A Vegetation Survey and Map

of

Fort Union National Monument, New Mexico

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A Vegetation Survey and Map of Fort Union National Monument Park, New Mexico [1]

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INTRODUCTION

To aid in the management of the natural and cultural resources of Fort Union National Monument, Natural Heritage New Mexico (NHNM)[3] has conducted a vegetation survey and produced a detailed vegetation map for the site. The survey included the development of a comprehensive plant species list along with a classification of vegetation communities of the park based on the National Vegetation Classification System (Grossman et al. 1998). The legend for the map is based on a vegetation classification with modifications for special features of the monument. The map was developed using available digital ortho-photography and ground checking, and is designed for use at the 1:6,000 scale, with a minimum mapping unit of size 0.10 ha. The species list and map form the foundation of a baseline inventory of plant resources of the monument, and were developed in concert with the guidelines of the National Park Service's Inventory and Monitoring Program to aid in network-wide park natural resource management.

STUDY AREA

Fort Union Nation Monument is located in northeast New Mexico, approximately 10 miles northwest of Watrous and Valmora in Mora County (Figure 1). The monument comprises 721 acres (292 ha), and was established in 1956 to preserve the remains of Fort Union, a complex of three historical forts established beginning in 1851 along the Mountain route of the Santa Fe Trail. The fort was abandoned in 1891, but the previous 40 years brought extensive changes to landscape as the fort became a focal point for not only military activities but also trade and agriculture in the Mora Valley and the region (Harrison and Ivey 1993; Schackel 1983). Following abandonment, the land reverted to general rangeland use up until the site was donated by the Fort Union Ranch to a local preservation society and then to the National Park Service. Since that time, the park has been exclosed from livestock to protect the cultural resources as well as improve range conditions.

The climate of Fort Union National Monument is semi-arid, with an average rainfall of 16.70 in (424 mm) and a mean annual temperature of 49.3°F (9.61°C). The majority of the precipitation (70%) falls during the summer "monsoon" rainy season (May through September), primarily derived from frontal storms off the Gulf of Mexico and to a limited degree the Gulf of California (Table 1; Figure 2). The remainder of precipitation comes in the form of rain and snow from storms out of the west. Seasonal temperature ranges can be extreme (Table 2), with

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[3] formerly known as the New Mexico Natural Heritage Program (NMNHP).

daily fluxes of 30°F (16.8°C) or more. This, in combination with low rainfall, generates a semi-arid, continental climate for the monument. With the exception of June 2000, summer monsoon rainfall during the period of sampling between 2000 and 2002 was significantly below normal, which was in keeping with regional drought conditions (Table 3).

The monument is located in a wide valley of the lower Wolf Creek watershed, a tributary of the Mora River. Elevations range from approximately 6,700 to 6,840 ft (2,040 to 2,085 m). There are two units to the monument. The largest comprises 637 acres and lies to the east of the creek and upslope along a broad alluvial fan piedmont that extends to the base of the Turkey Mountains. This unit houses the park headquarters and the ruins of the "Star Fort" and "Third Fort," and was the focus of the heaviest usage during the active days of the fort. This gentle terrain is primarily broken by old trails and arroyos that are artifacts of the old Santa Fe Trail system that converged at the forts. While the creek proper lies outside the boundaries of the units and within the Fort Union Ranch, there are small spring and seepage areas associated with the relatively steep slope that leads down to the creek bottom.

The smaller unit of 83.6 acres lies to the west of the creek up against a bluff that is an extension of Black Mesa. This unit sits on a short piedmont slope that leads down to the creek to the east, but it also contains a small amount of granitic rock outcrop along its western edge against the base of the mesa. This is the site of the "First Fort" established in 1851, which later became an arsenal site after the building of the Third Fort on the opposite slope. Hence, this smaller site also carries the legacy of heavy historical use that is reflected in the vegetation patterns we see today.

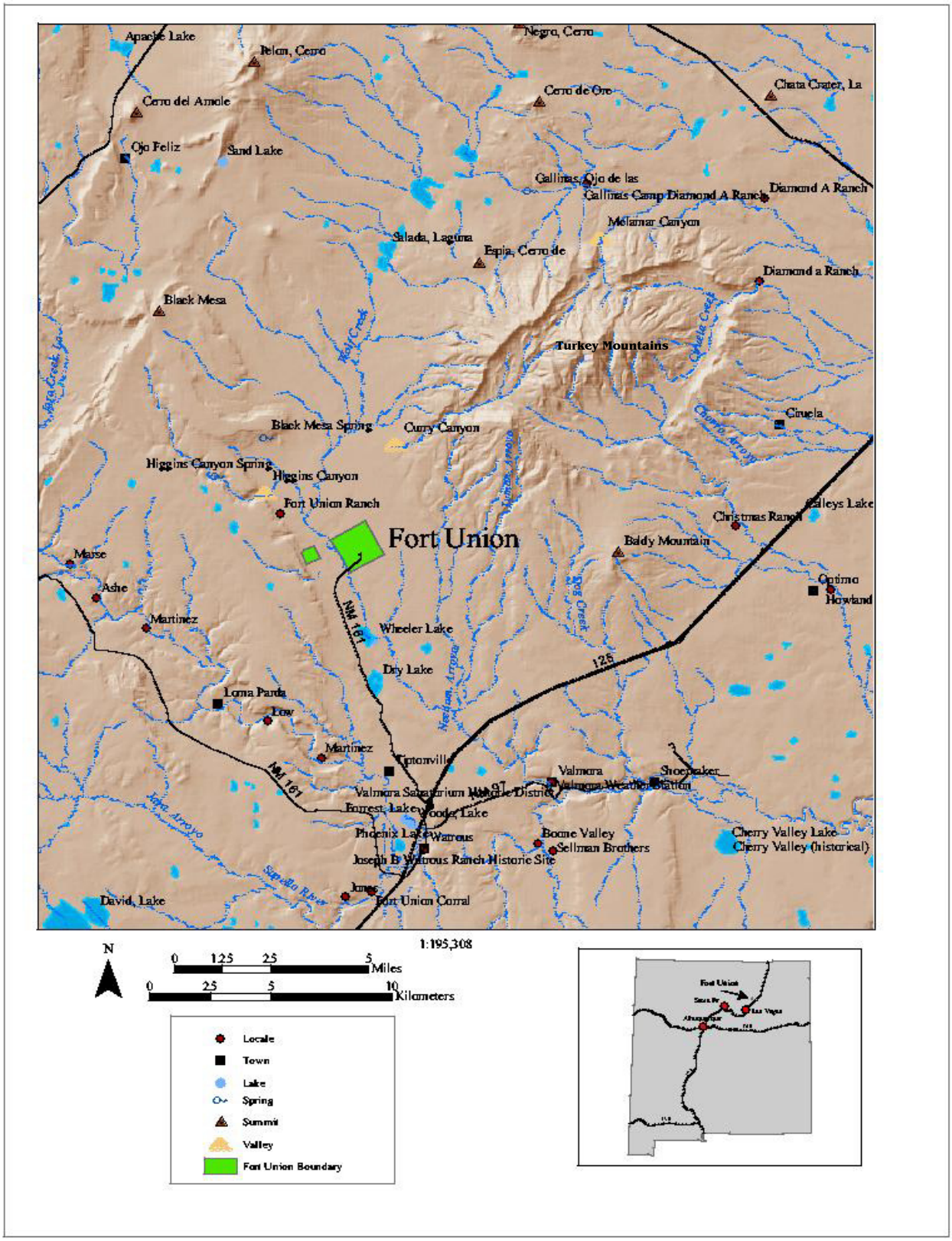

Figure 1. Location of Fort Union National Monument northeast of Las Vegas, NM, near Watrous and Valmora.

Table 1. Seasonal temperature summary for Valmora, NM, approximately 10 miles east of Fort Union National Monument. Period of record is from 1917 through 2003 at 6,310 ft (source: Western Regional Climate Center web page http://www.wrcc.dri.edu/).

	Monthly Ave			Daily Extremes				Monthly Extremes				Max Temp		Min Temp	
	Max.	Min.	Mean	High	Date	Low	Date	Highest Mean	Year	Lowest Mean	Year	>= 90 F	<= 32 F	<= 32 F	<= 0 F
	F	F	F	F	yyyy/mm/dd	F	yyyy/mm/dd	F	-	F	-	# Days	# Days	# Days	# Days
Annual	66.3	32.4	49.3	101	1963/07/24	-35	1963/01/13	52.1	34	47.4	61	14.2	8.7	183.6	6.1
Winter	50.0	15.7	32.8	82	1964/12/24	-35	1963/01/13	38.8	20	27.6	44	0.0	6.6	87.6	5.4
Spring	64.0	30.6	47.3	92	1996/05/17	-19	1948/03/05	52.4	89	42.8	98	0.2	1.1	51.1	0.3
Summer	83.0	50.6	66.8	101	1963/07/24	30	1919/06/01	70.5	22	62.8	40	13.3	0.0	0.1	0.0
Fall	67.9	32.8	50.4	94	1922/10/03	-13	1952/11/26	54.2	21	46.1	96	0.7	1.0	44.8	0.3

Table 2. Seasonal precipitation summary for Valmora, NM, approximately 10 miles east of Fort Union National Monument. Period of record is from 1917 through 2003 at 6,310 ft (source: Western Regional Climate Center web page http://www.wrcc.dri.edu/).

	Precipitation											Total Snowfall		
	Mean	High	Year	Low	Year	1 Day Max.	Date	>= 0.01 in.	>= 0.10 in.	>= 0.50 in.	>= 1.00 in.	Mean	High	Year
	in.	in.	-	in.	-	in.	yyyy/mm/dd	# Days	# Days	# Days	# Days	in.	in.	--
Annual	16.70	27.22	19	6.56	56	4.73	1965/06/15	58	38	10	3	22.9	75.8	87
Winter	1.30	4.06	87	0.09	37	1.02	1944/12/26	7	4	1	0	12.9	49.7	87
Spring	3.54	11.00	19	0.00	102	3.20	1955/05/19	12	8	2	1	6.9	49.0	58
Summer	8.15	14.80	91	3.50	102	4.73	1965/06/15	26	18	5	2	0.0	0.0	48
Fall	3.70	10.71	42	0.00	92	4.46	1942/09/01	12	8	2	1	3.0	33.0	84

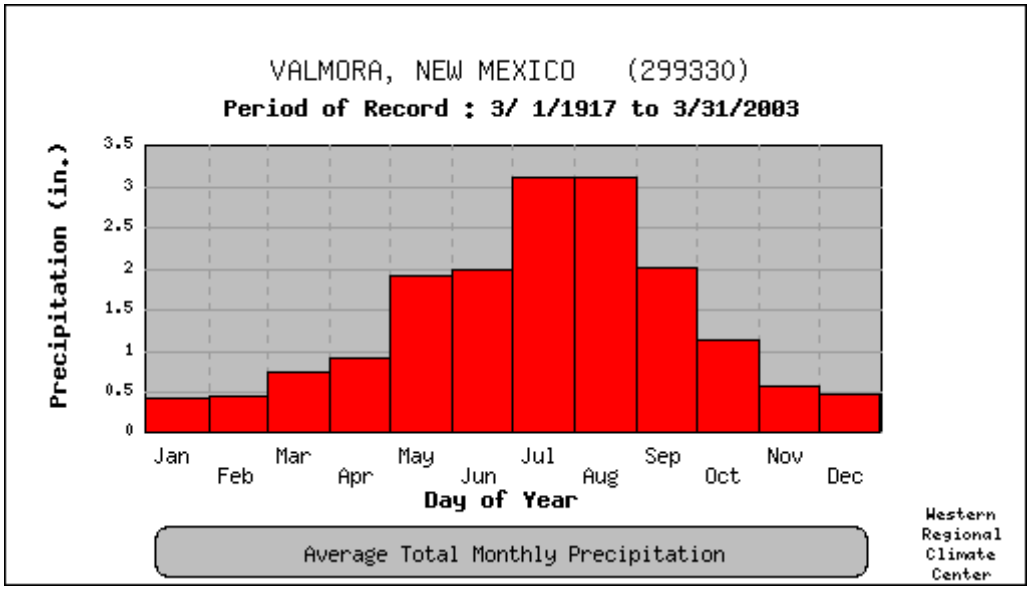

Figure 2. Monthly average precipitation at Valmora, NM, approximately 10 miles east of Fort Union National Monument. Period of record is from 1917 through 2003 (station 299330). Source: Western Regional Climate Center at http://www.wrcc.dri.edu/.

Table 3. Monthly precipitation (inches) for Valmora, 10 miles east of Fort Union National Monument, during the vegetation sampling period of 2000-2002, and the long term mean over the period of record from 1917 through 2003 (source: Western Regional Climate Center web page http://www.wrcc.dri.edu/).

Year	Jan	Feb	Mar	April	May	June	July	Aug	Sep	Oct	Nov	Dec	Total
2000	0.5	0	1.51	0	0	3.09	0.32	2.05	0.15	4.49	0.57	0.6	10.19
2001	1.75	0.3	2.47	0.08	1.36	1.55	0.88	1.26	0.23	0.3	0.1	0.1	9.02
2002	0.53	0.05	0	0	0	1.6	1.44	0.46	3.44	1.6	0.13	0.5	9.75
MEAN	0.42	0.43	0.75	0.91	1.88	1.94	3.11	3.1	2.01	1.13	0.57	0.46	16.73
YRS	79	82	82	82	82	81	83	81	81	81	80	83	64

Flora and Vegetation

Previous information on the flora and botany of Fort Union is limited. Schackel (1983) presented a review of the historical vegetation of the park as documented in the written and photographic record. She also provided an initial description of the modern dominant vegetation communities in the context of two Soil Conservation Service-defined range sites. The predominant range site was "loamy upland" dominated by blue grama grass (*Bouteloua gracilis*) with varying degrees of codominance with squirreltail (*Elymus elymoides*) and scattered western wheatgrass (*Pascopyrum smithii*), sideoats grama (*Bouteloua curtipendula*), and galleta (*Pleuraphis jamesii*). She also identified a "shallow upland" range site dominated by sideoats grama, blue grama, and little bluestem (*Schizachyrium scoparium*). She concluded that, while past landuses had had a significant impact on vegetation composition, with park protection the vegetation had recovered much of its original composition and abundance.

In addition to the work of Schackel (1983), an informal checklist of the flora of the park was compiled by Mary Whitmore (New Mexico Native Plant Society). She listed 103 vascular plant species, but whether these were vouchered is not known. Additional information on the natural resources is provided by Zhu (1992).

MATERIALS AND METHODS

Sampling

Over the course of three summer seasons, from 2000 through 2002, a flora survey of the monument was conducted. The floral survey consisted of comprehensive on-foot searches of all habitats found in both park units. Voucher collections of species were taken and identifications later confirmed using the materials at the herbarium of the Museum of Southwestern Biology at the University of New Mexico.

In addition to the floral survey, a series of quantitative plots and mapping points were established in homogeneous stands of vegetation and were used to classify the various plant associations found in the park. Plots were standard NHNM plots that were usually 400 m^2 and square, with other sizes occasionally used to fit the structure of a community, especially along drainages where vegetation stands conform to the channel shape. A list of all vascular plant species, stratified by lifeform (tree, shrub, subshrub, grass and forb layers) was compiled for each plot and aerial cover determined for each species using a modified Domin-Krajina Scale (Table 3). In addition, several site attributes were recorded including slope percent, aspect, slope shape, surface rock type, and ground cover (percent rock, gravel, bare soil and litter), along with narratives on species composition and site conditions. Besides the eight vegetation plots, 19 abbreviated mapping points were collected where only the dominants and their abundance were recorded. All plot locations were established with handheld Garmin GPS units and determined from a raw running average of one minute or more. Accuracy is estimated to be +/- 10 m or less (see Data Addendum for examples of sampling forms and detailed survey methods). All vegetation and site data were entered into a Microsoft Access 2000 database and quality controlled through error checking computer routines and manual read-backs. The computerized ASCII dataset and database are provided on a separate data CD.

Table 3. Modified Domin-Krajina Vegetation Cover Scale from Mueller-Dombois and Ellenberg (1974). Cover Class is the scalar value assigned in the field; Percent Canopy Cover is the range of cover the class represents; m2/ 400 m^2 is the actual area represented by the cover class within the 400 m^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]
+	< .05	<0.04 m	0.01
1	< 0.1	≥ 0.04 & < 0.5	0.05
2	< 1	≥ 0.5 & < 4	0.5
3	1 – 4	≥ 5 & < 20	2.5
4	5 – 10	≥ 20 & < 40	7.5
5	10 - 25	≥ 40 & <100	17.5
6	25 - 33	≥ 100 & <132	29.0
7	33 - 50	≥ 132 & <200	41.5
8	50 - 75	≥ 200 & <300	62.5
9	> 75	≥ 300 m	87.5

Vegetation Analysis

The vegetation plots were classified into plant associations according to the National Vegetation Classification (Grossman et al. 1998) as modified for use in New Mexico (Table 4). In general, each plot was classified into an Alliance based on dominant or indicator species, and then to a particular Plant Association (PA) based on codominance and/or other groups of differential species. Phases of associations were assigned as necessary to further define the character of the plant community. Since the National Vegetation Classification (NVC) is intended to be part of a universal international system, it, by design, lacks regional categories such as "Great Plains Grassland" or "Rocky Mountain Pinyon-Juniper Woodland," which are part of regional and state classifications such as Brown et al. (1998), Dick-Peddie et al. (1993) or the U.S. Fish and Wildlife Gap Analysis Project classification for New Mexico (Thompson et al. 1996). These regional "biomes" or "zones" are essentially floristically based and can be very useful for general analysis and planning. They conceptually reflect regional knowledge of broad vegetation types and serve as effective categories for communication among scientists, managers and the public in the Southwest. Recently, a new national classification of “ecological systems” has been developed by NatureServe to help addresses these regional entities (NatureServe 2003). Accordingly, NHNM has also attempted to incorporate the regional concepts of vegetation in the development of a comprehensive state classification. The state system keeps the alliance and association levels of the national classification but attempts to integrate regional formation and biome concepts from the above authors plus the NHNM wetland classification of Muldavin et al. (2000).

The plant associations are the fundamental unit of the classification. Ecologists use the concept of plant association to help describe and recognize patterns in the way vegetation occurs in the landscape. By grouping land areas based on the ability to support similar associations, general management observations and recommendations can be made for each grouping. In the past 30 years, 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. In addition, plant associations are used to define map unit components in the mapping process, providing the information linkage between vegetation spatial distribution and its ecology.

Table 4. NHNM state vegetation classification hierarchy.

Level	Definition	Example
I	Formation type: growth form and structure of vegetation	Grassland
II	Primarily climate zones within formations	Mesophytic Grassland
III	Biomes or Ecological Systems	Plains-Mesa-Foothill Grassland
IV	Regional floristically and environmentally related Alliance Groups	Short Grass Steppe
V	Alliance. A group of plant associations characterized by a common dominant(s) and/or diagnostic species	*Bouteloua gracilis* Grassland Alliance (Blue Grama)
IV.	Plant Association: fundamental unit of vegetation characterized by a set of dominant and/or diagnostic species from any stratum.	*Bouteloua gracilis-Artemisia frigida* Grassland (Blue Grama-Fringed Sage)

Map Development

The vegetation map was developed through aerial photo interpretation of available black and white digital ortho-photographs from 1984 and 1999. The photos were compiled into a GIS with a standard set of ancillary layers provided by the park service (boundaries, roads, facilities, etc.). Using the vegetation classification as the foundation for the map legend, map units were defined with respect to interpretable patterns in the photography, and with an eye to those patterns that would be most important in natural and cultural resources management within the park.

The map was produced through direct screen digitizing using ArcGIS software. Most interpretation was done at 1:3,000 scale with the intent of operational use at 1:6,000 scale. As a general guideline, the minimum map unit delineation size was 0.25 ha, but some polygons approached 0.1 ha. Given the small size of the monument, an independent, randomized validation would have been impossible. The map was simply error checked on foot in 2003 and 2004, and revised accordingly.

RESULTS

Floral Survey

A total of 142 taxa were identified over the three year period of sampling (Appendix A). For 123 of the taxa, 184 plant voucher specimens were collected to confirm field identifications. The voucher collection was then deposited and databased under the Fort Union National Monument designation at the University of New Mexico Herbarium. Specimens were identified to the lowest level possible given the material at hand (120 to species or lower) and with nomenclature following the PLANTS database (USDA-NRCS 2002). An additional 18 common species were not vouchered, but were observed as part of the vegetation plot record. Those species that were both vouchered and that occurred on the Native Plant Society list of Mary Whitman are indicated. In addition, there are 50 species on her list that that have not been confirmed (Appendix Table A3).

Figure 3. Wholeleaf Indian paintbrush (*Castilleja integra*) is typical of the wide variety of grassland, woodland and riparian/wetland associates found at Fort Union National Monument. (Photo: Geoff Carpenter)

Vegetation Classification

Sixteen plant associations (PA) among 11 alliances were identified for Fort Union National Monument (Table 5). Of these, eight were grassland associations belonging to the Western Great Plains Shortgrass Prairie Alliance Group (Figure 5). The most abundant grass was blue grama (*Bouteloua gracilis*), the characteristic species of the short grass prairie from Canada to Mexico. The most common associations on the monument were the Blue Grama/Fringed Sage Grassland (*Bouteloua gracilis/Artemisia frigida*) and the Blue Grama-Purple Threeawn (*Bouteloua gracilis-Aristida purpurea*). The former was previously reported for New Mexico by Dick-Peddie et al. (1993), and provisionally in Colorado (NatureServe 2002), but the record from Fort Union represents the first one in the NHNM database (how common the association is in New Mexico needs further study). With its preponderance of purple threeawn, the Blue Grama-Purple Threeawn PA is indicative of the long disturbance history of the monument. The Blue Grama-Soapweed

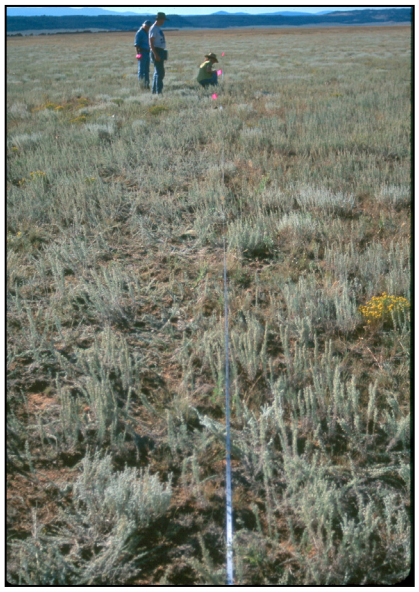

Figure 4. Blue Grama/Fringed Sage (*Bouteloua gracilis/Artemisia frigida*) Grassland dominates much of the Fort Union landscape. (Photo: E. Muldavin)

Yucca Grassland (*Bouteloua gracilis-Yucca glauca* PA), a common association elsewhere on the prairie in New Mexico, was found only in scattered patches (it too is sometimes indicative of past disturbance, particularly when soapweed yucca abundance is exceptionally high).

The disturbance history of the fort is also reflected in the lasting imprint of the numerous main and side trails associated with the Santa Fe Trail. The trails have a distinctive set of associations from those of the surrounding grasslands. These include the Blue Grama-Western Wheatgrass (*Bouteloua gracilis-Pascopyrum smithii*), Hairy Grama/Fringed Sage Grassland (*Bouteloua hirsuta/Artemisia frigida*), and Sleepygrass Grassland/Fringed Sage (*Stipa Robusta/Artemisia frigida*) PA's. Hairy grama is often associated with more compacted soils, while western wheatgrass and sleepygrass are associated with more mesic conditions reflecting a concentration of water in the trails during rainfall events. This has in turn led to some trails degrading through water erosion into arroyos that are dominated by combinations of western wheatgrass grasslands and ruderal (disturbed or weedy) herbaceous vegetation dominated by the Weakleaf Bur Ragweed-Lacy Tansyaster (*Ambrosia confertiflora-Machaeranthera pinnatifida*) PA along with areas of bare ground. The Weakleaf Bur Ragweed-Lacy Tansyaster PA is also commonly intermixed in the grasslands, particularly in areas recently dug up by Botta's pocket gophers (*Thomomys bottae*), or in sites heavily disturbed by past uses such as buildings, corrals, and adobe-making ditches.

There is a small occurrence of Little Bluestem-Sideoats Grama (*Schizachyrium scoparium-Bouteloua curtipendula*) grassland in the disjunct Old Fort unit to the west. This common prairie element is restricted here to a lower toeslope of the Black Mesa escarpment that just enters the park on its western edge. It is intermixed with the only representatives of Rocky Mountain woodland and shrublands found on the monument, i.e., Pinyon Pine/Blue Grama (*Pinus edulis/Bouteloua gracilis*) PA, Oneseed Juniper/Blue Grama (*Juniperus monosperma/Bouteloua gracilis*) PA, and the Wavyleaf Oak/Mountain Mahogany Shrubland (*Quercus undulata-Cercocarpus montanus*) PA. The pinyon and juniper woodland associations are only fragments of types that are more common upslope and outside of the monument. The Wavyleaf Oak /Mountain Mahogany montane shrubland occupies a granitic outcrop that forms the backdrop for the Old Fort just inside the fence line. All three of these associations are common in northern New Mexico.

Riparian woodlands and shrublands, and herbaceous wetlands make up the remaining natural vegetation communities on the monument. Coyote Willow/Baltic Rush (*Salix exigua/ Juncus articus var. balticus*) shrubland has become established along with a small patch of Narrowleaf Cottonwood/Coyote Willow (*Populus angustifolia/Salix exigua*) woodland in arroyo bottoms along the western edge of the main park unit. These riparian communities possibly become established naturally following the building of erosion control structures (check dams) in the arroyos meant to slow degradation. There is also a small patch of broadleaf cattail (*Typha latifolia*) wetland in the main arroyo. All of these arroyos appear to be traces of historic trails associated with the Santa Fe Trail. Narrowleaf cottonwood stands have also become established relatively recently around the wastewater ponds and near the freshwater storage tank in the southwestern and northeastern corners of the park, respectively.

Outside of the arroyos are herbaceous wetlands associated with seeps and springs along the lower western slope of the monument. These are characterized by the Baltic Rush/Wood's Rose (*Juncus articus* var. *balticus/Rosa woodsii*) PA. Besides Baltic rush and wood's rose, these scattered wetland sites can have a wide variety of species (e.g., switchgrass (*Panicum virgatum*), Carruth's sagewort (*Artemisia carruthii*), whorled milkweed (*Asclepias subverticillata*), carelessweed (*Amaranthus palmeri*), manyflowered mentzelia (*Mentzelia multiflora*) among others) and are perhaps the most biologically diverse vegetation communities on the monument.

Figure 5. Western Great Plains Shortgrass Prairie grassland associations that are dominated by blue grama characterize the landscape of Fort Union National Monument. The grasslands extend westward from the Turkey Mountains (background) along a long piedmont slope leading to Wolf Creek (mid-ground), and eastward along a shorter slope (foreground) leading away from the Black Mesa to the west.

Table 5. Fort Union National Monument Hierarchical Vegetation Classification, 2004. Vegetation units follow the Natural Heritage New Mexico vegetation classification system for New Mexico (see Table 4).

I. Woodland
- II. Cold Temperate Woodland
  - III. Rocky Mountain Conifer Woodland
    - IV. Southern Rocky Mountain Pinyon-Juniper Woodland
      - Pinyon Pine (*Pinus edulis*) Woodland Alliance
        - Pinyon Pine/Blue Grama Woodland
        - (*Pinus edulis/Bouteloua gracilis* PA)
    - IV. Southern Rocky Mountain Juniper Woodland and Savanna
      - Oneseed Juniper (*Juniperus monosperma*) Woodland Alliance
        - Oneseed Juniper/Blue Grama Woodland Savanna
        - (*Juniperus monosperma/Bouteloua gracilis* PA)

I. Mesophytic Shrubland
- II. Cold Temperate Shrubland
  - III. Rocky Mountain Montane Scrub
    - IV. Broadleaved Deciduous Rocky Mountain Montane Scrub
      - Wavyleaf Oak Shrub Alliance
        - Wavyleaf Oak /Mountain Mahogany Shrubland
        - (*Quercus undulata-Cercocarpus montanus* PA)

I. Grassland
- II. Cold Temperate Grassland
  - III. Great Plains Plains-Mesa-Foothill Grassland
    - IV. Western Great Plains Shortgrass Prairie
      - Blue Grama (*Bouteloua gracilis*) Herbaceous Alliance
        - Blue Grama/Fringed Sage Grassland
        - (*Bouteloua gracilis/Artemisia frigida* PA)
          - Typic Phase
          - Spike Muhly (Muhlenbergia wrightii) Phase
        - Blue Grama-Purple Threeawn Grassland
        - (*Bouteloua gracilis-Aristida purpurea* PA)
        - Blue Grama/Soaptree Yucca Grassland
        - (*Bouteloua gracilis/Yucca glauca* PA)
        - Blue Grama-Western Wheatgrass Grassland
        - (*Bouteloua gracilis-Pascopyrum smithii* PA)
      - Hairy Grama (*Bouteloua hirsuta*) Herbaceous Alliance
        - Hairy Grama/Fringed Sage Grassland
        - (*Bouteloua hirsuta/Artemisia frigida* PA)
      - Little Bluestem (Schizachyrium scoparium) Herbaceous Alliance
        - Little Bluestem-Sideoats Grama Grassland
        - (*Schizachyrium scoparium-Bouteloua curtipendula* PA)
    - Sleepygrass (*Stipa Robusta*) Alliance
      - Sleepygrass/Fringed Sage Grassland
        - (*Stipa Robusta/Artemisia frigida* PA)

Table 5 (continued). Fort Union National Monument Hierarchical Vegetation Classification, 2004.

Riparian/Wetland Vegetation

I. Forested Riparian/Wetland
  II. Cold Temperate Riparian/Wetland Forests
    III. Western Great Plains Riparian Woodland and Shrubland
      IV. Western Great Plains Riparian Woodland
        Narrowleaf Cottonwood (*Populus* angustifolia) Woodland Alliance
          Narrowleaf Cottonwood/Coyote Willow Woodland
          (*Populus angustifolia/Salix exigua* PA)
      IV. Western Great Plains Riparian Shrubland
          (Salix exigua) Shrubland Alliance
            Coyote Willow/Baltic Rush Shrubland
            (*Salix exigua/Juncus articus var. balticus* PA)

  II. Cold Temperate Persistent-Emergent Riparian/Wetlands
    III. Great Plains Persistent-Emergent Riparian/Wetlands
      IV. Great Plains Semi-Saturated Persistent-Emergent Riparian/Wetlands
          Baltic Rush (Juncus articus var. balticus) Herbaceous Alliance
            Baltic Rush/Wood's Rose Shrub-Herbaceous Wetland
            (*Juncus articus var. balticus-Rosa woodsii* PA)

          Broadleaf Cattail (*Typha latifolia*) Herbaceous Alliance
            Broadleaf Cattail/Monotypic Stand Herbaceous Vegetation
            (*Typha latifolia*-Monotype PA)

I. Miscellaneous Vegetation
  II. Seminatural/Altered Vegetation
    III. Ruderal (Disturbed) Vegetation
      IV. Ruderal (Disturbed) Herbaceous Vegetation
          Weakleaf Bur Ragweed (*Ambrosia confertiflora*) Alliance

            Weakleaf Bur Ragweed-Lacy Tansyaster Ruderal Herbaceous Vegetation
            (*Ambrosia confertiflora-Machaeranthera pinnatifida* PA)

Vegetation Map

Using the vegetation classification as a foundation, we have developed a vegetation map containing 19 mapping units (Table 3). The map has been produced on a single sheet at the original target scale of 1:6,000. While the map can be projected at finer scales in a GIS, we would caution against application at finer scales because of the limits posed by spatial error (geometric correction error of the imagery). More importantly, even though the minimum map delineation is small at 0.1 ha, the focus should remain on the large patch pattern in any interpretation.

Table 6. Vegetation map units for the Fort Union National Monument Vegetation Map.

MU#	Map Unit	Acres	Ha
1	Blue Grama/Fringed Sage Grassland	127.7	51.7
2	Blue Grama-Mixed Grassland	105.0	42.5
3	Western Wheatgrass-Hairy Grama Old Trail Grassland	91.6	37.1
4	Blue Grama-Mixed Grassland/Ruderal Vegetation	157.8	63.8
5	Little Bluestem-Blue Grama Grassland	0.5	0.2
20	Sleepygrass/Blue Grama Grassland	4.2	1.7
7	Herbaceous Wetland	9.7	3.9
9	Willow Riparian Shrubland	1.7	0.7
13	Narrowleaf Cottonwood Riparian Woodland	0.7	0.3
8	Wavyleaf Oak Montane Scrub/Pinyon-Juniper Woodland	26.0	10.5
6	Arroyo Old Trail Grassland/Ruderal Vegetation	13.4	5.4
10	Disturbed Grassland/Ruderal Vegetation - Adobe Field	37.5	15.2
11	Disturbed Grassland/Ruderal Vegetation- Old Fort Undeveloped	57.3	23.2
12	Disturbed Grassland /Ruderal Vegetation - Old Fort Restored	38.3	15.5
15	Disturbed Grassland	26.0	10.5
21	Ruderal Vegetation/Bare Ground	18.9	7.6
19	Bare Ground	4.0	1.6
17	Modern Road, Facilities, and Planted Vegetation	24.0	9.7
18	Water	0.8	0.3
	Total	720.2	291.5

MAP UNIT DESCRIPTIONS

Map unit descriptions for each map unit listed in Table 6 follow. For each unit, the primary and secondary components are listed along with inclusions. Primary components are those plant associations listed in Table 5 that together comprise the majority of the unit. Secondary components are minor associations that can occupy at least 10% of the unit, but are not the dominants. Inclusions are associations that occupy less than 10% of the area. Plant associations are also ordered by their importance within component groups.

Blue Grama/Fringed Sage Grassland	**1**
Acres: 127.7	**Ha:** 51.7
Primary Components: Blue Grama/Fringed Sage PA, Typic Phase	
Secondary Components: Blue Grama/Fringed Sage PA, Spike Muhly Phase	
Inclusions: Weakleaf Bur Ragweed-Lacy Tansyaster PA	
Distribution: A major grassland unit within the monument, particularly in the southeastern corner. It is typically bisected by Western Wheatgrass-Hairy Grama Grassland of the old Santa Fe Trail system (3).	

Blue Grama - Mixed Grassland	**2**
Acres: 105.0	**Ha:** 42.5
Primary Components: Blue Grama/Fringed Sage PA, Spike Muhly Phase	
Secondary Components: Blue Grama/Fringed Sage PA, Typic Phase	
Inclusions: Blue Grama-Purple Threeawn PA Blue Grama/Soaptree Yucca Weakleaf Bur Ragweed-Lacy TansyasterPA	
Distribution: A major grassland unit within the monument that is often found in transitional areas between Blue Grama/Fringed Sage Grassland (1) and Blue Grama-Mixed Grassland/Ruderal Vegetation (4).	

Western Wheatgrass - Hairy Grama Old Trail Grassland	**3**
Acres: 91.6	**Ha:** 37.1
Primary Components: Blue Grama-Western Wheatgrass PA Hairy Grama/Fringed Sage PA	
Secondary Components: Blue Grama/Fringed Sage PA, Spike Muhly Phase	
Inclusions: Blue Grama-Purple Threeawn PA	
Distribution: A major grassland unit typically confined to old trails that are part of the Santa Fe Trail system.	

Blue Grama - Mixed Grassland/ Ruderal Vegetation	**4**
Acres: 157.8	**Ha:** 63.8
Primary Components: Blue Grama-Purple Threeawn PA Weakleaf Bur Ragweed-Lacy TansyasterPA Blue Grama/Fringed Sage PA, Typic Phase	
Secondary Components: Blue Grama/Fringed Sage PA, Spike Muhly Phase Blue Grama-Western Wheatgrass PA Bare Ground	
Inclusions: Blue Grama/Soaptree Yucca	
Distribution: A major grassland unit associated with both past disturbance from historical fort activities and current disturbance due to pocket gopher. It is found primarily adjacent to fort structures and where the trail system converged into general use areas.	

Little Bluestem - Blue Grama Grassland	**5**
Acres: 0.5	**Ha:** 0.2
Primary Components: Little Bluestem-Sideoats Grama PA	
Secondary Components:	
Inclusions: Blue Grama/Fringed Sage PA, Typic Phase	
Distribution: A minor unit known only from the western edge of the Old Fort unit along the footslope of Black Mesa.	

Sleepygrass Grassland	**20**
Acres: 4.2	**Ha:** 1.7
Primary Components: Sleepygrass/Fringed Sage	
Secondary Components: Blue Grama/Fringed Sage PA, Typic Phase	
Inclusions: Blue Grama/Fringed Sage PA, Spike Muhly Phase Blue Grama-Western Wheatgrass PA	
Distribution: A minor unit that occurs in a small swale-outwash area at the distal end of a trail arroyo that enters the monument near the northeast corner.	

Herbaceous Wetland	**7**
Acres: 9.7	**Ha:** 3.9
Primary Components: Baltic Rush/Wood's Rose PA Broadleaf Cattail/Monotypic PA	
Secondary Components: Weakleaf Bur Ragweed-Lacy TansyasterPA	
Inclusions: Blue Grama-Purple Threeawn PA Blue Grama-Western Wheatgrass PA Coyote Willow/Baltic Rush PA	
Distribution: A major unit along the western boundary of the main park unit. It is associated with freshwater seepage and spring areas along the lower end of the piedmont slope that overlooks Wolf Creek. It is often found in a complex mosaic with Ruderal Vegetation/Bare Ground (21) and Blue Grama-Mixed Grassland/Ruderal Vegetation (4).	

Willow Riparian Shrubland	**9**
Acres: 1.7	**Ha:** 0.7
Primary Components: Coyote Willow/Baltic Rush PA	
Secondary Components: Broadleaf Cattail/Monotypic Stand PA	
Inclusions:	
Distribution: A minor unit associated with incised arroyo channels along the western edge of the monument. Coyote willow likely became naturally established following erosion control work on the arroyos.	

Narrowleaf Cottonwood Riparian Woodland	**13**
Acres: 0.7	**Ha:** 0.3
Primary Components: Narrowleaf Cottonwood/Coyote Willow	
Secondary Components: Coyote Willow/Baltic Rush	
Inclusions: Weakleaf Bur Ragweed-Lacy TansyasterPA Broadleaf Cattail/Monotypic Stand PA	
Distribution: A minor unit found in an incised arroyo channel along the western edge of the monument; around the waste water treatment ponds in the southwest corner, and as a small patch in a drainage outwash area in the northeast corner.	

Wavyleaf Oak Montane Scrub/Pinyon-Juniper Woodland	**8**
Acres: 26.0	**Ha:** 10.5
Primary Components: Wavyleaf Oak /Mountain Mahogany PA	
Secondary Components:	
Inclusions: Pinyon Pine/Blue Grama Woodland PA Oneseed Juniper/Blue Grama PA	
Distribution: A minor unit known only from the western edge of the Old Fort unit of the monument along the footslope of Black Mesa, where it is found on granitic boulder outcrops.	

Arroyo Old Trail Grassland/ Ruderal Vegetation	**6**
Acres: 13.4	**Ha:** 5.4
Primary Components: Blue Grama-Western Wheatgrass PA Weakleaf Bur Ragweed-Lacy Tansyaster PA Bare Ground	
Secondary Components: Blue Grama-Purple Threeawn PA	
Inclusions: Blue Grama/Fringed Sage PA, Typic Phase Blue Grama/Fringed Sage PA, Spike Muhly Phase Hairy Grama/Fringed Sage PA	
Distribution: A unit restricted to eroded trail arroyos where some grasses have become established in a matrix of ruderal (weedy) forb vegetation and bare ground.	

Disturbed Grassland/Ruderal Vegetation - Adobe Field	**10**
Acres: 37.5	**Ha:** 15.2
Primary Components: Blue Grama-Purple Threeawn PA Blue Grama-Western Wheatgrass PA Weakleaf Bur Ragweed-Lacy Tansyaster PA	
Secondary Components: Blue Grama/Fringed Sage PA, Typic Phase Blue Grama/Fringed Sage PA, Spike Muhly Phase Bare Ground	
Inclusions: Blue Grama/Soaptree Yucca PA	
Distribution: Located primarily in the northwestern corner of the monument, this vegetation resides in the long dugout troughs used for making adobes for the forts and in the intervening strips of prairie grassland.	

Disturbed Grassland/Ruderal Vegetation - Old Fort Undeveloped	**11**
Acres: 57.3	**Ha:** 23.2
Primary Components: Blue Grama-Western Wheatgrass PA Weakleaf Bur Ragweed-Lacy TansyasterPA	
Secondary Components: Blue Grama-Purple Threeawn PA	
Inclusions: Blue Grama/Fringed Sage PA, Typic Phase Blue Grama/Fringed Sage PA, Spike Muhly Phase	
Distribution: A major unit associated with those fort ruins that have not been extensively developed archeologically, particularly old corrals and shed sites. These sites typically have a mix of disturbance-related vegetation that can reflect both historical impacts and recent activity by pocket gophers.	

Disturbed Grassland /Ruderal Vegetation - Old Fort Restored	**12**
Acres: 38.3	**Ha:** 15.5
Primary Components: Blue Grama-Purple Threeawn PA	
Secondary Components: Blue Grama-Western Wheatgrass PA Weakleaf Bur RagweedLacy Tansyaster PA Bare Ground	
Inclusions: Blue Grama/Fringed Sage PA, Typic Phase Blue Grama/Fringed Sage PA, Spike Muhly Phase	
Distribution: A unit restricted to fort ruins that have been developed archeologically and that receive high visitorship. Typically, vegetation has been modified by and in response to visitor use.	

Disturbed Grassland	**15**
Acres: 26.0	**Ha:** 10.5
Primary Components: Blue Grama-Purple Threeawn PA	
Secondary Components: Blue Grama/Fringed Sage PA, Typic Phase Blue Grama/Fringed Sage PA, Spike Muhly Phase	
Inclusions: Blue Grama/Soaptree Yucca Weakleaf Bur Ragweed-Lacy Tansyaster PA	
Distribution: A localized unit adjacent to the fort ruins where ground disturbance is less than surrounding areas.	

Ruderal Vegetation/Bare Ground	**21**
Acres: 18.9	**Ha:** 7.6
Primary Components: Weakleaf Bur Ragweed-Lacy Tansyaster PA Bare Ground	
Secondary Components: Blue Grama-Purple Threeawn PA Blue Grama-Western Wheatgrass Grassland	
Inclusions: Baltic Rush/Wood's Rose Blue Grama/Fringed Sage PA, Typic Phase Blue Grama/Fringed Sage PA, Spike Muhly Phase	
Distribution: A widely distributed unit where ground disturbance was historically very high or where current pocket gopher activity is high. The sites support mostly ruderal forbs (weeds) and few grasses, but they can be found in a complex matrix with grasslands and wetlands.	

DISCUSSION

The vegetation of Fort Union National Monument is relatively diverse, given its limited size and location on the western edge of the shortgrass prairie. While shortgrass prairie grasslands are still the dominant feature, they exhibit a variety of compositions that bear the imprint of past and current land use, and much of the grassland pattern reflects recovery from the time when the fort was active (prior to 1891). This includes old trail swaths from the Santa Fe Trial system that have either grown in with grasslands or, conversely, eroded into active arroyos. Because the trails themselves are of archeological value and high interest to visitors, this presents a challenge for long-term vegetation management. While further erosion will ultimately destroy the trails, slowing erosion through vegetation controls can make the trails difficult to see and may eventually lead to filling of the trails with sediments, obliterating the trail system, at least on the surface. Nevertheless, this will be a slow process, and through careful surface water management, it may be possible to find an optimal balance between erosion acceleration and excess deposition to preserve what is one of the hallmarks of the monument.

The exclusion of grazing with the establishment of the monument has allowed the vegetation to respond differently from that in the surrounding ranch lands. Qualitatively, there is a higher cover of vegetation within the park boundary than outside, and a suggestion that the grasslands may be more diverse within the fence. Quantitative comparative studies would be useful for determining both the positive and negative impacts of grazing exclusion. What is likely is that without grazing, fuel loads can build and possibly allow for the reintroduction of fire into the grassland ecosystem. The effects of fire can be variable, depending on the species, and there is a large pool of literature on the effects of fire on individual species that can be mined in the process of developing a fire management plan for vegetation.[4] In general, fire in prairies is thought to increase biodiversity and reinvigorate ecosystem processes, but intensity and frequency remain open questions, particularly in the more arid shortgrass prairie of the monument. The use of fire will obviously be limited by the size of the monument and the need to protect the cultural resources, but most of the eastern portion of the monument presents an open grassland where fire could be introduced safely under correct conditions. Furthermore, through cooperation with adjacent landowners, landscape-scale fire becomes possible, but this needs to be considered carefully in the light of altering hydrological processes and the ensuing impacts that might have on the trail system and other cultural resources.

While fire might be considered a threat under certain circumstances, so might the current high density of Botta's pocket gophers (*Thomomys bottae*). This mostly ground-dwelling animal is excavating large patches of monument primarily in areas of past disturbance, both human and otherwise. They tend to be limited by soil depth and friability i.e., the softer and deeper the soil the better the habitat. Hence, many soils in and around the ruins that have been recently deposited or dug up for other purposes have become ideal habitats for these animals. However, they also seem to be expanding to some degree into the open grasslands, yet outside the park their numbers appear to drop off, perhaps due to cattle impacts and associated compaction. Their presence in large numbers leads to the development of large patches dominated by ruderal

[4] See: Fire Effects Information System, [Online]. U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (Producer). Available: http://www.fs.fed.us/database/feis [2004, April 9].

(disturbance-related) plant species and bare ground, and these areas along with developed monument areas may become sinks for exotic species invasions (as well as directly impacting cultural resources). On the other hand, these are native species, and their presence in small numbers adds to the natural landscape variability and increases local native plant biodiversity in a similar way to fire. Hence, neither total eradication (not likely possible) nor sidestepping the issue are desirable management strategies. Rather, population level studies should be conducted to determine the dynamics of these animals in relation to soil habitat, available resources, and climatic factors. Based on these studies the optimal control program can be designed that protects both biological and cultural resources while ensuring maximal biodiversity.

The wetlands of Fort Union National Monument are naturally established vegetation that would likely be categorized as jurisdictional wetlands under US Army Corps of Engineers rules (Environmental Laboratory 1987), both as function of species composition and soils conditions. In addition, they are perhaps the most biologically diverse sites on the monument in terms of plant species, and they are also a magnet for animals. Hence, we would suggest that management be oriented towards maintenance and enhancement of these sites primarily by avoiding adverse impacts to the hydrological regime for both surface and subsurface components.

While no rare species were detected at the monument, the complexity of the disturbance history plus the variety of habitats in a limited area without grazing impacts has contributed to a relatively high plant species diversity for the monument. With respect to exotics plant species, only 12 of the 141 taxa described for the monument would be considered non-native alien introductions. Of these, none poses a significant threat to native species at this time, although species such as horehound (*Marrubium vulgare*) or kochia (*Kochia scoparia*) once established on disturbed ground can be a significant impediment to colonization of native species. Furthermore, park personnel should remain vigilant for the possibility of significant cheat grass (*Bromus tectorum, B. japonicus*) establishment in the developed areas of the fort. Lastly, it must be remembered that the botanical survey was conducted under drought conditions in 2000 through 2002, and that additional surveys during good years are recommended to capture additional species for the record and track non-native species abundance. Ideally, comparative monitoring sites should be established inside the monument and on the adjacent grazed Fort Union Ranch to track biodiversity status through time with respect to grazing, fire, and alien species encroachment.

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Fort Union National Monument Vegetation Survey

Appendix A

Plant Species List

Figure A1. Dotted gayfeather (*Liatris punctata*) was a forb common associate in blue grama grasslands of the monument. Photo: Geoff Carpenter

Plants identified by Natural Heritage New Mexico as part of the vegetation survey of Fort Union National Monument from 2000 through 2002 are listed in the following tables. Species are listed alphabetically within lifeform (LF) where 1 = trees, 2 = shrubs, 2.5 = subshrubs, 3 = graminoid grass-like species, and 4 = forbs. NHNM code refers to code in the NHNM database, and PLANTS Symbol refers to the code in the national PLANTS database (http://plants.usda.gov/). "O" refers to origin as either native (N), introduced (I), or not determined for the taxa (-). "V" refers to whether a voucher specimen was collected (X), or not collected, but part of plot record (P). "Native Plant Society" refers to whether the plant was found on the species list of Mary Whitmore on file at the monument. In Table A1, species are listed alphabetically by scientific name within lifeform, in Table A2, alphabetically by common name within lifeform. Table 3 contains those species on the Native Plant Society list that were not found during the survey.

Table A1. Plant species surveyed at Fort Union National Monument by Natural Heritage New Mexico between 2000 and 2002. Alphabetical by scientific name within lifeform.

LF	NHNM Code	PLANTS Symbol	Scientific Name	Common Name	Family	O	V	Native Plant Society List
1	JUNMON	JUMO	Juniperus monosperma	oneseed juniper	Cupressaceae	N	X	
1	JUNSCO	JUSC2	Juniperus scopulorum	Rocky Mountain juniper	Cupressaceae	N	X	
1	PINEDU	PIED	Pinus edulis	pinyon pine	Pinaceae	N	X	
1	PINPONS	PIPOS	Pinus ponderosa var. scopulorum	ponderosa pine	Pinaceae	N	X	
1	POPANG	POAN3	Populus angustifolia	narrowleaf cottonwood	Salicaceae	N	X	
1	QUEGRI	QUGR3	Quercus grisea	gray oak	Fagaceae	N	X	
1	SALAMY	SAAM2	Salix amygdaloides	peachleaf willow	Salicaceae	N	X	
1	ULMPUM	ULPU	Ulmus pumila	Siberian elm	Ulmaceae	I	X	
2	AMOFRU	AMFR	Amorpha fruticosa	desert indigobush	Fabaceae	N	X	
2	ATRCAN	ATCA2	Atriplex canescens	fourwing saltbush	Chenopodiaceae	N	X	x
2	BRICAL	BRCA3	Brickellia californica	California brickellbush	Asteraceae	N	X	
2	BRIEUPC	BREUC2	Brickellia eupatorioides var. chlorolepis	false boneset	Asteraceae	N	X	
2	BRIMICS	BRMIS	Brickellia microphylla var. scabra	rough brickellbush	Asteraceae	N	X	
2	CHRNAUL	CHNAL2	Chrysothamnus nauseosus ssp. latisquamous	rubber rabbitbrush	Asteraceae	N	X	x (C. nauseosus)
2	CLELIG	CLLI2	Clematis ligusticifolia	western white clematis	Ranunculaceae	N	X	
2	FALPAR	FAPA	Fallugia paradoxa	Apacheplume	Rosaceae	N	X	x
2	KRALAN2	KRLA2	Krascheninnikovia lanata	winterfat	Chenopodiaceae	N	X	
2	NOLMIC	NOMI	Nolina microcarpa	sacahuista	Agavaceae	N	P	
2	PHYMON	PHMO4	Physocarpus monogynus	mountain ninebark	Rosaceae	N	X	
2	QUEUND	QUUN	Quercus undulata	wavyleaf oak	Fagaceae	N	X	
2	RHUTRI	RHTR	Rhus trilobata	skunkbush sumac	Anacardiaceae	N	P	x
2	RIBCER	RICE	Ribes cereum	wax currant	Grossulariaceae	N	X	
2	ROSWOO	ROWO	Rosa woodsii	Woods' rose	Rosaceae	N	X	
2	SALEXI	SAEX	Salix exigua	coyote willow	Salicaceae	N	X	
2	TOXRAD	TORA2	Toxicodendron radicans	poison ivy	Anacardiaceae	N	X	
2	YUCGLA	YUGL	Yucca glauca	soapweed yucca	Agavaceae	N	P	x
2.5	ARTFRI	ARFR4	Artemisia frigida	fringed sagewort	Asteraceae	N	P	x
2.5	BRIBRA	BRBR2	Brickellia brachyphylla	plumed brickellbush	Asteraceae	N	X	
2.5	ECHCOC	ECCO5	Echinocereus coccineus	scarlet hedgehog cactus	Cactaceae	N	P	
2.5	ECHVIR	ECVI2	Echinocereus viridiflorus	nylon hedgehog cactus	Cactaceae	N	P	x
2.5	GUTSAR	GUSA2	Gutierrezia sarothrae	broom snakeweed	Asteraceae	N	P	x

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LF	NHNM Code	PLANTS Symbol	Scientific Name	Common Name	Family	O	V	Native Plant Society List
2.5	OPUPHA	OPPH	Opuntia phaeacantha	tulip pricklypear	Cactaceae	N	P	
2.5	OPUPOL	OPPO	Opuntia polyacantha	plains pricklypear	Cactaceae	N	P	x
2.5	ZINGRA	ZIGR	Zinnia grandiflora	Rocky Mountain zinnia	Asteraceae	N	X	x
3	AGRGIG	AGGI2	Agrostis gigantea	redtop	Poaceae	I	X	
3	ARIDIV	ARDI5	Aristida divaricata	poverty threeawn	Poaceae	N	X	
3	ARIPUR	ARPU9	Aristida purpurea	purple threeawn	Poaceae	N	P	x
3	BOUCUR	BOCU	Bouteloua curtipendula	sideoats grama	Poaceae	N	P	
3	BOUGRA	BOGR2	Bouteloua gracilis	blue grama	Poaceae	N	P	x
3	BOUHIR	BOHI2	Bouteloua hirsuta	hairy grama	Poaceae	N	X	
3	BROANO	BRAN	Bromus anomalus	nodding brome	Poaceae	N	X	
3	BROCAT	BRCA6	Bromus catharticus	rescuegrass	Poaceae	I	X	x
3	CAREX	CAREX	Carex spp.	sedge	Cyperaceae	-	X	
3	CAROCC	CAOC2	Carex occidentalis	western sedge	Cyperaceae	N	X	
3	CARROS	CARO5	Carex rossii	Ross' sedge	Cyperaceae	N	X	
3	CYPFEN	CYFE2	Cyperus fendlerianus	Fendler's flatsedge	Cyperaceae	N	X	
3	DISSPI	DISP	Distichlis spicata	inland saltgrass	Poaceae	N	X	
3	ELYCAN	ELCA4	Elymus canadensis	Canada wildrye	Poaceae	N	X	
3	ELYELY	ELEL5	Elymus elymoides	bottlebrush squirreltail	Poaceae	N	X	x (X. longifolius)
3	ELYTRA	ELTR7	Elymus trachycaulus	slender wheatgrass	Poaceae	N	X	
3	JUNARCB	JUBA	Juncus arcticus var. balticus	Baltic rush	Juncaceae	N	X	
3	LYCSET	LYSE3	Lycurus setosus	Bristly Wolfstail	Poaceae	N	X	x
3	MUHMON	MUMO	Muhlenbergia montana	mountain muhly	Poaceae	N	X	
3	MUHTOR	MUTO2	Muhlenbergia torreyi	ring muhly	Poaceae	N	P	
3	MUHWRI	MUWR	Muhlenbergia wrightii	spike muhly	Poaceae	N	X	
3	ORYMIC	ORMI2	Oryzopsis micrantha	littleseed ricegrass	Poaceae	N	X	
3	PANCAP	PACA6	Panicum capillare	witchgrass	Poaceae	N	X	
3	PANOBT	PAOB	Panicum obtusum	vine mesquite	Poaceae	N	X	x
3	PANVIR	PAVI	Panicum virgatum	switchgrass	Poaceae	N	X	
3	PASSMI	PASM	Pascopyrum smithii	western wheatgrass	Poaceae	N	X	x (Elymus smithii)
3	SCHSCO	SCSC	Schizachyrium scoparium	little bluestem	Poaceae	N	X	
3	SPOAIR	SPAI	Sporobolus airoides	alkali sacaton	Poaceae	N	X	
3	SPOCRY	SPCR	Sporobolus cryptandrus	sand dropseed	Poaceae	N	X	

Table A1. Plant species surveyed at Fort Union National Monument by Natural Heritage New Mexico between 2000 and 2002. Alphabetical by scientific name within lifeform.

LF	NHNM Code	PLANTS Symbol	Scientific Name	Common Name	Family	O	V	Native Plant Society List
3	STIROB	STRO3	Stipa robusta	sleepygrass	Poaceae	N	X	
4	ALLCER	ALCE2	Allium cernuum	nodding onion	Liliaceae	N	X	
4	AMAHYB	AMHY	Amaranthus hybridus	slim amaranth	Amaranthaceae	N	X	x
4	AMAPAL	AMPA	Amaranthus palmeri	carelessweed	Amaranthaceae	N	P	
4	AMBCON	AMCO3	Ambrosia confertiflora	weakleaf bur ragweed	Asteraceae	N	X	no, but Ambrosia psilostachya
4	ARELANS	ARLAS	Arenaria lanuginosa ssp. saxosa	spreading sandwort	Caryophyllaceae	N	X	
4	ARTCAR	ARCA14	Artemisia carruthii	Carruth's sagewort	Asteraceae	N	X	
4	ARTLUD	ARLU	Artemisia ludoviciana	Louisiana sagewort	Asteraceae	N	X	x
4	ASCSUB	ASSU2	Asclepias subverticillata	whorled milkweed	Asclepiadaceae	N	X	no, but A. involucrata
4	BERLYR	BELY	Berlandiera lyrata	lyreleaf greeneyes	Asteraceae	N	X	x
4	CASINT	CAIN14	Castilleja integra	wholeleaf Indian paintbrush	Scrophulariaceae	N	X	x
4	CHAERI	CHER2	Chaetopappa ericoides	rose heath	Asteraceae	N	X	x
4	CHAFEN	CHFE3	Chamaesyce fendleri	Fendler's sandmat	Euphorbiaceae	N	X	
4	CHASER2	CHSE6	Chamaesyce serpyllifolia	thymeleaf sandmat	Euphorbiaceae	N	X	
4	CHEHIA	CHHI	Chenopodium hians	hians goosefoot	Chenopodiaceae	N	X	no, but C. watsonii
4	CHEINC	CHIN2	Chenopodium incanum	mealy goosefoot	Chenopodiaceae	N	X	
4	CHELEP	CHLE4	Chenopodium leptophyllum	narrowleaf goosefoot	Chenopodiaceae	N	X	
4	CIRUND	CIUN	Cirsium undulatum	wavyleaf thistle	Asteraceae	N	X	
4	CIRWHE	CIWH	Cirsium wheeleri	Wheeler's thistle	Asteraceae	N	X	
4	COMDIA	CODI4	Commelina dianthifolia	birdbill dayflower	Commelinaceae	N	X	
4	COMUMBP	COUMP	Comandra umbellata ssp. pallida	pale bastard toadflax	Santalaceae	N	X	
4	CONARV	COAR4	Convolvulus arvensis	field bindweed	Convolvulaceae	I	X	x
4	CONCAN	COCA5	Conyza canadensis	Canadian horseweed	Asteraceae	N	X	
4	CRYTHY	CRTH	Cryptantha thyrsiflora	calcareous cryptantha	Boraginaceae	N	X	no, but C. crassisepala
4	CUCFOE	CUFO	Cucurbita foetidissima	Missouri gourd	Cucurbitaceae	N	X	x
4	DALCANO	DACAO	Dalea candida var. oligophylla	white prairieclover	Fabaceae	N	P	
4	DALPUR	DAPU5	Dalea purpurea	purple prairieclover	Fabaceae	N	X	
4	DYSPAP	DYPA	Dyssodia papposa	fetid marigold	Asteraceae	N	X	x
4	ENGPER	ENPE4	Engelmannia peristenia	Engelmann's daisy	Asteraceae	N	X	= Engelmannia pinnatifida
4	ERIALA	ERAL4	Eriogonum alatum	winged buckwheat	Polygonaceae	N	P	x
4	ERICAN	ERCA4	Erigeron canus	hoary fleabane	Asteraceae	N	X	
4	ERIHIE	ERHI3	Eriogonum hieraciifolium	hawkweed buckwheat	Polygonaceae	N	X	

Table A1. Plant species surveyed at Fort Union National Monument by Natural Heritage New Mexico between 2000 and 2002. Alphabetical by scientific name within lifeform.

LF	NHNM Code	PLANTS Symbol	Scientific Name	Common Name	Family	O	V	Native Plant Society List
4	ERIJAM	ERJA	Eriogonum jamesii	James' buckwheat	Polygonaceae	N	X	
4	EUPDAV	EUDA5	Euphorbia davidii	David'sspurge	Euphorbiaceae	I	X	
4	GAUCOC	GACO5	Gaura coccinea	scarlet beeblossom	Onagraceae	N	X	x
4	GLYLEP	GLLE3	Glycyrrhiza lepidota	American licorice	Fabaceae	N	X	x
4	GRINUDA	GRNUA	Grindelia nuda var. aphanactis	curlytop gumweed	Asteraceae	N	X	no, but G. squarosa
4	HELANN	HEAN3	Helianthus annuus	common sunflower	Asteraceae	N	X	x
4	HETVILM	HEVIM3	Heterotheca villosa var. minor	hairy false goldenaster	Asteraceae	N	X	x (Chrysopsis villosa)
4	HYMFIL	HYFI	Hymenopappus filifolius	fineleaf hymenopappus	Asteraceae	N	X	x
4	IPOPUR	IPPU2	Ipomoea purpurea	tall morningglory	Convolvulaceae	I	X	
4	KOCSCO	KOSC	Kochia scoparia	common kochia	Chenopodiaceae	I	X	no, but K. americana
4	LATEUC	LAEU	Lathryus eucosmus	bush peavine	Fabaceae	N	X	x
4	LATHYR	LATHY	Lathyrus spp.	peavine	Fabaceae	-	X	
4	LIAPUN	LIPU	Liatris punctata	dotted gayfeather	Asteraceae	N	X	x
4	LYGJUN	LYJU	Lygodesmia juncea	rush skeletonplant	Asteraceae	N	X	
4	MACCANA	MACAA	Machaeranthera canescens var. ambigua	hoary tansyaster	Asteraceae	N	X	x (Machaeranthera canescens
4	MACPIN	MAPIP	Machaeranthera pinnatifida	lacy tansyaster	Asteraceae	N	X	x (Haplopappus spinulosus)
4	MARVUL	MAVU	Marrubium vulgare	horehound	Lamiaceae	I	X	x
4	MELOFF	MEOF	Melilotus officinalis	yellow sweetclover	Fabaceae	I	X	x
4	MENMUL	MEMU3	Mentzelia multiflora	manyflowered mentzelia	Loasaceae	N	X	x
4	MIRLIN	MILI3	Mirabilis linearis	narrowleaf four o'clock	Nyctaginaceae	N	X	x
4	OENCOR	OECO2	Oenothera coronopifolia	crownleaf evening-primrose	Onagraceae	N	X	no, but O. albicaulis
4	OXYTRO	OXYT	Oxytropis spp	Crazyweed	Fabaceae	N	X	
4	PHYHEDC	PHHEC	Physalis hederaefolia var. comata	ivyleaf groundcherry	Solanaceae	N	X	x (var. fendleri)
4	PINEDU1	PIED	Pinus edulis	pinyon pine	Pinaceae	N	X	
4	POROLE	POOL	Portulaca oleracea	common purslane	Portulacaceae	N	X	
4	PSOTEN	PSTE5	Psoralidium tenuiflorum	slimflower scurfpea	Fabaceae	N	X	x (Psorelea tenuiflora)
4	RATTAG	RATA	Ratibida tagetes	green prairie coneflower	Asteraceae	N	X	x
4	SALREF	SARE3	Salvia reflexa	lanceleaf sage	Lamiaceae	N	X	x
4	SALTRA	SATR12	Salsola tragus	prickly Russian thistle	Chenopodiaceae	I	X	x (S. kali)
4	SENSPAM	SENMUL	Senecio spartioides var. multicapitatus	broomlike ragwort	Asteraceae	N	X	
4	SOLELA	SOEL	Solanum elaeagnifolium	silverleaf nightshade	Solanaceae	N	X	x
4	SOLMOL	SOMO	Solidago mollis	velvety goldenrod	Asteraceae	N	X	

Table A1. Plant species surveyed at Fort Union National Monument by Natural Heritage New Mexico between 2000 and 2002. Alphabetical by scientific name within lifeform.

LF	NHNM Code	PLANTS Symbol	Scientific Name	Common Name	Family	O	V	Native Plant Society List
4	SPHCOC	SPCO	Sphaeralcea coccinea	scarlet globemallow	Malvaceae	N	X	x
4	SPHHAS	SPHA	Sphaeralcea hastulata	spear globemallow	Malvaceae	N	X	
4	SPHINC	SPIN2	Sphaeralcea incana	gray globemallow	Malvaceae	N	X	
4	SYMERI	SYERE	Symphyotrichum ericoides	heath aster	Asteraceae	N	X	
4	SYMFAL2	SYFAC2	Symphyotrichum falcatum var.crassulum	white prairie aster	Asteraceae	N	X	
4	SYMLANH	SYLAH6	Symphyotrichum lanceolatum ssp. hesperium	white panicle aster	Asteraceae	N	X	
4	TALPAR	TAPA3	Talinum parviflorum	showy flameflower	Portulacaceae	N	X	
4	TETACA	TEAC	Tetraneuris acaulis	stemless hymenoxys	Asteraceae	N	X	no, but T. grandiflora
4	TEULAC	TELA	Teucrium laciniatum	lacy germander	Lamiaceae	N	X	x
4	THEMEG	THME	Thelesperma megapotamicum	Hopi tea greenthread	Asteraceae	N	X	x
4	TRAPRA	TRPR	Tragopogon pratensis	meadow salsify	Asteraceae	I	X	no, but T. dubius
4	VERENC	VEEN	Verbesina encelioides	golden crownbeard	Asteraceae	N	X	x
4	VERMAC	VEMA	Verbena macdougalii	MacDougal verbena	Verbenaceae	N	P	no, but V. bipinnatifida
4	VERTHA	VETH	Verbascum thapsus	common mullein	Scrophulariaceae	I	P	x
4	ZIGELE	ZIEL2	Zigadenus elegans	mountain deathcamas	Liliaceae	N	X	

Table A2. Plant species surveyed at Fort Union National Monument by Natural Heritage New Mexico between 2000 and 2002. Alphabetical by common name within lifeform

LF	NHNM Code	PLANTS Symbol	Scientific Name	Common Name	Family	O	V	Native Plant Society List
1	QUEGRI	QUGR3	Quercus grisea	gray oak	Fagaceae	N	X	
1	POPANG	POAN3	Populus angustifolia	narrowleaf cottonwood	Salicaceae	N	X	
1	JUNMON	JUMO	Juniperus monosperma	oneseed juniper	Cupressaceae	N	X	
1	SALAMY	SAAM2	Salix amygdaloides	peachleaf willow	Salicaceae	N	X	
1	PINEDU	PIED	Pinus edulis	pinyon pine	Pinaceae	N	X	
1	PINPONS	PIPOS	Pinus ponderosa var. scopulorum	ponderosa pine	Pinaceae	N	X	
1	JUNSCO	JUSC2	Juniperus scopulorum	Rocky Mountain juniper	Cupressaceae	N	X	
1	ULMPUM	ULPU	Ulmus pumila	Siberian elm	Ulmaceae	I	X	
2	FALPAR	FAPA	Fallugia paradoxa	Apacheplume	Rosaceae	N	X	x
2	BRICAL	BRCA3	Brickellia californica	California brickellbush	Asteraceae	N	X	
2	SALEXI	SAEX	Salix exigua	coyote willow	Salicaceae	N	X	
2	AMOFRU	AMFR	Amorpha fruticosa	desert indigobush	Fabaceae	N	X	
2	BRIEUPC	BREUC2	Brickellia eupatorioides var. chlorolepis	false boneset	Asteraceae	N	X	
2	ATRCAN	ATCA2	Atriplex canescens	fourwing saltbush	Chenopodiaceae	N	X	x
2	PHYMON	PHMO4	Physocarpus monogynus	mountain ninebark	Rosaceae	N	X	
2	TOXRAD	TORA2	Toxicodendron radicans	poison ivy	Anacardiaceae	N	X	
2	BRIMICS	BRMIS	Brickellia microphylla var. scabra	rough brickellbush	Asteraceae	N	X	
2	CHRNAUL	CHNAL2	Chrysothamnus nauseosus ssp. latisquamous	rubber rabbitbrush	Asteraceae	N	X	x (C. nauseosus)
2	NOLMIC	NOMI	Nolina microcarpa	sacahuista	Agavaceae	N	P	
2	RHUTRI	RHTR	Rhus trilobata	skunkbush sumac	Anacardiaceae	N	P	x
2	YUCGLA	YUGL	Yucca glauca	soapweed yucca	Agavaceae	N	P	x
2	QUEUND	QUUN	Quercus undulata	wavyleaf oak	Fagaceae	N	X	
2	RIBCER	RICE	Ribes cereum	wax currant	Grossulariaceae	N	X	
2	CLELIG	CLLI2	Clematis ligusticifolia	western white clematis	Ranunculaceae	N	X	
2	KRALAN2	KRLA2	Krascheninnikovia lanata	winterfat	Chenopodiaceae	N	X	
2	ROSWOO	ROWO	Rosa woodsii	Woods' rose	Rosaceae	N	X	
2.5	GUTSAR	GUSA2	Gutierrezia sarothrae	broom snakeweed	Asteraceae	N	P	x
2.5	ARTFRI	ARFR4	Artemisia frigida	fringed sagewort	Asteraceae	N	P	x
2.5	ECHVIR	ECVI2	Echinocereus viridiflorus	nylon hedgehog cactus	Cactaceae	N	P	x
2.5	OPUPOL	OPPO	Opuntia polyacantha	plains pricklypear	Cactaceae	N	P	x
2.5	BRIBRA	BRBR2	Brickellia brachyphylla	plumed brickellbush	Asteraceae	N	X	
2.5	ZINGRA	ZIGR	Zinnia grandiflora	Rocky Mountain zinnia	Asteraceae	N	X	x

Table A2. Plant species surveyed at Fort Union National Monument by Natural Heritage New Mexico between 2000 and 2002. Alphabetical by common name within lifeform

LF	NHNM Code	PLANTS Symbol	Scientific Name	Common Name	Family	O	V	Native Plant Society List
2.5	ECHCOC	ECCO5	Echinocereus coccineus	scarlet hedgehog cactus	Cactaceae	N	P	
2.5	OPUPHA	OPPH	Opuntia phaeacantha	tulip pricklypear	Cactaceae	N	P	
3	SPOAIR	SPAI	Sporobolus airoides	alkali sacaton	Poaceae	N	X	
3	JUNARCB	JUBA	Juncus arcticus var. balticus	Baltic rush	Juncaceae	N	X	
3	BOUGRA	BOGR2	Bouteloua gracilis	blue grama	Poaceae	N	P	x
3	ELYELY	ELEL5	Elymus elymoides	bottlebrush squirreltail	Poaceae	N	X	x (E. longifolius)
3	LYCSET	LYSE3	Lycurus setosus	Bristly Wolfstail	Poaceae	N	X	x
3	ELYCAN	ELCA4	Elymus canadensis	Canada wildrye	Poaceae	N	X	
3	CYPFEN	CYFE2	Cyperus fendlerianus	Fendler's flatsedge	Cyperaceae	N	X	
3	BOUHIR	BOHI2	Bouteloua hirsuta	hairy grama	Poaceae	N	X	
3	DISSPI	DISP	Distichlis spicata	inland saltgrass	Poaceae	N	X	
3	SCHSCO	SCSC	Schizachyrium scoparium	little bluestem	Poaceae	N	X	
3	ORYMIC	ORMI2	Oryzopsis micrantha	littleseed ricegrass	Poaceae	N	X	
3	MUHMON	MUMO	Muhlenbergia montana	mountain muhly	Poaceae	N	X	
3	BROANO	BRAN	Bromus anomalus	nodding brome	Poaceae	N	X	
3	ARIDIV	ARDI5	Aristida divaricata	poverty threeawn	Poaceae	N	X	
3	ARIPUR	ARPU9	Aristida purpurea	purple threeawn	Poaceae	N	P	x
3	AGRGIG	AGGI2	Agrostis gigantea	redtop	Poaceae	I	X	
3	BROCAT	BRCA6	Bromus catharticus	rescuegrass	Poaceae	I	X	x
3	MUHTOR	MUTO2	Muhlenbergia torreyi	ring muhly	Poaceae	N	P	
3	CARROS	CARO5	Carex rossii	Ross' sedge	Cyperaceae	N	X	
3	SPOCRY	SPCR	Sporobolus cryptandrus	sand dropseed	Poaceae	N	X	
3	CAREX	CAREX	Carex spp.	sedge	Cyperaceae	-	X	
3	BOUCUR	BOCU	Bouteloua curtipendula	sideoats grama	Poaceae	N	P	
3	STIROB	STRO3	Stipa robusta	sleepygrass	Poaceae	N	X	
3	ELYTRA	ELTR7	Elymus trachycaulus	slender wheatgrass	Poaceae	N	X	
3	MUHWRI	MUWR	Muhlenbergia wrightii	spike muhly	Poaceae	N	X	
3	PANVIR	PAVI	Panicum virgatum	switchgrass	Poaceae	N	X	
3	PANOBT	PAOB	Panicum obtusum	vine mesquite	Poaceae	N	X	x
3	CAROCC	CAOC2	Carex occidentalis	western sedge	Cyperaceae	N	X	
3	PASSMI	PASM	Pascopyrum smithii	western wheatgrass	Poaceae	N	X	x (Elymus smithii)
3	PANCAP	PACA6	Panicum capillare	witchgrass	Poaceae	N	X	

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LF	NHNM Code	PLANTS Symbol	Scientific Name	Common Name	Family	O	V	Native Plant Society List
4	GLYLEP	GLLE3	Glycyrrhiza lepidota	American licorice	Fabaceae	N	X	x
4	COMDIA	CODI4	Commelina dianthifolia	birdbill dayflower	Commelinaceae	N	#	
4	SENSPAM	SENMUL	Senecio spartioides var. multicapitatus	broomlike ragwort	Asteraceae	N	X	
4	LATEUC	LAEU	Lathryus eucosmus	bush peavine	Fabaceae	N	X	x
4	CRYTHY	CRTH	Cryptantha thyrsiflora	calcareous cryptantha	Boraginaceae	N	X	no, but C. crassisepala
4	CONCAN	COCA5	Conyza canadensis	Canadian horseweed	Asteraceae	N	X	
4	AMAPAL	AMPA	Amaranthus palmeri	carelessweed	Amaranthaceae	N	P	
4	ARTCAR	ARCA14	Artemisia carruthii	Carruth's sagewort	Asteraceae	N	X	
4	KOCSCO	KOSC	Kochia scoparia	common kochia	Chenopodiaceae	I	X	no, but K. americana
4	VERTHA	VETH	Verbascum thapsus	common mullein	Scrophulariaceae	I	P	x
4	POROLE	POOL	Portulaca oleracea	common purslane	Portulacaceae	N	X	
4	HELANN	HEAN3	Helianthus annuus	common sunflower	Asteraceae	N	X	x
4	OXYTRO	OXYT	Oxytropis spp	Crazyweed	Fabaceae	N	X	
4	OENCOR	OECO2	Oenothera coronopifolia	crownleaf evening-primrose	Onagraceae	N	X	no, but O. albicaulis
4	GRINUDA	GRNUA	Grindelia nuda var. aphanactis	curlytop gumweed	Asteraceae	N	X	no, but G. squarosa
4	EUPDAV	EUDA5	Euphorbia davidii	David'sspurge	Euphorbiaceae	I	X	
4	LIAPUN	LIPU	Liatris punctata	dotted gayfeather	Asteraceae	N	X	x
4	ENGPER	ENPE4	Engelmannia peristenia	Engelmann's daisy	Asteraceae	N	X	= Engelmannia pinnatifida
4	CHAFEN	CHFE3	Chamaesyce fendleri	Fendler's sandmat	Euphorbiaceae	N	X	
4	DYSPAP	DYPA	Dyssodia papposa	fetid marigold	Asteraceae	N	X	x
4	CONARV	COAR4	Convolvulus arvensis	field bindweed	Convolvulaceae	I	X	x
4	HYMFIL	HYFI	Hymenopappus filifolius	fineleaf hymenopappus	Asteraceae	N	X	x
4	VERENC	VEEN	Verbesina encelioides	golden crownbeard	Asteraceae	N	X	x
4	SPHINC	SPIN2	Sphaeralcea incana	gray globemallow	Malvaceae	N	X	
4	RATTAG	RATA	Ratibida tagetes	green prairie coneflower	Asteraceae	N	X	x
4	HETVILM	HEVIM3	Heterotheca villosa var. minor	hairy false goldenaster	Asteraceae	N	X	x (Chrysopsis villosa)
4	ERIHIE	ERHI3	Eriogonum hieraciifolium	hawkweed buckwheat	Polygonaceae	N	X	
4	SYMERI	SYERE	Symphyotrichum ericoides	heath aster	Asteraceae	N	X	
4	CHEHIA	CHHI	Chenopodium hians	hians goosefoot	Chenopodiaceae	N	X	no, but C. watsonii
4	ERICAN	ERCA4	Erigeron canus	hoary fleabane	Asteraceae	N	X	
4	MACCANA	MACAA	Machaeranthera canescens var. ambigua	hoary tansyaster	Asteraceae	N	X	x (Machaeranthera canescens
4	THEMEG	THME	Thelesperma megapotamicum	Hopi tea greenthread	Asteraceae	N	X	x

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LF	NHNM Code	PLANTS Symbol	Scientific Name	Common Name	Family	O	V	Native Plant Society List
4	MARVUL	MAVU	Marrubium vulgare	horehound	Lamiaceae	I	X	x
4	PHYHEDC	PHHEC	Physalis hederaefolia var. comata	ivyleaf groundcherry	Solanaceae	N	X	x (var. fendleri)
4	ERIJAM	ERJA	Eriogonum jamesii	James' buckwheat	Polygonaceae	N	X	
4	TEULAC	TELA	Teucrium laciniatum	lacy germander	Lamiaceae	N	X	x
4	MACPIN	MAPIP	Machaeranthera pinnatifida	lacy tansyaster	Asteraceae	N	X	x (Haplopappus spinulosus)
4	SALREF	SARE3	Salvia reflexa	lanceleaf sage	Lamiaceae	N	X	x
4	ARTLUD	ARLU	Artemisia ludoviciana	Louisiana sagewort	Asteraceae	N	X	x
4	BERLYR	BELY	Berlandiera lyrata	lyreleaf greeneyes	Asteraceae	N	X	x
4	VERMAC	VEMA	Verbena macdougalii	MacDougal verbena	Verbenaceae	N	P	no, but V. bipinnatifida
4	MENMUL	MEMU3	Mentzelia multiflora	manyflowered mentzelia	Loasaceae	N	X	x
4	TRAPRA	TRPR	Tragopogon pratensis	meadow salsify	Asteraceae	I	X	no, but T. dubius
4	CHEINC	CHIN2	Chenopodium incanum	mealy goosefoot	Chenopodiaceae	N	X	
4	CUCFOE	CUFO	Cucurbita foetidissima	Missouri gourd	Cucurbitaceae	N	X	x
4	ZIGELE	ZIEL2	Zigadenus elegans	mountain deathcamas	Liliaceae	N	X	
4	MIRLIN	MILI3	Mirabilis linearis	narrowleaf four o'clock	Nyctaginaceae	N	X	x
4	CHELEP	CHLE4	Chenopodium leptophyllum	narrowleaf goosefoot	Chenopodiaceae	N	X	
4	ALLCER	ALCE2	Allium cernuum	nodding onion	Liliaceae	N	X	
4	COMUMBP	COUMP	Comandra umbellata ssp. pallida	pale bastard toadflax	Santalaceae	N	X	
4	LATHYR	LATHY	Lathyrus spp.	peavine	Fabaceae	-	X	
4	PINEDU1	PIED	Pinus edulis - yng regen	pinyon pine	Pinaceae	N	X	
4	SALTRA	SATR12	Salsola tragus	prickly Russian thistle	Chenopodiaceae	I	X	x (S. kali)
4	DALPUR	DAPU5	Dalea purpurea	purple prairieclover	Fabaceae	N	X	
4	CHAERI	CHER2	Chaetopappa ericoides	rose heath	Asteraceae	N	X	x
4	LYGJUN	LYJU	Lygodesmia juncea	rush skeletonplant	Asteraceae	N	X	
4	GAUCOC	GACO5	Gaura coccinea	scarlet beeblossom	Onagraceae	N	X	x
4	SPHCOC	SPCO	Sphaeralcea coccinea	scarlet globemallow	Malvaceae	N	X	x
4	TALPAR	TAPA3	Talinum parviflorum	showy flameflower	Portulacaceae	N	X	
4	SOLELA	SOEL	Solanum elaeagnifolium	silverleaf nightshade	Solanaceae	N	X	x
4	AMAHYB	AMHY	Amaranthus hybridus	slim amaranth	Amaranthaceae	N	X	x
4	PSOTEN	PSTE5	Psoralidium tenuiflorum	slimflower scurfpea	Fabaceae	N	X	x (Psorelea tenuiflora)
4	SPHHAS	SPHA	Sphaeralcea hastulata	spear globemallow	Malvaceae	N	X	
4	ARELANS	ARLAS	Arenaria lanuginosa ssp. saxosa	spreading sandwort	Caryophyllaceae	N	X	

Table A2. Plant species surveyed at Fort Union National Monument by Natural Heritage New Mexico between 2000 and 2002. Alphabetical by common name within lifeform

LF	NHNM Code	PLANTS Symbol	Scientific Name	Common Name	Family	O	V	Native Plant Society List
4	TETACA	TEAC	Tetraneuris acaulis	stemless hymenoxys	Asteraceae	N	X	no, but T. grandiflora
4	IPOPUR	IPPU2	Ipomoea purpurea	tall morningglory	Convolvulaceae	I	X	
4	CHASER2	CHSE6	Chamaesyce serpyllifolia	thymeleaf sandmat	Euphorbiaceae	N	X	
4	SOLMOL	SOMO	Solidago mollis	velvety goldenrod	Asteraceae	N	X	
4	CIRUND	CIUN	Cirsium undulatum	wavyleaf thistle	Asteraceae	N	X	
4	AMBCON	AMCO3	Ambrosia confertiflora	weakleaf bur ragweed	Asteraceae	N	X	no, but Ambrosia psilostachya
4	CIRWHE	CIWH	Cirsium wheeleri	Wheeler's thistle	Asteraceae	N	X	
4	SYMLANH	SYLAH6	Symphyotrichum lanceolatum ssp. hesperium	white panicle aster	Asteraceae	N	X	
4	SYMFAL2	SYFAC2	Symphyotrichum falcatum var.crassulum	white prairie aster	Asteraceae	N	X	
4	DALCANO	DACAO	Dalea candida var. oligophylla	white prairieclover	Fabaceae	N	P	
4	CASINT	CAIN14	Castilleja integra	wholeleaf Indian paintbrush	Scrophulariaceae	N	X	x
4	ASCSUB	ASSU2	Asclepias subverticillata	whorled milkweed	Asclepiadaceae	N	X	no, but A. involucrata
4	ERIALA	ERAL4	Eriogonum alatum	winged buckwheat	Polygonaceae	N	P	x
4	MELOFF	MEOF	Melilotus officinalis	yellow sweetclover	Fabaceae	I	X	x

Table A3. Plant species on the Native Plant Society list of Mary Whitmore that were *not* collected (nc) by Natural Heritage New Mexico as part of the vegetation survey between 2000 and 2002. Alphabetical by scientific name within lifeform.

LF	NHNM Code	PLANTS Symbol	Scientific Name	Common Name	Family	O	Comment
2.5	DALALB	DAAL	Dalea albiflora	whiteflower prairie clover	Fabaceae	N	nc
2.5	ERISIM	ERSI3	Erigeron simplex	onestem fleabane	Asteraceae	N	nc but add to list
2.5	HETVIL	HEVI4	Heterotheca villosa	hairy goldenaster	Asteraceae	N	NHNM:Heterotheca villosa var. minor
3	BROJAP	BRJA	Bromus japonicus	Japanese brome	Poaceae	I	nc
3	BROTEC	BRTE	Bromus tectorum	cheatgrass	Poaceae	I	nc
3	BUCDAC	BUDA	Buchloe dactyloides	buffalograss	Poaceae	N	nc
3	ELYLON	ELLO3	Elymus longifolius	longleaf squirreltail	Poaceae	N	syn = Elymus elymoides
3	MUHREP	MURE	Muhlenbergia repens	creeping muhly	Poaceae	N	nc
3	NASVIR	NAVI4	Nassella viridula	green needlegrass	Poaceae	N	nc
3	SCHPAN	SCPA	Schedonnardus paniculatus	tumblegrass	Poaceae	N	nc
4	AMBPSI	AMPS	Ambrosia psilostachya	Cuman ragweed	Asteraceae	N	nc, but Ambrosia confertiflora
4	ASCINV	ASIN14	Asclepias involucrata	dwarf milkweed	Asclepiadaceae	N	nc
4	ASTAGR	ASAG2	Astragalus agrestis	purple milkvetch	Fabaceae	N	nc
4	ASTCRA	ASCR2	Astragalus crassicarpus	groundplum milkvetch	Fabaceae	N	nc
4	ASTMOL	ASMO7	Astragalus mollissimus	woolly milkvetch	Fabaceae	N	nc
4	CASAPPM	CAAPM	Castilleja chromosa	wavyleaf Indian paintbrush	Scrophulariaceae		nc = Castilleja applegatei ssp. martinii
4	CHACOR	CHCO2	Chamaesaracha coronopus	greenleaf five eyes	Solanaceae	N	nc
4	CHEWAT	CHWA	Chenopodium watsonii	Watson's goosefoot	Chenopodiaceae	N	nc
4	CIRNEO	CINE	Cirsium neomexicana	New Mexico thistle	Asteraceae	N	nc
4	CRYCRA	CRCR3	Cryptantha crassisepala	hiddenflower	Boraginaceae	N	nc
4	DESPIN	DEPI	Descurainia pinnata	western tanseymustard	Brassicaceae	N	nc
4	ERIDIV	ERDI4	Erigeron divergens	spreading fleabane	Asteraceae	N	nc
4	EROCIC	ERCI6	Erodium cicutarium	redstem stork's bill	Geraniaceae	I	nc
4	ERYCAP	ERCA14	Erysimum capitatum	sanddune wallflower	Brassicaceae	N	nc
4	GAIPIN	GAPI	Gaillardia pinnatifida	red dome blanketflower	Asteraceae	N	nc
4	GLABIP	GLBI2	Glandularia bipinnatifida	Dakota mock vervain	Verbenaceae	N	nc
4	GRISQU	GRSQ	Grindelia squarrosa	curlycup gumweed	Asteraceae	N	nc, but Grindelia nuda var. aphanactis
4	KOCAME	KOAM	Kochia americana	greenmolly	Chenopodiaceae	N	syn=Kochia scoparia
4	LAPOCC	LAOC3	Lappula occidentalis	flatspine stickseed	Boraginaceae	N	nc
4	LEPDEN	LEDE	Lepidium densiflorum	common pepperweed	Brassicaceae	N	nc
4	LINARI2	LIAR3	Linum aristatum	bristle flax	Linaceae	N	nc
4	LINLEW	LILE3	Linum lewisii	prairie flax	Linaceae	N	nc

Table A3. Plant species on the Native Plant Society list of Mary Whitmore that were *not* collected (nc) by Natural Heritage New Mexico as part of the vegetation survey between 2000 and 2002. Alphabetical by scientific name within lifeform.

LF	NHNM Code	PLANTS Symbol	Scientific Name	Common Name	Family	O	Comment
4	LITINC	LIIN2	Lithospermum incisum	narrowleaf gromwell	Boraginaceae	N	nc
4	MACBIG	MABI	Machaeranthera biglovii	Bigelow's tansyaster	Asteraceae	N	nc
4	MACCAN	MACA2	Machaeranthera canescens	hoary aster	Asteraceae	N	NHNM: Machaeranthera canescens var. ambigua
4	MEDLUP	MELU	Medicago lupulina	black medick	Fabaceae	I	nc
4	OENALB	OEAL	Oenothera albicaulis	whitest eveningprimrose	Onagraceae	N	nc, but Oenothera coronopifolia
4	OROFAS	ORFA	Orobanche fasciculata	clustered broomrape	Orobanchaceae	N	nc
4	PENWHI	PEWH	Penstemon whippleanus	Whipple's penstemon	Scrophulariaceae	N	nc
4	PHLNAN	PHNA2	Phlox nana	Santa Fe phlox	Polemoniaceae	N	nc
4	PHYHEDF	PHHEF	Physalis hederaefolia var. fendleri	Fendler's groundcherry	Solanaceae	N	nc, but Physalis hederaefolia var. comata
4	PLAPAT	PLPA2	Plantago patagonica	woolly plantain	Plantaginaceae	N	nc
4	PRUVUL	PRVU	Prunella vulgaris	common selfheal	Lamiaceae	N	nc
4	PSEMON	PSMO	Pseudocymopterus montanus	alpine false springparsley	Apiaceae	N	nc
4	SENMUL	SESPM	Senecio multicapitatus	broomlike ragwort	Asteraceae	N	syn=Senecio spartioides var. multicapitatus
4	SONASP	SOAS	Sonchus asper	spiny sowthistle	Asteraceae	I	nc
4	TAROFF	TAOF	Taraxacum officinale	common dandelion	Asteraceae	I	nc
4	TETSCAS	TESCS	Tetraneuris scaposa var. scaposa	stemmy four-nerve daisy	Asteraceae	N	nc, but Tetraneuris acaulis
4	TEUCAN	TECA3	Teucrium canadense	Canada germander	Lamiaceae	N	nc, but Teucrium laciniatum
4	TRADUB	TRDU	Tragopogon dubius	yellow salsify	Asteraceae	I	nc, but Tragopogon pratensis