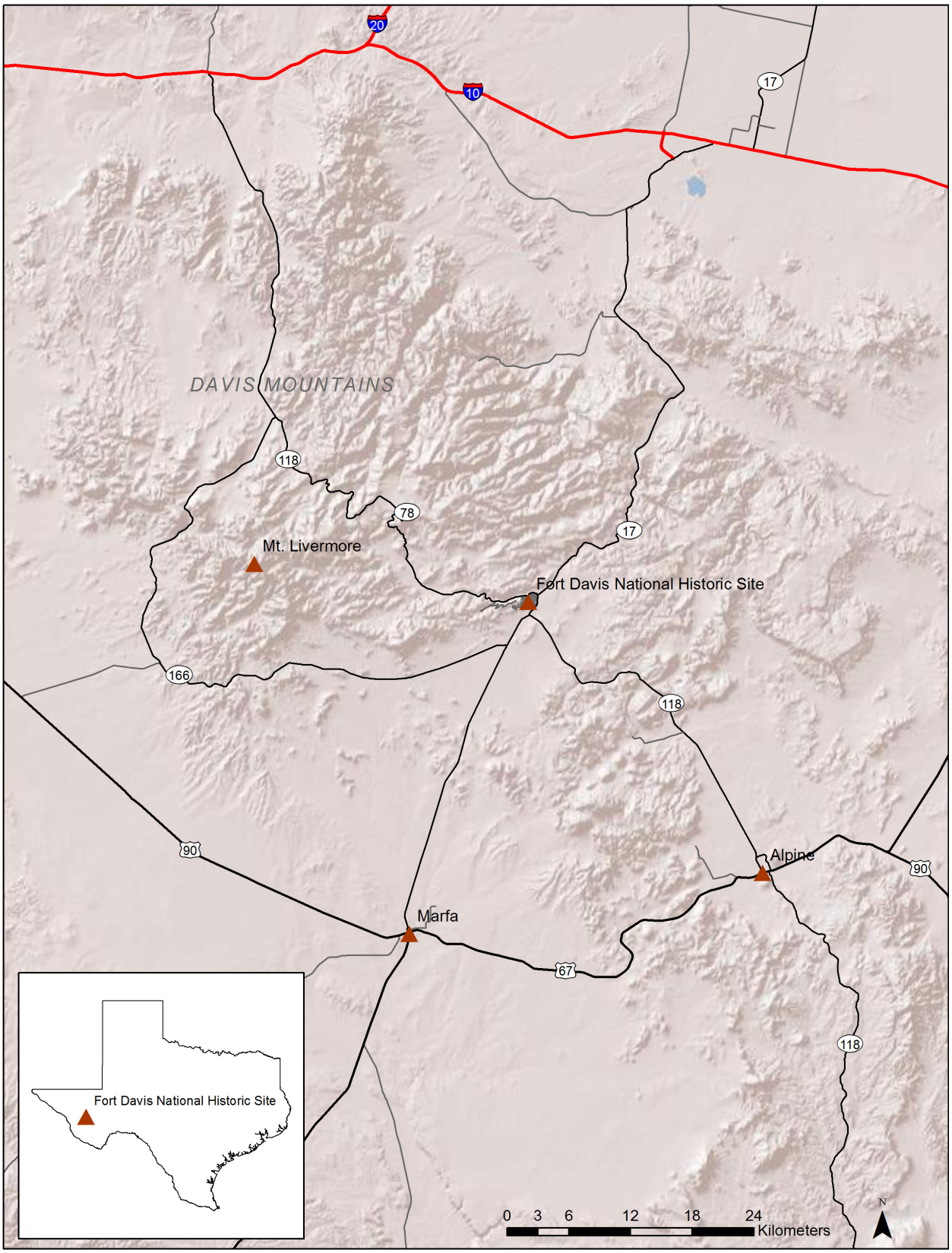


Figure 1. Fort Davis National Historic Site is located adjacent to the town of Fort Davis in the Davis Mountains of the Trans-Pecos region in western Texas.

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. As a result 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 enabled the NPS to move forward with dozens of new park-unit vegetation classification and mapping projects, including the project at Fort Davis NHS. 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 (Lee 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.

1.3 Park Environment

1.3.1 Location and Cultural Setting

Fort Davis NHS is located in the western Trans-Pecos region of Texas along the southern edge of the Davis Mountains (Figures 1 and 2). The town of Fort Davis abuts the park along its southern boundary. The town has a population of about 1,050 and is the the county seat for Jeff Davis County. When established in 1961, the park consisted of 186 ha (460 ac); in 1999, 5.6 ha (14) acres were added by donation, followed by an acquisition of an additional 20 ha (50 ac) in 2011 along the western boundary for a total of 211.6 ha (523 ac).

As part of the General Management Plan, the park was divided into three Resource Opportunity Areas (ROAs) (Figure 3). The Historic Core ROA contains most of the fort's historic structures and ruins that lie at the mouth of Hospital Canyon and extends westward into the canyon to incorporate the old hospital, water facilities, and other structures. The historic core was heavily used during the fort's heyday and contains 24 restored historic buildings and over 100 ruins and foundations. The Historic Core ROA is flanked by the Natural Backdrop ROA consisting of Sleeping Lion Ridge to the south and North Ridge to the north. This ROA consists mostly of natural vegetation with a signed dirt nature trail that loops from the Historic Core ROA up onto North Ridge at the eastern end and back down into Hospital Canyon at the west end. The Foreground ROA incorporates the areas along the eastern boundary that historically were used for agriculture and grazing along with other auxiliary activities of the fort, and includes a remnant cottonwood grove that has served as a picnic ground in the past.

Elevation ranges from 1,470 m (4,830 ft) along the eastern boundary to 1,630 m (5,355 ft) on North Ridge and 1,585 m (5,200 ft) on Sleeping Lion Ridge. Slopes of the ridges are steep and boulder strewn with large areas of conspicuous cliffs that lend not only to the scenic character of the site, but also point to why the fort may have been established in this relatively protected site. In addition, an ephemeral stream course extends along Hospital Canyon and

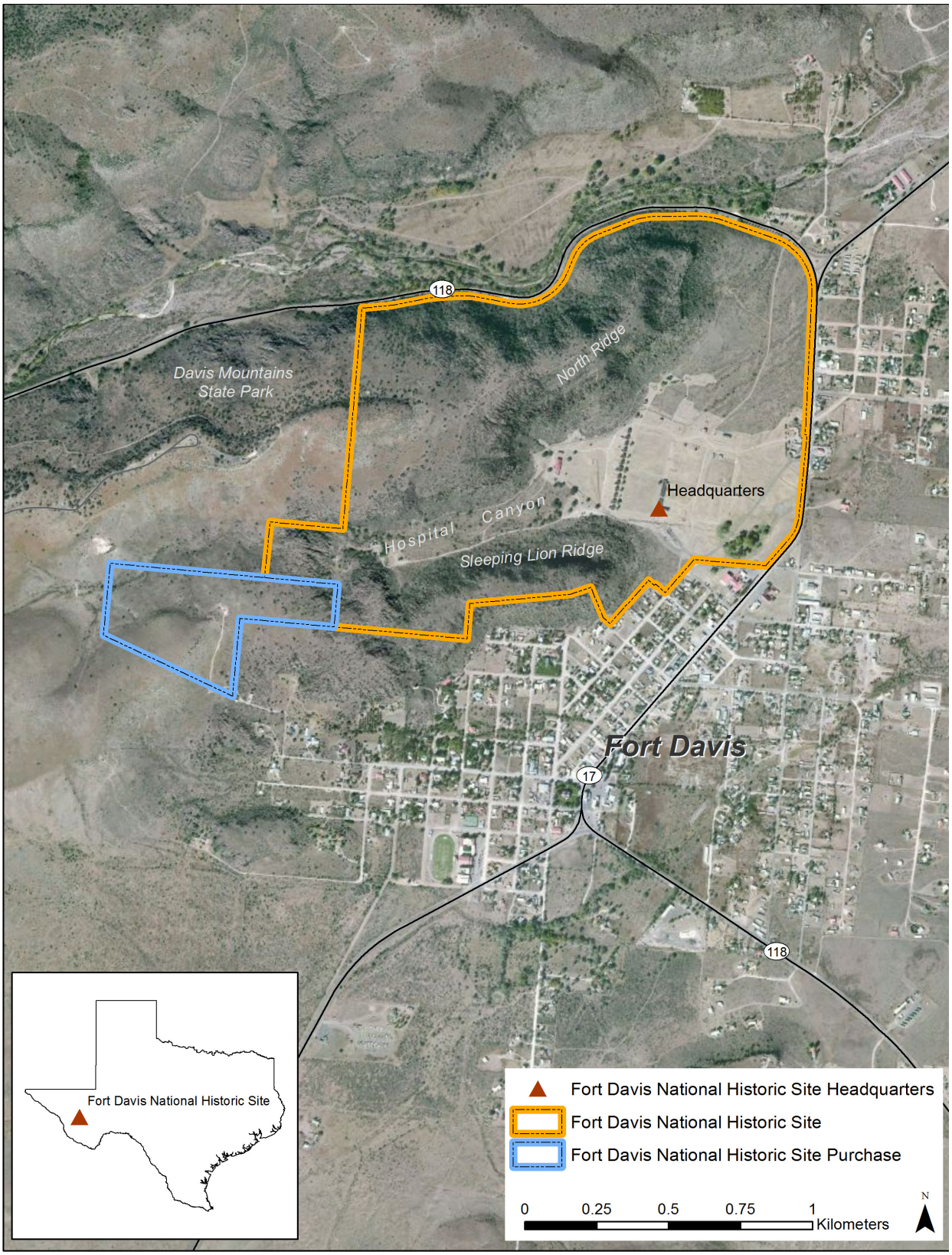


Figure 2. Fort Davis National Historic Site mapping study area includes both the original site plus the new extension added in 2011.

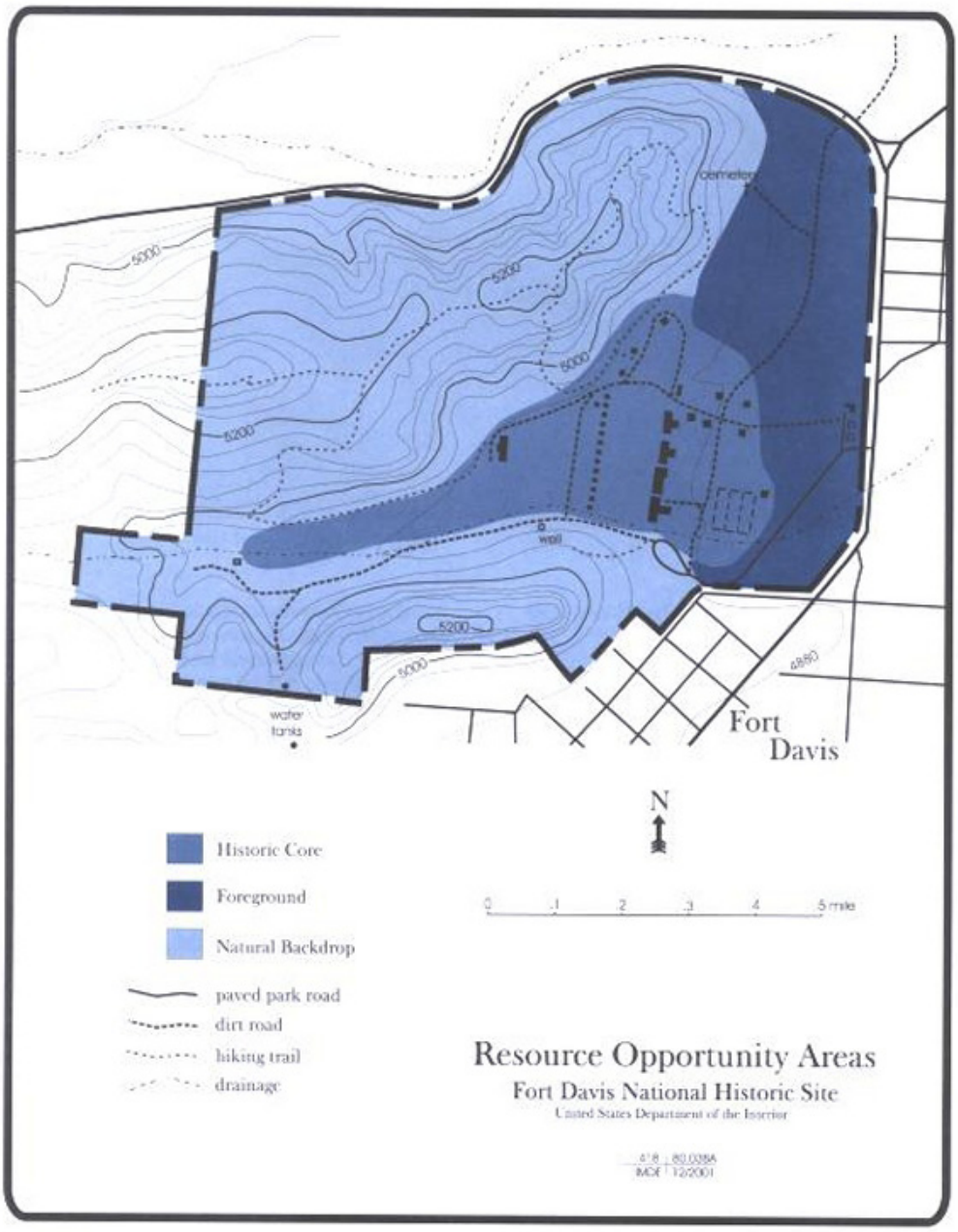
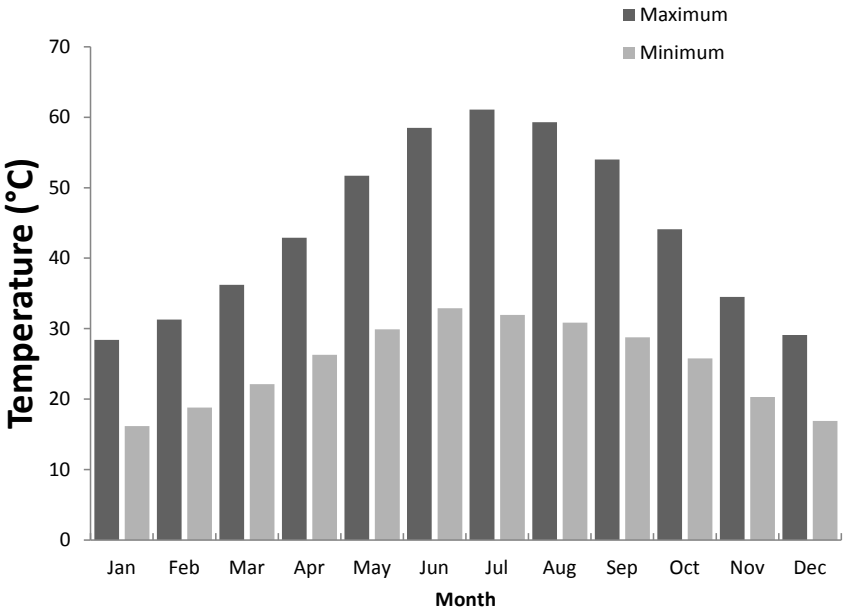


Figure 3. Resource Opportunity Areas delineated as part of the Fort Davis National Historic Site General Management Plan (NPS 2002).

at the upper end there is a small retention dam that seasonally captures runoff water in a small pool (now mostly filled in). This drainage and the springs along it served as a drinking-water source during much of the fort's active years. At its peak in the 1880s, the fort housed 400 or more enlisted men and was the staging point for thousands of emigrants, freighters, and travelers. And while the site was likely occupied by Comanche and Mescalero Apache Indians prior to the fort establishment, it is the fort and the associated settlement of the town that has left the lasting imprint of human use on the landscape and its vegetation pattern.

1.3.2 Climate

The climate of Fort Davis NHS is characterized by cool-to-cold, relatively dry winters, and warm, wet (monsoonal) summers (Figure 4a). In Fort Davis, the daily temperature extremes range between -18 °C (0.4 °F) in winter to 42 °C (107.6 °F) in summer, reflecting an essentially continental climate (Figure 4b). Mean annual precipitation is 437 mm (17.23) with



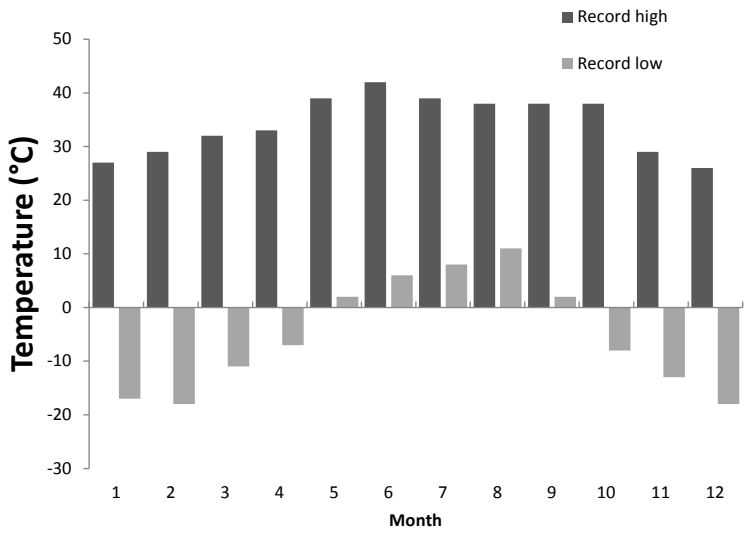


Figure 4. a) average monthly minimum and maximum daily temperatures and b) record monthly minimums and maximums at Fort Davis National Historic Site (Coop station 413262; "Climatography of the United States NO.20." National Oceanic and Atmospheric Administration. Accessed February 13, 2011).

only 21% (87 mm) of the precipitation in winter (October through March) (Figure 5). This precipitation is delivered principally by low-pressure systems that sweep from west to east across the Southwest, coalescing with moisture from the Pacific Ocean or the Gulf of Mexico. Winter precipitation is generally followed by a seasonal dry period during the months of April through May. This dry period is defined as much by the increased potential evapo-transpiration that accompanies increased day length, solar radiation, and temperatures, as by decreased precipitation. The spring dry period is usually relieved by the onset of the Mexican-Arizona monsoon during the months of June through September where precipitation averages 316 mm (12.4 in). This summer precipitation is associated mostly with short-duration, high-intensity thunderstorms, and can be localized, leading to high year-to-year variability of precipitation over small areas. During the project period, 2009 and 2010 precipitation was near normal at 429 mm (16.9 in) and 494 mm (19.5 in), respectively, but 2011was an extreme drought year with only to 142 mm (5.6 in). Most of that fell in the summer but was still well below the summer mean (34% below normal).

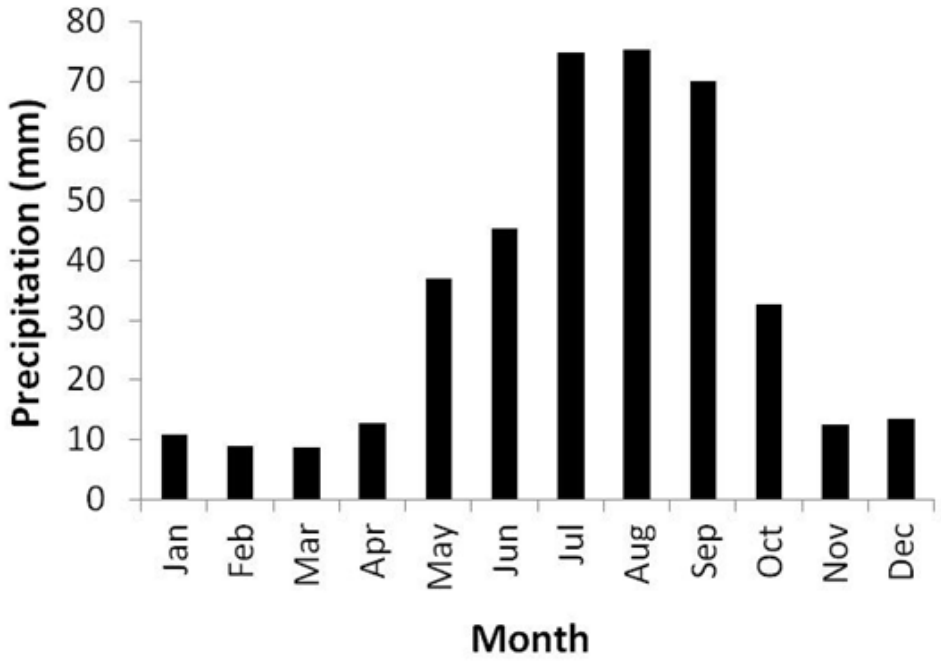


Figure 5. Average monthly precipitation distribution at Fort Davis National Historic Site. Summer rainfall predominates, but in any given year winter precipitation can be significant, particularly in years where the El Niño/ Southern Oscillation (ENSO) index is positive (i.e., an El Niño year). (Coop station 413262: "Climatography of the United States NO.20." National Oceanic and Atmospheric Administration. Accessed February 13, 2011).

1.3.3 Geology and Soils

Fort Davis NHS is located along the southern edge of the Davis Mountains, which are part of the eastern belt of the Tertiary Trans-Pecos volcanic field that erupted some 38 to 35 million years ago (Henry et al. 1994). Erupted rocks are primarily silicic lava flows termed flood rhylolites, while basalt flows are minor elements (Anderson et al. 1995). At Fort Davis NHS, three silicic lava formations have been mapped plus a quaternary alluvium (Figure 6). Both Sleeping Lion and North Ridges are comprised primarily of the Sleeping Lion Formation, a low-silica rhyolite lava flow estimated at 35.92+/- 0.06 Ma in age (Henry et al. 1994). It is the exposed columnar jointing of this flow that provides the distinctive cliffs and boulder-strewn slopes that flank the fort (Figure 7). The Sleeping Lion Formation is underlain by the Frazier Canyon Formation, a rhyolitic tuff that is exposed along the base of the cliffs primarily at the eastern edge of the ridges. The younger Barrel Springs Formation caps the Sleeping Lion in the western portions of park and estimated at 35.6 to 35.3 MA in age. Everett (1967) described it as a welded tuff called ignimbrite while Henry et al. (1994) referred to it as a rhylolitic rheomorphic ash flow. Rock from this formation was apparently an important construction material for the fort and the town (Thomas et al. 1999). The intervening valley bottom of Hospital Canyon, and core and foreground areas are mapped as Quaternary alluvial fan deposits.

While these geological formations are limited in number on the fort, they impart distinctive features to the soils and vegetation. Turner and Jaco (1969) and Turner (1977) mapped Fort Davis NHS soils with nine map units comprised of 20 different soils (Figure 8). Haynie (2000) summarized their findings as follows:

"Soils are distinct between the low elevations of the Fort's historic military parade grounds versus the soils of the Hospital Canyon and the two mountain areas. The parade grounds and the flat areas are comprised of the Musquiz association of soils. The groupings of soils within this association consists of 50 to 70% Musquiz soils, 10 to 30% soils that are similar to Musquiz soils (including Redona, Chispa, Santo Tomas, Verhalen, and Reagen soils), and 0 to 40% other soils. The soils of this association have high available-water capacity. The Hospital Canyon soils are the Gageby series of deep, noncalcereous, loamy, well-drained soils.

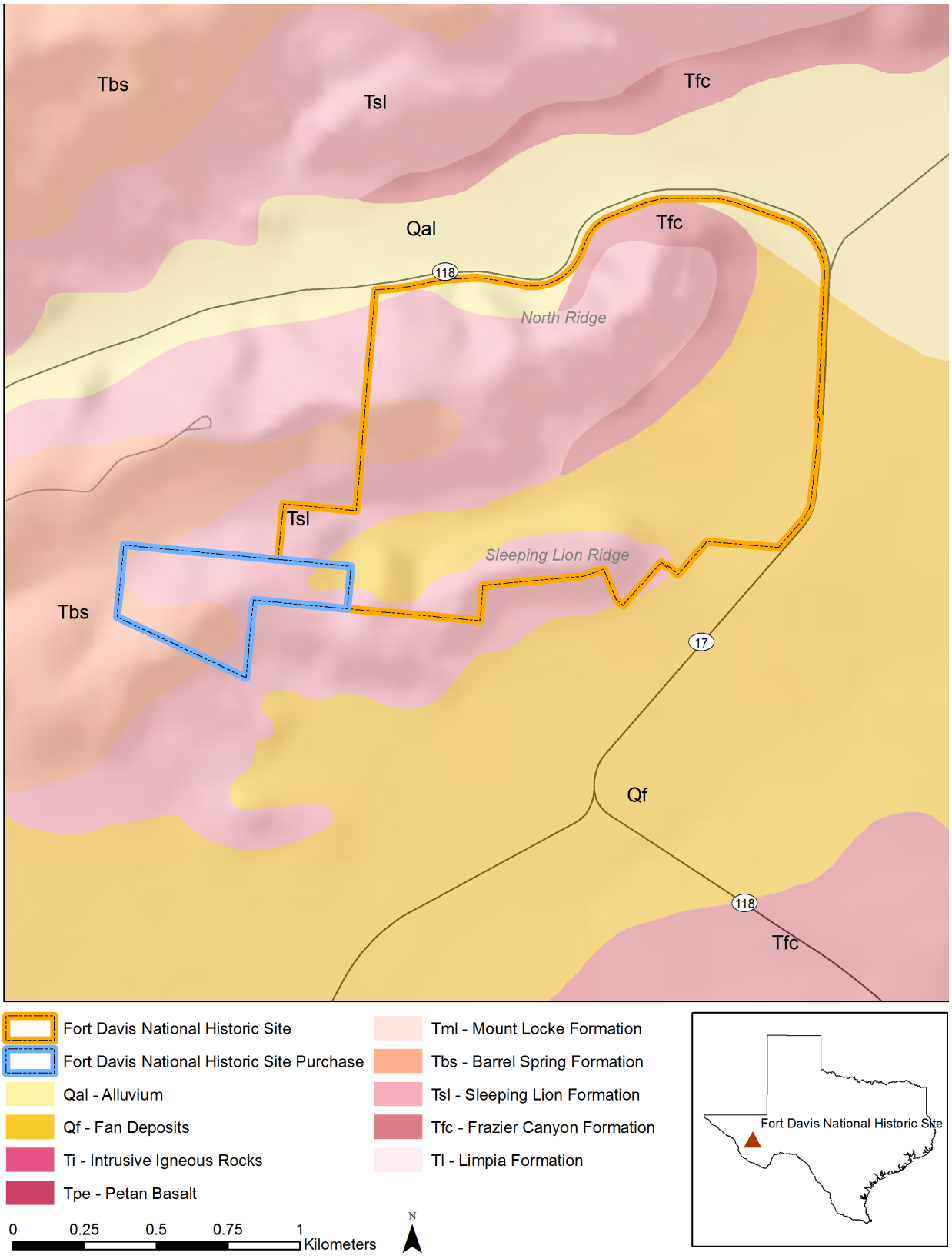


Figure 6. The general geology of Fort Davis National Historic Site as mapped by Anderson et al. (1995).

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Figure 7. Columnar jointing of the Sleeping Lion Formation rhyolitic lavas provides the distinctive cliff boulder backdrop to Fort Davis National Historic Site.

The Gageby association contains 80 to 90% Gageby soils and 0 to 20% other soils. The other soils include Rockhouse, Medley, and Santo Tomas soils. The Rockhouse soils are located on low ground by the dry streambed. The Gageby association has high available-water capacity. The slopes of North Ridge Mountain, including the slopes of Hospital Canyon, consist of the Santo Tomas-Medley association of soils. The Santo Tomas-Medley association contains 20 to 60% Santo Tomas gravelly loam, 30 to 70% Medley loam and 10 to 40% other soils. The soils of the association include Boracho, Espy, Limpia, Brewster, and Volco soils. The Santo Tomas soils have medium available-water capacity while the Medley soils have high available-water capacity. The soils of North Ridge and Sleeping Lion mountains are of the Rock outcrop-Brewster association. The Rock outcrop-Brewster association consists of 50 to 90% igneous rock outcrop, 10 to 40% Brewster soils, and 0 to 20% other soils. This association has rocky soils and a low water capacity."

1.3.4 Previous Botanical and Vegetation Studies

Haynie (2000) conducted a botanical survey and an analysis of both historical and current vegetation patterns on Fort Davis NHS. She reviewed the historical botanical collections and provided a list of 227 species based on her collections in 1996 and 1997. Of these, 104 had not been previously recorded from the site.

Using Hendrickson and Johnston's (1983) vegetation classification system as guide, she identified and mapped based on visual dominance, six different plant communities:

1. Grama Grassland dominated by *Bouteloua gracilis* (blue grama), *B. curtipendula* (sideoats grama), *Bothriochloa barbinodis* (cane bluestem), *Sorghum halepense* (Johnsongrass), and *Muhlenbergia rigens* (deergrass).

2. Mixed-desert Scrub dominated by *Acacia constricta* (white-thorn acacia) and *Mimosa aculeaticarpa* var. *biuncifera* (catclaw mimosa).

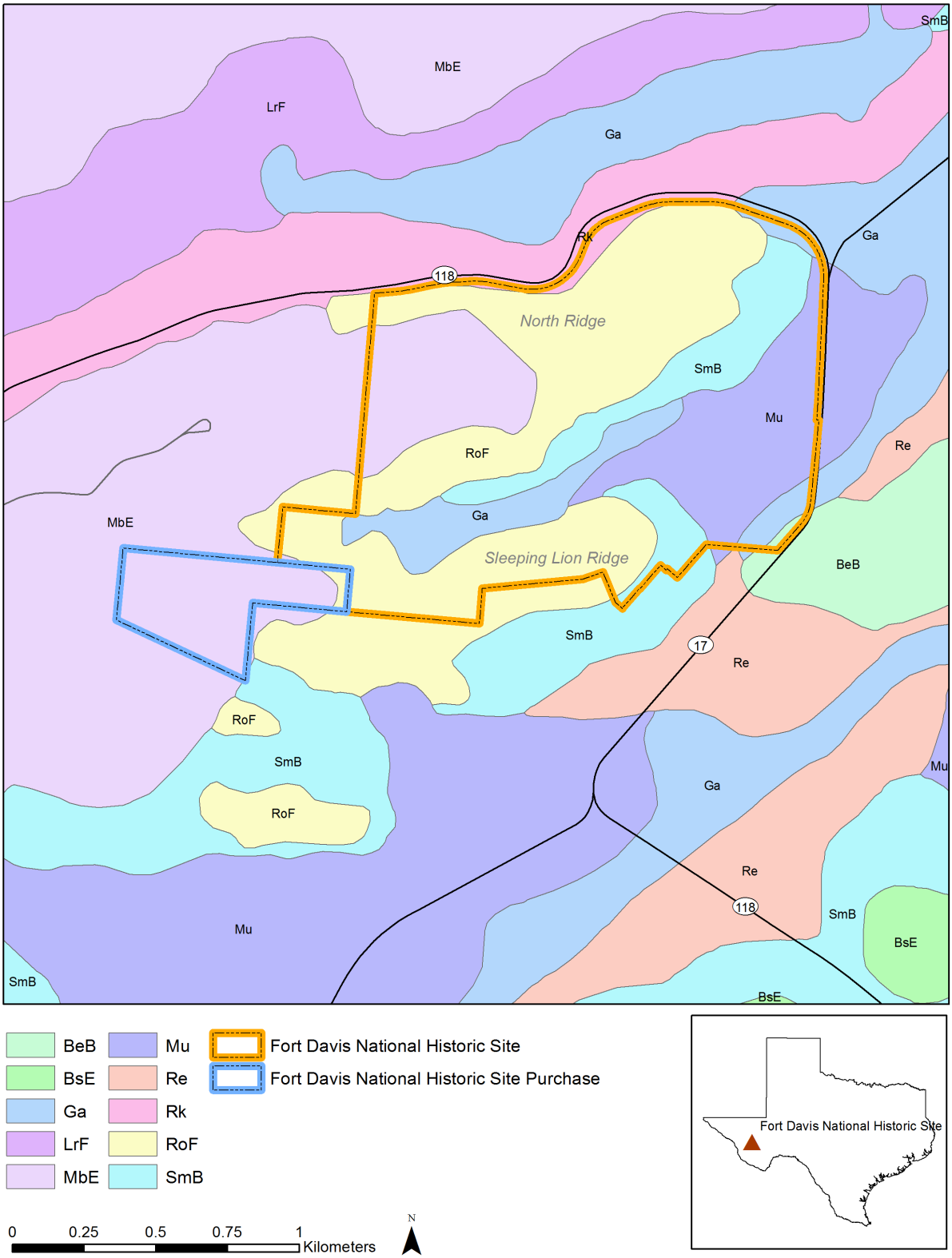

Figure 8. Soils map for Fort Davis National Historic Site derived from Turner and Jaco (1969). BeB=Boracho-Espy association, gently sloping; BsE=Brewster association, hilly; Ga=Bigetty association; LrF=Liv-Mainstay-Rock outcrop association, steep; MbE=Mainstay-Brewster association, hilly; Mu=Musquiz association; Re=Redona association; Rk=Rockhouse-Bigetty association; RoF=Rock outcrop-Brewster association, steep; and SmB=Santo Tomas-Medley association, gently sloping.

3. Sotal Scrub with D*asylirion leiophyllum* (green sotol) and *Yucca elata* (soaptree yucca) as conspicuous elements mixed with *Acacia constricta*, *Mimosa aculeaticarpa* var. *biuncifera*, *Rhus microphylla* (littleleaf sumac), *Aloysia wrightii* (organillo), and other shrubs, but with grassy understory.

4. Sandy Arroyo Scrub characterized by *Brickellia californica* (California brickellbush), *Brickellia baccharidea* (resinleaf brickellbush), *Celtis laevigata* var. *reticulata* (net-leaf hackberry), *Chilopsis linearis* (desert willow), *Juglans microcarpa* (little walnut), and *Baccharis salicina* (willow Baccharis).

5. Canyon Scrub characterized by *Sophora secundiflora* (Texas mountain laurel), *Rhus trilobata*, *Ungnadia speciosa* (Mexican buckeye), *Diospyros texana* (Texas persimmon), and *Leucaena retusa* (littleleaf tree).

6. Montane Chaparral dominated by *Quercus grisea* (gray oak), *Q. emoryi* (Emory oak), *Rhus virens* (evergreen sumac), *Mahonia trifoliolata* (algerita), and *Sophora secundiflora* among other shrubs and grasses.

With the exception of sandy arroyo scrub and canyon scrub, these communities had historical correlates based on paired photo-point comparisons. She suggest that the mixed-desert scrub and the montane chaparral communities have expanded since the mid 1800s, perhaps as a function of decreased precipitation, fire suppression, or cattle grazing.

Chapter 2 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 Fort Davis NHS, 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 Fort Davis NHS classification.

2.1 Classification Methods

2.1.1 The National Vegetation Classification Standard

The classification system used in CHDN vegetation mapping projects is based on the National Vegetation Classification Standard (NVCS) adopted by the Federal Geographic Data Committee (FGDC) in 1997 and updated in 2008 (FGDC 1997 and 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 non-governmental agencies (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.

2.1.2 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

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

Level	Level name	Criteria	Example
Upper levels			
1	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)
2	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)
3	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			
4	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)
5	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)
6	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			
7	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)
8	Association	Diagnostic species, usually from multiple growth forms or layers, and more narrowly similar composition that reflect topo-edaphic climate, substrates, hydrology, and disturbance regimes.	*Andropogon gerardii–Panicum virgatum–Helianthus grosseserratus* Herbaceous Vegetation (Central Wet-mesic Tallgrass Prairie)

during the rainy season between July 15 and 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 for which a series of daily routes for the sampling crews were designed in a GIS using the 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 foot by a field crew (sampling days were ten hours long to further increase daily efficiency). Routes were distributed as widely as possible throughout the study area. While using the GIS was an excellent planning tool that took much of the guesswork out of plot placement, final plot locations were determined by field-based decisions predicated on positioning the sampling point in homogenous stands of vegetation and habitat.

Field crews were composed of two people with a senior technician crew chief, who was responsible for botany and vegetation sampling, while the second and third members were junior technicians responsible for gathering 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 0.5 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 life form (tree, shrub, subshrub, grass, and forb layers) and height strata was compiled, and cover estimated for each species using a modified Domin-Krajina Scale (Table 2) (Mueller-Dombois and Ellenberg 1974). Total non-overlapping cover was also recorded by stratum. Site attributes for plots, including slope percent, aspect, slope shape, surface rock type, and ground cover (percent rock, gravel, bare soil and litter) were noted, along with 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 cardinal 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 was logged for future reference. See Appendix A for NHNM field-survey handbook and examples of sampling forms and detailed descriptions of sampling procedures.

We primarily used standard plots to support vegetation classification development, and three to five can be established in a day. For maximizing ground control for the mapping process, we employed stripped-down mapping plots (quick plots) for which 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). Lastly, we utilized simple observation points (OPs) for which we recorded GPS locations, plant association designation, and brief qualitative descriptions. Sixty-five plots in total were collected for the classification and mapping portion of the project (Figure 9). Of these 65 plots, 44 were standard plots and 21 were quick plots.

We collected plant voucher specimens to confirm field identifications when necessary. NHNM botanist Yvonne Chauvin identified specimens to the lowest level possible, given the material at hand, and assigned names 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.

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

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; $m^2/400\ m^2$ is the actual area represented by the cover class within the $400m^2$ 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]
+	<0.05	<0.04 m	0.01
1	<0.1	≥0.04 and 0.5	0.05
2	<1	≥0.5 and <4	0.5
3	1–4	≥5 and <20	2.5
4	5–10	≥20 and <40	7.5
5	10-25	≥40 and <100	17.5
6	25-33	≥100 and <132	29.0
7	33-50	≥132 and <200	41.5
8	50-75	≥200 and <300	62.5
9	>75	≥300 m	87.5

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_ FODA.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.

2.1.3 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.

2.2 Classification Results

While Fort Davis NHS is a small park, the vegetation communities were relatively diverse. We identified 33 plant associations (PAs) among ten groups, most of which were semi-arid grasslands and shrublands, but there are also oak and riparian woodlands, and a set of ruderal types that reflected past cultural disturbance. In Table 3, we present the PAs ordered by the NVCS hierarchy, along with their classification status, number of

FODA (Fort Davis NHS) plots, NatureServe/NHNM database code, and which map units they are included in (see Chapter 3). Only four PAs were considered established or provisional types according to the NVC, i.e., they are well documented, either in the park or in the region, and have been entered into the NVC database and assigned a global NatureServe database code beginning with "CEGL." The other 29 have not been reviewed by Natureserve and have been provisionally assigned NHNM database codes ("NHNH" or "NPS"). Some of these are only documented at Fort Davis NHS and, hence, are considered "Park Specials," which need further documentation before being officially included in the NVC. Others have been documented elsewhere in the Southwest and have been proposed by NHNM for inclusion in the NVC. Lastly, some associations were detected in the 2010 accuracy assessment of Von Loh and Cogan (in press) and in the supplemental 2011 sampling in the extension area. These are considered incidental associations pending additional sampling in the park. With the exception of the incidental associations and the non-vegetated types, we provide local plant association 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 related inclusion, or a contrasting inclusion (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 within the park in the context of the new NVCS hierarchy. We focus on the middle tiers of the hierarchy (Division, Macrogroup, and Group), with brief summaries of plant association (PA) composition and distribution (Table 1).

2.2.1 Woodlands

Woodlands on Fort Davis NHS fall into three groups. There are four oak-dominated woodland associations that belong to the Madrean Encinal Group: a group with floristic affinities associated with the Sierra Madre of Mexico (Figure 10). These four associations are dominated by either *Quercus emoryi* (Emory oak) or *Quercus grisea* (gray oak), and form open to closed stands on the northerly slopes and summits of Sleeping Lion and North Ridges. The exception is the *Quercus emoryi-Celtis laevigata* var. *reticulata* Woodland (Emory's Oak-Netleaf Hackberry Woodland), which occurs along the bottom of Hospital Canyon and sometimes extending upslope along the drainages. These communities have diverse understories which are typically grass dominated with a mixture of shrubs. The most abundant and diagnostic grasses include *Muhlenbergia emersleyi* (bull grass), *Heteropogon contortus* (tanglehead), *Bouteloua chondrosioides* (sprucetop grama), *Bouteloua curtipendula* (sideoats grama), *Eragrostis intermedia* (plains lovegrass), and *Schizachyrium cirratum* (Texas bluestem). Shrubs are well represented, and among the 33 species the most commonly recorded species were *Rhus virens* (evergreen sumac), *Aloysia gratissima* (whitebrush), *Rhus microphylla* (littleleaf sumac), *Mimosa aculeaticarpa* var. *biuncifera* (catclaw mimosa), *Rhus trilobata* (skunkbush sumac), *Opuntia engelmannii* (cactus apple), and *Sophora secundiflora* (mescal bean). While often common, these shrubs are more abundant and representative among the various shrublands of the park described below (see section 2.2.2). The woodlands are the closest analog to what Haynie (2000) called Montane Chaparral—she did not describe a specific woodland type. And although she suggested that "montane chaparral" was possibly expanding since the 19th century based on repeat photographs, most of the oak stands we sampled had older, large trees suggesting that these stands have been in place for a long time (while shrubby oaks can occur they are never dominant either in the woodlands or shrublands). The recent 2011 fire did burn through some oak woodlands burning mature trees, but most were resprouting. How long it takes large trees to grow back in this landscape is unknown, but it may take as much as 100 years, suggesting that fire-return intervals may need to be long to maintain older mature stands.

Intermixed with the oak woodlands are stands dominated by the small-statured

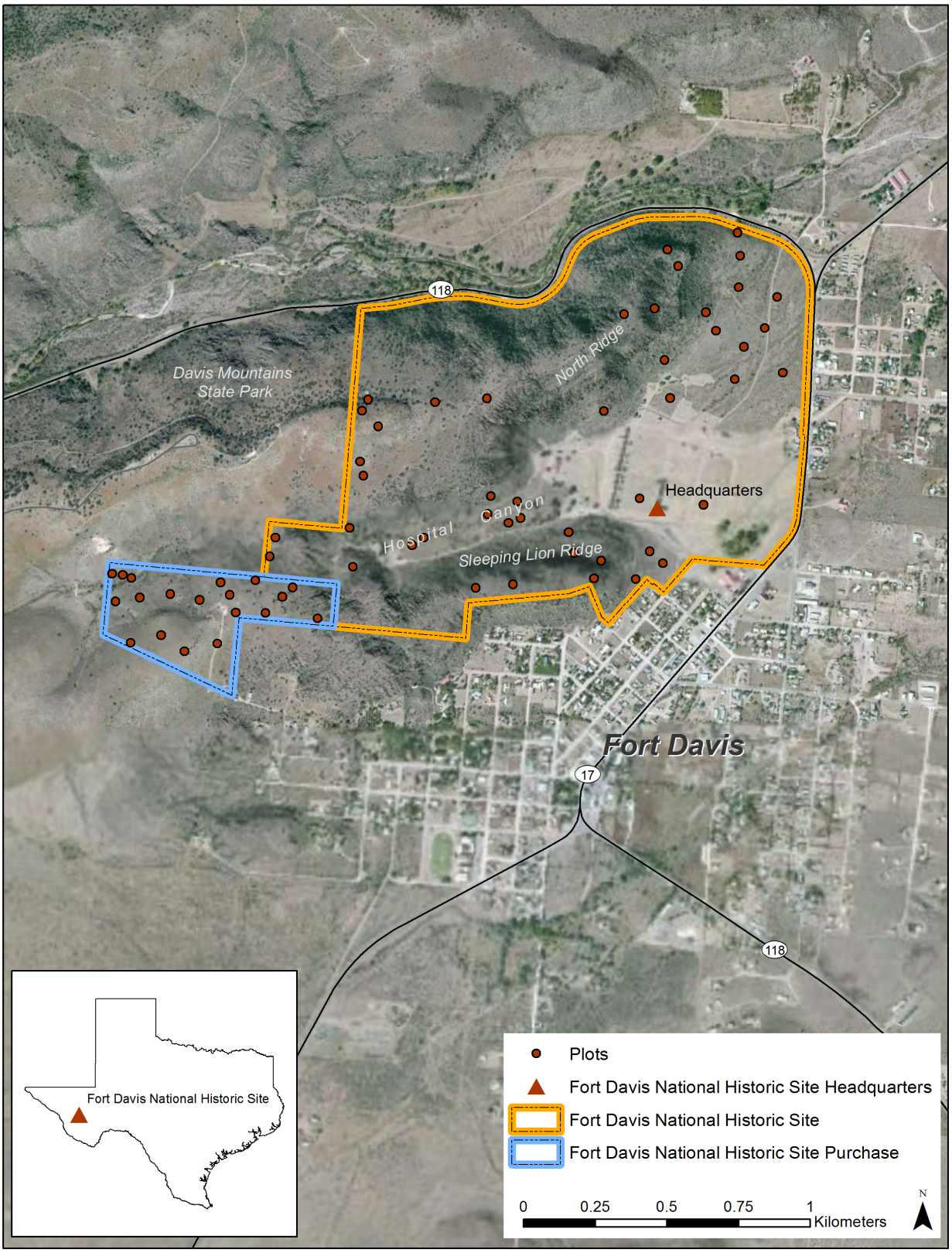

Figure 9. Distribution of 65 vegetation plots used in the development of the vegetation classification and map for Fort Davis National Historic Site.

Table 3. A hierarchical vegetation classification for the Fort Davis National Historic Site 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). "I" refers to the importance of the association within the park as either a major (maj) element (.i.e., relatively abundant within the park), a minor (min) element (limited distribution in the park), or incidental (reported as part of the accuracy assessment or only in the 2011 extension area survey). The "n" refers to the number of quantitative plots gathered for the association on Fort Davis NHS (excludes semi-quantitative observation points). The status (S) of a plant association is indicated as either established (E) in the national classification or a provisional pending review 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 (Ri) (see Table 5).

Class	Subclass	Formation	Division	Macrogroup Key	MacroGroup	Group Key	Group	Plant Association	I	n	S	Code	Map Units
1 Forest & Woodland (Mesomorphic Tree Vegetation)													
	1.C Temperate Forest												
		1.C.1 Warm Temperate Forest											
			1.C.1.c Western North American Warm Temperate Forest										
				M010	Madrean Warm Lowland Evergreen Woodland								
						G201	Madrean Encinal Group						
								Quercus emoryi - Celtis laevigata var. *reticulata* Woodland	Maj	3	P	NHNM000701	2B
								Quercus emoryi / Heteropogon contortus Woodland	Maj	1	P	NHNM000704	2C
								Quercus emoryi / Muhlenbergia emersleyi Woodland	Incid	1	E	CEGL000685	2C
								Quercus grisea - Quercus emoryi Woodland	Maj	4	P	NHNM000719	2A

Table 3. A hierarchical vegetation classification for the Fort Davis National Historic Site following the National Vegetation Classification System of seven levels: Class, Subclass, Formation, Division, MacroGroup, Group, and Plant Association (*continued*).

Class	Subclass	Formation	Division	Macrogroup Key	MacroGroup	Group Key	Group	Plant Association	I	n	S	Code	Map Units
						G487	Madrean Juniper Savanna & Woodland Group							
								Juniperus pinchotii / Bouteloua curtipendula Woodland	Maj	1	P	NHNM000465	1A
		1.C.3 Temperate Flooded & Swamp Forest											
			1.C.3.d Western North American Warm Temperate Flooded & Swamp Forest										
				M036	Warm Mediterranean & Desert Riparian, Flooded & Swamp Forest								
						G508	Sonoran-Chihuahuan Lowland Riparian Forest Group						
								Celtis laevigata var. *reticulata* / *Brickellia californica* Woodland	Min	1	P	NHNM000370	2B
								Populus deltoides (ssp. *wislizeni*, ssp. *monilifera*) / Ruderal Disturbance Woodland	Min	N/A	P	NHNM000852	7A
3 Semi-Desert (Xeromorphic Scrub & Herb Vegetation)													
	3.A Warm Semi-Desert Scrub & Grassland												
		3.A.1 Warm Semi-Desert Scrub & Grassland											
			3.A.1.a North American Warm Desert Scrub & Grassland										

Table 3. A hierarchical vegetation classification for the Fort Davis National Historic Site following the National Vegetation Classification System of seven levels: Class, Subclass, Formation, Division, MacroGroup, Group, and Plant Association (*continued*).

Class	Subclass	Formation	Division	Macrogroup Key	MacroGroup	Group Key	Group	Plant Association	I	n	S	Code	Map Units
				M086	Chihuahuan Desert Scrub								
						G288	Chihuahuan Creosotebush Mixed Desert Scrub Group						
								Acacia constricta - *Opuntia engelmannii* Shrubland	Maj	1	P	NHNM000290	3B, 3D
								Aloysia wrightii / *Bouteloua curtipendula* Shrubland	Min	1	P	NHNM000329	3D
								Mimosa aculeaticarpa var. *biuncifera* - A*loysia gratissima* / *Bouteloua curtipendula* Shrubland	Maj	2	P	NHNM000502	3D
								Mimosa aculeaticarpa var. *biuncifera* - *Aloysia gratissima* / *Bouteloua gracilis* Shrubland	Min	2	P	NHNM000503	3D
								Mimosa aculeaticarpa var. *biuncifera* - *Aloysia gratissima* - *Opuntia engelmannii* Shrubland	Maj	3	P	NHNM000814	3E

Table 3. A hierarchical vegetation classification for the Fort Davis National Historic Site following the National Vegetation Classification System of seven levels: Class, Subclass, Formation, Division, MacroGroup, Group, and Plant Association (*continued*).

Class	Subclass	Formation	Division	Macrogroup Key	MacroGroup	Group Key	Group	Plant Association	I	n	S	Code	Map Units
								Mimosa aculeaticarpa var. *biuncifera* / *Bouteloua curtipendula* Shrubland	Maj	3	P	NHNM000507	3C
								Mimosa aculeaticarpa var. *biuncifera* / *Bouteloua gracilis* Shrubland	Min	3	P	NHNM000509	3C
								Sophora secundiflora - *Aloysia wrightii* Shrubland	Maj	1	P	NHNM000794	3A
						G289	Apacherian-Chihuahuan Mesquite Upland Scrub Group						
								Prosopis glandulosa / *Bouteloua gracilis* Shrubland	Maj	4	E	CEGL001383	4A
								Prosopis glandulosa var. *torreyana* Shrubland	Incid	1	E	CEGL001381	4A

Table 3. A hierarchical vegetation classification for the Fort Davis National Historic Site following the National Vegetation Classification System of seven levels: Class, Subclass, Formation, Division, MacroGroup, Group, and Plant Association (*continued*).

Class	Subclass	Formation	Division	Macrogroup Key	MacroGroup	Group Key	Group	Plant Association	I	n	S	Code	Map Units
				M087	Apacherian - Chihuahuan Semi-Desert Grassland & Shrub-steppe								
						G490	Apacherian - Chihuahuan Semi-Desert Grassland and Shrub-steppe Group						
								Bouteloua curtipendula - Heteropogon contortus Herbaceous Vegetation	Maj	1	P	NHNM000024	5B
								Bouteloua curtipendula / Rockland Herbaceous Vegetation	Min	1	P	NHNM000039	2A, 6A
								Bouteloua gracilis - Bouteloua curipendula - Mixed Shrub Herbaceous Vegetation					
								Bouteloua gracilis - Setaria leucopila Herbaceous Vegetation	Min	3	P	NHNM000815	5D

Table 3. A hierarchical vegetation classification for the Fort Davis National Historic Site following the National Vegetation Classification System of seven levels: Class, Subclass, Formation, Division, MacroGroup, Group, and Plant Association (*continued*).

Class	Subclass	Formation	Division	Macrogroup Key	MacroGroup	Group Key	Group	Plant Association	I	n	S	Code	Map Units
								Bouteloua hirsuta - Bouteloua eriopoda Herbaceous Vegetation	Maj	4	P	NHNM000107	5C
								Dasylirion leiophyllum / Bouteloua curtipendula Shrub Herbaceous Vegetation	Incid	4	P	NHNM000030	5E
								Muhlenbergia emersleyi - Bouteloua curtipendula Herbaceous Vegetation	Min	2	E	CEGL001644	1A, 5A
								Nolina texana / Bouteloua curtipendula Shrub Herbaceous Vegetation	Incid	3	P	NHNM000036	5F
								Nolina texana / Bouteloua eriopoda Shrub Herbaceous Vegetation	Maj	1	P	NHNM000082	5A

Table 3. A hierarchical vegetation classification for the Fort Davis National Historic Site following the National Vegetation Classification System of seven levels: Class, Subclass, Formation, Division, MacroGroup, Group, and Plant Association (*continued*).

Class	Subclass	Formation	Division	Macrogroup Key	MacroGroup	Group Key	Group	Plant Association	I	n	S	Code	Map Units
								Parthenium incanum / *Bouteloua eriopoda* Shrub Herbaceous Vegetation	Min	1	P	NHNM000083	5A
				MSWU	Miscelleneous Southwestern Herbaceous Vegetation								
						GSWU	Miscellaneous Southwestern Herbaceous Vegetation Group						
								Bouteloua curtipendula / Ruderal Herbaceous Vegetation	Min	1	P	NHNM000040	5C
								Bouteloua gracilis / Ruderal Herbaceous Vegetation	Maj	4	P	NPS_NM043	5D, 7C
								Sorghum halepense / Monotypic Herbaceous Vegetation	Maj	1	P	NHNM000252	7B
								Ruderal Disturbance Vegetation	Incd	AA	P	NPS_NM027	7C
6 Nonvascular & Sparse Vascular Rock Vegetation (Lithomorphic Vegetation)													
	6.C Semi-Desert Rock Vegetation												
		6.C.1 Warm Semi-Desert Cliff, Scree & Rock Vegetation											
			6.C.1.a North American Warm Semi-Desert Cliff, Scree & Rock Vegetation										

Table 3. A hierarchical vegetation classification for the Fort Davis National Historic Site following the National Vegetation Classification System of seven levels: Class, Subclass, Formation, Division, MacroGroup, Group, and Plant Association (*continued*).

Class	Subclass	Formation	Division	Macrogroup Key	MacroGroup	Group Key	Group	Plant Association	I	n	S	Code	Map Units
				M117	North American Warm Semi-Desert Cliff, Scree & Rock Vegetation								
						G569	North American Warm Semi-Desert Cliff, Scree & Rock Vegetation						
								Sparse Vegetation / Boulder Rockland	Incid	1	P	NPS_NM013	6A
8 Developed Vegetation (Hortomorphic Vegetation)													
		8.1. Herbaceous & Woody Developed Vegetation											
			8.1.B. Other Developed Urban / Built Up Vegetation										
				CMNEW	Other Urban / Build Up Vegetation								
						CGNEW	Southwestern Urban / Build Up Vegetation						
								Ruin-Restored					
								Ruin-Unrestored					
								Urban / Built-up Vegetation					
								Disturbed / Non-vegetated	Incid	1	P	NPS_NM047	6B, 7C

P. NEVILLE

Figure 10. Evergreen oak woodlands dominated by Emory's oak (*Quercus emoryi*) and gray oak (*Q. grisea*) cloak the north-facing slopes and ridges of Sleeping Lion and North Ridge.

conifer *Juniperus pinchotii* (Pinchot's juniper) which are part of the Madrean Juniper Savanna and Woodland Group (Figure11). These are open-canopied grassland savannas with relatively high grass cover dominated by *Bouteloua curtipendula*, *Eragrostis intermedia*, *Aristida purpurea* var. *nealleyi* (Nealley's threeawn), *Hesperostipa neomexicana* (New Mexico needlegrass), and *Muhlenbergia emersleyi*. Shrubs are typically few and scattered. Fire is 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

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Figure 11. Madrean Juniper Savanna dominated by *Juniperus pinchotii* (Pinchot's juniper) occur on the northern slopes of the ridges and on the summits.

regime of high-frequency, low-intensity surface fires. Whether the woodland fire regime on Fort Davis NHS has been significantly altered from pre-settlement conditions is not known. The 2011 fire that moved through some of the savannas definitely killed some junipers and created more open woodlands and grasslands.

Associated with the *Quercus emoryi-Celtis laevigata* var. *reticulata* Woodland along the drainage of Hospital Canyon is the similar *Celtis laevigata* var. *reticulata -Brickellia californica* Woodland that lacks the oak component (Figure 12). It is classified as a dry-riparian element of the Sonoran-Chihuahuan Lowland Riparian Forest Group, but can be low-statured and shrubby. This association is species rich and includes some 30 shrubs and herbs. The most abundant are grasses such as *Bouteloua gracilis* (blue grama), *Setaria leucopila* (streambed bristlegrass), *Bouteloua curtipendula*, and *Leptochloa dubia* (green sprangletop). *Populus deltoides* (ssp. *wislizeni*, ssp. *monilifera*)/Ruderal Disturbance Woodland is also part of this group and is represented on Fort Davis NHS by a remnant grove of old trees in a swale in the southeast portion of the Foreground ROA. Records indicate that this grove was planted by officer's wives and used as a picnic ground and likely later by livestock when he site was a ranch. Hence, its classification as a ruderal or weedy community.

2.2.2 Shrublands

Most of the shrublands on Fort Davis NHS are considered part of the Chihuahuan Creosotebush Mixed Desert Scrub Group (G288) and mostly dominated by *Mimosa aculeaticarpa* var. *biuncifera*, *Aloysia gratissima, Aloysia wrightii* (Wright's beebrush), and *Sophora secundiflora*. In addition, there are stands of *Acacia constricta* (whitethorn)-*Opuntia engelmannii* Shrubland that are characterized by the dominance of cacti and other succulents in the understory and between the whitethorn shrubs. In contrast to the woodlands, these shrublands cloak much of the southerly rocky slopes of Sleeping Lion and North Ridges and extend onto their summits (Figure 13). Aside from these dominant shrubs, diversity is high, with some 40 others shrubs reported. Most stands also have a strong and diverse grassy component characterized by B*outeloua curtipendula*¸ *Bouteloua gracilis*, *Bouteloua eriopoda* (black grama), *Eragrostis intermedia*, and *Heteropogon contortus* which are also major components of adjacent grasslands. Other stands have less grass cover and a strong prevalence of succulents and other shrubs such as *Opuntia engelmannii*, *Cylindropuntia imbricata* (tree cholla), and *Parthenium*

P. NEVILLE

Figure 12. Netleaf hack berry (*Celtis reticulata* var. *laevigata*) line the drainage of Hospital Canyon along with evergreen oaks.

C. FLYNN

Figure 13. Shrublands dominated by *Mimosa aculeaticarpa* var. *biuncifera* (Catclaw mimosa), *Aloysia gratissima* (Beebrush), *Aloysia wrightii* (Wright's beebrush), *Sophora secundiflora*, and *Acacia constricta* (whitethorn acacia) are common dominats of Chihuahuan mixed desert scrub found on easterly to southerly slopes and summits of North Ridge and Sleeping Lion.

incanum (Mariola) as per the *Mimosa aculeaticarpa* var. *biuncifera- Aloysia gratissima-Opuntia engelmannii* Shrubland and *Acacia constricta-Opuntia engelmannii* Shrubland associations. Lastly, the *Sophora secundiflora-Aloysia wrightii* Shrubland, which is a community found primarily among the boulder and cliffs, is both low in grass cover and succulents.

There are also shrublands dominated by *Prosopis glandulosa* (honey mesquite) that are prevalent in the Foreground ROA and that are classified in their own Apacherian-Chihuahuan Mesquite Upland Scrub Group (Figure 14). *Prosopis* spp. typically form open canopies with grassy intershrub spaces dominated by *Bouteloua gracilis*, *Scleropogon brevifolius* (burrograss), *Aristida divaricata*

Y. CHAUVIN

Figure 14. Mesquite is prevalent in the Foreground ROA where it has invaded grama grasslands.

(poverty threeawn), *Setaria leucopila*, and *Bouteloua curtipendula*. Stands are most prevalent on soils derived from the alluvial fan deposits on the east side of the park that historically, likely supported grasslands. With disturbance following settlement, however, mesquite invaded, as it has elsewhere in the Southwest (Buffington and Herble 1964, Dick-Peddie 1993). Haynie (2000), who included all Fort Davis NHS shrublands in her "Mixed-desert Scrub," also states that these shrublands had expanded since settlement, based on historical photographs.

2.2.3 Grasslands

Most grasslands of Fort Davis NHS fall within the Apacherian-Chihuahuan Semi-Desert Grassland & Shrub-steppe Group (Figure 15). These desert grasslands are also called shrub-steppes because there is always a shrub component, but grasses remain the dominant element. The grasslands are interspersed among shrublands and woodlands on Sleeping Lion and North Ridges, and dominate the new extension area landscape. Among the 26 grass species recorded, *Heteropogon contortus*, *Muhlenbergia emersleyi*, *Bouteloua eriopoda*, *Bouteloua curtipendula*, *Bouteloua hirsuta*, *Bothriochloa barbinodis*, *Bouteloua gracilis*, and *Bouteloua chondrosioides* are the most prevalent. Species that are conspicuous and diagnostic shrubs of desert foothill grasslands include *Dasylirion leiophyllum* (green sotol), *Nolina texana* (Texas sacahuista), and *Yucca torreyi* (Torrey's yucca). Two associations are primarily found on the alluvial fan piedmonts that extend out from the hill fronts: *Bouteloua gracilis -Bouteloua curtipendula* Mixed Shrub Herbaceous Vegetation and *Bouteloua gracilis-Setaria leucopila* Herbaceous Vegetation) (Figure 16).

As previously stated, given the proximity of the fort and town settlements, there was likely intensive grazing since the 19th century until park establishment in 1961. These practices likely lead to shrub encroachment of grasslands, and that we are now calling these areas, shrublands. This includes not only *Prosopis glandulosa*, but also *Mimosa aculeaticarpa* var. *biuncifera* and *Acacia constricta* (the invasive capacity of *Aloysia* is not well-understood). Fires naturally occur in these semi-arid grasslands, and although historical and current frequencies have not been fully investigated, they are likely to occur at intervals between 10 and 30 years, depending on fuel accumulation (McPherson 1995). The impact of fires on established shrubs is equivocal. Following the 2011 fire, most shrubs resprouted despite ensuing drought conditions. This suggests that multiple fires would likely be required to reduce shrubs significantly, but that would risk also reducing grass cover.

Y. CHAUVIN

Figure 15. Chihuahuan Semi-Desert Foothill Grassland are common on the upper slopes of Fort Davis NHS to the west and are dominated by grama grasses along with *Heteropogon contortus*, *Muhlenbergia emersleyi* and scattered shrubs such as *Dasylirion leiophyllum* (green sotol), *Nolina texana* (Texas sacahuista), and *Yucca torreyi* (Torrey's yucca).

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Figure 16. Grama grasses dominate the grasslands on the piedmont slope that extends out from North Ridge to east.

2.2.4 Miscellaneous Vegetation Types

We assigned a set of five plant associations that primarily occur on disturbed ground to a Miscellaneous Southwest Group (GSWU), pending the revision of NVCS to accommodate these semi-natural vegetation communities. While still predominantly native in composition, many species in this group tend to be weedy (ruderal), reflecting the underlying soil disturbance (e.g., *Argemone squarrosa* (hedgehog pricklypoppy), *Amaranthus palmeri* (carelessweed), *Conyza canadensis* (Canadian horseweed), *Verbesina encelioides* (golden crownbeard), *Stephanomeria pauciflora* (brownplume wirelettuce), *Cirsium undulatum* (wavyleaf thistle), *Xanthisma spinulosum* (lacy tansyaster), and *Xanthium strumarium* (rough cocklebur)). There are also significant exotics such as *Sorghum halepense* (Johnsongrass), an invasive grass of wetlands, wet meadows, and drainages.

The extensive, sparsely vegetated rhyolitic lava rockland and cliffs at Fort Davis NHS are classified in a generalized Sparse Vegetation/Boulder Rockland and are now accommodated in the NVCS in a separate division, Nonvascular and Sparse Vascular Rock Vegetation (Lithomorphic Vegetation) that contains North American Warm Semi-Desert Cliff, Scree and Rock Vegetation Group (G569).

2.3 Classification Discussion

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 the 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 Fort Davis NHS, we suggest that additional work is needed in the Davis Mountains and the Trans-Pecos Region in general to confirm the status of the many "Park Special" associations described here. Such work would help also support delineation at the Group level of the classification, and revision of alliances within the new FGDC (2008) NVCS hierarchy.

2.4 Vegetation Communities of Conservation Interest

Fort Davis NHS, although small, is part of a limited network of southwestern reserves that support semi-desert grasslands. One branch of this unofficial network, within the U.S., runs from Petroglyph National Monument and the Sevilleta National Wildlife Refuge (north-central New Mexico), southward to include White Sands Missile Range, Fort Bliss (Otero Mesa), Guadalupe Mountains National Park, and Fort Davis NHS in the Davis Mountains, then south to Big Bend National Park into the Sierra Madre Orientale of Mexico. The other branch runs southwestward through the New Mexico "bootheel" into the Sierra Madre Occidental. While semi-desert grassland as a shrub-steppe has a natural component of shrubs, as a whole, they are considered vulnerable to invasive shrubs in the Southwest U.S. and Mexico due to the intensive grazing pressure of the last 150 years. All extant grass stands should be managed for protection.

Chapter 3 Fort Davis National Historic Site Vegetation Map

3.1 Mapping Process Overview

The vegetation map for Fort Davis NHS 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 geographic information system (GIS) along with ancillary spatial layers. A working map 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 combination of hands-on manual digitizing on a screen (heads-up screen digitizing) of polygons based on image interpretation and supervised image classifications was conducted. 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 site characteristics.

The key mapping standards of the National Vegetation Mapping Program call for spatial data to be provided with a horizontal positional accuracy meeting National Map Accuracy Standards at the 1:24,000 scale, i.e., each well-defined object in the spatial database must be within 1/50-of-an-inch display scale or 12.2 m (40 ft) of its actual location (http://biology.usgs.gov/npsveg/). In addition, each vegetation map class (unit) should meet or exceed 80% accuracy at the 90%-confidence level, and the minimum mapping unit (MMU) should be 0.5 ha (1.24 ac). A review of an independent accuracy assessment for the Fort Davis NHS vegetation map is provided in Chapter 4.

3.2 Mapping Methods

3.2.1 Data Sources and Processing

3.2.1.1 Aerial Photography

Aerial photography was the foundation imagery for the vegetation map. The primary photo-base for this project was a National Agricultural Imagery Program (NAIP) digital ortho-photo quarter quad (DOQQ). This photo was acquired on September 12, 2004 as a digital, three-band, color-infrared dataset (with the visible green, visible red, and near-infrared wavelength portions of the spectrum partitioned into Bands 3, 2, and 1 respectively). As a part of their original processing, the photos had been ortho-rectified into a one-meter spatial resolution and projected into a UTM Projection, NAD83 Datum, GRS80 spheroid as a Mr. SIDs data format. For this project, the photo was imported into an ERDAS Imagine (v. 9.3) .img format. In addition, BingMaps photo database, high-resolution, natural-color imagery from 2010 was used to support final image interpretation.

3.2.1.2 Satellite Imagery

To complement the digital aerial photography and in order to enhance the vegetative components of the landscape, DigitalGlobe's QuickBird satellite imagery was acquired over Fort Davis NHS on February 16, 2007. Quickbird data consists of four-band, multi-spectral imagery at 2.4-meters spatial resolution (Table 4) as well as a 0.6-meter spatial panchromatic band (0.4-0.9 **µ**ms). Despite having the best spatial resolution, the panchromatic band integrates spectral reflectance over the visible and near-infrared wavelengths into just one output response per pixel. The multi-spectral satellite imagery, on the other hand, records the different reflectance values for each the four spectral bands, denoting the variations in surface materials such as rocks, plants, soils, and water. Variations in plant reflection and absorption due to biochemical composition produce distinct spectral "signatures" (Jensen 2007). These

Table 4. Multi-spectral band descriptions for Quickbird satellite imagery used in the mapping of Fort Davis National Historic Site.

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.

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, as well as visually enhance photo-interpretation through its greater spectral capabilities.

The Quickbird imagery was further processed to create a Normalized Difference Vegetation Index (NDVI) from the near-infrared and visible red bands. 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. Adding "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.

All of these images were combined into a single image, which was then classified using a supervised classification process. Polygon-based seeds derived from previously collected field data were used to gather image statistics for each plot; this statistical data was used to classify the rest of the imagery through a maximum-likelihood decision rule. The resulting classification was recoded into vegetation community-based map units.

Despite being geo-corrected, the Quickbird imagery was acquired off-nadir, which can generate significant geometric errors in certain areas when compared to the ortho-rectified photography, mostly in areas of high relief, such as along cliffs, especially at the scale of mapping (1:6,000 to 1:3,000). The difference between the images may have been as high as 20 m in some locations, and negligible in others. Because of this, the classification was used to provide basic locational information as to where the communities exist and where the community boundaries are, but all polygon development was based on the aerial photography.

As the DOQQ had both near-infrared and visible-red wavelength data, a NDVI was computed using the formula stated in Equation 1. This NDVI was combined with the other bands of the DOQQ to aid in the discrimination of community types. In this case, not only did it help pull out differences between the riparian oak communities from the oak-dominated cliff regimes, but it also helped to highlight the disturbance-rich ruderal grasslands and the grasslands where mesquite was becoming invasive.

3.2.1.3 Ancillary Spatial Datasets

In addition to the imagery, standard spatial datasets such as digital elevation models, digital raster graphics (DRGs) of 1:24,000-scale USGS topographic maps, roads, ownership, geology, soils, etc., were brought

into the GIS. In particular, the NPS data sets of trails and historic sites were incorporated into the classification.

3.2.2 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 plant association, others were composed of two or more plant associations that either form fine-scale patterns not separable at the scale of mapping (structured complexes), or are not separable spectrally regardless of scale, although the ecological organization of the associations within the unit may be understood to some degree (structured complexes). For example, it was often difficult to separate *Mimosa*-dominated associations in the imagery and the five associations were grouped into three map units. In contrast, the *Bouteloua curtipendula*/ Rockland Herbaceous Vegetation occurred as small patches within woodlands and was mapped accordingly as a inclusion within one of the woodland map unit complexes.

We hierarchically structured the legend into two tiers: (1) a basic, lower Level 2 composed of simple map units or complexes as defined by plant associations, and (2) 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's and the Ecological Society of America's 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 is 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 went through several iterations as ground data was gathered through the years and new imagery acquired.

3.2.3 Final Map Development

All of the above imagery and ancillary spatial data layers were compiled into a geodatabase using ArcGIS (v. 10). Using the draft legend as the guide, Level 2 map unit polygons were drawn using heads-up digitizing in ArcGis based on the ground-control plots, the various image classifications, and photo-interpretation. 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 of Fort Davis NHS, an operational scale of 1: 5,000 was chosen for the output of poster-size maps of around ten square feet. The minimum mapping polygon size was also reduced to 1,000 m^2. Throughout the mapping process, map units were evaluated for coherence and the legend modified accordingly. Final map products included the geodabase and 1:5,000 poster maps.

3.3 Mapping Results

A vegetation map for Fort Davis NHS and its associated legend were developed with nine Level 1 and 25 Level 2 map units (Table 5). In Figure 17, we present the vegetation map at a reduced scale for ease of interpretation in the report. Full-size maps at 1:5,000 scale are available as both a PDF and a 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, except for Managed Landscapes and Urban or Built-up Land, whose groups are still under construction in the NVCS. At Level 2, there are 22 vegetation units and five generalized land-cover units. In Table 5, each Level 2 map unit is defined in terms of component plant associations—primary components, secondary components, related inclusions—and tied by database code to the national vegetation classification in Table 3. Conversely, in Table 3, the plant associations are cross-referenced to the Level 2 map units of Table 5. While some units are more heterogeneous than others, the attempt was made to keep the map units as monophyletic as possible, that is, to minimize the overlap of associations from one unit to the next. 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.

3.4 Mapping Discussion

The combination of land-use history, geology, soils, and processes like fire and drought have likely shaped much of the vegetation pattern of Fort Davis NHS. Yet, a general biogeographic pattern emerged that reflects elements of both montane Sierra Madrean and Chihuahuan Desert shrub and grassland ecosystems. The former were distributed primarily on north faces of Sleeping Lion and North Ridges while the latter dominated the warmer, south-facing slopes and bottomlands. Overall, the combination of the annotated legend (Appendix G) and the detailed floristic and site descriptions of individual plant associations (Appendix F) provide for a vegetation map that is rich in ecological information and one that can serve multiple purposes in the management of the park and the broader network of parks.

Table 5. A hierarchical legend for the Fort Davis NHS map composed of two nested levels, L1 and L2, along with component plant associations and their database code 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 Inclusion (Incl). The number of polygons representing the level 2 map unit is indicated, along with total area in hectares and acres.

Map Unit 1	Map Unit 2	Map Unit Name/Plant Association	Comp. Type	No. of Polys	Area (ha)	Area (ac)	Association DB Code
1		**Madrean Juniper Savanna and Woodland Group [G487]**					
	A	Pinchot's Juniper/Sideoats Grama Woodland		4	5.4	13.2	
		Juniperus pinchotii/Bouteloua curtipendula Woodland	1				NHNM000465
		Muhlenbergia emersleyi-Bouteloua curtipendula Herbaceous Vegetation	Incl				CEGL001644
2		**Madrean Encinal Group [G201]**					
	A	Gray Oak/Emory Oak Woodland		14	32.2	79.6	
		Quercus grisea-Quercus emoryi Woodland	1				NHNM000719
		Bouteloua curtipendula/Rockland Herbaceous Vegetation	Incl				NHNM000039
	B	Emory Oak/Netleaf Hackberry Woodland		4	3.9	9.7	
		Quercus emoryi-Celtis laevigata var. *reticulata* Woodland	1				NHNM000701
		Celtis laevigata var. *reticulata/Brickellia* californica Woodland	Incl				NHNM000370
	C	Emory Oak/Tanglehead-Bullgrass Woodland		6	6.4	15.8	
		Quercus emoryi/Heteropogon contortus Woodland	1				NHNM000704
		Quercus emoryi/Muhlenbergia emersleyi Woodland	Incl				CEGL000685
3		**Chihuahuan Creosotebush Mixed Desert Scrub Group [G288]**					
	A	Mescal Bean-Wright's Beebrush Shrubland		7	4.0	10.0	
		Sophora secundiflora-Aloysia wrightii Shrubland	1				NHNM000794
		Sparse Vegetation/Boulder Rockland	Incl				NPS_NM013
	B	Whitethorn Acacia-Texas Pricklypear Shrubland		3	3.1	7.7	
		Acacia constricta-Opuntia engelmannii Shrubland	1				NHNM000290
	C	Catclaw Mimosa/Grama Grass Shrubland		11	13.2	32.5	
		Mimosa aculeaticarpa var. *biuncifera/Bouteloua curtipendula* Shrubland	1				NHNM000507
		Mimosa aculeaticarpa var. *biuncifera/Bouteloua gracilis* Shrubland	2				NHNM000509
	D	Catclaw Mimosa-Whitebrush/Grama Grass Shrubland		13	17.5	43.4	
		Mimosa aculeaticarpa var. *biuncifera-Aloysia gratissima/Bouteloua curtipendula* Shrubland	1				NHNM000502
		Mimosa aculeaticarpa var. *biuncifera-Aloysia gratissima/Bouteloua gracilis* Shrubland	2				NHNM000503
		Aloysia wrightii/Bouteloua curtipendula Shrubland	Incl				NHNM000329
		Acacia constricta-Opuntia engelmannii Shrubland	Incl				NHNM000290

Table 5. A hierarchical legend for the Fort Davis NHS map composed of two nested levels, L1 and L2, along with component plant associations and their database code that make up each map unit (*continued*).

Map Unit 1	Map Unit 2	Map Unit Name/Plant Association	Comp. Type	No. of Polys	Area (ha)	Area (ac)	Association DB Code
	E	Catclaw Mimosa-Whitebrush-Pricklypear Shrubland		3	7.4	18.3	
		Mimosa aculeaticarpa var. *biuncifera-Aloysia gratissima-Opuntia engelmannii* Shrubland	1				NHNM000814
4		**Apacherian-Chihuahuan Mesquite Upland Scrub Group [G289]**					
	A	Honey Mesquite/Blue Grama Shrubland		9	12.9	31.8	
		Prosopis glandulosa/Bouteloua gracilis Shrubland	1				CEGL001383
		Prosopis glandulosa var. *torreyana* Shrubland	Incl				CEGL001381
5		**Apacherian-Chihuahuan Semi-Desert Grassland and Shrub-steppe Group [G490]**					
	A	Black Grama/Texas Sacahuista Semi-desert Grassland		3	3.7	9.2	
		Nolina texana/Bouteloua eriopoda Shrub Herbaceous Vegetation	1				NHNM000082
		Parthenium incanum/Bouteloua eriopoda Shrub Herbaceous Vegetation	2				NHNM000083
		Muhlenbergia emersleyi-Bouteloua curtipendula Herbaceous Vegetation	Incl				CEGL001644
	B	Sideoats Grama/Tanglehead Semi-desert Grassland		1	2.5	6.3	
		Bouteloua curtipendula-Heteropogon contortus Herbaceous Vegetation	1				NHNM000024
	C	Mixed Grama Grass Semi-desert Grassland		3	5.3	13.1	
		Bouteloua hirsuta-Bouteloua eriopoda Herbaceous Vegetation	1				NHNM000107
		Bouteloua curtipendula/Ruderal Herbaceous Vegetation	2				NHNM000040
	D	Blue Grama/Ruderal Semi-desert Grassland		20	13.2	32.6	
		Bouteloua gracilis/Ruderal Herbaceous Vegetation	1				NPS_NM043
		Bouteloua gracilis-Bouteloua curtipendula-Mixed Shrub Herbaceous Vegetation	2				NHNM000853
		Bouteloua gracilis-Setaria leucopila Herbaceous Vegetation	2				NHNM000815
	E	Sideoats Grama/Sotol Semi-desert Grassland		1	6.3	15.7	
		Dasylirion leiophyllum/Bouteloua curtipendula Shrub Herbaceous Vegetation	1				NHNM000030
	F	Blue Grama/Sideoats Grama Texas Sacahuista Semi-desert Grassland		3	7.5	18.4	
		Nolina texana/Bouteloua curtipendula Shrub Herbaceous Vegetation	1				NHNM000036
		Bouteloua gracilis-Bouteloua curtipendula-Mixed Shrub Semi-desert Grassland	2				NHNM000853

Table 5. A hierarchical legend for the Fort Davis NHS map composed of two nested levels, L1 and L2, along with component plant associations and their database code that make up each map unit (*continued*).

Map Unit 1	Map Unit 2	Map Unit Name/Plant Association	Comp. Type	No. of Polys	Area (ha)	Area (ac)	Association DB Code
6		**Sparsely Vegetated**					
	A	Rockland/Scarp/Cliff		31	25.4	62.9	
		Sparse Vegetation/Boulder Rockland	1				NPS_NM013
		Bouteloua curtipendula/Rockland Herbaceous Vegetation	Incl				NHNM000039
	B	Upland Barren Soil/Disturbed Ground		10	1.8	4.5	
		Disturbed/Non-vegetated	1				NPS_NM047
7		**Managed Landscapes**					
	A	Cottonwood/Ruderal Herbaceous Vegetation Woodland		2	1.5	3.7	
		Populus deltoides (ssp. *wislizeni*, ssp. *monilifera*)/ Ruderal Disturbance Woodland	1				NHNM000852
	B	Johnsongrass/Ruderal Herbaceous Vegetation		3	0.4	1.0	
		Sorghum halepense/Monotypic Herbaceous Vegetation	1				NHNM000252
	C	Urban/Built-up Vegetation		43	23.7	58.6	
		Urban/Built-up Vegetation	1				NotAssigned
		Disturbed/Non-vegetated	2				NPS_NM047
		Ruderal Disturbance Vegetation	Incl				NPS_NM027
		Bouteloua gracilis/Ruderal Herbaceous Vegetation	Incl				NPS_NM043
	D	Residential Vegetation		2	0.8	1.9	
8		**Urban or Built-up Land**					
	A	Building/Other Development		13	0.3	0.7	
	B	Ruin-Restored		40	0.9	2.3	
	C	Ruin-Unrestored		43	3.6	8.8	
	D	Trail		7	3.0	7.5	
	E	Road		2	4.0	10.0	

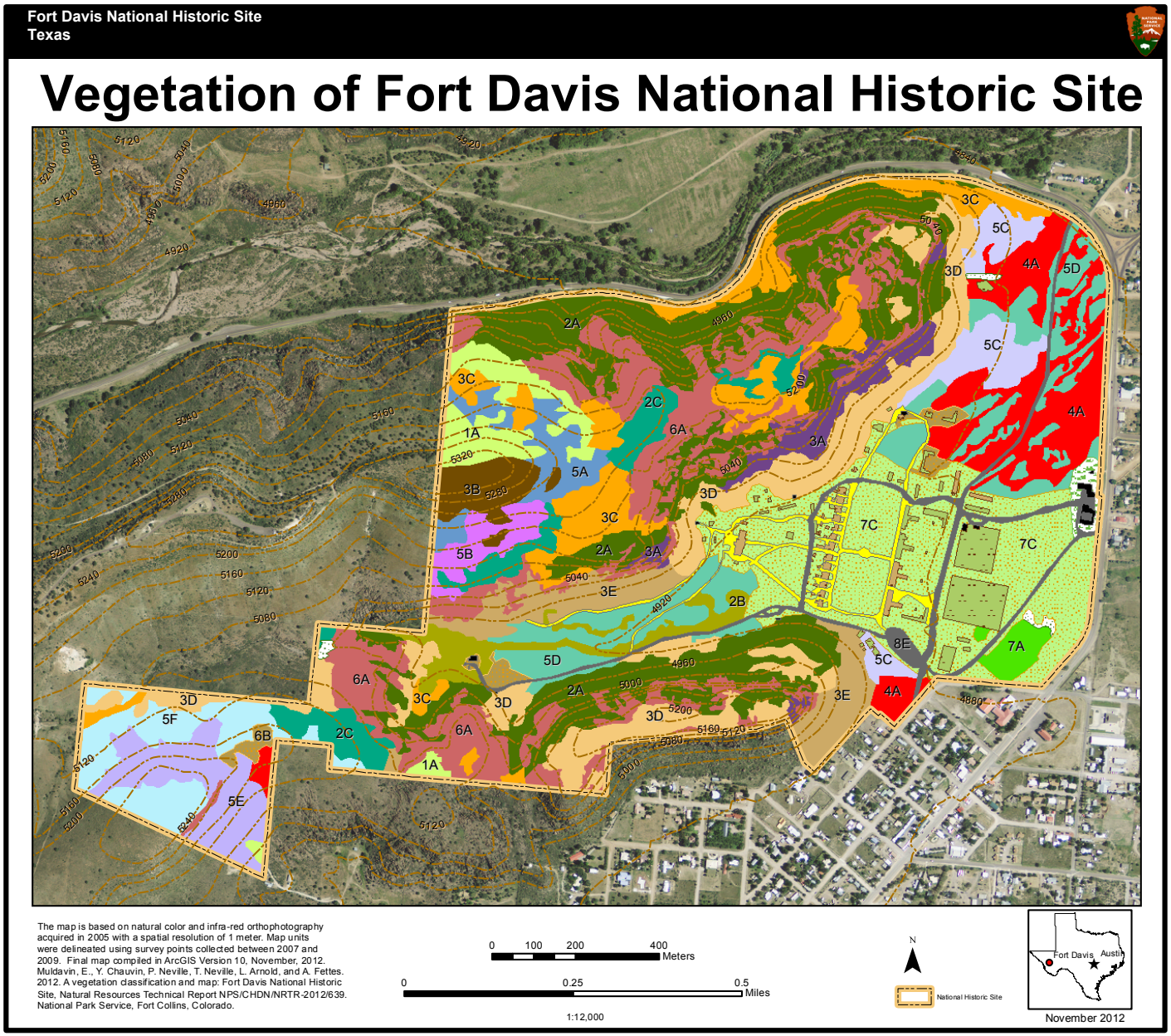

Figure 17. The vegetation map of Fort Davis National Historic Site portraying the Level 2 units (see Table 5 and Appendix E for map unit definitions). A full-scale, 1:6,000 version is available at http://biology.usgs.gov/npsveg/products/parkname.html.

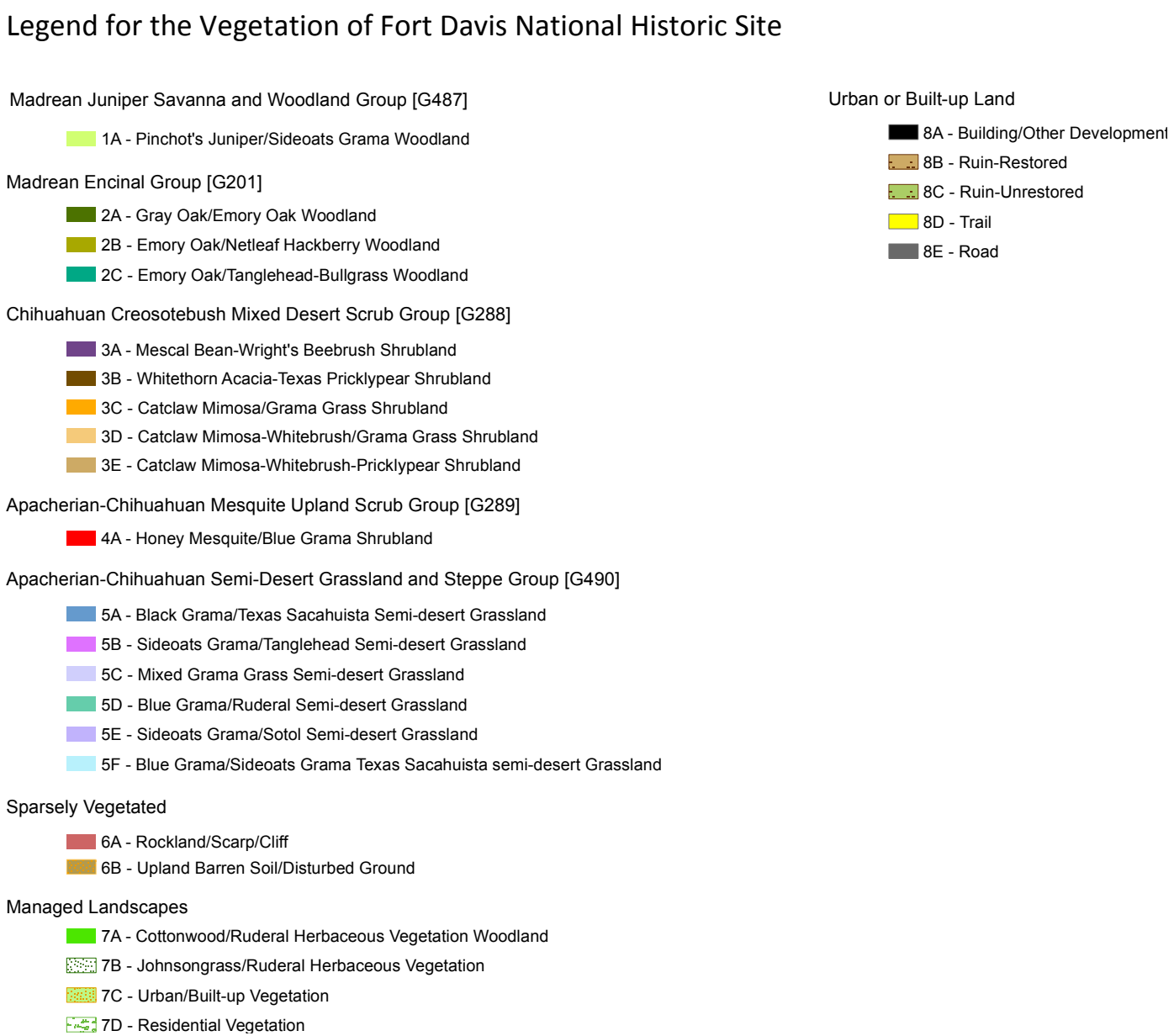

Figure 17 (continued). The legend for the vegetation map of Fort Davis National Historic Site.

Chapter 4 Accuracy Assessment Review

The thematic accuracy of the Fort Davis NHS vegetation map was assessed independently by Von Loh and Cogan (in-press) following the USGS-NPS guidelines (ESRI et al. 1994, Lea and Curtis 2010):

- The Accuracy Assessment (AA) will be independent of the mapping process.
- The AA will be point based with an observational unit equivalent to or larger than the minimum mapping unit (MMU=0.5 ha or 1.24 acres).
- The recommended number of AA samples per map class will reflect the abundance of each map class in Fort Davis, a small park in size.
- Thematic accuracy will be expressed using contingency matrices adjusted for chance agreement with a Kappa index (Foody 1994).
- AA will ideally capture all components of uncertainty associated with vegetation mapping.
- AA procedures will be tested operationally to determine if the methodology needs to be refined.

Under these guidelines, the goal is to achieve overall and individual map unit accuracies greater than 80% from both producers' and users' perspectives.

Positional accuracy is usually omitted from USGS-NPS National Vegetation Mapping Program products because 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 permits the assumption that all products derived from them are well within National Map Accuracy Standards for 1:12,000-scale maps (±10 m or ±30 feet).

Von Loh and Cogon (in-press) used a stratified random approach to allocate 85 sampling locations to 16 map units in the draft final map that we provided to them in 2009 (the extension was not part of the park at that time and was excluded from the AA). The number of locations per map unit were weighted by mapping unit (MU) area and ranged from 14 to one per unit. At sample locations, cover data was taken on the dominants, the plant association identified using the key in Appendix B, and the map unit either assigned to the point as the best attribution (First Field Call) or next best (Second Field Call). Using a GIS, the calls were compared to the map-polygon assignments, and where plant associations for a given MU did not match the field calls, an error was registered. Errors were compiled into a two-way contingency table with Observed AA point classification going across rows representing the user's errors (errors of commission), and the predicted map class going down columns representing the users' accuracy (errors of omission) along with calculations of overall accuracy, confidence limits, and Kappa scores (K).

Van Loh and Cogan (in-press) reported an overall accuracy of 79.9% and a Kappa of 75.6%, slightly below the 80% target. In 2011, we conducted a field review of the sample points they deemed as errors to confirm the calls and evaluate efficacy with respect to the guidelines above. Of the 19 error points, we suggest that six of them be discounted because (1) they lie within the positional error window of the correct polygon; (2) the test polygon was well below the minimum mapping unit delineation size (not all small fragments had been removed before submitting the map for assessment); and (3) the species composition we observed did correspond with that reported by the AA team for that GPS point (see Appendix F for plot list). If this is done, then the total sample size would be reduced to 79 points and the corresponding overall accuracy would increase to 83.5%.

Regardless, there were still some problematic, closely related map units. The three units dominated by catclaw mimosa (3C, 3D, and 3E in Table 3) cross-classified with each other and, in the case of 3D, with 3B, the Whitethorn Acacia-Texas Pricklypear Shrubland unit. We clearly

overlooked *Acacia constricta* patches that occurred in unit 3D (Catclaw Mimosa-Whitebrush/Grama Grass Shrubland), and accordingly added *Acacia constricta -Opuntia engelmannii* Shrubland as an inclusion in 3D (the errors in the contingency tables remain). The overall combined error rate for 3C, 3D, and 3E was 70%, both users' and producers'. These are closely related map units and combining them is a possible consideration, but because they have distinct mapped distributions that are not largely intertwined, we have chosen to keep them separate at this time. The other map units with low users' accuracy were 2B, 2C, 5A, and 7A, but the sample size for each was only two points, so we cannot recommend any changes at this time.

Von Loh and Cogan (in-press) provided a list of possible additional associations they encountered which they suggest might be added to the classification (see Appendix F for list). At this time, we recommend further sampling with standard plots to fully describe the species composition to confirm the associations. It is also possible that some of these may be phases or variants of the existing associations that were not accounted for in the key.

Overall, the main sources of error discovered during the accuracy assessment process were primarily due to thematic content of the units and the associated limits to the image interpretation (fundamental error). Additional sources were the positional accuracy AA points (particularly with respect to narrow linear polygons and small vegetation fragments) and possibly the structure and accuracy of the classification key. We feel that the map sufficiently meets overall NPS accuracy standards, exceeds the target resolution, and will prove useful as is for park management for years to come.

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Appendix A Field Handbook and Field Datasheets

The Natural Heritage New Mexico Vegetation Survey Handbook that was the guiding document for all vegetation plot data taken during the course of the Fort Davis National Historic Site 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.

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 square meters and either circular with an 11.3 m radius or square and 20 m on a side. These are the typical dimension for a forest or closed woodland. They can vary in dimension depending on the vegetation type. For riparian types, long and narrow (10 m x 40 m) plots, fitted into the linear structure of a river bar or terrace is a common design. In large, for open savanna or grassland types, the plots may need to be larger (50 m 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 m 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 m x 10 m by itself or even a single quadrat frame in the latter case. Use a cloth tape or a self winding "Spencer" tape to measure the boundaries.

Plot Types

Relevé 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 relevé 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 the plant association level. Site info includes as a minimum the GPS location, one photo showing the general character of the site, along with a brief description of the site. 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 m x 30 m macroplot (400 m^2). One meter quadrat frames are placed at every third meter and cover 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 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 grasslands.

Along each line, 150 point intercepts are read for basal cover (intercept at ground level) at 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, or if there are transects such as in a monitoring plot, at each end of a transect. 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 meter 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-inch 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 wire or similar gauge. 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 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 Description 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 (2 digits), the first and second initial of lead surveyor as designated under the Surveyors field (2 characters) or the assignment as designated for the project (2 characters), and the plot ascension number (3 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 are recorded and their abundance estimated, may also include Element Quality Ranking using the ranking form.

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

QP = Quick plot where only the dominant and most common species recorded 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 recorded with their abundance, location, community type and size; and at least one photos.

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 is 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, for 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 CT 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 behind the assignment in the **PA COMMENT** field. If you are uncertain about what to call it, enter **UNCLASS.**

EO/PA Comment: Comments on plant association designation. Indicate whether it was assigned in the field or in the office; was vegetation key used or an analysis of the quantitative data. 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," "Animas Canyon Main Spring"
4. Avoid using temporary GIS-based designations such as "Site 6b" or "polygon 41"

SURVEYORS: Last names 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 the 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 Biological Conservation Database – BCD).

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 with what (rebar, PVC, etc.), where it is located (such as center of plot) and height of marker (note whether 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 person taking the photographs

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 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 or 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 of 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: Is 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: Dwarf mistletoe damage (give a rating of average % extent spread of within and among trees); insect damage (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 utilization 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, i.e., 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 gpysum

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: Plot Radius or Length: enter plot radius (for circular plots) or length (for rectangular plots). Indicate units of measurement. Note: a 400 m squared plot has a radius of 11.3 m (37.1 ft); a 100 m squared 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 % 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. dia. (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 years 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 or "@" for fruiting; "X" if it is 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 2nd 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	0.4				
G2 BROMUS - 05YC001 - G5		5	0.2				
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 for lifeform classification for verification.

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

DWARF SHRUBS: usually multi-stemmed woody species, spiny rosettes and succulents (cacti, yuccas, and 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 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 graminoides an additional category is added for %

green which includes the current years growth (green or tawny), but disregards the standing dead litter (grey).

COV: percent cover for each species within the plot is estimated by either directly using the precision guidelines below, or the Modified Domin-Krajina scale in Table A1 (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 <0.05% (trace <0.2m^2/400m^2)

0.1% — for 0.05 - <0.5% (>0.2m^2 - <2.0 m^2/400m^2)

0.5% – for 0.5 - <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 A1. 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	0.001	
+	<0.05%	solitary or very few	0.025	0.025	<0.2 m^2
1	0.05-0.124%	very scattered	0.0875	0.1	0.2 m^2-<0.5 m^2
2	0.125-0.99%	scattered	0.56	0.5	0.5 m^2-<4 m^2
3	1.0-4.9%	common	3.0	3.0	4 m^2-<2 0m^2
4	5.0-9.9%	well-represented	7.5	7.5	20 m^2-<40 m^2
5	10.0-24.9%		17.5	17.5	40 m^2-<100 m^2
6	25.0-32.9%	abundant	29.0	29.0	100 m^2-<132 m^2
7	33.0-49.9%		41.5	41.5	132 m^2-<200 m^2
8	50.0-74.9%	luxuriant	62.5	62.5	200 m^2-<300 m^2
9	75.0-94.9%		85.0	85.0	300 m^2-<380 m^2
10	95.0-100%	full cover	97.5	97.5	380 m^2-400 m^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 3 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 = 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).

TRANSECT POINT INTERCEPT FORM

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 the New Mexico Natural Heritage Program 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 A1); 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 (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 function of disturbance, but the effect of disturbance will vary from community to community. Streambank conditions apply to wetland/riparian occurrence only. Contaminants range potentially 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_____
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** □ **Condition**____ **Landscape Context**_____ ☐
EOMapped:_____
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___
Stump →													DRC___ DBH___
Snag													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 Vegetation of Fort Davis National Historic Site Species List

Table B1. Plant species recorded at Fort Davis National Historic Site during the vegetation mapping project.

LFC	Life Form	Scientific Name	Common Name	Family	PLANTS Symbol	NHNM Acronym	C
1	Tree	*Arbutus xalapensis*	Texas madrone	Ericaceae	ARXA80	ARBXAL	No
1	Tree	*Celtis laevigata* var. *reticulata*	netleaf hackberry	Ulmaceae	CELAR	CELLAER	No
1	Tree	*Juniperus coahuilensis*	redberrry juniper	Cupressaceae	JUCO11	JUNCOA	Yes
1	Tree	*Juniperus pinchotii*	Pinchot's juniper	Cupressaceae	JUPI	JUNPIN	No
1	Tree	*Juniperus pinchotii* x *J. coahuilensis*	Pinchot's/ redberry juniper hybrid	Cupressaceae		JUNPINC	Yes
1	Tree	*Leucaena retusa*	Littleleaf leadtree	Fabaceae	LERE5	LEURET	Yes
1	Tree	*Pinus cembroides*	Mexican pinyon	Pinaceae	PICE	PINCEM	Yes
1	Tree	*Prunus serotina*	black cherry	Rosaceae	PRSE2	PRUSER	No
1	Tree	*Prunus serotina* var. *virens*	Southwestern chokecherry	Rosaceae	PRSEV	PRUSERV	No
1	Tree	*Quercus emoryi*	Emory's oak	Fagaceae	QUEM	QUEEMO	No
1	Tree	*Quercus grisea*	gray oak	Fagaceae	QUGR3	QUEGRI	No
2	Shrub	*Acacia constricta*	mescat acacia	Fabaceae	ACCO2	ACACON	No
2	Shrub	*Adolphia infesta*	Texas adolphia	Rhamnaceae	ADIN	ADOINF	Yes
2	Shrub	*Aloysia gratissima*	beebrush	Verbenaceae	ALGR2	ALOGRA	No
2	Shrub	*Aloysia wrightii*	Wright's beebrush	Verbenaceae	ALWR	ALOWRI	No
2	Shrub	*Ambrosia monogyra*	singlewhorl burrobush	Asteraceae	AMMO6	AMBMON	Yes
2	Shrub	*Atriplex canescens*	fourwing saltbush	Chenopodiaceae	ATCA2	ATRCAN	No
2	Shrub	*Baccharis biglovii*	Bigelow's falsewillow	Asteraceae	BABI	BACBIG	Yes
2	Shrub	*Baccharis pteronioides*	yerba de pasmo	Asteraceae	BAPT	BACPTE	No
2	Shrub	*Bouvardia ternifolia*	scarlet bouvardia, trompetilla	Rubiaceae	BOTE2	BOUTER	Yes
2	Shrub	*Brickellia californica*	California brickellbush	Asteraceae	BRCA3	BRICAL	No
2	Shrub	*Brickellia laciniata*	splitleaf brickellbush	Asteraceae	BRLA	BRILAC	Yes
2	Shrub	*Buddleja scordioides*	escobilla butterflybush	Buddlejaceae	BUSC	BUDSCO	Yes
2	Shrub	*Cissus trifoliata*	sorrelvine	Vitaceae	CITR2	CISTRI	Yes
2	Shrub	*Condalia ericoides*	javelina bush	Rhamnaceae	COER5	CONERI	No
2	Shrub	*Croton fruticulosus*	bush croton	Euphorbiaceae	CRFR	CROFRU	Yes

Table B1. Plant species recorded at Fort Davis National Historic Site during the vegetation mapping project (*continued*).

LFC	Life Form	Scientific Name	Common Name	Family	PLANTS Symbol	NHNM Acronym	C
2	Shrub	*Cylindropuntia imbricata*	tree cholla	Cactaceae	CYIM2	CYLIMB	No
2	Shrub	*Cylindropuntia leptocaulis*	Christmas cactus	Cactaceae	CYLE8	CYLLEP	No
2	Shrub	*Dasylirion leiophyllum*	green sotol	Agavaceae	DALE2	DASLEI	No
2	Shrub	*Ephedra* spp.	jointfir	Ephedraceae	EPHED	EPHEDR	No
2	Shrub	*Fallugia paradoxa*	Apacheplume	Rosaceae	FAPA	FALPAR	Yes
2	Shrub	*Flourensia cernua*	tarbush	Asteraceae	FLCE	FLOCER	No
2	Shrub	*Iresine leptoclada*	Texas shrub	Amaranthaceae	IRLE	IRELEP	Yes
2	Shrub	*Lantana urticoides*	West Indies lantana	Verbenaceae	LAUR2	LANURT	Yes
2	Shrub	*Larrea tridentata*	creosotebush	Zygophyllaceae	LATR2	LARTRI	No
2	Shrub	*Mahonia trifoliolata*	algerita	Berberidaceae	MATR3	MAHTRI	No
2	Shrub	*Mimosa aculeaticarpa* var. *biuncifera*	catclaw mimosa	Fabaceae	MIACB	MIMACUB	No
2	Shrub	*Nolina texana*	Texas sacahuista	Agavaceae	NOTE	NOLTEX	No
2	Shrub	*Opuntia engelmannii*	cactus apple	Cactaceae	OPEN3	OPUENG	No
2	Shrub	*Opuntia engelmannii* var. *lindheimeri*	Texas pricklypear	Cactaceae	OPENL	OPUENGL	No
2	Shrub	*Prosopis glandulosa*	honey mesquite	Fabaceae	PRGL2	PROGLA	No
2	Shrub	*Rhus microphylla*	littleleaf sumac	Anacardiaceae	RHMI3	RHUMIC	No
2	Shrub	*Rhus trilobata*	skunkbush sumac	Anacardiaceae	RHTR	RHUTRI	No
2	Shrub	*Rhus virens*	Evergreen sumac	Anacardiaceae	RHVI3	RHUVIR	No
2	Shrub	*Rhus virens* var. *virens*	evergreen sumac	Anacardiaceae	RHVIV	RHUVIRV	Yes
2	Shrub	*Sophora secundiflora*	mescal bean	Fabaceae	SOSE3	SOPSEC	No
2	Shrub	*Tecoma stans*	Yellow trumpetbush	Bignoniaceae	TEST	TECSTA	No
2	Shrub	*Ungnadia speciosa*	Mexican buckeye	Sapindaceae	UNSP	UNGSPE	No
2	Shrub	*Yucca baccata*	banana yucca	Agavaceae	YUBA	YUCBAC	No
2	Shrub	*Yucca elata*	soaptree yucca	Agavaceae	YUEL	YUCELA	No
2	Shrub	*Yucca faxoniana*	Giant dagger	Agavaceae	YUFA	YUCFAX	No
2	Shrub	*Yucca torreyi*	Torrey's yucca	Agavaceae	YUTO	YUCTOR	No
2	Shrub	*Ziziphus obtusifolia*	lotebush	Rhamnaceae	ZIOB	ZIZOBT	No
2.5	Sub-shrub	*Agave parryi* ssp. *neomexicana*	Parry's agave	Agavaceae	AGPAN6	AGAPARN	No

Table B1. Plant species recorded at Fort Davis National Historic Site during the vegetation mapping project (*continued*).

LFC	Life Form	Scientific Name	Common Name	Family	PLANTS Symbol	NHNM Acronym	C
2.5	Sub-shrub	*Ageratina wrightii*	Wright's snakeroot	Asteraceae	AGWR2	AGEWRI	Yes
2.5	Sub-shrub	*Brickellia lemmonii* var. *lemmonii*	Lemmon's brickellbush	Asteraceae	BRLEL	BRILEML	Yes
2.5	Sub-shrub	*Carphochaete bigelovii*	Bigelow's bristlehead	Asteraceae	CABI6	CARBIG	No
2.5	Sub-shrub	*Coryphantha* spp.	beehive cactus	Cactaceae	CORYP	CORYPH	No
2.5	Sub-shrub	*Croton suaveolens*	scented croton	Euphorbiaceae	CRSU7	CROSUA	Yes
2.5	Sub-shrub	*Dalea formosa*	featherplume	Fabaceae	DAFO	DALFOR	Yes
2.5	Sub-shrub	*Dalea frutescens*	black prairieclover	Fabaceae	DAFR2	DALFRU	No
2.5	Sub-shrub	*Echinocactus horizonthalonius*	devilshead	Cactaceae	ECHO	ECHHOR	No
2.5	Sub-shrub	*Echinocereus coccineus*	scarlet hedgehog cactus	Cactaceae	ECCO5	ECHCOC	No
2.5	Sub-shrub	*Echinocereus viridiflorus* var. *cylindricus*	brownspine hedgehog cactus	Cactaceae	ECVIC2	ECHVIRC2	Photo
2.5	Sub-shrub	*Echinomastus intertextus*	white fishhook cactus	Cactaceae	ECIN2	ECHINT	Photo
2.5	Sub-shrub	*Eriogonum wrightii*	Wright's buckwheat	Polygonaceae	ERWR	ERIWRI	No
2.5	Sub-shrub	*Ferocactus hamatacanthus*	turk's head	Cactaceae	FEHA2	FERHAM	No
2.5	Sub-shrub	*Gutierrezia sarothrae*	broom snakeweed	Asteraceae	GUSA2	GUTSAR	No
2.5	Sub-shrub	*Gymnosperma glutinosum*	gumhead	Asteraceae	GYGL	GYMGLU	No
2.5	Sub-shrub	*Hibiscus denudatus*	paleface	Malvaceae	HIDE	HIBDEN	No
2.5	Sub-shrub	*Koanophyllon solidaginifolium*	shrubby thoroughwort	Asteraceae	KOSO	KOASOL	No
2.5	Sub-shrub	*Macrosiphonia lanuginosa* var. *macrosiphon*	Plateau rocktrumpet	Apocynaceae	MALAM	MACLANM	No
2.5	Sub-shrub	*Mammillaria meiacantha*	little nipple cactus	Cactaceae	MAME6	MAMMEI	No
2.5	Sub-shrub	*Menodora longiflora*	showy menodora	Oleaceae	MELO2	MENLON	No
2.5	Sub-shrub	*Opuntia macrocentra*	purple pricklypear	Cactaceae	OPMA8	OPUMAC	No
2.5	Sub-shrub	*Opuntia phaeacantha*	tulip pricklypear	Cactaceae	OPPH	OPUPHA	Photo
2.5	Sub-shrub	*Parthenium incanum*	mariola	Asteraceae	PAIN2	PARINC	No
2.5	Sub-shrub	*Ruellia parryi*	Parry's wild petunia	Acanthaceae	RUPA3	RUEPAR	No
3	Grass	*Aristida adscensionis*	sixweeks threeawn	Poaceae	ARAD	ARIADS	No

Table B1. Plant species recorded at Fort Davis National Historic Site during the vegetation mapping project (*continued*).

LFC	Life Form	Scientific Name	Common Name	Family	PLANTS Symbol	NHNM Acronym	C
3	Grass	*Aristida divaricata*	poverty threeawn	Poaceae	ARDI5	ARIDIV	Yes
3	Grass	*Aristida purpurea*	purple threeawn	Poaceae	ARPU9	ARIPUR	No
3	Grass	*Aristida purpurea var. nealleyi*	Nealley's threeawn	Poaceae	ARPUN	ARIPURN	Yes
3	Grass	*Aristida schiedeana* var. *orcuttiana*	Single threeawn	Poaceae	ARSCO	ARISCHO	Yes
3	Grass	*Bothriochloa barbinodis*	cane bluestem	Poaceae	BOBA3	BOTBAR	No
3	Grass	*Bothriochloa laguroides ssp. torreyana*	silver beardgrass	Poaceae	BOLAT	BOTLAGT	Yes
3	Grass	*Bouteloua aristidoides*	needle grama	Poaceae	BOAR	BOUARI	No
3	Grass	*Bouteloua chondrosioides*	sprucetop grama	Poaceae	BOCH	BOUCHO	Yes
3	Grass	*Bouteloua curtipendula*	sideoats grama	Poaceae	BOCU	BOUCUR	No
3	Grass	*Bouteloua eriopoda*	black grama	Poaceae	BOER4	BOUERI	Yes
3	Grass	*Bouteloua gracilis*	blue grama	Poaceae	BOGR2	BOUGRA	No
3	Grass	*Bouteloua hirsuta*	hairy grama	Poaceae	BOHI2	BOUHIR	Yes
3	Grass	*Bouteloua trifida*	red grama	Poaceae	BOTR2	BOUTRI	No
3	Grass	*Chloris verticillata*	tumble windmill grass	Poaceae	CHVE2	CHLVER	No
3	Grass	*Chloris virgata*	feather fingergrass	Poaceae	CHVI4	CHLVIR	Yes
3	Grass	*Cyperus retroflexus*	oneflower flatsedge	Cyperaceae	CYRE14	CYPRET	Yes
3	Grass	*Cyperus sphaerolepis*	Rusby's flatsedge	Cyperaceae	CYSP7	CYPSPH	Yes
3	Grass	*Dasyochloa pulchella*	fluffgrass	Poaceae	DAPU7	DASPUL	Yes
3	Grass	*Digitaria californica*	Arizona cottontop	Poaceae	DICA8	DIGCAL	No
3	Grass	*Digitaria pubiflora*	western witchgrass	Poaceae	DIPU9	DIGPUB	No
3	Grass	*Echinochloa crus-galli*	barnyardgrass	Poaceae	ECCR	ECHCRU	No
3	Grass	*Elionurus barbiculmis*	woolyspike balsamscale	Poaceae	ELBA	ELIBAR	Yes
3	Grass	*Eragrostis intermedia*	plains lovegrass	Poaceae	ERIN	ERAINT	No
3	Grass	*Eragrostis mexicana*	mexican lovegrass	Poaceae	ERME	ERAMEX	No
3	Grass	*Erioneuron avenaceum*	shortleaf woollygrass	Poaceae	ERAV	ERIAVE	No

Table B1. Plant species recorded at Fort Davis National Historic Site during the vegetation mapping project (*continued*).

LFC	Life Form	Scientific Name	Common Name	Family	PLANTS Symbol	NHNM Acronym	C
3	Grass	*Hesperostipa neomexicana*	New Mexico needlegrass	Poaceae	HENE5	HESNEO	Yes
3	Grass	*Heteropogon contortus*	tanglehead	Poaceae	HECO10	HETCON	No
3	Grass	*Hilaria belangeri*	curly mesquite	Poaceae	HIBE	HILBEL	Yes
3	Grass	*Leptochloa dubia*	green sprangletop	Poaceae	LEDU	LEPDUB	Yes
3	Grass	*Lycurus setosus*	bristly wolfstail	Poaceae	LYSE3	LYCSET	Yes
3	Grass	*Muhlenbergia arenicola*	sand muhly	Poaceae	MUAR2	MUHARE2	Yes
3	Grass	*Muhlenbergia emersleyi*	bullgrass	Poaceae	MUEM	MUHEME	Yes
3	Grass	*Muhlenbergia polycaulis*	cliff muhly	Poaceae	MUPO	MUHPOL	Yes
3	Grass	*Muhlenbergia porteri*	bush muhly	Poaceae	MUPO2	MUHPOR	Yes
3	Grass	*Muhlenbergia repens*	creeping muhly	Poaceae	MURE	MUHREP	No
3	Grass	*Muhlenbergia tenuifolia*	slimflower muhly	Poaceae	MUTE4	MUHTEN	Yes
3	Grass	*Nassella tenuissima*	Finestem needlegrass	Poaceae	NATE3	NASTEN	Yes
3	Grass	*Panicum bulbosum*	bulb panicgrass	Poaceae	PABU	PANBUL	Yes
3	Grass	*Panicum hallii*	Hall's panicgrass	Poaceae	PAHA	PANHAL	No
3	Grass	*Panicum obtusum*	vine mesquite	Poaceae	PAOB	PANOBT	No
3	Grass	*Piptochaetium fimbriatum*	pinyon ricegrass	Poaceae	PIFI	PIPFIM	Yes
3	Grass	*Pleuraphis mutica*	tobosa	Poaceae	PLMU3	PLEMUT	Yes
3	Grass	*Schizachyrium cirratum*	Texas bluestem	Poaceae	SCCI2	SCHCIR	Yes
3	Grass	*Scleropogon brevifolius*	burrograss	Poaceae	SCBR2	SCLBRE	No
3	Grass	*Setaria grisebachii*	Grisebach's bristlegrass	Poaceae	SEGR6	SETGRI	Yes
3	Grass	*Setaria leucopila*	streambed bristlegrass	Poaceae	SELE6	SETLEU	No
3	Grass	*Sorghum halepense*	johnsongrass	Poaceae	SOHA	SORHAL	No
3	Grass	*Sporobolus cryptandrus*	sand dropseed	Poaceae	SPCR	SPOCRY	No
4	Forb	*Abutilon incanum*	Indian mallow	Malvaceae	ABIN	ABUINC	Yes
4	Forb	*Abutilon wrightii*	Wright's Indian mallow	Malvaceae	ABWR	ABUWRI	Yes
4	Forb	*Amaranthus palmeri*	carelessweed	Amaranthaceae	AMPA	AMAPAL	Yes
4	Forb	*Ambrosia psilostachya*	Cuman ragweed	Asteraceae	AMPS	AMBPSI	Yes

Table B1. Plant species recorded at Fort Davis National Historic Site during the vegetation mapping project (*continued*).

LFC	Life Form	Scientific Name	Common Name	Family	PLANTS Symbol	NHNM Acronym	C
4	Forb	*Argemone squarrosa*	hedgehog pricklypoppy	Papaveraceae	ARSQ	ARGSQU	No
4	Forb	*Artemisia ludoviciana*	white sagebrush	Asteraceae	ARLU	ARTLUD	No
4	Forb	*Astrolepis cochisensis*	Cochise scaly cloakfern	Pteridaceae	ASCO42	ASTCOC	No
4	Forb	*Astrolepis integerrima*	hybrid cloakfern	Pteridaceae	ASIN19	ASTINT	Yes
4	Forb	*Astrolepis sinuata*	wavy scaly cloakfern	Pteridaceae	ASSI9	ASTSIN	Yes
4	Forb	*Bahia bigelovii*	Bigelow's bahia	Asteraceae	BABI2	BAHBIG	Yes
4	Forb	*Berlandiera lyrata*	lyreleaf greeneyes	Asteraceae	BELY	BERLYR	No
4	Forb	*Bidens bigelovii*	Bigelow's beggarticks	Asteraceae	BIBI	BIDBIG	Yes
4	Forb	*Boechera fendleri*	Fendler's rockcress	Brassicaceae	BOFE	BOEFEN	No
4	Forb	*Boerhavia coccinea*	scarlet spiderling	Nyctaginaceae	BOCO	BOECOC	Yes
4	Forb	*Boerhavia gracillima*	slimstalk spiderling	Nyctaginaceae	BOGR	BOEGRA	Yes
4	Forb	*Bommeria hispida*	copper fern	Pteridaceae	BOHI	BOMHIS	No
4	Forb	*Cevallia sinuata*	stinging serpent	Loasaceae	CESI	CEVSIN	No
4	Forb	*Chaetopappa ericoides*	rose heath	Asteraceae	CHER2	CHAERI	Yes
4	Forb	*Chamaesyce dioica*	royal sandmat	Euphorbiaceae	CHDI5	CHADIO	Yes
4	Forb	*Chamaesyce fendleri*	Fendler's sandmat	Euphorbiaceae	CHFE3	CHAFEN	Yes
4	Forb	*Chamaesyce serpyllifolia*	thymeleaf sandmat	Euphorbiaceae	CHSE6	CHASER2	Yes
4	Forb	*Cheilanthes bonariensis*	golden lipfern	Pteridaceae	CHBO5	CHEBON	Yes
4	Forb	*Cheilanthes eatonii*	Eaton's lipfern	Pteridaceae	CHEA	CHEEAT	Yes
4	Forb	*Cheilanthes feei*	slender lipfern	Pteridaceae	CHFE	CHEFEE	No
4	Forb	*Cheilanthes villosa*	villous lipfern	Pteridaceae	CHVI	CHEVIL	Yes
4	Forb	*Cheilanthes wrightii*	Wright's lipfern	Pteridaceae	CHWR	CHEWRI	Yes
4	Forb	*Chenopodium atrovirens*	pinyon goosefoot	Chenopodiaceae	CHAT	CHEATR	Yes
4	Forb	*Chenopodium neomexicanum*	New Mexico goosefoot	Chenopodiaceae	CHNE3	CHENEO	Yes
4	Forb	*Cirsium ochrocentrum*	yellowspine thistle	Asteraceae	CIOC2	CIROCH	Yes
4	Forb	*Cirsium undulatum*	wavyleaf thistle	Asteraceae	CIUN	CIRUND	No
4	Forb	*Cologania pallida*	pale cologania	Fabaceae	COPA4	COLPAL	No

Table B1. Plant species recorded at Fort Davis National Historic Site during the vegetation mapping project (*continued*).

LFC	Life Form	Scientific Name	Common Name	Family	PLANTS Symbol	NHNM Acronym	C
4	Forb	*Commelina dianthifolia*	birdbill dayflower	Commelinaceae	CODI4	COMDIA	Yes
4	Forb	*Commelina erecta*	whitemouth dayflower	Commelinaceae	COER	COMERE	Yes
4	Forb	*Convolvulus equitans*	Texas bindweed	Convolvulaceae	COEQ	CONEQU	No
4	Forb	*Conyza canadensis*	Canadian horseweed	Asteraceae	COCA5	CONCAN	Yes
4	Forb	*Croton pottsii*	leatherweed	Euphorbiaceae	CRPO5	CROPOT	No
4	Forb	*Cucurbita foetidissima*	buffalo gourd	Cucurbitaceae	CUFO	CUCFOE	No
4	Forb	*Cyphomeris gypsophiloides*	red cyphomeris	Nyctaginaceae	CYGY	CYPGYP	Yes
4	Forb	*Dalea brachystachya*	Fort Bowie prairieclover	Fabaceae	DABR	DALBRA	Yes
4	Forb	*Dalea lachnostachys*	glandleaf prairieclover	Fabaceae	DALA	DALLAC	Yes
4	Forb	*Dalea nana*	dwarf prairieclover	Fabaceae	DANA	DALNAN	Yes
4	Forb	*Dalea wrightii*	Wright's prairieclover	Fabaceae	DAWR	DALWRI	Yes
4	Forb	*Datura wrightii*	sacred thornapple	Solanaceae	DAWR2	DATWRI	No
4	Forb	*Dichondra argentea*	silver ponysfoot	Convolvulaceae	DIAR2	DICARG	No
4	Forb	*Dichondra brachypoda*	New Mexico ponysfoot	Convolvulaceae	DIBR	DICBRA	Yes
4	Forb	*Dyschoriste decumbens*	spreading snakeherb	Acanthaceae	DYDE	DYSDEC	Yes
4	Forb	*Dyschoriste linearis*	polkadots	Acanthaceae	DYLI	DYSLIN	No
4	Forb	*Dyssodia papposa*	fetid marigold	Asteraceae	DYPA	DYSPAP	No
4	Forb	*Engelmannia peristenia*	Engelmann's daisy	Asteraceae	ENPE4	ENGPER	No
4	Forb	*Erigeron flagellaris*	trailing fleabane	Asteraceae	ERFL	ERIFLA	Yes
4	Forb	*Eriogonum tenellum*	tall buckwheat	Polygonaceae	ERTE9	ERITEN	No
4	Forb	*Eryngium heterophyllum*	Wright's eryngo	Apiaceae	ERHE3	ERYHET	No
4	Forb	*Euphorbia davidii*	David's spurge	Euphorbiaceae	EUDA5	EUPDAV	Yes
4	Forb	*Euphorbia exstipulata*	squareseed spurge	Euphorbiaceae	EUEX4	EUPEXS	Yes
4	Forb	*Evolvulus alsinoides*	Ojo de vibora	Convolvulaceae	EVAL	EVOALS	No
4	Forb	*Evolvulus nuttallianus*	shaggy dwarf morningglory	Convolvulaceae	EVNU	EVONUT	Yes
4	Forb	*Evolvulus sericeus*	silver dwarf morningglory	Convolvulaceae	EVSE	EVOSER	No
4	Forb	*Froelichia arizonica*	Arizona snakecotton	Amaranthaceae	FRAR2	FROARI	No

Table B1. Plant species recorded at Fort Davis National Historic Site during the vegetation mapping project (*continued*).

LFC	Life Form	Scientific Name	Common Name	Family	PLANTS Symbol	NHNM Acronym	C
4	Forb	*Froelichia gracilis*	slender snakecotton	Amaranthaceae	FRGR3	FROGRA	No
4	Forb	*Galium microphyllum*	bracted bedstraw	Rubiaceae	GAMI	GALMIC	No
4	Forb	*Gaura coccinea*	scarlet beeblossom	Onagraceae	GACO5	GAUCOC	No
4	Forb	*Glandularia bipinnatifida* var. *bipinnatifida*	Dakota mock vervain	Verbenaceae	GLBIB	GLABIPB	Yes
4	Forb	*Glandularia bipinnatifida* var. *ciliata*	Davis Mountain mock vervain	Verbenaceae	GLBIC	GLABIPC	No
4	Forb	*Gutierrezia sphaerocephala*	roundleaf snakeweed	Asteraceae	GUSP	GUTSPH	Yes
4	Forb	*Helianthus petiolaris*	prairie sunflower	Asteraceae	HEPE	HELPET	No
4	Forb	*Heliomeris longifolia*	longleaf falsegoldeneye	Asteraceae	HELO6	HELLON	No
4	Forb	*Heliomeris longifolia var. longifolia*	longleaf falsegoldeneye	Asteraceae	HELOL	HELLONL	Yes
4	Forb	*Herissantia crispa*	bladdermallow	Malvaceae	HECR3	HERCRI	Yes
4	Forb	*Heterosperma pinnatum*	wingpetal	Asteraceae	HEPI2	HETPIN	Yes
4	Forb	*Hoffmannseggia glauca*	Indian rushpea	Fabaceae	HOGL2	HOFGLA	No
4	Forb	*Ipomopsis aggregata*	skyrocket gilia	Polemoniaceae	IPAG	IPOAGG	No
4	Forb	*Iresine heterophylla*	standley's bloodleaf	Amaranthaceae	IRHE	IREHET	Yes
4	Forb	*Iva ambrosiifolia*	ragged marshelder	Asteraceae	IVAM	IVAAMB	No
4	Forb	*Justicia pilosella*	Gregg's tube-tongue	Acanthaceae	JUPI5	JUSPIL	Yes
4	Forb	*Laennecia coulteri*	conyza	Asteraceae	LACO13	LAECOU	No
4	Forb	*Liatris punctata*	dotted gayfeather	Asteraceae	LIPU	LIAPUN	Yes
4	Forb	*Lotus plebeius*	New Mexico birdsfoot trefoil	Fabaceae	LOPL2	LOTPLE	Yes
4	Forb	*Lygodesmia texana*	Texas skeletonplant	Asteraceae	LYTE	LYGTEX	No
4	Forb	*Machaeranthera gracilis*	slender goldenweed	Asteraceae		MACGRA	No
4	Forb	*Marrubium vulgare*	horehound	Lamiaceae	MAVU	MARVUL	No
4	Forb	*Maurandella antirrhiniflora*	roving sailor	Scrophulariaceae	MAAN9	MAUANT	No
4	Forb	*Mentzelia oligosperma*	chickenthief	Loasaceae	MEOL	MENOLI	No

Table B1. Plant species recorded at Fort Davis National Historic Site during the vegetation mapping project (*continued*).

LFC	Life Form	Scientific Name	Common Name	Family	PLANTS Symbol	NHNM Acronym	C
4	Forb	*Mirabilis linearis*	narrowleaf four o'clock	Nyctaginaceae	MILI3	MIRLIN	Yes
4	Forb	*Notholaena standleyi*	star cloak fern	Pteridaceae	NOST	NOTSTA	No
4	Forb	*Oxalis albicans* ssp. *albicans*	radishroot woodsorrel	Oxalidaceae	OXALA	OXAALBA	Yes
4	Forb	*Parthenium confertum var. lyratum*	Gray's feverfew	Asteraceae	PACOL	PARCONL	No
4	Forb	*Pellaea intermedia*	intermediate cliffbrake	Pteridaceae	PEIN	PELINT	Yes
4	Forb	*Pellaea wrightiana*	Wright's cliffbrake	Pteridaceae	PEWR	PELWRI	Yes
4	Forb	*Penstemon barbatus*	beardlip penstemon	Scrophulariaceae	PEBA2	PENBAR	No
4	Forb	*Perityle rupestris*	leafy cliffdaisy	Asteraceae	PERU3	PERRUP	No
4	Forb	*Perityle rupestris* var. *rupestris*	leafy cliffdaisy	Asteraceae	PERUR	PERRUPR	Yes
4	Forb	*Phacelia rupestris*	silky phacelia	Hydrophyllaceae	PHRU2	PHARUP	Yes
4	Forb	*Phyllanthus polygonoides*	smartweed leafflower	Euphorbiaceae	PHPO3	PHYPOL	Yes
4	Forb	*Physalis* spp.	groundcherry	Solanaceae	PHYSA	PHYSAL	No
4	Forb	*Polygala barbeyana*	blue milkwort	Polygalaceae	POBA	POLBAR	Yes
4	Forb	*Portulaca suffrutescens*	shrubby purslane	Portulacaceae	POSU3	PORSUF	No
4	Forb	*Pseudognaphalium stramineum*	cottonbatting cudweed	Asteraceae	PSST7	PSESTR	Yes
4	Forb	*Psilactis brevilingulata*	Trans-Pecos tansyaster	Asteraceae	PSBR5	PSIBRE	Yes
4	Forb	*Ratibida columnifera*	upright prairie coneflower	Asteraceae	RACO3	RATCOL	No
4	Forb	*Rhynchosia senna* var. *texana*	Texas snoutbean	Fabaceae	RHSET	RHYSENT	Yes
4	Forb	*Rivina humilis*	Rougeplant	Phytolaccaceae	RIHU2	RIVHUM	Yes
4	Forb	*Salsola tragus*	prickly Russian thistle	Chenopodiaceae	SATR12	SALTRA	No
4	Forb	*Schkuhria pinnata*	pinnate false threadleaf	Asteraceae	SCPI3	SCHPIN	Yes
4	Forb	*Schoenocrambe linearifolia*	slimleaf plainsmustard	Brassicaceae	SCLI12	SCHLIN	No
4	Forb	*Selaginella mutica*	bluntleaf spikemoss	Selaginellaceae	SEMU	SELMUT	No
4	Forb	*Selaginella peruviana*	Peruvian spikemoss	Selaginellaceae	SEPE	SELPER	Yes
4	Forb	*Senecio flaccidus*	threadleaf ragwort	Asteraceae	SEFL3	SENFLA	No
4	Forb	*Senecio flaccidus* var. *flaccidus*	threadleaf ragwort	Asteraceae	SEFLF	SENFLAF	No

Table B1. Plant species recorded at Fort Davis National Historic Site during the vegetation mapping project (*continued*).

LFC	Life Form	Scientific Name	Common Name	Family	PLANTS Symbol	NHNM Acronym	C
4	Forb	*Senna roemeriana*	twoleaf wild sensitive plant	Fabaceae	SERO8	SENROE	Yes
4	Forb	*Seymeria scabra*	limpia blacksenna	Scrophulariaceae	SESC3	SEYSCA	Yes
4	Forb	*Sida abutifolia*	spreading fanpetals	Malvaceae	SIAB	SIDABU	No
4	Forb	*Sida neomexicana*	New Mexico fanpetals	Malvaceae	SINE	SIDNEO	Yes
4	Forb	*Simsia calva*	awnless bushsunflower	Asteraceae	SICA7	SIMCAL	Yes
4	Forb	*Solanum elaeagnifolium*	silverleaf nightshade	Solanaceae	SOEL	SOLELA	No
4	Forb	*Sophora nuttalliana*	silky sophora	Fabaceae	SONU	SOPNUT	No
4	Forb	*Sphaeralcea coccinea*	scarlet globemallow	Malvaceae	SPCO	SPHCOC	Yes
4	Forb	*Sphaeralcea hastulata*	spear globemallow	Malvaceae	SPHA	SPHHAS	Yes
4	Forb	*Stenaria nigricans* var. *nigricans*	diamond-flowers	Rubiaceae	STNIN	STENIGN	Yes
4	Forb	*Stephanomeria pauciflora*	brownplume wirelettuce	Asteraceae	STPA4	STEPAU	No
4	Forb	*Talinum paniculatum*	Trans-Pecos fameflower	Portulacaceae	TAPA2	TALPAN	Yes
4	Forb	*Tetraclea coulteri*	Coulter's wrinklefruit	Verbenaceae	TECO	TETCOU	Yes
4	Forb	*Thamnosma texana*	rue of the mountains	Rutaceae	THTE2	THATEX	No
4	Forb	*Thelypodium wrightii*	Wright's thelypody	Brassicaceae	THWR	THEWRI	Yes
4	Forb	*Tragia ramosa*	branched noseburn	Euphorbiaceae	TRRA5	TRARAM	No
4	Forb	*Trixis californica*	California trixis	Asteraceae	TRCA8	TRICAL	Yes
4	Forb	*Verbesina encelioides*	golden crownbeard	Asteraceae	VEEN	VERENC	No
4	Forb	*Viguiera cordifolia*	heartleaf goldeneye	Asteraceae	VICO	VIGCOR	Yes
4	Forb	*Viguiera dentata*	toothleaf goldeneye	Asteraceae	VIDE3	VIGDEN	No
4	Forb	*Xanthisma gracile*	slender goldenweed	Asteraceae	MAGR10	XANGRA	Yes
4	Forb	*Xanthisma spinulosum*	lacy tansyaster	Asteraceae	MAPI	XANSPI2	No
4	Forb	*Xanthium strumarium*	rough cocklebur	Asteraceae	XAST	XANSTR	No
4	Forb	*Zinnia grandiflora*	Rocky Mountain zinnia	Asteraceae	ZIGR	ZINGRA	No

Appendix C Keys to Fort Davis National Historic Site Plant Associations

A dichotomous key to the major plant associations of Fort Davis National Monument Historic Site 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 C-1. There are separate keys for the major classes (e.g., forests and woodlands, shrublands, etc.) as specified in the first key. Descriptions for each association can be found in Appendix D.

Table C1. Text descriptors for canopy cover and density with associated quantitative ranges 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. Substrate of mostly rocks and boulders with total vegetation cover <10% or dominated by lithomorphic species or urban built-up land:

KEY 4 – Lithomorphic Vegetation (page C-4)

KEY 5 – Urban or Built-up (page C-4)

A. Total vegetation cover generally >10% and not dominated by lithomorphic species or non-vegetated built-up land: (B)

B. Trees dominant, typically >25% canopy cover; or if <25%, clearly the dominant and/or the characteristic growth form: **KEY 1 – Forests and Woodlands** (page C-2)

B. Trees <10%, clearly not predominant: (C)

C. Shrubs >25%, or if <25%, clearly the dominant and/or the characteristic growth form:

KEY 2 — Shrublands (page C-2)

C. Shrubs usually <25%, herbs clearly the dominant and/or characteristic growth form:

KEY 3 – Herbaceous Vegetation (page C-X)

KEY 1 – Forests and Woodlands (woodlands dominated by *Populus deltoides*, *Quercus* spp., and *Juniperus pinchotii*)

1. Populus deltoides well represented to abundant, dominant:

    ***Populus deltoides*/Ruderal Herbaceous Woodland**

1. *Populus deltoides* absent: **(2)**

2 (1). *Quercus* spp. well represented to dominant: **(3)**

2. *Quercus* spp. absent, *Juniperus pinchotii* dominant shrub or small tree: **(5)**

    J*uniperus pinchotii*/*Bouteloua curtipendula* Woodland

3 (2). *Quercus grisea* well represented, >25% relative to total *Quercus* spp. cover:

    ***Quercus grisea - Quercus emoryi* Woodland**

3. *Quercus grisea* poorly represented, <25% relative to total *Quercus* spp. cover: **(4)**

4 (3). *Celtis laevigata* var. *reticulata* common to well represented:

    ***Quercus emoryi-Celtis laevigata* var. *reticulata* Woodland**

4. Celtis laevigata var. reticulata poorly represented or absent:

    ***Quercus emoryi*/*Heteropogon contortus* Woodland**

KEY 2 – Shrublands

1. *Acacia constricta* usually abundant, the dominant shrub:

    ***Acacia constricta - Opuntia englemannii* Shrubland**

1. Acacia constricta poorly represented or absent: **(2)**

2. (1). *Sophora secundiflora* abundant, dominant:

    ***Sophora secundiflora - Aloysia wrightii* Shrubland**

2. S*ophora secundiflora* poorly represented or absent: **(3)**

3 (2). *Mimosa aculeaticarpa* var. *biuncifera* well represented to abundant, dominant: **(4)**

3. *Mimosa aculeaticarpa* var. *biuncifera* poorly represented or absent, *Prosopis glandulosa* >10% cover

    ***Prosopis glandulosa* / *Bouteloua gracilis* Shrubland**

4 (3). *Aloysia gratissima* abundant: **(5)**

4. **Aloysia gratissima** absent: **(7)**

5 (4). *Opuntia englemannii* abundant:

    ***Mimosa aculeaticarpa* var. b*iuncifera - Aloysia gratissima - Opuntia englemannii* Shrubland**

5. *Opuntia englemannii* scattered or absent: **(6)**

6 (5). *Bouteloua gracilis* common, the dominant or co-dominant grass:

***Mimosa aculeaticarpa* var. *biuncifera - Aloysia gratissima/Bouteloua gracilis* Shrubland**

6. *Bouteloua gracilis* poorly represented:

***Mimosa aculeaticarpa* var. *biuncifera - Aloysia gratissima/Bouteloua curtipendula* Shrubland**

7 (4). *Bouteloua gracilis* abundant, the dominant or co-dominant grass:

***Mimosa aculeaticarpa* var. *biuncifera/Bouteloua gracilis* Shrubland**

7. *Bouteloua gracilis* poorly represented or absent:

***Mimosa aculeaticarpa* var. *biuncifera/Bouteloua curtipendula* Shrubland**

KEY 3 – Herbaceous Vegetation

1. *Muhlenbergia emersleyi* abundant, dominant or codominant:

***Muhlenbergia emersleyi - Bouteloua curtipendula* Herbaceous Vegetation**

1. *Muhlenbergia emersleyi* poorly represented or absent: **(2)**

2 (1). *Bouteloua eriopoda* abundant, dominant or codominant: **(3)**

2. *Bouteloua eriopoda* poorly represented or absent: **(4)**

3 (2). *Nolina texana* common to abundant:

***Bouteloua eriopoda/Nolina texana* Herbaceous Vegetation**

3. *Nolina texana* poorly represented or absent; *Parthenium incanum* or other desert shrubs common:

***Bouteloua eriopoda/Parthenium incanum* Herbaceous Vegetation**

4 (2). *Bouteloua hirsuta* abundant:

***Bouteloua hirsuta - Bouteloua eriopoda* Herbaceous Vegetation**

4. *Bouteloua hirsuta* poorly represented or absent: **(5)**

5 (4). *Bouteloua gracilis* well represented to abundant: **(6)**

5. *Bouteloua gracilis* poorly represented or absent: **(7)**

6 (5). *Prosopis glandulosa* >5% but less that 10% (>10% see: (3) ***Prosopis glandulosa/ Bouteloua gracilis* Shrubland**).

***Bouteloua gracilis*/Ruderal Vegetation, *Prosopis glandulosa* Phase**

6. *Prosopis glandulosa* poorly represented or absent:

***Bouteloua gracilis*/Ruderal Herbaceous Vegetation**

7 (5). *Bouteloua curtipendula* common to abundant: **(8)**

7. *Bouteloua curtipendula* sparse or absent; Sorghum halepense well represented to abundant.

***Sorghum halepense* / Ruderal Herbaceous Vegetation**

8 (7). *Heteropogon contortus* well represented, dominant or codominant grass.

Bouteloua curtipendula - Heteropogon contortus Herbaceous Vegetation

8. *Heteropogon contortus* sparse or absent:

***Bouteloua curtipendula*/Ruderal Herbaceous Vegetation**

KEY 4 – Lithmorphic Vegetation

1. 1. Substrate dominated by exposed bedrock or large boulders:

Sparse Vegetation/Boulder Rockland

1. Substrate dominated by stream channel alluvial deposits:

Sparse Vegetation/Recent Alluvial Deposits

KEY 5 – Non-vegetation Units — Urban or Built-up Land

Building/Other Development

Ruin-Restored — actively maintained

Ruin-Unrestored — sites may have ruderal vegetation

Trail

Road

Appendix D Local Plant Association Descriptions for Fort Davis National Historic Site

As part of the Fort Davis NHS vegetation classification and mapping project, local plant association descriptions were written for 26 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 Fort Davis NHS 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 a new hierarchy per FGDC (2008) and Table 5 of the main report.

1. Forest & Woodland (Mesomorphic Tree Vegetation)

1.C. Temperate Forest

1.C.1. Warm Temperate Forest

1.C.1.c. Western North American Warm Temperate Forest

MG010. Madrean Warm Lowland Evergreen Woodland

G201. Madrean Encinal Group

***Quercus emoryi - Celtis laevigata* var. *reticulata* Woodland**
Emory's Oak - Netleaf Hackberry Woodland
Identifier: NHNM000701

NVC CLASSIFICATION

Division	Western North American Warm Temperate Forest [1.C.1.c]
Macrogroup	Madrean Warm Lowland Evergreen Woodland [MG010]
Group	Madrean Encinal Group [G201]
Association	*Quercus emoryi - Celtis laevigata* var. *reticulata* Woodland

DISTRIBUTION
Fort Davis National Historic Site
This association is known from Hospital Canyon and isolated occurrences in the northeast corner of the site.

ENVIRONMENTAL DESCRIPTION
Fort Davis National Historic Site
This association occurs from 1,505 to 1,550 m (4,940 to 5,080 ft) in elevation typically along drainages with a low gradient (2-4%), but may extend upslope along small drainages. Soils along the drainages are comprised of alluvial deposits from the surrounding rhyolitic lava formations. The ground surface is characterized by gravel and cobble in the drainage channel with abundant herbaceous cover along the terrace edges. Heavy accumulation of leaf litter and exposed soil mixed with gravel is common in the inter-spaces.

VEGETATION DESCRIPTION
Fort Davis National Historic Site
This semi-riparian woodland is characterized by variably canopy (20-70%) of the evergreen oak, Quercus emoryi, mixed with the deciduous Celtis laevigata var. reticulata. The shrub canopy is typically well represented and can be as high as 30% cover. Aloysia gratissima, Mimosa aculeaticarpa var. biuncifera, Rhus trilobata, Brickellia californica, and Prunus serotina var. virens are the most abundant shrubs. In the herbaceous layer, grasses are often abundant in the drainages and include Bouteloua curtipendula, Panicum bulbosum, Leptochloa dubia, and Setaria leucopila. Overall, forbs can also be well represented but variable in composition. Artemisia ludoviciana, Pseudognaphalium stramineum, Commelina dianthifolia, Maurandella antirrhiniflora, Pellaea intermedia, and Bidens bigelovii were the most abundant and consistent among the 32 species recorded for the association.

MOST ABUNDANT SPECIES
Fort Davis National Historic Site

Stratum	Species
Tree (canopy)	*Quercus emoryi, Celtis laevigata* var. *reticulata*
Graminoid	*Bouteloua curtipendula, Panicum bulbosum*

OTHER NOTEWORTHY SPECIES
Fort Davis National Historic Site
None.

CLASSIFICATION COMMENTS
Fort Davis National Historic Site
Data are not available.

CLASSIFICATION CONFIDENCE:

ELEMENT SOURCES
Fort Davis National Historic Site Inventory Notes: Data are not available.
Fort Davis National Historic Site Plots: NHNM plots 07FD008, 07FD018, 09FD019.
Local Description Authors: A. Fettes; E. H. Muldavin

***Quercus emoryi / Heteropogon contortus* Woodland**
Emory's Oak / Tanglehead Woodland
Identifier: NHNM000704

NVC CLASSIFICATION

Division	Western North American Warm Temperate Forest [1.C.1.c]
Macrogroup	Madrean Warm Lowland Evergreen Woodland [MG010]
Group	Madrean Encinal Group [G201]
Association	*Quercus emoryi / Heteropogon contortus* Woodland

DISTRIBUTION
Fort Davis National Historic Site
This association is known from the North Ridge of the site.

ENVIRONMENTAL DESCRIPTION
Fort Davis National Historic Site
This association is known from an occurrence around 1,580 m (5,190 ft) in elevation on rocky ridges with moderate slopes (11%) and southeasterly aspect. The ground surface is characterized by scattered to patchy herbaceous vegetation establishment over exposed rhyolitic bedrock, which is prevalent throughout. Accumulation of leaf litter over areas of rock, gravel, and soil is common.

VEGETATION DESCRIPTION
Fort Davis National Historic Site
This woodland savanna association is characterized by an open canopy of the evergreen oak, *Quercus emoryi*, with grassy inter-tree spaces dominated by *Heteropogon contortus*, *Bouteloua chondrosioides*, *Schizachyrium cirratum*, *Bothriochloa laguroides* ssp. *torreyana*, and *Bouteloua hirsuta* among the 17 graminoids species recorded. Total grass cover can be as high as 20%. Shrubs are typically scattered, but *Mimosa aculeaticarpa* var. *biuncifera* may be common throughout. Forbs can be well represented; however, composition and cover are highly variable. *Selaginella peruviana*, *Pseudognaphalium stramineum*, *Sida neomexicana*, and *Eriogonum tenellum* are the most abundant representatives among the 18 species recorded.

MOST ABUNDANT SPECIES
Fort Davis National Historic Site

Stratum	**Species**
Tree (canopy)	*Quercus emoryi*
Graminoid	*Heteropogon contortus*, *Bouteloua chondrosioides*

OTHER NOTEWORTHY SPECIES
Fort Davis National Historic Site
None.

CLASSIFICATION COMMENTS
Fort Davis National Historic Site
Data are not available.

CLASSIFICATION CONFIDENCE: 3

ELEMENT SOURCES
Fort Davis National Historic Site Inventory Notes: Data are not available.
Fort Davis National Historic Site Plots: NHNM plot 07FD013.
Local Description Authors: A. Fettes; E. H. Muldavin

***Quercus grisea - Quercus emoryi* Woodland**
Gray Oak - Emory oak Woodland
Identifier: NHNM000719

NVC CLASSIFICATION

Division	Western North American Warm Temperate Forest [1.C.1.c]
Macrogroup	Madrean Warm Lowland Evergreen Woodland [MG010]
Group	Madrean Encinal Group [G201]
Association	*Quercus grisea - Quercus emoryi* Woodland

DISTRIBUTION
Fort Davis National Historic Site
This association is known from Sleeping Lion Mountain and the North Ridge.

ENVIRONMENTAL DESCRIPTION
Fort Davis National Historic Site
This association occurs from 1,550 to 1,575 m (5,080 to 5,170 ft) in elevation along moderate to steep slopes (15-45%) with cool, northwestern to northeastern aspects. Exposed rhyolitic bedrock and boulder-like formations are prevalent throughout. The ground surface is characterized by scattered to patchy herbaceous vegetation with accumulations of leaf litter common under the tree and shrub canopies. Areas of exposed rock, gravel, and soil are common in the tree interspaces.

VEGETATION DESCRIPTION
Fort Davis National Historic Site
This evergreen oak woodland association is characterized by an open canopy (15-30% cover) of *Quercus grisea* and *Quercus emoryi*. The understory is usually shrubby and with a mix of shrub and dwarf-shrub species. *Mimosa aculeaticarpa* var. *biuncifera*, *Rhus trilobata, Baccharis biglovii, Sophora secundiflora*, and *Opuntia engelmannii* were the most common and consistent representatives among the 28 species recoded. The herb layer approaches ranges between 10 and 25% cover. Of the 19 graminoid species, *Bouteloua curtipendula* is the dominant and *Eragrostis intermedia* and *Muhlenbergia emersleyi* are also common. Forbs are diverse and variable. The prevalent species are *Cheilanthes eatonii, Artemisia ludoviciana, Tragia ramosa, Bidens bigelovii, Bommeria hispida, Rivina humilis, Thelypodium wrightii, Pseudognaphalium stramineum, Astrolepis sinuata, Galium microphyllum,* and *Pellaea intermedia*.

MOST ABUNDANT SPECIES
Fort Davis National Historic Site

Stratum	Species
Tree (canopy)	*Quercus grisea, Quercus emoryi*
Shrub	*Rhus trilobata,*
Graminoid	*Bouteloua curtipendula*

OTHER NOTEWORTHY SPECIES
Fort Davis National Historic Site
None.

CLASSIFICATION COMMENTS
Fort Davis National Historic Site
Data are not available.

CLASSIFICATION CONFIDENCE: 2

ELEMENT SOURCES
Fort Davis National Historic Site Inventory Notes: Data are not available.
Fort Davis National Historic Site Plots: NHNM plot 07FD002, 07FD009, 09FD004, 09FD006.
Local Description Authors: A. Fettes; E. H. Muldavin

G487. Madrean Juniper Savanna & Woodland Group
***Juniperus pinchotii / Bouteloua curtipendula* Woodland**
Pinchot's Juniper / Sideoats Grama Woodland
Identifier: NHNM000465

NVC CLASSIFICATION

Division	Western North American Warm Temperate Forest [1.C.1.c]
Macrogroup	Madrean Warm Lowland Evergreen Woodland [MG010]
Group	Madrean Juniper Savanna & Woodland Group [G487]
Association	*Juniperus pinchotii / Bouteloua curtipendula* Woodland

DISTRIBUTION
Fort Davis National Historic Site
This association is known from the north ridge near the western boundary of the site.

ENVIRONMENTAL DESCRIPTION
Fort Davis National Historic Site
This association occurs at around 1,610 m (5,280 ft) in elevation on moderate to steep slopes with north-facing aspects. Substrates are derived from the underlying rhyolitic bedrock. Sites tend to be rocky with the ground surface characterized by abundant herbaceous vegetation, litter accumulation, gravel, and soil in the interspaces.

VEGETATION DESCRIPTION
Fort Davis National Historic Site
This evergreen woodland association is characterized by a moderately dense canopy (40%) of *Juniperus pinchotii* x *J. coahuilensis* with *Bouteloua curtipendula* abundant in the understory. Total grass cover can be as high as 30%. *Aristida purpurea* var. *nealleyi* and *Eragrostis intermedia* are common associates. Scattered shrubs are common and typically represented by *Mahonia trifoliolata, Rhus microphylla*, and *R. trilobata*. Forbs are typically low in abundance and scattered and may include *Artemisia ludoviciana, Tragia ramosa*, and *Pellaea intermedia*.

MOST ABUNDANT SPECIES
Fort Davis National Historic Site

Stratum	Species
Tree	*Juniperus pinchotii* x *J. coahuilensis*
Graminoid)	*Bouteloua curtipendula*

OTHER NOTEWORTHY SPECIES
Fort Davis National Historic Site
None.

CLASSIFICATION COMMENTS
Fort Davis National Historic Site
Data are not available.

CLASSIFICATION CONFIDENCE: 2

ELEMENT SOURCES
Fort Davis National Historic Site Inventory Notes: Data are not available.
Fort Davis National Historic Site Plots: NHNM plot 07FD023.
Local Description Authors: A. Fettes; E. H. Muldavin

1.C.3. Temperate Flooded & Swamp Forest

1.C.3.d. Western North American Warm Temperate Flooded & Swamp Forest

MG036. Warm Mediterranean & Desert Riparian, Flooded & Swamp Forest

G508. Sonoran-Chihuahuan Lowland Riparian Forest Group

***Celtis laevigata* var. *reticulata* / *Brickellia californica* Woodland**
Netleaf Hackberry / California brickellbush
Identifier: NHNM000370

NVC CLASSIFICATION

Division	Western North American Warm Temperate Flooded & Swamp Forest [1.C.3.d]
Macrogroup	Warm Mediterranean & Desert Riparian, Flooded & Swamp Forest [MG036]
Group	Sonoran-Chihuahuan Lowland Riparian Forest Group [G508]
Association	*Celtis laevigata* var. *reticulata* / *Brickellia californica* Woodland

DISTRIBUTION
Fort Davis National Historic Site
This association is known from Hospital Canyon.

ENVIRONMENTAL DESCRIPTION
Fort Davis National Historic Site
This association occurs at around 1,500 m (4,920 ft) in elevation typically along drainages with a low gradient (2-4%), but may extend upslope along small drainages. Soils along the drainages are comprised of alluvial deposits from the surrounding rhyolitic lava formations. Ground cover is dominated by herbaceous vegetation with exposed soil and herbaceous litter accumulation in the abundant interspaces.

VEGETATION DESCRIPTION
Fort Davis National Historic Site
This desert riparian woodland is characterized by an open canopy of *Celtis laevigata* var. *reticulata* which can also occur as a shrub. *Brickellia californica* and *Rhus microphylla* are other shrubs that reflect the more mesic conditions, but more upland species such as *Mimosa aculeaticarpa* var. *biuncifera* and *Aloysia gratissima* may be common. Herbaceous cover can be luxuriant with *Bouteloua gracilis* the dominant and *Setaria leucopila*, *Leptochloa dubia*, *Bouteloua curtipendula*, and *Setaria grisebachii* indicative of the more mesic conditions (total grass cover can be as high as 60%). Forbs are few and scattered.

MOST ABUNDANT SPECIES
Fort Davis National Historic Site

Stratum	Species	
Tree	Broad-leaved deciduous	*Celtis laevigata* var. *reticulata*
Shrub	Broad-leaved deciduous`	*Brickellia californica*
Herb (field)	Graminoid	*Setaria leucopila, Bouteloua gracilis*

OTHER NOTEWORTHY SPECIES
Fort Davis National Historic Site
None.

CLASSIFICATION COMMENTS
Fort Davis National Historic Site
Data are not available.

CLASSIFICATION CONFIDENCE:

ELEMENT SOURCES
Fort Davis National Historic Site Inventory Notes: Data are not available.
Fort Davis National Historic Site Plots: NHNM plot 09FD014.
Local Description Authors: A. Fettes; E. H. Muldavin

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

3.A. Warm Semi-Desert Scrub & Grassland

3.A.1. Warm Semi-Desert Scrub & Grassland

3.A.1.a. North American Warm Desert Scrub & Grassland

MG086. Chihuahuan Desert Scrub

G289. Chihuahuan Creosotebush Mixed Desert Scrub Group

***Aloysia wrightii* / *Bouteloua curtipendula* Shrubland**
Wright's Beebrush / Sideoats Grama Shrubland
Identifier: NHNM000329

NVC CLASSIFICATION

Division	North American Warm Desert Scrub & Grassland [3.A.1.a]
Macrogroup	Chihuahuan Desert Scrub [MG086]
Group	Chihuahuan Creosotebush Mixed Desert Scrub Group [G289]
Association	*Aloysia wrightii* / *Bouteloua curtipendula* Shrubland

DISTRIBUTION
Fort Davis National Historic Site
This association is known from the lower slopes of North Ridge.

ENVIRONMENTAL DESCRIPTION
Fort Davis National Historic Site
This association is known from a site at 1,540 m (5,060 ft) in elevation, with a moderately steep slope (35%) with a warm south-southeast aspect. Soils are derived from the underlying rhyolitic bedrock formation. Sites tend to be quite rocky with large boulders common throughout. Gravel and litter accumulation are typically well represented in the interspaces.

VEGETATION DESCRIPTION
Fort Davis National Historic Site
This Chihuahuan Desert shrubland is characterized by an open canopy of *Aloysia wrightii* with *Sophora secundiflora* and *Opuntia engelmannii* as common shrub associates. Average shrub cover is 30%. The inter-shrub spaces are characteristically grassy and dominated by *Bouteloua curtipendula* with *B. eriopoda* a well represented associate. Forbs are variable in composition and cover with the perennials *Mentzelia oligosperma* and *Viguiera cordifolia* as the most abundant representatives.

MOST ABUNDANT SPECIES
Fort Davis National Historic Site

Stratum	Species	
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Aloysia wrightii*
		Sophora secundiflora
Herb (field)	Graminoid	*Bouteloua curtipendula*
		Bouteloua eriopoda

OTHER NOTEWORTHY SPECIES
Fort Davis National Historic Site
None.

CLASSIFICATION COMMENTS
Fort Davis National Historic Site
Data are not available.

CLASSIFICATION CONFIDENCE: 3

ELEMENT SOURCES
Fort Davis National Historic Site Inventory Notes: Data are not available.
Fort Davis National Historic Site Plots: NHNM plot 09FD007.
Local Description Authors: A. Fettes; E. H. Muldavin

***Mimosa aculeaticarpa* var. *biuncifera - Aloysia gratissima - Opuntia engelmannii* Shrubland**
Catclaw Mimosa - Beebrush - Cactus Apple Shrubland
Identifier: NHNM000814

NVC CLASSIFICATION

Division	North American Warm Desert Scrub & Grassland [3.A.1.a]
Macrogroup	Chihuahuan Desert Scrub [MG086]
Group	Chihuahuan Creosotebush Mixed Desert Scrub Group [G289]
Association	*Mimosa aculeaticarpa* var. *biuncifera - Aloysia gratissima - Opuntia engelmannii* Shrubland

DISTRIBUTION
Fort Davis National Historic Site
This association is known from the lower slopes of North Ridge and Sleeping Lion.

ENVIRONMENTAL DESCRIPTION
Fort Davis National Historic Site
This association occurs from 1,500 to 1,510 m (4,920 to 4,960 ft) in elevation over variably steep (10-40%), rocky, lower slopes with warm, south-facing aspects. Large boulder-shaped protrusions of andesite and rhyolitic bedrock from the underlying formation are abundant

throughout. The ground surface between rock outcroppings is characterized by dense shrub and herbaceous cover. Herbaceous litter accumulation and gravelly soil are common in the interspaces.

VEGETATION DESCRIPTION
Fort Davis National Historic Site
This foothill desert shrubland is characterized by dense and mixed stands of microphyllus shrub dominated by *Mimosa aculeaticarpa* var. *biuncifera*, *Aloysia wrightii*, and occasionally *A. wrightii* along with the succulent *Opuntia engelmannii*. Total shrub and sub-shrub cover can be as high as 50%, with 23 species recorded. Grass cover can reach 10% with patches of *Bouteloua curtipendula* common and often intermixed with and *Bouteloua gracilis* and *B. eriopoda*. orbs are common but variable in composition.

MOST ABUNDANT SPECIES
Fort Davis National Historic Site

Stratum	Species	
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Mimosa aculeaticarpa* var. *biuncifera*
		Aloysia wrightii
Shrub/sapling (tall & short)	Succulent shrub	*Opuntia engelmannii*

OTHER NOTEWORTHY SPECIES
Fort Davis National Historic Site
None.

CLASSIFICATION COMMENTS
Fort Davis National Historic Site
Data are not available.

CLASSIFICATION CONFIDENCE: 3

ELEMENT SOURCES
Fort Davis National Historic Site Inventory Notes: Data are not available.
Fort Davis National Historic Site Plots: NHNM plots 09FD00, 11FO0033, and 09FD018.
Local Description Authors: A. Fettes; E. H. Muldavin

***Mimosa aculeaticarpa* var. *biuncifera - Aloysia gratissima* / *Bouteloua curtipendula* Shrubland**
Catclaw Mimosa - Beebrush / Sideoats Grama Shrubland
Identifier: NHNM000502

NVC CLASSIFICATION

Division	North American Warm Desert Scrub & Grassland [3.A.1.a]
Macrogroup	Chihuahuan Desert Scrub [MG086]
Group	Chihuahuan Creosotebush Mixed Desert Scrub Group [G289]
Association	*Mimosa aculeaticarpa* var. *biuncifera - Aloysia gratissima* / *Bouteloua curtipendula* Shrubland

DISTRIBUTION
Fort Davis National Historic Site
This association is known from the eastern to southern slopes of North Ridge and Sleeping Lion.

ENVIRONMENTAL DESCRIPTION
Fort Davis National Historic Site
This association occurs from 1,500 to 1,540 m (4,930 to 5,060 ft) in elevation over moderate (10%) rocky slopes with east-southeast- facing aspects. Stands are found on rocky, colluvial slopes underlain by rhyolitic or andesitic lava rock. The ground surface is dominated by herbaceous vegetation with exposed gravelly soil and litter accumulation common in the interspaces.

VEGETATION DESCRIPTION
Fort Davis National Historic Site
This foothill desert shrubland is characterized by dense and mixed stands of microphyllus shrub dominated by *Mimosa aculeaticarpa* var. *biuncifera*, *Aloysia gratissima*, and *A. wrightii*. Total shrub cover can reach 40%. The grassy understory is dominated by *Bouteloua curtipendula* often intermixed with *B. gracilis, Pleuraphis mutica, Bothriochloa laguroides* ssp. *torreyana*, and *Lycurus setosus* as common associates. Forbs are common but variable in composition. Among the 18 forb species recorded, P*seudognaphalium stramineum*, *Justicia pilosella, Evolvulus alsinoides, Tragia ramosa*, and *Trixis californica* were the most abundant.

MOST ABUNDANT SPECIES
Fort Davis National Historic Site

Stratum	Species
Shrub/sapling (tall & short)	*Mimosa aculeaticarpa* var. *biuncifera*, *Aloysia gratissima, Aloysia wrightii*
Graminoid	*Bouteloua curtipendula*

OTHER NOTEWORTHY SPECIES
Fort Davis National Historic Site
None.

CLASSIFICATION COMMENTS
Fort Davis National Historic Site
Data are not available.

CLASSIFICATION CONFIDENCE:

ELEMENT SOURCES
Fort Davis National Historic Site Inventory Notes: Data are not available.
Fort Davis National Historic Site Plots: NHNM plots 07FD007 and 09TN003.
Local Description Authors: A. Fettes; E. H. Muldavin

***Mimosa aculeaticarpa* var. *biuncifera* - *Aloysia gratissima* / *Bouteloua gracilis* Shrubland**
Catclaw Mimosa - Beebrush / Blue Grama Shrubland
Identifier: NHNM000503

NVC CLASSIFICATION

Division	North American Warm Desert Scrub & Grassland [3.A.1.a]
Macrogroup	Chihuahuan Desert Scrub [MG086]
Group	Chihuahuan Creosotebush Mixed Desert Scrub Group [G289]
Association	*Mimosa aculeaticarpa* var. *biuncifera* - *Aloysia gratissima* / *Bouteloua gracilis* Shrubland

DISTRIBUTION
Fort Davis National Historic Site
This association is known from Sleeping Lion.

ENVIRONMENTAL DESCRIPTION
Fort Davis National Historic Site
This association occurs between 1,500 m (4,920 ft) and 1,585 m (5,200 ft) in elevation along ridge summits and warm southeast-facing slopes. Stands are found on rocky, colluvial slopes underlain by rhyolitic or andesitic lava rock. Large boulders are common. The ground surface between rock outcroppings is characterized by dense shrub and herbaceous cover. Herbaceous litter accumulation and exposed soil is common in the interspaces.

VEGETATION DESCRIPTION
Fort Davis National Historic Site
This semi-desert foothill shrubland is characterized by dense stands of *Mimosa aculeaticarpa* var. *biuncifera* and *Aloysia gratissima*. Total shrub cover can be as high as 60%. The grassy understory is dominated by *Bouteloua gracilis* with *Bouteloua curtipendula*, *B. eriopoda*, *Schizachyrium cirratum*, and *Leptochloa dubia* as common associates. Forbs are common but variable in composition. Among the 12 species recorded, *Pseudognaphalium stramineum*, *Artemisia ludoviciana*, and *Schkuhria pinnata* are typical associates.

MOST ABUNDANT SPECIES
Fort Davis National Historic Site

Stratum	Species
Shrub/sapling (tall & short)	*Mimosa aculeaticarpa* var. *biuncifera*, *Aloysia gratissima*
Graminoid	*Bouteloua gracilis*

OTHER NOTEWORTHY SPECIES
Fort Davis National Historic Site
None.

CLASSIFICATION COMMENTS
Fort Davis National Historic Site
Data are not available.

CLASSIFICATION CONFIDENCE:

ELEMENT SOURCES
Fort Davis National Historic Site Inventory Notes: Data are not available.
Fort Davis National Historic Site Plots: NHNM plots 07FD004 and 09FD008.
Local Description Authors: A. Fettes; E. H. Muldavin

***Mimosa aculeaticarpa* var. *biuncifera* / *Bouteloua curtipendula* Shrubland**
Catclaw Mimosa / Sideoats Grama Shrubland
Identifier: NHNM000507

NVC CLASSIFICATION

Division	North American Warm Desert Scrub & Grassland [3.A.1.a]
Macrogroup	Chihuahuan Desert Scrub [MG086]
Group	Chihuahuan Creosotebush Mixed Desert Scrub Group [G289]
Association	*Mimosa aculeaticarpa* var. *biuncifera* / *Bouteloua curtipendula* Shrubland

DISTRIBUTION
Fort Davis National Historic Site
This association is known from multiple hill-slope locations throughout the entire site.

ENVIRONMENTAL DESCRIPTION
Fort Davis National Historic Site
This association ranges from 1,482 m (4865 ft) to 1,550 m (5,080 ft) in elevation along moderate lower slopes (25%) with varying aspects. Stands are found on rocky, colluvial slopes underlain by rhyolitic or andesitic lava rock. Large boulders and exposed areas of rhyolitic bedrock are often abundant throughout. The ground surface between rock outcroppings are characterized by patchy but dense shrub and herbaceous cover. Herbaceous litter accumulation and exposed soil is common in the interspaces.

VEGETATION DESCRIPTION
Fort Davis National Historic Site
This foothill desert shrubland is characterized by dense stands of *Mimosa aculeaticarpa* var. *biuncifera* with a grassy understory dominated by *Bouteloua curtipendula*. Total shrub cover can be as high as 60%. *Rhus microphylla, Mahonia trifoliolata,* and *Opuntia engelmannii* are common to well represented. Grass cover can reach 60% and may also include *Leptochloa dubia, Bouteloua eriopoda*, and *B. gracilis* as common associates. Forbs are common but variable in composition. Among the 18 forb species recorded, *Cheilanthes eatonii, C. wrightii*, and *Tragia ramosa* were the most frequent representatives.

MOST ABUNDANT SPECIES
Fort Davis National Historic Site

Stratum	**Species**	
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Mimosa aculeaticarpa* var. *biuncifera*
Herb (field)	Graminoid	*Bouteloua curtipendula*

OTHER NOTEWORTHY SPECIES
Fort Davis National Historic Site
None.

CLASSIFICATION COMMENTS
Fort Davis National Historic Site
Data are not available.

CLASSIFICATION CONFIDENCE: 2

ELEMENT SOURCES
Fort Davis National Historic Site Inventory Notes: Data are not available.
Fort Davis National Historic Site Plots: NHNM plots 07FD021, 09FD013, and 11FO012.
Local Description Authors: A. Fettes; E. H. Muldavin

***Mimosa aculeaticarpa* var. *biuncifera* / *Bouteloua gracilis* Shrubland**
Catclaw Mimosa / Blue Grama Shrubland
Identifier: NHNM000509

NVC CLASSIFICATION

Division	North American Warm Desert Scrub & Grassland [3.A.1.a]
Macrogroup	Chihuahuan Desert Scrub [MG086]
Group	Chihuahuan Creosotebush Mixed Desert Scrub Group [G289]
Association	*Mimosa aculeaticarpa* var. *biuncifera* / *Bouteloua gracilis* Shrubland

DISTRIBUTION
Fort Davis National Historic Site
This association is known from Hospital Canyon, the adjacent slopes of Sleeping Lion, and the 2011 extension area.

ENVIRONMENTAL DESCRIPTION
Fort Davis National Historic Site
This association occurs at around 1,520 m (4,992 ft) in elevation on moderate, lower colluvial, rocky slopes with north-facing aspects. The ground surface is characterized by abundant herbaceous cover. Herbaceous litter and exposed soil are common in the interspaces.

VEGETATION DESCRIPTION
Fort Davis National Historic Site
This foothill desert shrubland is characterized by open stands of *Mimosa aculeaticarpa* var. *biuncifera*, with an understory dominated by *Bouteloua gracilis*. Total shrub cover can be as high as 25%. *Rhus trilobata* and *Opuntia engelmannii* usually present but less than 5% cover. Graminoids are particularly abundant with 16 recorded species with total cover as high as 60%. *Bouteloua curtipendula, B. eriopoda*, and *Eragrostis intermedia* are common associates with *B. gracilis*. Forbs are prevalent but variable in composition. Among the 22 species recorded, *Artemisia ludoviciana*, *Pseudognaphalium stramineum*, and *Selaginella peruviana* were the most abundant representatives.

MOST ABUNDANT SPECIES
Fort Davis National Historic Site

Stratum	Species	
Shrub/sapling (tall & short)	Broad-leaved deciduous shrub	*Mimosa aculeaticarpa* var. *biuncifera*
Herb (field)	Graminoid	*Bouteloua gracilis*

OTHER NOTEWORTHY SPECIES
Fort Davis National Historic Site
None.

CLASSIFICATION COMMENTS
Fort Davis National Historic Site
Data are not available.

CLASSIFICATION CONFIDENCE:

ELEMENT SOURCES
Fort Davis National Historic Site Inventory Notes: Data are not available.
Fort Davis National Historic Site Plots: NHNM plots 07FD001, 09FD005 and 11FO006.
Local Description Authors: A. Fettes; E. H. Muldavin

***Sophora secundiflora - Aloysia wrightii* Shrubland**
Texas Mountain Laurel - Wright's Beebrush Shrubland
Identifier: NHNM000794

NVC CLASSIFICATION

Division	North American Warm Desert Scrub & Grassland [3.A.1.a]
Macrogroup	Chihuahuan Desert Scrub [MG086]
Group	Chihuahuan Creosotebush Mixed Desert Scrub Group [G289]
Association	*Sophora secundiflora - Aloysia wrightii* Shrubland

DISTRIBUTION
Fort Davis National Historic Site
This association is known from Sleeping Lion and North Ridge.

ENVIRONMENTAL DESCRIPTION
Fort Davis National Historic Site
This association occurs at around 1,555 m (5,100 ft) in elevation, over steep slopes (55%) with moderately warm, southeastern aspects. Exposed rhyolitic bedrock dominates the ground surface with scattered herbaceous cover throughout the interspaces. Abundant accumulation of leaf litter is typical beneath the shrub canopies.

VEGETATION DESCRIPTION
Fort Davis National Historic Site
This chaparral shrubland is characterized by an open canopy of *Sophora secundiflora* with *Aloysia wrightii* as a well represented diagnostic. Total shrub cover can be as high as 25%. *Mimosa aculeaticarpa* var. *biuncifera*, *Opuntia engelmannii*, and *Tecoma stans* are common associates but typically do not exceed 5% cover. Among dwarf shrubs, P*arthenium incanum* is well represented. Graminoids and forbs are typically scattered. *Bouteloua curtipendula* and *Artemisia ludoviciana* are the common representatives.

MOST ABUNDANT SPECIES
Fort Davis National Historic Site

Stratum	**Species**
Shrub/sapling (tall & short)	*Sophora secundiflora, Aloysia wrightii, Parthenium incanum*

OTHER NOTEWORTHY SPECIES
Fort Davis National Historic Site
None.

CLASSIFICATION COMMENTS
Fort Davis National Historic Site
Data are not available.

CLASSIFICATION CONFIDENCE: 3

ELEMENT SOURCES
Fort Davis National Historic Site Inventory Notes: Data are not available.
Fort Davis National Historic Site Plots: NHNM plot 07FD003.
Local Description Authors: A. Fettes; E. H. Muldavin

G289. Chihuahuan Mesquite Upland Scrub Group
***Prosopis glandulosa* / *Bouteloua gracilis* Shrubland**
Honey Mesquite / Blue Grama Shrubland
Identifier: CEGL001383

NVC CLASSIFICATION

Division	North American Warm Desert Scrub & Grassland [3.A.1.a]
Macrogroup	Chihuahuan Desert Scrub [MG086]
Group	Chihuahuan Mesquite Upland Scrub Group [G289]
Association	*Prosopis glandulosa* / *Bouteloua gracilis* Shrubland

DISTRIBUTION
Fort Davis National Historic Site
This association is known from the Foreground Resource Opportunity Area on the northeast side of the park.

ENVIRONMENTAL DESCRIPTION
Fort Davis National Historic Site
This association occurs from 1,475 to 1,490 m (4,845 to 4,895 ft) in elevation on gentle alluvial piedmont slopes extending from the base of the surrounding rhyolitic and andesitic hills. The ground surface is characterized by large, dense patches of herbaceous cover with abundant areas of exposed gravelly soil in the interspaces.

VEGETATION DESCRIPTION
Fort Davis National Historic Site
This desert shrubland is characterized by an open canopy of *Prosopis glandulosa* with luxuriant patches of *Bouteloua gracilis* throughout the understory and intershrub spaces. Additional graminoid species such as *Scleropogon brevifolius*, *Aristida divaricata, A. adscensionis,* and *Bouteloua curtipendula* may be common to abundant, with total grass cover as high as 70%. Forbs are common but variable in composition and often weedy (e.g., *Evolvulus sericeus, Solanum elaeagnifolium*, and *Chaetopappa ericoides*).

MOST ABUNDANT SPECIES
Fort Davis National Historic Site

Stratum	Species
Shrub/sapling (tall & short)	*Prosopis glandulosa*
Graminoid	*Bouteloua gracilis*

OTHER NOTEWORTHY SPECIES
Fort Davis National Historic Site
Prosopis glandulosa is considered invasive of grama grasslands in this instance as a function of past human disturbance, particularly grazing.

CLASSIFICATION COMMENTS
Fort Davis National Historic Site
Data are not available.

CLASSIFICATION CONFIDENCE: 1

ELEMENT SOURCES
Fort Davis National Historic Site Inventory Notes: Data are not available.
Fort Davis National Historic Site Plots: NHNM plot 09FD002, 09FD010, 09FD011, and 07FD010
Local Description Authors: A. Fettes; E. H. Muldavin

G286. Chihuahuan Succulent Desert Scrub Group
***Acacia constricta* - *Opuntia engelmannii* Shrubland**
Mescat Acacia - Engelmann's Prickly Pear Shrubland
Identifier: NHNM000290

NVC CLASSIFICATION

Division	North American Warm Desert Scrub & Grassland [3.A.1.a]
Macrogroup	Chihuahuan Desert Scrub [MG086]
Group	Chihuahuan Succulent Desert Scrub Group [G286]
Association	*Acacia constricta* - *Opuntia engelmannii* Shrubland

DISTRIBUTION
Fort Davis National Historic Site
This association is known from the North Ridge summit near the western boundary of the park.

ENVIRONMENTAL DESCRIPTION
Fort Davis National Historic Site
This association occurs around 1,620 m (5320 ft) in elevation, over moderately steep (25%) shoulder slopes and ridge tops with warm south-southeastern aspects. Soils are derived from the underlying rhyolitic bedrock formation. The ground surface is characterized by large dense patches of herbaceous cover with abundant areas of exposed rocky and gravelly soil in the interspaces.

VEGETATION DESCRIPTION
Fort Davis National Historic Site
This desert shrubland is characterized by an open canopy of *Acacia constricta* with *Leptochloa dubia* very abundant in the sub canopy and inter-shrub spaces. The succulent shrub *Opuntia engelmannii* is well represented throughout. Total average shrub cover is 40%, decreasing toward the ridge top. Additional common grasses include *Bouteloua gracilis* and *B. curtipendula*. Total grass cover can be as high as 40%. Forbs are poorly represented and scattered.

MOST ABUNDANT SPECIES
Fort Davis National Historic Site

Stratum	Species
Shrub/sapling (tall & short)	*Acacia constricta*
Succulent shrub	*Opuntia engelmannii*
Graminoid	*Leptochloa dubia*

OTHER NOTEWORTHY SPECIES
Fort Davis National Historic Site
None.

CLASSIFICATION COMMENTS
Fort Davis National Historic Site
Data are not available.

CLASSIFICATION CONFIDENCE:

ELEMENT SOURCES
Fort Davis National Historic Site Inventory Notes: Data are not available.
Fort Davis National Historic Site Plots: NHNM plot 07FD016.
Local Description Authors: A. Fettes

MG087. Appacherian - Chihuahuan Semi-Desert Grassland & Steppe

GSW1. Appacherian - Chihuahuan Semi-Desert Foothill Grassland Group

***Bouteloua curtipendula - Heteropogon contortus* Herbaceous Vegetation**
Sideoats Grama - Tanglehead Grassland
Identifier: NHNM000024

NVC CLASSIFICATION

Division	North American Warm Desert Scrub & Grassland [3.A.1.a]
Macrogroup	Chihuahuan Semi-Desert Grassland & Steppe [MG087]
Group	Chihuahuan Semi-Desert Foothill Grassland Group [GSW1]
Association	*Bouteloua curtipendula - Heteropogon contortus* Herbaceous Vegetation

DISTRIBUTION
Fort Davis National Historic Site
This association is known from North Ridge near the western boundary.

ENVIRONMENTAL DESCRIPTION
Fort Davis National Historic Site
This association occurs around 1,565 m (5,140 ft) in elevation, over moderately steep slopes (25%) with warm southern aspects. Soils are derived from the underlying rhyolitic bedrock formation. Sites tend to be moderately rocky, with abundant gravel and litter accumulation in the interspaces.

VEGETATION DESCRIPTION
Fort Davis National Historic Site
This open foothill grassland is characterized by *Bouteloua curtipendula* with *Heteropogon contortus* abundant and often co-dominant. *Aristida purpurea, Bothriochloa laguroides* ssp. *torreyana, Bouteloua hirsuta* and *B. eriopoda* are common associates. Total graminoid cover can be as high as 50%. Scattered shrubs are common but clearly subordinate to the grasses (<10% total cover). *Dasylirion leiophyllum, Nolina texana,* and *Opuntia engelmannii* may be common throughout. Forbs are poorly represented and scattered.

MOST ABUNDANT SPECIES
Fort Davis National Historic Site

Stratum	Species
Shrub/sapling (tall & short)	*Dasylirion leiophyllum*
Graminoid	*Bouteloua curtipendula, Heteropogon contortus*

OTHER NOTEWORTHY SPECIES
Fort Davis National Historic Site
None.

CLASSIFICATION COMMENTS
Fort Davis National Historic Site
Data are not available.

CLASSIFICATION CONFIDENCE: 3

ELEMENT SOURCES
Fort Davis National Historic Site Inventory Notes: Data are not available.
Fort Davis National Historic Site Plots: NHNM plot 07FD019.
Local Description Authors: A. Fettes; E. H. Muldavin

***Bouteloua curtipendula* / Rockland Herbaceous Vegetation**
Sideoats Grama / Rockland Grassland
Identifier: NHNM000039

NVC CLASSIFICATION

Division	North American Warm Desert Scrub & Grassland [3.A.1.a]
Macrogroup	Chihuahuan Semi-Desert Grassland & Steppe [MG087]
Group	Chihuahuan Semi-Desert Foothill Grassland Group [GSW1]
Association	*Bouteloua curtipendula* / Rockland Herbaceous Vegetation

DISTRIBUTION
Fort Davis National Historic Site
This association is known from North Ridge and Sleeping Lion.

ENVIRONMENTAL DESCRIPTION
Fort Davis National Historic Site
This association occurs around 1,590 m (5,210 ft) in elevation, over moderately steep (15%), rocky shoulder slopes with varying aspects. Exposed bedrock and boulders from the underlying rhyolitic formation are abundant with rock surface cover as high as 80%. Herbaceous cover and litter accumulation is scattered in the rock/boulder interspaces.

VEGETATION DESCRIPTION
Fort Davis National Historic Site
This sparsely vegetated, rocky foothill grassland is characterized by patches of *Bouteloua curtipendula*, *Bothriochloa laguroides* ssp. *torreyana*, *Eragrostis intermedia*, and *Schizachyrium cirratum* growing in the rock/boulder interspaces. Shrubs and dwarf shrubs are poorly represented; however, scattered individuals of *Mimosa aculeaticarpa* var. *biuncifera*, *Yucca torreyi*, and *Dasylirion leiophyllum* may be common. Forbs are scattered,with rock ferns such as *Cheilanthes eatonii*, *Notholaena standleyi*, and *Astrolepis sinuata* indicative of the rocky environment.

MOST ABUNDANT SPECIES
Fort Davis National Historic Site

Stratum	Species
Graminoid	*Bouteloua curtipendula*
Forbs	*Cheilanthes eatonii*, *Notholaena standleyi*, and *Astrolepis sinuata*

OTHER NOTEWORTHY SPECIES
Fort Davis National Historic Site
None.

CLASSIFICATION COMMENTS
Fort Davis National Historic Site
Data are not available.

CLASSIFICATION CONFIDENCE:

ELEMENT SOURCES
Fort Davis National Historic Site Inventory Notes: Data are not available.
Fort Davis National Historic Site Plots: NHNM plot 07FD012.
Local Description Authors: A. Fettes; E.H. Muldavin

***Bouteloua hirsuta - Bouteloua eriopoda* Herbaceous Vegetation**
Hairy Grama - Black Grama Grassland
Identifier: NHNM000107

NVC CLASSIFICATION

Division	North American Warm Desert Scrub & Grassland [3.A.1.a]
Macrogroup	Chihuahuan Semi-Desert Grassland & Steppe [MG087]
Group	Chihuahuan Semi-Desert Foothill Grassland Group [GSW1]
Association	*Bouteloua hirsuta - Bouteloua eriopoda* Herbaceous Vegetation

DISTRIBUTION
Fort Davis National Historic Site
This association is known from below North Ridge near the northeast corner of the site.

ENVIRONMENTAL DESCRIPTION
Fort Davis National Historic Site
This association occurs from 1,485 to 1,495 m (4,870 to 4,910 ft) in elevation, over gentle slopes (8%) with east-southeastern aspects. Stands are found on gentle alluvial piedmont slopes extending from the base of the surrounding rhyolitic and andesitic hills. Ground cover is dominated by herbaceous vegetation, with exposed soil and herbaceous litter accumulation in the interspaces.

VEGETATION DESCRIPTION
Fort Davis National Historic Site
This semi-desert foothill grassland association is characterized by the dominance of *Bouteloua hirsuta* and *B. eriopoda*. Total grass cover can be as high as 60%. *Bouteloua gracilis, B. curtipendula, B. chondrosioides*, and *Aristida divaricata* may also be common throughout. Forbs are represented by a mix of annual, biennial, and perennial species including *Pseudognaphalium stramineum* and *Croton pottsii*, but cover seldom exceeds 5%. Shrubs and dwarf shrubs are generally scattered; however, *Opuntia engelmannii, Yucca elata*, and *Gutierrezia sarothrae* may be common.

MOST ABUNDANT SPECIES
Fort Davis National Historic Site

Stratum	**Species**
Graminoid	*Bouteloua hirsuta, Bouteloua eriopoda*

OTHER NOTEWORTHY SPECIES
Fort Davis National Historic Site
None.

CLASSIFICATION COMMENTS
Fort Davis National Historic Site
Data are not available.

CLASSIFICATION CONFIDENCE:

ELEMENT SOURCES
Fort Davis National Historic Site Inventory Notes: Data are not available.
Fort Davis National Historic Site Plots: NHNM plots 07FD005, 07FD006, 09FD001, and 09FD012.
Local Description Authors: A. Fettes; E. H.Muldavin

***Muhlenbergia emersleyi - Bouteloua curtipendula* Herbaceous Vegetation**
Bull Muhly - Sideoats Grama Herbaceous Vegetation
Identifier: CEGL001644

NVC CLASSIFICATION

Division	North American Warm Desert Scrub & Grassland [3.A.1.a]
Macrogroup	Chihuahuan Semi-Desert Grassland & Steppe [MG087]
Group	Chihuahuan Semi-Desert Foothill Grassland Group [GSW1]
Association	*Muhlenbergia emersleyi - Bouteloua curtipendula* Herbaceous Vegetation

DISTRIBUTION
Fort Davis National Historic Site
This association is known from North Ridge near the western boundary of the site.

ENVIRONMENTAL DESCRIPTION
Fort Davis National Historic Site
This association occurs at around 1,620 m (5,320 ft) in elevation over moderately steep, colluvial slopes with north-facing aspects. Sites are rocky and derived from the underlying rhyolitic lavas. The ground surface is characterized by abundant herbaceous cover with areas of rock, gravel, and exposed soil common in the interspaces.

VEGETATION DESCRIPTION
Fort Davis National Historic Site
This semi-desert foothill grassland association is dominated by a luxuriant cover of *Muhlenbergia emersleyi* with *Bouteloua curtipendula* as an abundant associate. Total graminoid cover can be as high as 60%. Trees and shrubs are generally absent; however, scattered individuals of *Leucaena retusa* and *Nolina texana* may be common. Forbs are common but variable in composition. Among the 11 species recorded, *Pseudognaphalium stramineum, Cheilanthes eatonii*, and *Artemisia ludoviciana* are the most abundant.

MOST ABUNDANT SPECIES
Fort Davis National Historic Site

Stratum	Species
Graminoid	*Muhlenbergia emersleyi, Bouteloua curtipendula*

OTHER NOTEWORTHY SPECIES
Fort Davis National Historic Site
None.

CLASSIFICATION COMMENTS
Fort Davis National Historic Site
Data are not available.

CLASSIFICATION CONFIDENCE: 2

ELEMENT SOURCES
Fort Davis National Historic Site Inventory Notes: Data are not available.
Fort Davis National Historic Site Plots: NHNM plot 07FD015.
Local Description Authors: A. Fettes; E. H. Muldavin

***Nolina texana* / *Bouteloua eriopoda* Shrub Herbaceous Vegetation**
Texas Sacahuista / Black Grama Shrub Grassland
Identifier: NHNM000082

NVC CLASSIFICATION

Division	North American Warm Desert Scrub & Grassland [3.A.1.a]
Macrogroup	Chihuahuan Semi-Desert Grassland & Steppe [MG087]
Group	Chihuahuan Semi-Desert Foothill Grassland Group [GSW1]
Association	*Nolina texana* / *Bouteloua eriopoda* Shrub Herbaceous Vegetation

DISTRIBUTION
Fort Davis National Historic Site
This association is known from North Ridge near the western boundary of the site.

ENVIRONMENTAL DESCRIPTION
Fort Davis National Historic Site
This association is known from around 1,595 m (5,230 ft) in elevation on a moderate slope (20%) of a north-facing aspect. Rocks from the underlying rhyolitic bedrock are abundant

throughout. The ground surface is characterized by abundant herbaceous cover with areas of rock, gravel, and exposed soil common in the interspaces.

VEGETATION DESCRIPTION
Fort Davis National Historic Site
This semi-desert grassland association is dominated by *Bouteloua eriopoda*, with the rosettophylous *Nolina texana* shrub well represented throughout. Total grass cover can be as high as 50%, with *Bothriochloa laguroides* ssp. torreyana and *Bouteloua curtipendula* well represented to abundant, in addition to *B. eriopoda*. Forbs are common but variable in composition. Among the 14 species recorded, *Croton pottsii*, *Artemisia ludoviciana*, *Dyschoriste decumbens*, and *Sida neomexicana* are representative.

MOST ABUNDANT SPECIES
Fort Davis National Historic Site

Stratum	Species
Shrub/sapling (tall & short)	*Nolina texana*
Graminoid	*Bouteloua eriopoda*

OTHER NOTEWORTHY SPECIES
Fort Davis National Historic Site
None.

CLASSIFICATION COMMENTS
Fort Davis National Historic Site
Data are not available.

CLASSIFICATION CONFIDENCE:

ELEMENT SOURCES
Fort Davis National Historic Site Inventory Notes: Data are not available.
Fort Davis National Historic Site Plots: NHNM plot 07FD014.
Local Description Authors: A. Fettes; E. H. Muldavin

***Parthenium incanum* / *Bouteloua eriopoda* Shrub Herbaceous Vegetation**
Mariola / Black Grama Shrub Grassland
Identifier: NHNM000083

NVC CLASSIFICATION

Division	North American Warm Desert Scrub & Grassland [3.A.1.a]
Macrogroup	Chihuahuan Semi-Desert Grassland & Steppe [MG087]
Group	Chihuahuan Semi-Desert Foothill Grassland Group [GSW1]
Association	*Parthenium incanum* / *Bouteloua eriopoda* Shrub Herbaceous Vegetation

DISTRIBUTION
Fort Davis National Historic Site
This association is known from North Ridge.

ENVIRONMENTAL DESCRIPTION
Fort Davis National Historic Site
This association is known from 1,580 m (5,180 ft) in elevation on a moderate, colluvial slope (22%) with a south-facing aspect. Rock from the underlying rhyolitic bedrock can be abundant. The ground surface is characterized by exposed gravelly soils with abundant patches of herbaceous cover.

VEGETATION DESCRIPTION
Fort Davis National Historic Site
This semi-desert grassland association is dominated by *Bouteloua eriopoda* with *Parthenium incanum* as an abundant and diagnostic dwarf-shrub associate. Total graminoid cover can be as high as 30% and *Bouteloua curtipendula* is abundant and often co-dominant, while *B. gracilis, B. hirsute, Aristida purpurea,* and *Bothriochloa laguroides* ssp. *torreyana* are well represented associates. Forbs are common but variable in composition. Among the 10 species recorded, *Croton pottsii*, *Zinnia grandiflora*, and *Dalea lachnostachy*s are representative.

MOST ABUNDANT SPECIES
Fort Davis National Historic Site

Stratum	Species
Shrub/sapling (tall & short)	*Parthenium incanum*
Graminoid	*Bouteloua eriopoda, Bouteloua curtipendula*

OTHER NOTEWORTHY SPECIES
Fort Davis National Historic Site
None.

CLASSIFICATION COMMENTS
Fort Davis National Historic Site
Data are not available.

CLASSIFICATION CONFIDENCE: 1

ELEMENT SOURCES
Fort Davis National Historic Site Inventory Notes: Data are not available.
Fort Davis National Historic Site Plots: NHNM plot 07FD022.
Local Description Authors: A. Fettes; E. H. Muldavin

G490. Chihuahuan Semi-Desert Grassland & Steppe Group

***Bouteloua gracilis - Bouteloua curtipendula* - Mixed Shrub Herbaceous Vegetation**
Blue Grama - Sideoats Grama Mixed Shrub Herbaceous Vegetation
Identifier: NHNM000853

NVC CLASSIFICATION

Division	Great Plains Grassland & Shrubland [2.C.1.b]
Macrogroup	Great Plains Shortgrass Prairie & Shrubland [MG053]
Group	Great Plains Shortgrass Prairie Group [G144]
Association	*Bouteloua gracilis - Bouteloua curtipendula* - Mixed Shrub Herbaceous Vegetation

DISTRIBUTION
Fort Davis National Historic Site
This association is known from the piedmont area below North Ridge.

ENVIRONMENTAL DESCRIPTION
Fort Davis National Historic Site
This association occurs from around 1,480 to 1,490 m (4,860 to 4,890 ft) in elevation on gentle piedmont slopes. Substrates are derived from alluvial fan deposits from the surrounding rhyolitic formations. The ground surface is characterized by luxuriant herbaceous cover with exposed gravelly soil and litter accumulation abundant throughout the interspaces.

VEGETATION DESCRIPTION
Fort Davis National Historic Site
This semi-desert grassland association is co-dominated by *Bouteloua gracilis* and *Bouteloua curtipendula*. Total grass cover can be as high as 70%, with *Bouteloua eriopoda* and *Aristida divaricata* additional common associates. Shrubs are scattered and may include *Yucca elata* and *Dasylirion leiophyllum*. Forbs are common but variable in composition.

MOST ABUNDANT SPECIES
Fort Davis National Historic Site

Stratum	**Species**
Graminoid	*Bouteloua gracilis, Bouteloua curtipendula*

OTHER NOTEWORTHY SPECIES
Fort Davis National Historic Site
None.

CLASSIFICATION COMMENTS
Fort Davis National Historic Site
Data are not available.

CLASSIFICATION CONFIDENCE: 1

ELEMENT SOURCES
Fort Davis National Historic Site Inventory Notes: Data are not available.
Fort Davis National Historic Site Plots: NHNM plots 11FO014, 11FO015, 11FO010, 11FO017, and 09TN002
Local Description Authors: A. Fettes; E. H. Muldavin

***Bouteloua gracilis - Setaria leucopila* Herbaceous Vegetation**
Blue Grama - Streambed Bristlegrass Grassland
Identifier: NHNM000815

NVC CLASSIFICATION

Division	North American Warm Desert Scrub & Grassland [3.A.1.a]
Macrogroup	Chihuahuan Semi-Desert Grassland & Steppe [MG087]
Group	Chihuahuan Semi-Desert Grassland & Steppe Group [G490]
Association	*Bouteloua gracilis - Setaria leucopila* Herbaceous Vegetation

DISTRIBUTION
Fort Davis National Historic Site
This association is known from Hospital Canyon.

ENVIRONMENTAL DESCRIPTION
Fort Davis National Historic Site
This association occurs at around 1,500 m (4,920 ft) in elevation on gentle slopes in alluvial valley bottoms. Soils are derived from fan deposits from the surrounding rhyolitic formations. The ground surface is characterized by luxuriant herbaceous cover and abundant litter accumulation, with areas of exposed soil common throughout the interspaces.

VEGETATION DESCRIPTION
Fort Davis National Historic Site
This semi-desert grassland association is characterized by luxuriant grass cover dominated by *Bouteloua gracilis*, with *Setaria leucopila* as an abundant and often co-dominant associate. Total grass cover can be as high as 70%. Shrubs are typically poorly represented and scattered. Forbs are common but variable in composition.

MOST ABUNDANT SPECIES
Fort Davis National Historic Site

Stratum	Species
Graminoid	*Bouteloua gracilis, Setaria leucopila*

OTHER NOTEWORTHY SPECIES
Fort Davis National Historic Site
None.

CLASSIFICATION COMMENTS
Fort Davis National Historic Site
Data are not available.

CLASSIFICATION CONFIDENCE:

ELEMENT SOURCES
Fort Davis National Historic Site Inventory Notes: Data are not available.
Fort Davis National Historic Site Plots: NHNM plots 09FD015, 09FD016, 09FD017.
Local Description Authors: A. Fettes

MGSWU. Miscellaneous Southwestern Herbaceous Vegetation

GSWU. Miscellaneous Southwestern Herbaceous Vegetation Group

***Bouteloua curtipendula* / Ruderal Herbaceous Vegetation**
Sideoats Grama / Weedy Herbs Vegetation Grassland
Identifier: NHNM000040

NVC CLASSIFICATION

Division	North American Warm Desert Scrub & Grassland [0.0.0.0]
Macrogroup	Miscellaneous Southwest Herbaceous Vegetation [MGSWU]
Group	Miscellaneous Southwest Herbaceous Vegetation Group [GSWU]
Association	*Bouteloua curtipendula* / Ruderal Herbaceous Vegetation

DISTRIBUTION
Fort Davis National Historic Site
This association is known primarily from the Foreground Resource Opportunity Area in the northeast portion of the park.

ENVIRONMENTAL DESCRIPTION
Fort Davis National Historic Site
This association occurs at around 1,480 m (4,860 ft) in elevation, over relatively flat terrain. Substrates are derived from alluvial fan deposits from the surrounding rhyolitic formations. Ground cover is dominated by herbaceous vegetation with exposed soil and abundant litter accumulation in the interspaces.

VEGETATION DESCRIPTION
Fort Davis National Historic Site
This disturbed grassland association is characterized by a very abundant cover of *Bouteloua curtipendula* with *Bouteloua gracilis* as a common associate. Total grass cover can exceed 40%. Forbs, however, may exceed grass cover in some areas (as high as 50% total cover) and are typically dominated by the annual and perennial ruderal forbs such as *Ambrosia psilostachya, Chenopodium neomexicanum, Erigeron flagellaris, Cucurbita foetidissima, Conyza canadensis, Convolvulus equitans*, and *Cirsium undulatum*.

MOST ABUNDANT SPECIES
Fort Davis National Historic Site

Stratum	Species
Graminoid	*Bouteloua curtipendula*
Forb	*Ambrosia psilostachya*

OTHER NOTEWORTHY SPECIES
Fort Davis National Historic Site
None.

CLASSIFICATION COMMENTS
Fort Davis National Historic Site
Data are not available.

CLASSIFICATION CONFIDENCE: 3

ELEMENT SOURCES
Fort Davis National Historic Site Inventory Notes: Data are not available.
Fort Davis National Historic Site Plots: NHNM plot 07FD011.
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	North American Warm Desert Scrub & Grassland [0.0.0.0]
Macrogroup	Miscellaneous Southwest Herbaceous Vegetation [MGSWU]
Group	Miscellaneous Southwest Herbaceous Vegetation Group [GSWU]
Association	*Bouteloua gracilis* / Ruderal Herbaceous Vegetation

DISTRIBUTION
Fort Davis National Historic Site
This association is known from throughout the old fort area and parade grounds.

ENVIRONMENTAL DESCRIPTION
Fort Davis National Historic Site
This association occurs from 1,485 to 1,490 m (4,870 to 4,890 ft) in elevation on relatively flat, managed terrain. Substrates are fan deposits derived from the surrounding rhyolitic formations. The ground surface is characterized by luxuriant herbaceous cover with moderate amounts of soil mixed with gravel and abundant litter accumulation in the interspaces.

VEGETATION DESCRIPTION
Fort Davis National Historic Site
This disturbance-grassland association is dominated by a luxuriant cover of *Bouteloua gracilis*, with the ruderal grasses such as *Chloris virgata*, *Aristida adscensiones*, and *A. divaricata* common associates. Total grass cover can be as high as 60%. Forbs may be common but are variable in composition and cover. Weedy disturbance-related annuals and perennials (*Chamaesyce dioica* and *Portulaca suffrutescens*) may be common.

MOST ABUNDANT SPECIES
Fort Davis National Historic Site

Stratum	Species
Graminoid	*Bouteloua gracilis, Chloris virgata*

OTHER NOTEWORTHY SPECIES
Fort Davis National Historic Site
None.

CLASSIFICATION COMMENTS
Fort Davis National Historic Site
Data are not available.

CLASSIFICATION CONFIDENCE:

ELEMENT SOURCES
Fort Davis National Historic Site Inventory Notes: Data are not available.
Fort Davis National Historic Site Plots: NHNM plots 07FD017, 09FD009, 09FD020 and 09FD021.
Local Description Authors: A. Fettes; E. H. Muldavin

***Sorghum halepense* / Monotypic Herbaceous Vegetation**
Johnsongrass / Monotypic Stand Grassland
Identifier: NHNM000252

NVC CLASSIFICATION

Division	North American Warm Desert Scrub & Grassland [0.0.0.0]
Macrogroup	Miscellaneous Southwest Herbaceous Vegetation [MGSWU]
Group	Miscellaneous Southwest Herbaceous Vegetation Group [GSWU]
Association	*Sorghum halepense* / Monotypic Herbaceous Vegetation

DISTRIBUTION
Fort Davis National Historic Site
This association is known from the old dam area in Hospital Canyon.

ENVIRONMENTAL DESCRIPTION
Fort Davis National Historic Site
This association occurs at around 1,542 m (5,060 ft) in elevation on sediment fill behind an abandoned dam.

VEGETATION DESCRIPTION
Fort Davis National Historic Site
This herbaceous association is characterized by a nearly monotypic cover of exotic *Sorghum halepense*. Total graminoid cover can be as high as 90% and also include the facultative wetland indicator, but exotic, *Echinochloa crus-galli*.

MOST ABUNDANT SPECIES
Fort Davis National Historic Site

Stratum	Species
Graminoid	*Sorghum halepense*

OTHER NOTEWORTHY SPECIES
Fort Davis National Historic Site
Facultative wetland indicator: Echinochloa crus-galli

CLASSIFICATION COMMENTS
Fort Davis National Historic Site
Data are not available.

CLASSIFICATION CONFIDENCE: 3

ELEMENT SOURCES
Fort Davis National Historic Site Inventory Notes: Data are not available.
Fort Davis National Historic Site Plots: NHNM plot 07FD020.
Local Description Authors: A. Fettes; E. H. Muldavin

Other Incidental Associations

Incidental associations are usually known only from one plot or observation point, or they may have been identified during the accuracy assessment phase of the project. They listed below pending the acquisition additional data on their distribution, composition, and environment.

Woodlands

***Populus deltoides* (ssp. *wislizeni*, ssp. *monilifera*) / Ruderal Disturbance Woodland (NHNM000852)**
***Quercus emoryi* / *Muhlenbergia emersleyi* Woodland (CEGL000685)**

Shrublands

***Prosopis glandulosa* var. *torreyana* Shrubland (CEGL001381)**

Grasslands

***Dasylirion leiophyllum* / *Bouteloua curtipendula* Shrub Herbaceous Vegetation (NHNM000030)**
***Nolina texana* / *Bouteloua curtipendula* Shrub Herbaceous Vegetation (NHNM000036)**

Miscelleaneous

Ruderal Disturbance Herbaceous Vegetation (NPS_NM027)

Sparse Vegetation / Boulder Rockland (NPS_NM013)

Disturbed / Non-vegetated (NPS_NM047)

Literature Cited

Grossman, D. H., D. Faber-Langendoen, A. S. Weakley, M. Anderson, P. Bourgeron, R. Crawford, K. Goodin, S. Landaal, M. Metzler, K. Patterson, M. Pyne, M. Reid, and L. Sneddon. 1998. Vol. I. International classification of ecological communities: Terrestrial vegetation of the United States. The Nature Conservancy, Arlington, Virginia.

Federal Geographic Data Committee (FGDC). 2008. Vegetation Classification Standard, Version 2. FGDC-STD-005, v2, Washington, D.C.

Appendix E Fort Davis National Historic Site Annotated Vegetation Map Legend

Below is the annotated map legend for the vegetation map of Fort Davis National Historic Site 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 2009 color aerial photography (Photo Map Detail);
- The total hectares and acres of the unit and number of polygons as derived from the GIS.

1 Madrean Juniper Savanna and Woodland Group [G487]

A Pinchot's Juniper/Sideoats Grama Woodland

Primary Component Associations:

Juniperus pinchotii / *Bouteloua curtipendula* Woodland [NHNM000465]

Secondary Component Associations:

Inclusions:

Muhlenbergia emersleyi - *Bouteloua curtipendula* Herbaceous Vegetation [CEGL001644]

Elevation:
5,029.63 to 5,332.58ft.
(1,533m to 1,625.4m)

Summary: Open woodland savanna is characterized by scattered Pinchot's juniper with grassy inter-tree spaces dominated by side-oats grama, bullgrass, and plains lovegrass. Stands are found mostly on north-facing slopes and summits of Sleeping Lion and North Ridge. It is often intermixed with stands of Gray Oak/Emory's Oak Woodland (2A), Emory Oak/Tanglehead-Bullgrass Woodland (2C), or various grasslands or scrub types.

Distribution

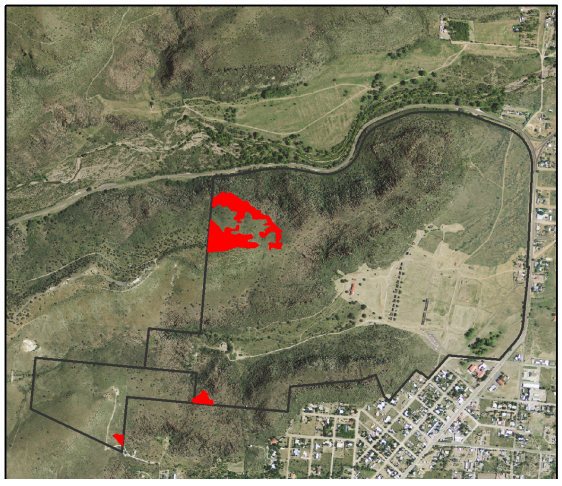


Photo Map Detail

Ha: 5.4 **Acres: 13.2** **Polygons: 4**

2 Madrean Encinal Group [G201]

A Gray Oak/Emory Oak Woodland

Primary Component Associations:

Quercus grisea - Quercus emoryi Woodland [NHNM000719]

Secondary Component Associations:

Inclusions:

Bouteloua curtipendula / Rockland Herbaceous Vegetation [NHNM000039]

Elevation:
4,853.7 to 5,205 ft.
(1,479.4 to 1,586.5m.)

Summary: This open-canopied evergreen oak woodland is dominated by gray and Emory's oak with a moderately-grassy understory of sideoats grama, plains lovegrass, or bullgrass, among others. Stands are most commonly found on steep rocky and boulder-strewn slopes of Sleeping Lion and North Ride and are particularly abundant on north-facing slopes.

Distribution

Photo Map Detail

Ha: 32.2 **Acres: 79.6** **Polygons: 14**

2 Madrean Encinal Group [G201]

B Emory Oak/Netleaf Hackberry Woodland

Primary Component Associations:

Quercus emoryi - Celtis laevigata var. *reticulata* Woodland [NHNM000701]

Secondary Component Associations:

Inclusions:

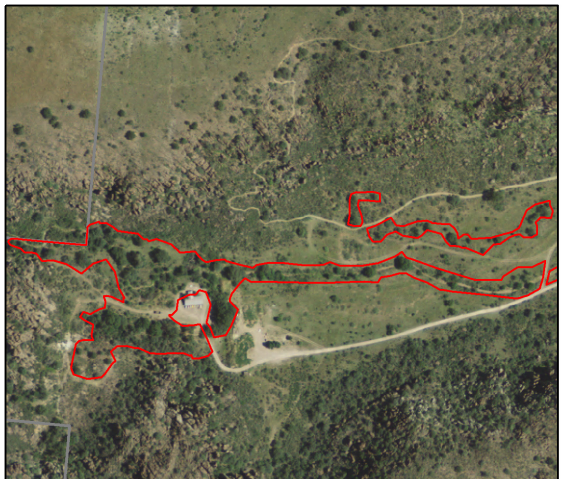
Celtis laevigata var. *reticulata / Brickellia californica* Woodland [NHNM000370]

Elevation:
4,905.6 to 4,983.2 ft.
(1,495.2 to 1,518.9 m.)

Summary: This semi-riparian woodland has a mixed canopy of evergreen oaks (Emory's and gray oak) and the deciduous netleaf hackberry. The understory is typically shrubby with a rich herbaceous layer. Shrubs indicative of the riparian character of the unit are Southwestern chokecherry, skunkbush sumac, and California brickellbush plus several others that enter the zone from the adjacent uplands. Similarly, grasses such as streambed bristlegrass, green sprangletop, and bulb panicgrass are indicative of the more mesic conditions. Stands occur primarily along the alluvial floodplain of Hospital Canyon but extend up the slopes along small drainages.

Distribution

Photo Map Detail



Ha: 3.9 **Acres: 9.7** **Polygons: 4**

2 Madrean Encinal Group [G201]

C Emory Oak/Tanglehead-Bullgrass Woodland

Primary Component Associations:

Quercus emoryi / *Heteropogon contortus* Woodland [NHNM000704]

Secondary Component Associations:

Inclusions:

Quercus emoryi / *Muhlenbergia emersleyi* Woodland [CEGL000685]

Elevation:
5,044.46 to 5,216.6 ft.
(1,537.5 to1590 m.)

Summary: This open-canopied evergreen oak woodland savanna is dominated by Emory's oak with grassy inter-tree spaces of tanglehead, bullgrass, sprucetop grama, and Texas bluestem, among others. Stands occur on the ridges and somewhat warmer, more south-facing slopes of North Ridge and Sleeping Lion and in the extension area.

Distribution

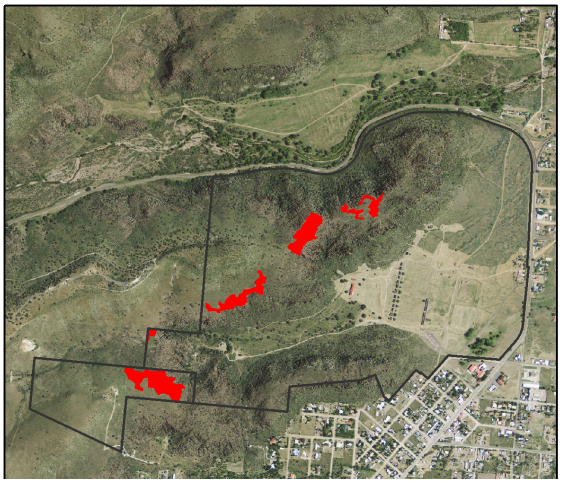
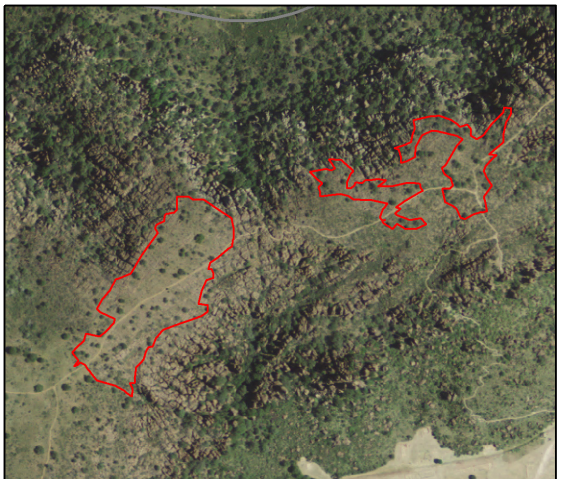


Photo Map Detail



Ha: 6.4 **Acres: 15.8** **Polygons: 6**

3 Chihuahuan Creosotebush Mixed Desert Scrub Group [G288]

A Mescal Bean-Wright's Beebrush Shrubland

Primary Component Associations:

Sophora secundiflora - Aloysia wrightii Shrubland [NHNM000794]

Secondary Component Associations:

Inclusions:

Sparse Vegetation / Boulder Rockland [NPS_NM013]

Elevation:
4,933.8 to 5,207.9 ft.
(1,503.8 to 1,587.4 m.)

Summary: Desert shrubland is characterized by mescal bean and Wright's beebrush growing amongst the boulders on the south-facing slopes of North Ridge and Sleeping Lion. Other shrubs include yellow trumpetbush, along with cacti can such as cactus apple, tree cholla, Christmas cactus, Texas pricklypear, or scarlet hedgehog cactus.

Distribution

Photo Map Detail

Ha: 4.0 **Acres: 10.0** **Polygons: 7**

3 Chihuahuan Creosotebush Mixed Desert Scrub Group [G288]

B Whitethorn Acacia-Texas Pricklypear Shrubland

Primary Component Associations:

Acacia constricta - Opuntia engelmannii Shrubland [NHNM000290]

Secondary Component Associations:

Inclusions:

Elevation:
5,138.8 to 5,339.2 ft.
(1,566.3 to 1,627.4 m.)

Summary: Desert shrubland is dominated by whitethorn acacia with a mixture of the other shrubs that may include cactus apple, Wright's beebrush, tree cholla, algerita, tulip pricklypear, and mariola. Grasses are sparse to abundant and include green sprangletop, blue grama, and sideoats grama. The largest stand occurs on the west end of North Ridge on soils with exposed volcanic rhylolitic lava rocks.

Distribution

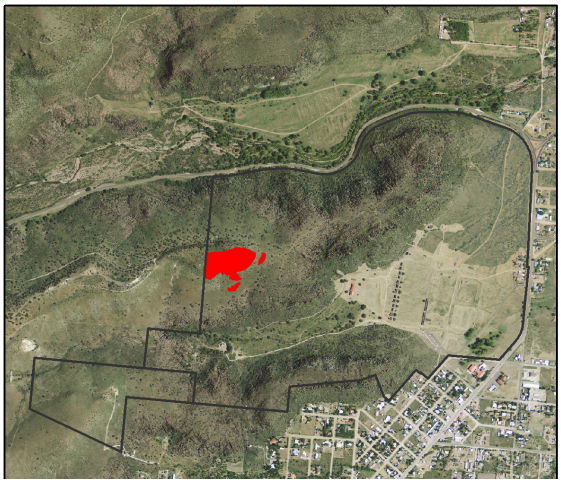
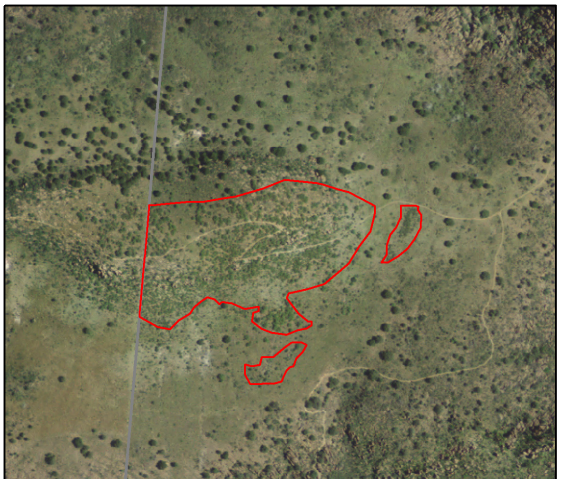


Photo Map Detail



Ha: 3.1 **Acres: 7.7** **Polygons: 3**

3 Chihuahuan Creosotebush Mixed Desert Scrub Group [G288]

C Catclaw Mimosa/Grama Grass Shrubland

Primary Component Associations:

Mimosa aculeaticarpa var. *biuncifera* / *Bouteloua curtipendula* Shrubland [NHNM000507]

Secondary Component Associations:

Mimosa aculeaticarpa var. *biuncifera* / *Bouteloua gracilis* Shrubland [NHNM000509]

Inclusions:

Elevation:
4,841.4 to 5,240 ft.
(1,475.7 to 1,597 m.)

Summary: Desert shrubland is dominated by a moderate to dense canopy of catclaw mimosa with a grassy understory of sideoats grama, blue grama, black grama, plains lovegrass, and Hall's panicgrass. Stands occur on the ridges and upper southerly slopes of North Ridge and Sleeping Lion, and along the lower north slope of North Ridge.

Distribution

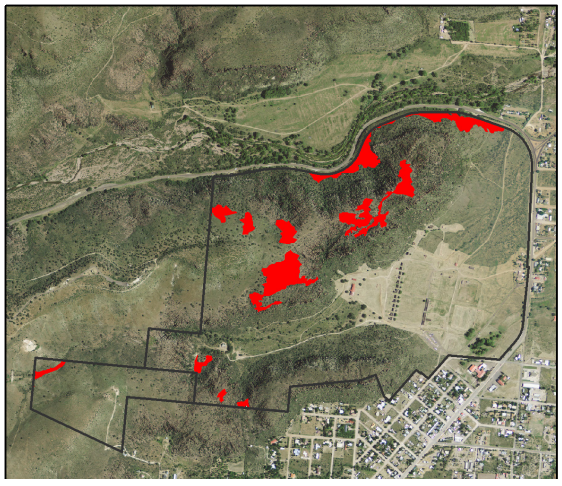
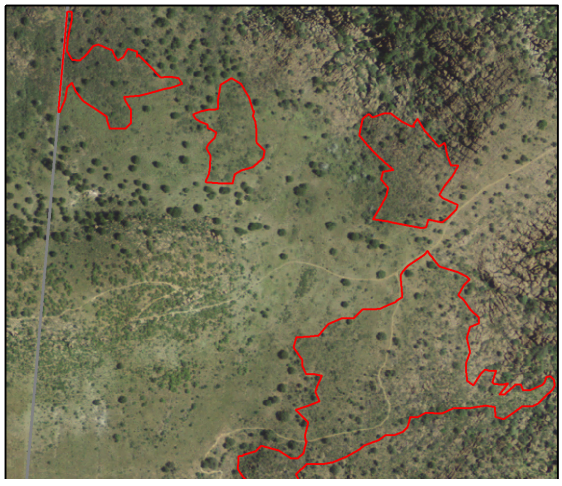


Photo Map Detail



Ha: 13.2 **Acres: 32.5** **Polygons: 11**

3 Chihuahuan Creosotebush Mixed Desert Scrub Group [G288]

D Catclaw Mimosa-Whitebrush/Grama Grass Shrubland

Primary Component Associations:

Mimosa aculeaticarpa var. *biuncifera - Aloysia gratissima / Bouteloua curtipendula* Shrubland [NHNM000502]

Secondary Component Associations:

Mimosa aculeaticarpa var. *biuncifera - Aloysia gratissima / Bouteloua gracilis* Shrubland [NHNM000503]

Inclusions:

Aloysia wrightii / Bouteloua curtipendula Shrubland [NHNM000329]

Acacia constricta - Opuntia engelmannii Shrubland [NHNM000290]

Elevation: 4,910.5 to 5,212.4 ft. (1,496.7 to 1,588.7 m.)

Summary: Desert shrubland is dominated by a moderate to dense canopy of catclaw mimosa and beebrush with a grassy understory of sideoats grama, blue grama, black grama, and Texas bluestem. Stands occur along the lower south- and east-facing slopes of North Ridge and Sleeping Lion, and along the lower north slope of Sleeping Lion. Small-patch inclusions of whitethorn acacia-Texas pricklypear shrubland may be present.

Distribution

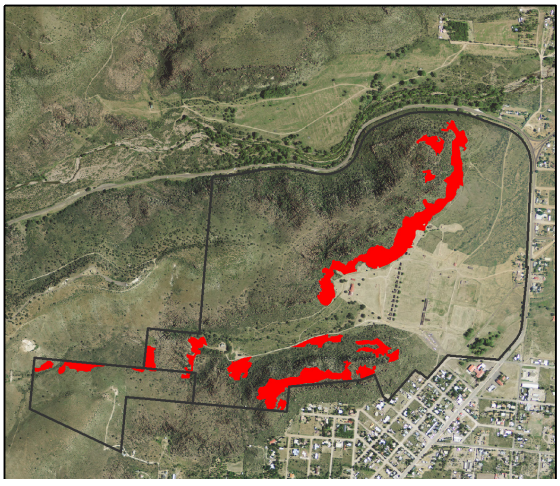
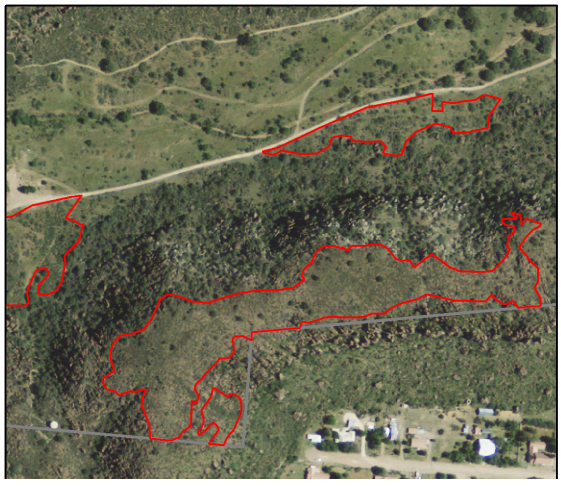


Photo Map Detail



Ha: 17.5 **Acres: 43.4** **Polygons: 13**

3 Chihuahuan Creosotebush Mixed Desert Scrub Group [G288]

E Catclaw Mimosa-Whitebrush-Pricklypear Shrubland

Primary Component Associations:

Mimosa aculeaticarpa var. *biuncifera - Aloysia gratissima - Opuntia engelmannii* Shrubland [NHNM000814]

Secondary Component Associations:

Inclusions:

Elevation:
4,897.6 to 5,094.8 ft.
(1,498.8 to 1,552.9 m.)

Summary: Desert shrubland is dominated by a moderate to dense canopy of catclaw mimosa and beebrush with conspicuous succulents that include cactus apple, Texas pricklypear, and tree cholla along with Wright's beebrush. Grasses are often poorly represented, but sideoats grama, blue grama, or black grama may be common. Stands occur along the lower south-facing slope of North Ridge in Hospital Canyon.

Distribution

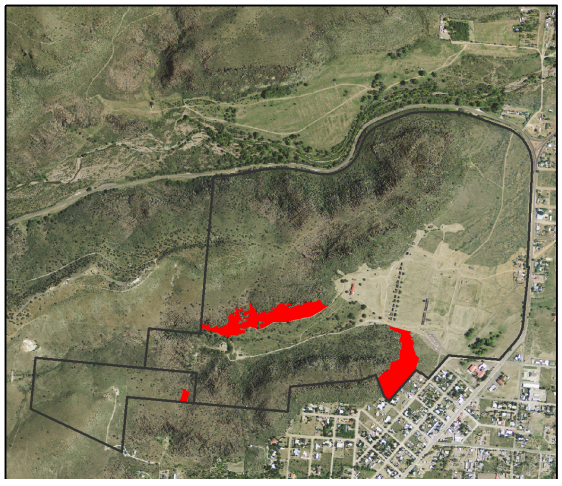


Photo Map Detail

Ha: 7.4 **Acres: 18.3** **Polygons: 3**

4 Apacherian-Chihuahuan Mesquite Upland Scrub Group [G289]

A Honey Mesquite/Blue Grama Shrubland

Primary Component Associations:

Prosopis glandulosa / *Bouteloua gracilis* Shrubland [CEGL001383]

Secondary Component Associations:

Inclusions:

Prosopis glandulosa var. *torreyana* Shrubland [CEGL001381]

Elevation:
4,840.4 to 5,176.4 ft.
(1,475.4 to 1,577.8 m.)

Summary: Desert shrubland is dominated by a moderate canopy of honey mesquite with a grassy understory dominated by blue grama, along with poverty threeawn and sideoats grama as common associates. Stands are found mostly on the alluvial piedmont of the Foreground ROA, often in a mosaic with Mixed Grama Grass Herbaceous Vegetation (5C) and Blue Grama/Ruderal Herbaceous Vegetation (5D) where honey mesquite has not invaded.

Distribution

Photo Map Detail

Ha: 12.9 **Acres: 31.8** **Polygons: 9**

5 Apacherian-Chihuahuan Semi-Desert Grassland and Shrub-steppe Group [G490]

A Black Grama/Texas Sacahuista Semi-desert Grassland

Primary Component Associations:

Nolina texana / *Bouteloua eriopoda* Shrub Herbaceous Vegetation [NHNM000082]

Secondary Component Associations:

Parthenium incanum / *Bouteloua eriopoda* Shrub Herbaceous Vegetation NHNM000083]

Inclusions:

Muhlenbergia emersleyi - *Bouteloua curtipendula* Herbaceous Vegetation [CEGL001644]

Elevation:
5,138.8 to 5,287.9 ft.
(1,566.3 to 1,611.78 m.)

Summary: Semi-desert grassland dominated by black grama along with bull grass, and sideoats grama. Shrubs are a conspicuous component, but not dominant (usually less than 10% cover). Typical species include Texas sacahuista, mariola, green sotol, and Torrey's yucca. Stands are found on the ridges and upper slopes of North Ridge.

Distribution

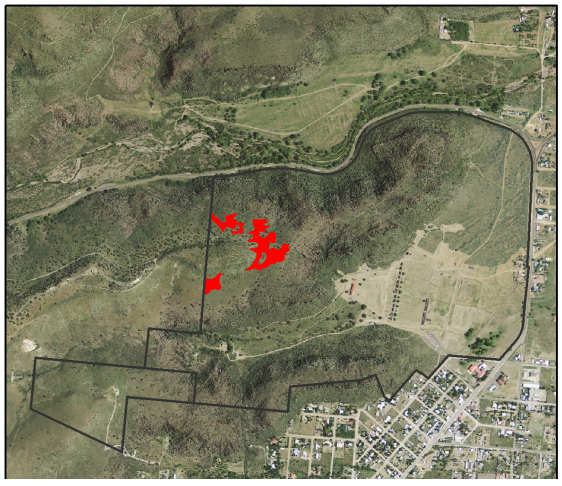


Photo Map Detail

Ha: 3.7 **Acres: 9.2** **Polygons: 3**

5 Apacherian-Chihuahuan Semi-Desert Grassland and Shrub-steppe Group [G490]

B Sideoats Grama/Tanglehead Semi-desert Grassland

Primary Component Associations:

Bouteloua curtipendula - Heteropogon contortus Herbaceous Vegetation [NHNM000024]

Secondary Component Associations:

Inclusions:

Elevation:
5,033 to 5,232.6 ft.
(1,534 to 1,594.9 m.)

Summary: Semi-desert grassland dominated by sideoats grama and tanglehead. Shrubs are often a conspicuous component, but not dominant (usually less than 10% cover). Typical shrub species include Texas sacahuista, green sotol, and Torrey's yucca. Stands are found the southerly slope of North Ridge.

Distribution

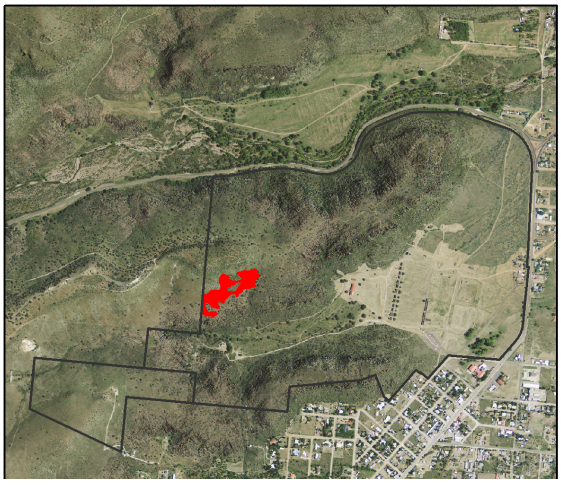
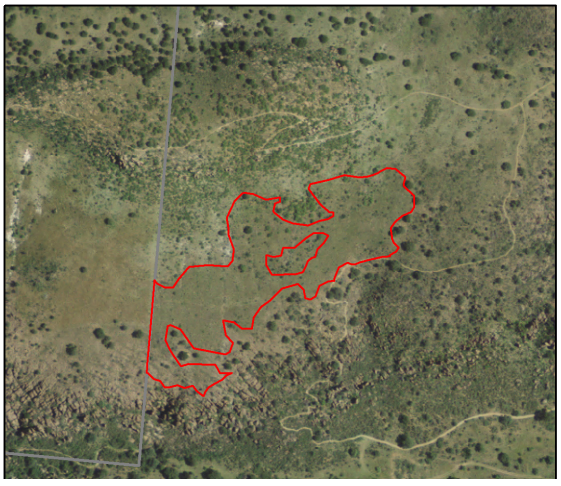


Photo Map Detail



Ha: 2.5 **Acres: 6.3** **Polygons: 1**

5 Apacherian-Chihuahuan Semi-Desert Grassland and Shrub-steppe Group [G490]

C Mixed Grama Grass Semi-desert Grassland

Primary Component Associations:

Bouteloua hirsuta - Bouteloua eriopoda Herbaceous Vegetation [NHNM000107]

Secondary Component Associations:

Bouteloua curtipendula / Ruderal Herbaceous Vegetation [NHNM000040]

Inclusions:

Elevation:
4,848.6 to 4,932.6 ft.
(1,477.8 to 1,503.5 m.)

Summary: Semi-desert grassland dominated by a mix of grama grasses that include hairy, black, sideoats, and blue grama. Shrubs are scattered and not dominant (usually less than 5% cover). Typical shrub species include soaptree yucca along with succulents such as cactus apple and tulip pricklypear. Stands are found mostly on the alluvial piedmont of the Foreground ROA, often in a mosaic with Honey Mesquite/Blue Grama Shrubland (4A) and Blue Grama/Ruderal Herbaceous Vegetation (5D).

Distribution

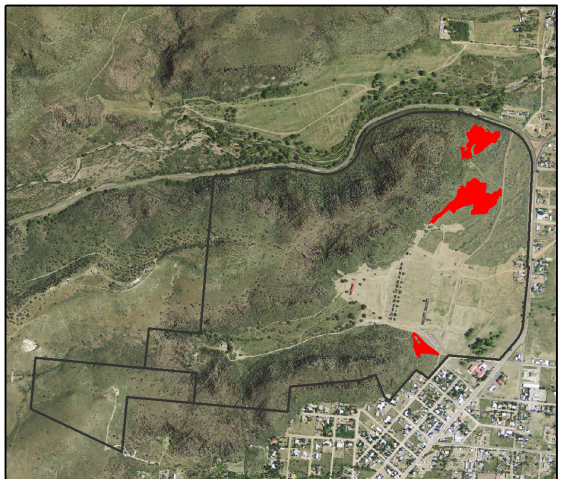


Photo Map Detail

Ha: 5.3 **Acres: 13.1** **Polygons: 3**

5 Apacherian-Chihuahuan Semi-Desert Grassland and Shrub-steppe Group [G490]

D Blue Grama/Ruderal Semi-desert Grassland

Primary Component Associations:

Bouteloua gracilis / Ruderal Herbaceous Vegetation [NPS_NM043]

Secondary Component Associations:

Bouteloua gracilis - Bouteloua curtipendula - Mixed Shrub Herbaceous Vegetation [NHNM000853]

Bouteloua gracilis - Setaria leucopila Herbaceous Vegetation [NHNM000815]

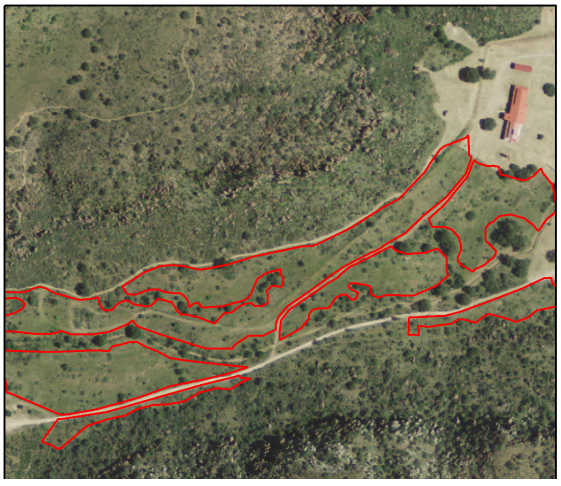
Inclusions:

Elevation:
4,840.3 to 4,958 ft.
(1,475.4 to 1,511.2 m.)

Summary: Disturbed semi-desert grassland dominated by blue grama, sixweeks threeawn, poverty threeawn, feather fingergrass, and streambed bristlegrass. Shrubs are scattered and not dominant (usually less than 5% cover). Typical shrub species include soaptree yucca and jointfir, along with succulents such as cactus apple and tulip pricklypear. Stands are found mostly on the alluvial piedmont of the Foreground ROA, often in a mosaic with Honey Mesquite/Blue Grama Shrubland (4A) and Mixed Grama Grass Herbaceous Vegetation (5C).

Distribution

Photo Map Detail



Ha: 13.2 **Acres: 32.6** **Polygons: 20**

5 Apacherian-Chihuahuan Semi-Desert Grassland and Shrub-steppe Group [G490]

E Sideoast Grama/Sotal Semi-desert Grassland

Primary Component Associations:

Dasylirion leiophyllum / *Bouteloua curtipendula* Shrub Herbaceous Vegetation [NHNM000030]

Secondary Component Associations:

Inclusions:

Elevation:
5,021.8 to 5,254 ft.
(1,530.6 to 1,601.5 m.)

Summary: Semi-desert grassland dominated by sideoats grama with green sotol as a conspicuous shrub element, but shrubs are not dominant (usually less than 10% cover). Other shrub species include Texas sacahuista and Torrey's yucca. Stands are found on upper slopes in the extension area to the west.

Distribution

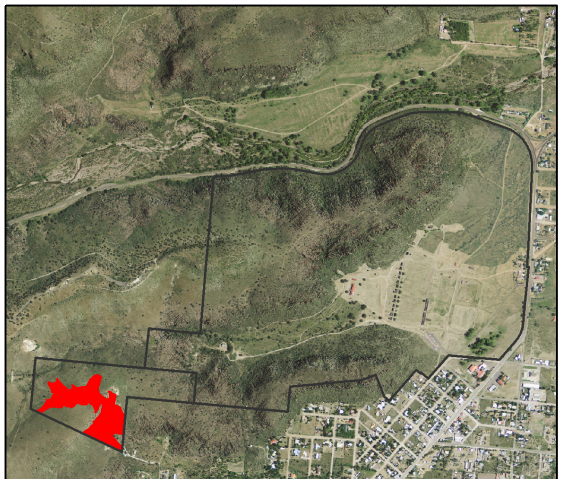
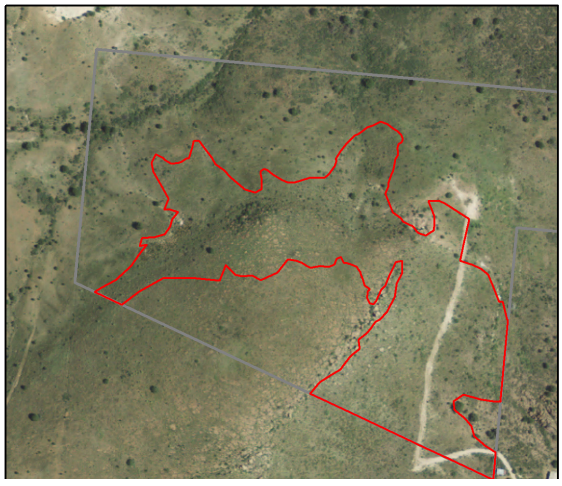


Photo Map Detail



Ha: 6.3 **Acres: 15.7** **Polygons: 1**

5 Apacherian-Chihuahuan Semi-Desert Grassland and Shrub-steppe Group [G490]

F Blue Grama/Sideoast Grama Texas Sacahuista Semi-desert Grassland

Primary Component Associations:

Nolina texana / Bouteloua curtipendula Semi-desert Grassland [NHNM000036]

Secondary Component Associations:

Bouteloua gracilis - Bouteloua curtipendula - Mixed Shrub Semi-desert Grassland [NHNM000853]

Inclusions:

Elevation:
5,087.7 to 5,256.5 ft.
(1,550.7 to 1,602.2 m.)

Summary: Semi-desert grassland dominated by blue grama along with sideoats grama. Shrubs are a conspicuous component, but not dominant (usually less than 10% cover). Typical species include Texas sacahuista, green sotol, and Torrey's yucca. Stands are found on lower slopes in the extension area to the west.

Distribution

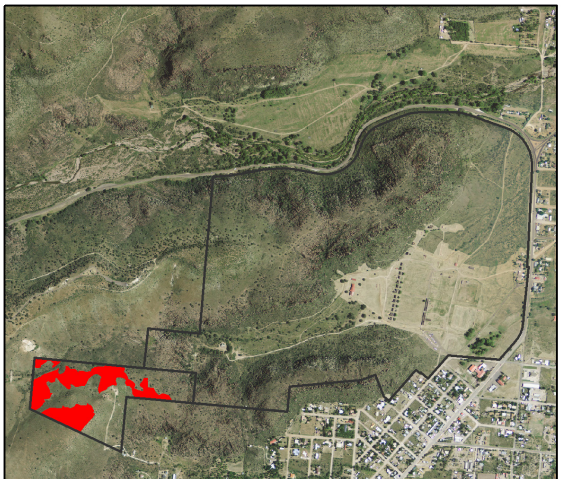
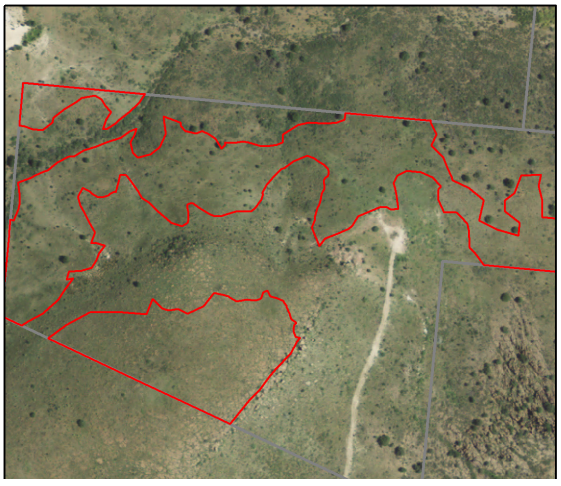


Photo Map Detail



Ha: 7.5 **Acres: 18.4** **Polygons: 3**

6 Sparsely Vegetated

A Rockland/Scarp/Cliff

Primary Component Associations:

Sparse Vegetation / Boulder Rockland [NPS_NM013]

Secondary Component Associations:

Inclusions:

Bouteloua curtipendula / Rockland Herbaceous Vegetation [NHNM000039]

Elevation:
4,959.8 to 5,235.4 ft.
(1,511.8 to 1,595.7 m.)

Summary: Sparsely vegetated rockland and steep boulder-strewn slopes. Grasses such as sideoats grama can be conspicuous amongst the rocks and crevices.

Distribution

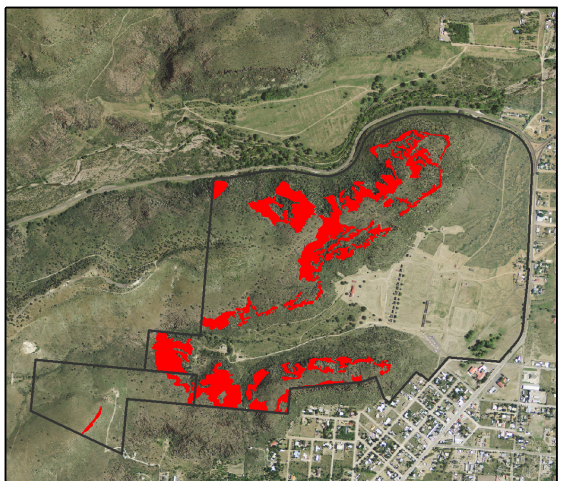


Photo Map Detail

Ha: 25.4 **Acres: 62.9** **Polygons: 31**

6 Sparsely Vegetated

B Upland Barren Soil/Disturbed Ground

Primary Component Associations:

Disturbed / Non-vegetated [NPS_NM047]

Secondary Component Associations:

Inclusions:

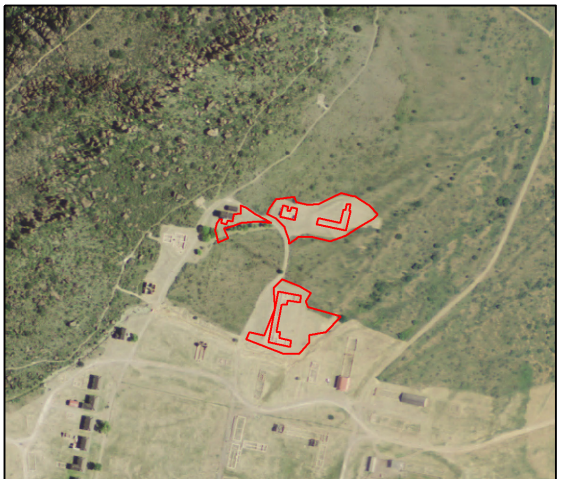
Elevation: 4,880.3 to 5,210.1 ft. (1,487.5 to 1,588 m.)

Summary: Sparsely vegetated disturbed ground that may support occasional blooms of ruderal annual and perennial forbs. Sites are usually associated with human disturbance such as buildings, roads, and quarries but may occur under relatively natural conditions following fire or animal disturbance.

[No photo available.]

Distribution

Photo Map Detail



Ha: 1.8 **Acres: 4.5** **Polygons: 10**

7 Managed Landscapes

A Cottonwood/Ruderal Herbaceous Vegetation Woodland

Primary Component Associations:

Populus deltoides (ssp. wislizeni, ssp. monilifera) / Ruderal Disturbance Woodland [NHNM000852]

Secondary Component Associations:

Inclusions:

Elevation:
4,872.4 to 4,878.8 ft.
(1,485.1 to 1,487 m.)

Summary: Remnant cottonwood grove once used as a picnic ground.

Distribution

Photo Map Detail

Ha: 1.5 **Acres: 3.7** **Polygons: 2**

7 Managed Landscapes

B Johnsongrass/Ruderal Herbaceous Vegetation

Primary Component Associations:

Sorghum halepense / Monotypic Herbaceous Vegetation [NHNM000252]

Secondary Component Associations:

Inclusions:

Elevation:
4,871.3 to 5,051 ft.
(1,484.8 to 1,539.6 m.)

Summary: Exotic wetland grassland dominated by Johnsongrass associated with reservoir fill and drainages.

Distribution

Photo Map Detail

Ha: 0.4 **Acres: 1.0** **Polygons: 3**

7 Managed Landscapes

C Urban/Built-up Vegetation

Primary Component Associations:

Urban / Built-up Vegetation [Not Assigned]

Secondary Component Associations:

Disturbed / Non-vegetated [NPS_NM047]

Inclusions:

Ruderal Disturbance Vegetation [NPS_NM027]

Bouteloua gracilis / Ruderal Herbaceous Vegetation [NPS_NM043]

Elevation:
4,862.8 to 4,950.2 ft.
(1,482.2 to 1,508.8 m.)

Summary: Cultural and weedy disturbance vegetation associated with core site ROA.

Distribution

Photo Map Detail

Ha: 23.7 **Acres: 58.6** **Polygons: 43**

7 Managed Landscapes

D Residential Vegetation

Primary Component Associations:

Secondary Component Associations:

Inclusions:

Elevation: 4,858.6 to 4,865.3 ft. (1,480.9 to 1,482.97 m.)

Summary: Cultural and weedy disturbance vegetation associated with residential areas.

[No photo available.]

Distribution

Photo Map Detail

Ha: 0.8 **Acres: 1.9** **Polygons: 2**

8 Managed Landscapes

A Building/Other Development

Primary Component Associations:

Secondary Component Associations:

Inclusions:

Elevation: 4,860.1 to 4,960.4 ft. (1,481.4 to 1,511.9 m.)

Summary: Public facilities and archeological sites that may be associated with cultural or weedy vegetation.

[No photo available.]

Distribution

Photo Map Detail

Ha: 0.3 **Acres: 0.7** **Polygons: 13**

8 Managed Landscapes

B Ruin-Restored

Primary Component Associations:

Secondary Component Associations:

Inclusions:

Elevation: 4,875.8 to 4,924.4 ft. (1,486 to 1,500.9 m.)

Summary: Public facilities and archeological sites that may be associated with cultural or weedy vegetation.

[No photo available.]

Distribution

Photo Map Detail

Ha: 0.9 **Acres: 2.3** **Polygons: 40**

8 Managed Landscapes

C Ruin-Unrestored

Primary Component Associations:

Secondary Component Associations:

Inclusions:

Elevation: 4,872.8 to 4,939.7 ft. (1,485.25 to 1,505.6 m.)

Summary: Public facilities and archeological sites that may be associated with cultural or weedy vegetation.

[No photo available.]

Distribution

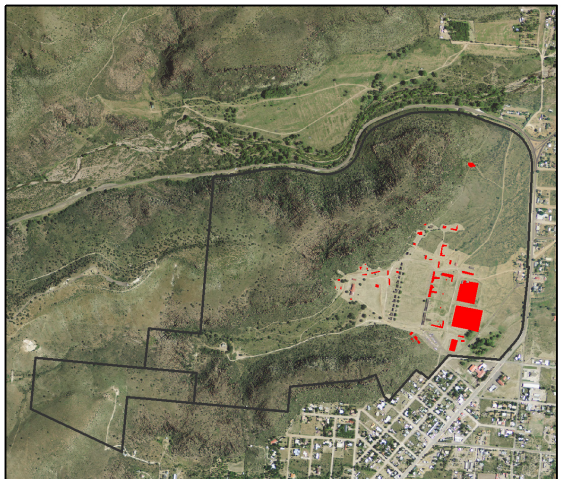


Photo Map Detail

Ha: 3.6 **Acres: 8.8** **Polygons: 43**

8 Managed Landscapes

D Trail

Primary Component Associations:

Secondary Component Associations:

Inclusions:

Elevation: 4,881.3 to 4,950.3 ft. (1,487.8 to 1,508.9 m.)

Summary: Maintained main trails and roads.

[No photo available.]

Distribution

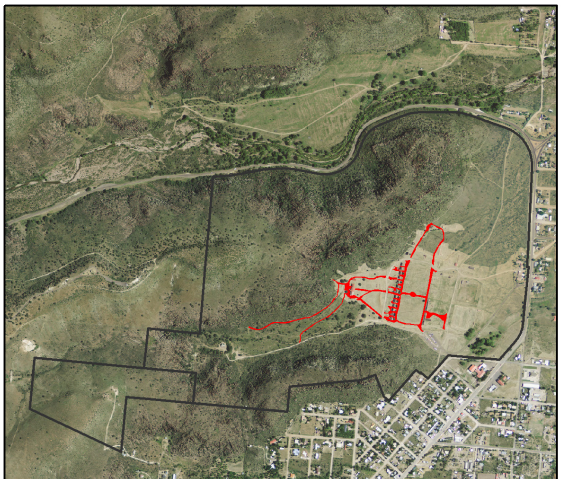


Photo Map Detail

Ha: 3.0 **Acres: 7.5** **Polygons: 7**

8 Managed Landscapes

E Road

Primary Component Associations:

Secondary Component Associations:

Inclusions:

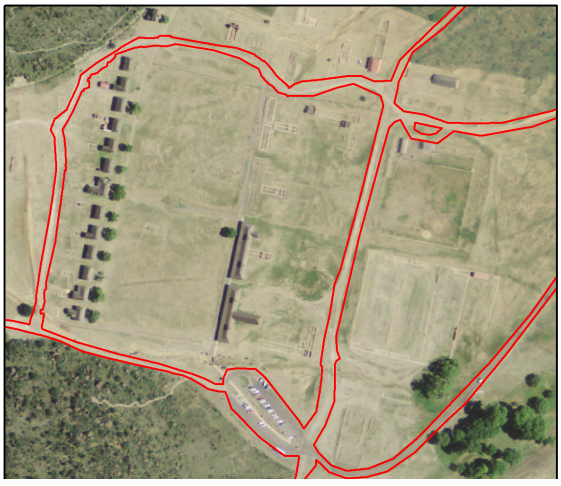
Elevation: 4,840.9 to 4,966.2 ft. (1,475.5 to 1,513.7 m.)

Summary: Maintained main trails and roads.

[No photo available.]

Distribution

Photo Map Detail



Ha: 4.0 **Acres: 10.0** **Polygons: 2**

Appendix F Fort Davis National Historic Site Plant Accuracy Assessment Review Supporting Materials

Table F1. Fort Davis NHS accuracy assessment (AA) plot review summary. "AA ID" refers the original Von Loh and Cogan (in-press) plot number from their accuracy assessment, and "AA Final Call" refers to their map unit assignment using the keys in Appendix C. "FODA Map Unit" is the map unit the AA plot fell within in the draft final FODA vegetation map per Table 5 of the main report. "NHNM Call" is the final map unit call based on the Natural Heritage New Mexico (NHNM) field AA review in 2011. "NHNM Revision" are the NHNM recommendations for revisions in the accuracy assessment where "Accept" means that a AA Final Calls is correct, and "Discount" means that the AA Final Call is incorrect per the comments and should be removed from the accuracy final determination (see Chapter 4 of the main report).

AA ID	AA Final Call	FODA Map Unit	NHNM Call	Comments	NHNM Revision
14	2B	3D	2B	Sampling same stand as AA ID 16 and is 6 m from that ploygon (2A) and 25 m from AA ID 16; clearly a small fragment inclusion in target polygon.	Discount
15	3B	2A	3B	AA call correct	Accept
16	2B	2A	2B	AA sample is 5m from NHNM sample that calls this 2A; AA call a fragment or inclusion too small accept	Discount
31	3E	3C	3C	ALOWRI not present in AA call; Clearly 3C	Discount
34	5D	3C	5D	AA is correct	Accept
35	5D	3C	5D	Accept AA 5D; borderline some Mimosa and Aloysia wrightii; lump with adjacent polygon	Accept
38	3B	3D	3B	Is Acacia	Accept
40	3E	3D	3E	OK	Accept
46	3D	3E	3D	OK	Accept
49	3C	3E	3C	OK	Accept
51	3D	3A	3A	on boundary between 3A and 3D	Accept
53	3B	3A	3A	Aacia was not in the vicity of the AA point (AA sample was estimated downslope from actual GPS location)	Discount
54	3B	3A	3B	Is Acacia	Accept
60	5B	5A	5A	Small patch of Aacia (<25 square meters); AA pointt should have been moved laterally to main grassaland stand in 5A	Discount
61	1A	5A	1A	OK	Accept
62	3C	5A	3C	OK	Accept
66	2A	2B	2A	OK	Accept
68	2A	2B	2B	Lacks Celtis in immediate vacinity in this small polygon but is in nearby	Discount
77	3C	7A	3C	AA plot right on polygon boundary; either 2B or 3C are correct; but cottonwood occurs just outside the park boundary in the same stands which is why it was mapped as 7A; this has been corrected; but is still a marginal error	Accept

Table F2. Potential additional plant associations identified in during the Fort Davis NHS accuracy assessment by Von Loh and Cogan (in-press). NHNM has provided some recommendation on how to address their status pending full review of the classification.

AA Additional Field Associations	NHNM Recommendations
1. *Bouteloua curtipendula - Bouteloua eriopoda* Herbaceous Vegetation	Pending more data, part of NHNM000853 *Bouteloua gracilis - Bouteloua curtipendula* - Mixed Shrub Herbaceous Vegetation
2. *Bouteloua eriopoda - Bouteloua curtipendula - Bouteloua gracilis* Herbaceous Vegetation	Pending more data, part of NHNM000853 *Bouteloua gracilis - Bouteloua curtipendula* - Mixed Shrub Herbaceous Vegetation
3. *Celtis laevigata* var. *reticulata* / *Bouteloua curtipendula* Woodland	Pending more data, part of NHNM000370 *Celtis laevigata* var. *reticulata* / *Brickellia californica* Woodland
4. *Celtis laevigata* var. *reticulata* / *Bouteloua gracilis* Woodland	Pending more data, part of NHNM000370 *Celtis laevigata* var. *reticulata* / *Brickellia californica* Woodland
5. *Heteropogan contortus* Herbaceous Vegetation	Covered by keep in BOUCR HETCON
6. *Mimosa aculeaticarpa* var. *biuncifera* / *Heteropogon contortus* Shrubland	Consider as a phase of NHNM000507 *Mimosa aculeaticarpa* var. *biuncifera* / *Bouteloua curtipendula* Shrubland
7. *Mimosa aculeaticarpa* var. *biuncifera* / *Muhlenbergia emersleyi* Shrubland	Consider as a phase of NHNM000507 *Mimosa aculeaticarpa* var. *biuncifera* / *Bouteloua curtipendula* Shrubland
8. *Quercus grisea* / *Bouteloua gracilis* / Ruderal Herbaceous Woodland	Pending more data, part of NHNM000719 *Quercus grisea - Quercus emoryi* Woodland
9. *Quercus grisea - Juniperus pinchotii* Woodland	Pending more data, part of NHNM000719 *Quercus grisea - Quercus emoryi* Woodland
10. *Quercus grisea* / *Bouteloua gracilis* / Ruderal Herbaceous Wooded Herbaceous Vegetation	Same as #8 above
11. *Setaria* sp. - *Bouteloua eriopoda* - *Bouteloua gracilis* Herbaceous Vegetation	Pending more data, part of NHNM000853 *Bouteloua gracilis - Bouteloua curtipendula* - Mixed Shrub Herbaceous Vegetation

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NPS 418/117473, November 2012

National Park Service
U.S. Department of the Interior

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