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VEGETATION OF FORT BOWIE NATIONAL HISTORIC SITE, ARIZONA

by

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Marina C. Hoy —

and

Wilton E. Hoy

*Marina's contribution
was the flora which
is not included.
Since her ~~work~~ efforts
were deleted, why does
her name appear as
co-author?*

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INTRODUCTION

Fort Bowie National Historic Site was authorized as a unit of the National Park Service on August 30, 1954 and formally established on July 28, 1972 for the protection and interpretation of fort ruins. The Historic Site was established also to commemorate the Butterfield Overland Trail and Stage Station, the fort's soldiers, and their adversaries, the Chiricahua Apache Indians. The Fort Bowie Master Plan (1975) provides a brief summary of area's development policy:

Fort Bowie National Historic Site provides a matchless opportunity to interpret the genesis, growth and eventual decline of a southwestern frontier settlement during the last half of the 1800's. A classic western military outpost situated in the heartland of the Chiricahua Apaches, Fort Bowie bore witness to the tragic clash of cultures that characterized America's western expansion.

Much of the land surrounding the site of this early outpost remains as it appeared during the height of the fort's historic period a century ago. The surviving natural and historic resources lend themselves to preservation in a primitive state - not to modern restoration or reconstruction.

The national historic site, consisting of nearly 1,000 acres, is located in Apache Pass, between the Chiricahua Mountains to the south and the Dos Cabeza Mountains to the north. Apache Pass also separates the San Simon Valley to the north-east from the Sulphur Springs Valley to the south-west. The elevation within the historic site ranges from 4600 feet in lower Siphon Canyon to 5200 feet in upper Apache Pass southwest of the cemetery.

Fort Bowie is located at the north-western edge, and at the upper elevational extremes, of the Chihuahuan Desert. The site is located in a region of complex intermingling of floristic elements from the Chihuahuan Desert, Madrean evergreen woodlands, and semi-desert grassland. Desert species such as creosote bush and mesquite are found at the lower, warmer elevations, but in many locations they are found in mixed stands codominated by various grasses including, side oats grama, hairy grama, and tanglehead. The higher slopes support a mixture of chaparral and woodland, characterized by shrubs such as manzanita, mountain mahogany and scrub oak, and trees such as oaks, pinyon pines, and

junipers. The canyon bottoms support a riparian woodland characterized by velvet ash and hackberry. This mix of vegetation types includes 477 plant species, representing 270 genera and 72 families (Hoy, 1975), and provides habitat for an equally diverse wildlife fauna (Lowe and Johnson 1976).

APACHE PASS AND FORT BOWIE: THE HUMAN STORY

We followed the bed of a dry arroya where there was scarcely room for the wagon wheels, let alone room for the driver. The road was overshadowed by handsome trees among which I noticed the pecans, ash, willow, etc.

Robert Eccleston
Immigrant in
Apache Pass,
1849

It was the rich natural setting of a mountain corridor called Apache Pass and the nearby spring (Apache Spring) that attracted a procession of inhabitants and passersby: Indian, Mexican, and American. With the American acquisition of the Gadsden Purchase from Mexico in 1853-1854, Apache Pass began to serve as a crossroad for emigrants, miners, surveyors, and soldiers. In 1858, the Butterfield Overland Mail created a station at Apache Pass and improved the Apache Pass road, but antagonism between Americans and Chiricahua Apaches interfered with "civilizing" the area. In 1861, atop a hill next to Apache Spring, a small fort, name Fort Bowie after its regimental commander, was established. From 1861 to 1872 the "Cochise War" against the Apaches raged. In 1867, the American soldiers moved their fort to its present site, and expanded their mission to fighting Indians throughout southeastern Arizona, southwest New Mexico, and northern Chihuahua and Sonora, Mexico. Although a peace agreement was reached in 1872 and the Chiricahua Apaches were herded onto reservations, outbreaks of fighting and war continued. Cochise died in 1874, but other Chiricahuas continued the battle. Geronimo's band of warriors finally surrendered in 1886, 25 years after the war between the Chiricahuas and American soldiers began, and the Indian wars ended. In 1894, Fort Bowie was abandoned.

After Fort Bowie

During and after the Fort Bowie years, solitary miners and prospectors sporadically picked at claims within the pass, such as those in Willow Canyon and the Bowie Peak-Helen's Dome massif.

In 1911, the 6 square mile military reservation was auctioned to ranchers, and the grasslands and water resources of Apache Pass fell almost exclusively their use as rangeland.

In 1964, Congress authorized Fort Bowie National Historic Site as a unit of the National Park Service to commemorate the two Forts, the Chiricahua Apache Indians, and the Butterfield Overland Train and station. The development theme is characterized by "abandonment and wildness". Visitor access to the ruins is by a 1.5 mile foot trail, and no public vehicular access is available or presently contemplated.

As a condition of the Fort Bowie National Historic Site enabling act, extant cattle already grazing within the site are permitted to remain. Primary management is the responsibility of the Bureau of Land Management via a cooperative agreement with the National Park Service. Since 1967, fences around the first and second forts and the cemetery have excluded cattle from the fragile ruins and headstones. Seasonal hunting of mule deer, javelina, quail and dove is permitted within the historic site.

Historic Impacts

Historic photographs show evidence of disturbance and changes in the natural vegetation of Fort Bowie since its origin as a fort. Although the once dusty fort grounds and old roads are scarcely visible today, old stumps of juniper up to four feet in diameter, as well as oak and pinyon pine are conspicuous on Bowie Peak and other hills. Old photographs show stacks of wood and hay bales. Horses and cattle have been grazed in the vicinity for more than 125 years. In early photographs, grasses, and small shrubs appear to have provided more or less continuous ground cover on rocky, lower slopes. The woody vegetation of the foothills, as it appears in these photographs, formed open, savanna-like cover on open slopes, and a mixture of woodland and chaparral along draws and steep, north-facing slopes.

CLIMATE

Climate mild, generally warm during summer months; and occasional fall of snow during the characteristic winter; average temperature 62.27 degrees thermometer; 55.39 degrees hygrometer.

Captain Ruben Bernard
Commanding Officer,
Camp Bowie
August 1870

The climate of the Apache Pass region is mild; the average annual temperature is 60 degrees F. The highest recorded temperature at Fort Bowie was 106 degrees F in June 1874. The lowest recorded temperature was 5 degrees F taken in February 1871. July is usually the warmest month, with an average temperature of 78 degrees F, and January is the coldest, averaging 44.6 degrees F.

Precipitation occur in two distinct seasons. Winter rains, typically gentle precipitation coming from the Pacific Ocean, usually arrive in December or early January and continue sporadically into March. Summer convectional rains, consisting of brief, local intense showers accompanied by thunder and lightning, come from the Gulf of Mexico. These summer showers usually begin in early July and continue into September, and comprise the highest percentage of yearly precipitation. Average annual rainfall at Fort Bowie, based on records from 1870-1877, is 12.3 inches. The wettest year on record was 1871 with 22.8 inches, and the driest year was 1873 with 7.76 inches of precipitation.

Table 1 is a comparison of weather records from Fort Bowie during 1870-1874 and 1870-1874. Maximum and minimum temperatures remained relatively similar, but precipitation was slightly higher in the 1800's over the 1900's.

Table 1. Average monthly temperature in degrees Farenheit, and precipitation in inches, from 1870-1874 and 1970-1974 at Fort Bowie National Historic Site. (Records from Fort Bowie files).

	Temperature (F)		Precipitation			
	1870-74		1970-74		1870-74	1970-74
	<u>Max.</u>	<u>Min.</u>	<u>Max.</u>	<u>Min.</u>		
July	96.5	67.2	98.2	56.7	3.64	2.26
August	94.7	64.5	96.2	54.2	4.35	3.54
September	94.2	59.7	93.2	46.2	0.69	0.93
October	89.5	39.5	88.7	34.7	0.18	1.70
November	76.5	34.0	78.5	27.2	0.31	0.44
December	72.0	26.2	70.7	19.0	1.24	1.00
January	67.0	18.2	72.0	16.2	0.58	0.85
February	68.5	28.0	73.5	16.0	1.64	0.69
March	79.5	33.5	81.2	27.7	0.93	0.76
April	84.7	33.0	84.7	32.7	0.15	0.00
May	96.5	52.0	91.7	41.5	0.36	0.46
June	100.7	64.2	101.7	52.5	0.44	0.24
Annual	85.0	43.0	85.8	35.3	14.51	12.87

precipitation

FOR THE UNITED STATES DEPARTMENT OF THE INTERIOR

BUREAU OF LAND MANAGEMENT

REPORT OF INVESTIGATION

*Vegetation strongly
relates to geology here
Formations need better
descriptions*

GEOLOGY

The Fort Bowie ruins are on a northwest-trending overthrust block of Horquilla Limestone that was folded after being overthrust. The folded thrust is separated from the Rattlesnake Point Granite of Sabins (1957) to the southwest by the Apache Pass fault...

E. S. Davidson,
1965

*grossly
inadequate*

The Chiricahua and Dos Cabeza mountains are located within the Mexican Highland portion of the Basin and Range Province. The 2.5 mile corridor of Apache Pass divides the two ranges. However, because the ranges on either side of the pass are geologically similar (Sabins 1957b), this is a separation in name only.

The western section of the historic site consists of coarse, nonfoliated Rattlesnake Point granite of Precambrian age (Sabins 1957a). East of Apache Spring, and east of the Apache Pass fault on which the spring lies, the geology within the ruins area consists of Pennsylvanian-age Horquilla Limestone, which contains chert and a variety of fossils. East of the second fort are exposed strata of the middle and upper Bisbee Group consisting of reddish-purple siltstone.

WATER SOURCES

No permanent streams exist within Apache Pass, however, during heavy summer rains, ephemeral streams may run short distances for a brief time. Three major springs flow within the Apache Pass area: Apache Spring, located 0.25 mile west of the second fort ruins; Goodwin Spring, in Goodwin Canyon on the north side of the pass; and Bear Springs, in Bear Canyon, southeast of the fort ruins. Four or five small intermittent springs are also present in the pass area. Apache Spring is located on the Apache Pass fault that separates Rattlesnake Point Granite from the overthrust plate of Horquilla Limestone (Sabin 1957a).

During the occupation of the fort, Bear Spring supplied the garrison with 21,103 gallons of water a day. But with the overtaxing of the spring and the drought of 1892-1893, the water supply dwindled, forcing the garrison to find and utilize a different water source. At present, the spring is intermittent.

How were sample sites chosen?

Reconnaissance or analytic techniques?
(My impression is that a recon technique was used. Prominence is undefined. How does reader know that prominence guesses are any good? What, if any calibration was used so another worker could duplicate)

METHODS

The classification of vegetation into associations was made based on a series of thirty-six site samples. At each sample location a complete species list was made of perennial plants within the stand. Each sample included approximately one acre. All species were assigned a prominence rank at the site ranging from 1 to 5 where "1" is the rarest and "5" is the most abundant. A rank of 5 indicates a single site dominant where no other species shares codominance. A rank of 4 indicates those species that share codominance at a site. A rank of 3 indicates species that are common and widespread. A rank of 2 indicates species that are uncommon, and may be represented by a few individuals at a site. A rank of 1 indicates a species that is very uncommon at a site and is probably only represented by a single individual in the sample area.

Subjective
No 2 workers
could
duplicate

How?
What does
similar
mean -
quantitative
similarities
or
qualitative
judgements?

Site data were sorted manually into groups that were floristically similar and that shared landform distribution characteristics. In some species, distribution tends to be patchy, especially in the case of some perennial grasses such as black grama, that spread vegetatively to form clumps. In some mixed grass/shrub associations such clumping was patchy within the type, but the type description is based on the more consistent general distribution of associated species.

VEGETATION ASSOCIATIONS

Survey of the vegetation of Fort Bowie has revealed the presence of eleven associations (Table 1). Most of these associations (or types) represent transitional conditions between more widely distributed vegetation communities, for example, four of the types are a mixture of chaparral and woodland species, and five of the types are various combinations of desert scrub and grassland elements.

The complex geology and long history of human disturbance in the area contribute to the difficulty of interpreting vegetation associations at Fort Bowie. In many of the vegetation types, the dominant species are weedy invasive species such as mesquite and burroweed. Disturbance is particularly noticeable on level locations with good soil development where high grass cover would be expected at this altitude; instead perennial grasses may be quite sparse and the dominants are weedy shrubs and erosion of the soil surface is evident.

It is no coincidence that the historic site is located in an area of geologic complexity. The fault running through the site is the source of the spring that has been the focus of human

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activity there for many decades. In several locations plant association change abruptly across the fault as the transition is made from granitic rocks on the west side to limestone rocks on the east.

Table 2. Plant associations of Fort Bowie
National Historic Site.

Riparian Associations:

1. Arizona Walnut - Nettleleaf Hackberry - Gum Bumelia Assoc.

Woodland/Chaparral Associations:

2. Emory Oak - Pointleaf Manzanita - Beargrass Assoc.
3. Emory Oak - Turpentine Bush - Grama Grass Assoc.
4. One-seed Juniper - Scrub Oak - Beargrass Assoc.
5. Deerbrush - Mountain-mahogany - Desert Sumac Assoc.

Shrub/Grassland Associations:

6. Mesquite - Turpentine Bush - Burrowweed Assoc.
7. Turpentine Bush - Fairy Duster - Mixed Grass Assoc.
8. Ocotillo - Mariola - Grama Grass Assoc.
9. Mesquite - Desert Sumac - Snakeweed Assoc.
10. Russian Thistle - Snakeweed - Mixed Grass Assoc.

Desertscrub Associations:

11. Creosotebush - Mesquite - Mariola Assoc.
-

VEGETATION ASSOCIATION DESCRIPTIONS

Descriptive accounts of each vegetation association are presented on the following pages.

1. Arizona Walnut - Nettleaf Hackberry - Gum Bumelia Association
(Juglans major - Celtis reticulata - Bumelia lanuginosa)

Description: This type is a mixed-broadleaf deciduous woodland with a more-or-less continuous closed canopy that occurs in linear corridors along intermittent stream courses. The canopy is generally 30 to 40 feet in height, with an overstory of deciduous trees of varying sizes and a shrub understory. Arizona grape is a co-dominant whose tangled vines occasionally bind the trees and shrubs together into dense thickets. Relative abundance of the common species is patchy, with the dominants shifting from site to site along the stream corridor. In the upper, more open portions of Siphon Canyon the tree canopy is more open and broken than in the shadier lower portions.

Floristics: (3 sample sites)

Dominants and co-dominants:

Arizona Walnut
Nettleaf Hackberry
Gum Bumelia
Velvet Ash
Arizona Grape
Desert-willow

Juglans major
Celtis reticulata
Bumelia lanuginosa
Fraxinus velutina
Vitis arizonica
Chilopsis linearis

Other Common Associates:

Mesquite
Desert Sumac
Soapberry
Seepwillow
Turpentine Bush
Catclaw Mimosa
One-seed Juniper
Clammyweed

Prosopis glandulosa
Rhus microphylla
Sapindus saponaria
Baccharis salicifolia
Haplopappus laricifolius
Mimosa biuncifera
Juniperus monosperma
Polanisia dodecandra

Distinguishing features: This association differs from other mixed-broadleaf riparian forests by the presence of Gum Bumelia, a tree that has limited distribution in Arizona, and the absence of Arizona Sycamore, a tree that is common in most similar types.

Distribution: This type is found along Siphon Canyon from Siphon Spring, at 4900 feet down to the park boundary at 4600 feet. It occurs on sandy alluvium of the canyon bottom.

Quercus emoryi / *Arctostaphylos pungens* (6W) in USFS (1987)

2. Emory Oak - Pointleaf Manzanita - Beargrass Association

(*Quercus emoryi* - *Arctostaphylos pungens* - *Nolina microcarpa*)

Description: This type has an open overstory of small evergreen trees whose cover may range from 10 to 20 percent and a relatively dense understory of evergreen sclerophyllous shrubs that may have 20 to 40 percent cover. Height of the shrubs is 3 to 6 feet and of the trees is 10 to 20 feet. The herbaceous component of the understory is variable, but may be abundant in some areas with numerous beargrass and bull grass.

Floristics:

Dominants and Codominants:

- Emory Oak	<u><i>Quercus emoryi</i></u>
- Point-leaf Manzanita	<u><i>Arctostaphylos pungens</i></u>
- Beargrass	<u><i>Nolina microcarpa</i></u>
- Scrub Oak	<u><i>Quercus turbinella</i></u>
- One-seed Juniper	<u><i>Juniperus monosperma</i></u>

J. erythrocarpa ?

Other Common Associates:

- Banana Yucca	<u><i>Yucca baccata</i></u>
- Silktassel	<u><i>Garrya wrightii</i></u>
- Turpentine Bush	<u><i>Haplopappus laricifolius</i></u>
- Cane Cholla	<u><i>Opuntia spinosior</i></u>
- Bull Grass	<u><i>Muhlenbergia emersleyi</i></u>
- Wild Buckwheat	<u><i>Eriogonum wrightii</i></u>
- Hairy Grama	<u><i>Bouteloua hirsuta</i></u>
- Sotol	<u><i>Dasylirion wheeleri</i></u>
- Catclaw Mimosa	<u><i>Mimosa biuncifera</i></u>

Distinguishing Features: This type shares many species with other similar woodland/chaparral associations in the area. It differs from the Emory Oak savannah type by the higher total cover of woody species, greater shrub diversity and lower grass abundance. It differs from the One-seed Juniper-Scrub Oak type in the abundance of manzanita and Emory oak, and the relative absence of deerbrush.

Distribution: This type is found on moderately steep north-facing slopes above 5,000 feet elevation, although it rarely extends down to 4,800 feet. The substrate on which it occurs is generally igneous or metamorphic rock with very shallow, rocky soil. This is the most mesic upland association in the park, and it occurs up to the highest point in the park.

3. Emory Oak - Turpentine Bush - Grama Grass Association

(Quercus Emoryi - Haplopappus laricifolius - Bouteloua spp.)

Description: This type is an open savannah with cover of scattered trees and shrubs totalling 10 to 20 percent, and a diverse herbaceous strata dominated by perennial grasses with 20 to 40 percent cover. Cactus, especially Opuntia, are common. Within this type in swales and drainages sclerophyllous chaparral shrubs may be locally more common

Floristics:

Dominants and Codominants:

- Emory Oak
- Turpentine Bush
- Beargrass
- Hairy Grama
- Tangle-head
- Bullgrass
- Alligator Juniper

Quercus emoryi
~~Haplopappus laricifolius~~
Nolina microcarpa
Bouteloua hirsuta
Heteropogon contortum
Muhlenbergia emerslevi
Juniperus deppeana

= *Ericameria*
laricifolia

Other Common Associates:

- Sideoats Grama
- Sprucetop Grama
- Black Grama
- Prickly Pear
- Cane Cholla
- Wild Buckwheat
- Sotol
- Rainbow Cactus
- Point-leaf Manzanita

B. curtispindula
B. chondrosioides
B. eriopoda
Opuntia phaeacantha
Opuntia spinosior
Eriogonum wrightii
Dasyliirion wheeleri
Echinocereus pectinatus
Arctostaphylos pungens

Distinguishing Features: This type is an open savannah woodland with relatively low shrub diversity and a well developed herbaceous strata. It differs from the shrub/grass associations by the presence of an open tree strata, and from the woodland types by its sparse woody cover and relatively high perennial grass cover.

Distribution: Throughout the western and central parts of the park between 4700 and 5100 feet elevation on gently rolling terrain with slopes up to 30 percent. The substrate is very rocky, usually with igneous or metamorphic parent rock.

4. Scrub Oak - Beargrass - One-seed Juniper Association

(Quercus turbinella - Nolina microcarpa - Juniperus monosperma)

Description: This type is dominated by a relatively dense shrub canopy of chaparral species, including evergreen and deciduous species, with an open overstory of evergreen trees. Total woody cover generally ranges from 30 to 40 percent. There is frequently a diverse but patchy herbaceous understory in a number of bunch-grasses and perennial herbs. Herbaceous cover is variable and may range from 5 to 20 percent.

Floristics:

Dominants and Codominants:

- Scrub Oak
- Beargrass
- One-seed Juniper
- Deerbrush
- Banana Yucca
- Hairy Grama

Quercus turbinella
Nolina microcarpa
Juniperus monosperma
Ceanothus greggii
Yucca baccata
Bouteloua hirsuta

J. erythrocarpa?

Other Common Associates:

- Point-leaf Manzanita
- Wild Buckwheat
- Sideoats
- Silktassle
- Oreganillo
- Turpentine Bush
- Bullgrass
- Prickly Pear
- Cane Cholla
- Sotol

Arctostaphylos pungens
Eriogonum wrightii
Bouteloua curtipendula
Garrya wrightii
Aloysia wrightii
Haplopappus laricifolius
Muhlenbergia emerslevi
Opuntia phaeacantha
Opuntia spinosior
Dasyllirion wheeleri

Distinguishing Features: This type is floristically very similar to the Deerbrush - Oreganillo association, but differs in its greater abundance of scrub oak, presence of a tree overstory, and generally higher woody cover. The shrub strata in this type is also similar to the Emory oak - manzanita association, but it lacks Emory oak, and manzanita is much less abundant.

Distribution: Generally on steep, north-facing slopes with very rocky soil. The parent rock is usually igneous or metamorphic. This type is found on the drier slopes of the north half of the park between 4,600 and 5,000 feet elevation.

Compare with Wentworth (1981) chaparral on limestone in Mule Mts.

I don't believe this community is similar enough to be the same as his type.

5. Deerbrush - Mountain-mahogany - Desert Sumac Association

(Ceanothus greggii - Cercocarpus montanus - Rhus microphylla)

Description: This type is dominated by evergreen shrubs four to six feet tall, most of which are characteristic of chaparral habitats, but also including several of Chihuahuan affinities such as Desert Sumac and Indigo-bush. A few evergreen trees occur in low abundance. Total woody cover is typically 30 to 50 percent. The patchy herbaceous understory includes perennial grasses and a variety of herbs such as Astragalus, Hedeoma, Castilleja, Erigeron, and Dyssodia.

Floristics:

Dominants and Codominants:

Deerbrush
Mountain-mahogany
Desert sumac
Snakeweed
Oreganillo
Banana Yucca

Ceanothus greggii
Cercocarpus montanus
Rhus microphylla
Gutierrezia sarothrae
Aloysia wrightii
Yucca baccata

Other Common Associates:

Indigo-bush
Sideoats Grama
Hairy Grama
Century Plant
Prickly-pear
Beargrass
Bricklebush
One-seed Juniper
Pinyon Pine
Sotol

Dalea formosa
Bouteloua curtipendula
Bouteloua hirsuta
Agave chrysantha
Opuntia phaeacantha
Nolina microcarpa
Brickellia sp.
Juniperus monosperma
Pinus edulis
Dasyllirion wheeleri

Pinus discolor?

Gambel's

Distinguishing Features: This type is similar to the other mixed chaparral woodland types, but it has a somewhat more xeric aspect with more Chihuahuan desertscrub species, fewer trees, and fewer sclerophyllous shrubs such as manzanita and silktassle.

Distribution: This type is found on moderate to steep north facing slopes between 4,800 and 5,100 feet with very shallow, rocky soil. The factor that likely contributes to the floristic differences between this and other similar types is that it is generally found on limestone. It is restricted to the eastern end of the park where limestone is found.

How about
ferns?
Cheilanthes
Notholaena
Pellaea
etc.

6. Mesquite - Turpentine Bush - Burroweed Association

(Prosopis glandulosa - Haplopappus laricifolius - Haplopappus tenuisectus)

Description: This type is apparently a shrub-dominated disclimax of what was previously a grassland. All of the dominant shrubs are invasive weedy species that typically invade following intense livestock grazing, and resultant destruction of grass cover.

Floristics:

Dominants and Codominants:

Mesquite
Turpentine Bush
Burroweed
Snakeweed
Hairy Grama

Prosopis glandulosa
Haplopappus laricifolius = *Ericameria* l.
Haplopappus tenuisectus = *Isocoma* t.
Gutierrezia sarothrae
Bouteloua hirsuta

Other Common Associates:

Banana Yucca
Sideoats Grama
Black Grama
Century Plant
Prickly-pear
Cane Cholla
Catclaw Mimosa
Emory Oak
Beargrass
Desert sumac
Wild Buckwheat
Plains Lovegrass

Yucca baccata
Bouteloua curtipendula
B. eriopoda
Agave chrysantha
Opuntia phaeacantha
O. spinosior
Mimosa biuncifera
Quercus emoryi
Nolina microcarpa
Rhus microphylla
Eriogonum wrightii
Eragrostis intermedia

Distinguishing Features: This type differs from most of the other associations of the park because the low-diversity shrub stratum is composed entirely of invasive weedy species, and the herbaceous understory is very depauperate.

Distribution: This type generally occurs on the most level terrain in the park in areas where the soil, though gravelly, is relatively deep and well developed. The substrate is often alluvium, and slopes typically vary from level up to 10 percent. This type is best represented in the broad valley that forms the divide between upper Siphon Canyon and Cutoff Canyon through which the trail runs. This area at one time was likely a preferred pasture for the fort and the stage station.

7. Turpentine Bush - Fairy Duster- Ocotillo Association

(Haplopappus laricifolius - Calliandra eriophylla - Fouquieria splendens)

Description: This type is a mixed shrub/grassland in which shrub and grass species often share dominance. The shrub stratum, which may vary from 10 to 40 percent cover, is often composed of relatively small species that are 1 to 3 feet tall (with the exception of ocotillo). Herbaceous cover, consisting mostly of perennial grasses, is usually 20 to 40 percent.

Floristics:

Dominants and Codominants:

Turpentine Bush
Fairy Duster
Ocotillo
Hairy Grama
Sideoats Grama
Prickly-pear
Snakeweed

Haplopappus laricifolius
Calliandra eriophylla
Fouquieria splendens
Bouteloua hirsuta
Bouteloua curtipendula
Opuntia phaeacantha
Gutierrezia sarothrae

Other Common Associates:

Black Grama
Century Plant
Mesquite
Cane Cholla
Tanglehead
Leather Weed
Catclaw Acacia

B. eriopoda
Agave chrysantha
Prosopis glandulosa
O. spinosior
Heteropogon contortum
Croton corymbulosus
Acacia greggii

Distinguishing Features: This type has the best developed perennial grass stratum of any type in the park. The open overstory of small shrubs, combined with good grass cover, make this one of the most open types in the park.

Distribution: This type is found on south-facing slopes with shallow rocky soil between 4,600 and 5,100 feet. The soil is derived from granitic or metamorphic rock.

8. Ocotillo - Mariola - Grama Grass Association

(Fouquieria splendens - Parthenium incanum - Bouteloua spp.)

Description: This is a shrub-dominated association with good representation of Chihuahuan species such as Ocotillo, Mariola, Desert Sumac, and Feather-plume Dalea. The shrub canopy is composed of species generally 2 to 4 feet tall, with the exception of ocotillo that commonly grows between 10 and 12 feet tall. The herbaceous understory is dominated by several species of Grama Grass plus a few other perennial grasses. Total woody cover is usually between 20 and 40 percent, and total herbaceous cover is usually 10 to 20 percent.

Floristics:

Dominants and Codominants:

Ocotillo
Mariola
Hairy Grama
Sideoats Grama
Black Grama
Snakeweed

Fouquieria splendens
Parthenium incanum
Bouteloua hirsuta
B. curtipendula
B. eriopoda
Gutierrezia sarothrae

Other Common Associates:

Fairy Duster
Prickly-pear
Century Plant
Mesquite
Cane Cholla
Tanglehead
Wolf-tail
Desert Sumac

Calliandra eriophylla
Opuntia phaeacantha
Agave chrysantha
Prosopis glandulosa
O. spinosior
Heteropogon contortum
Lycurus phleoides
Rhus microphylla

Distinguishing Features: The aspect of this type differs from all others in the park due to the dominance of Ocotillo, whose tall spindly stems tower above the short shrub stratum. This type is perhaps the most typical Chihuahuan desertscrub association in the park, although a number of chaparral species are found scattered through the association as well.

Distribution: This type is found on south-facing limestone slopes between 4,700 and 5,100 feet elevation. The soils is quite shallow and rocky with frequent bedrock outcrops. It is generally restricted to the east end of the park to limestone east of the fault zone.

9. Mesquite - Desert Sumac - Snakeweed Association

(Prosopis glandulosa - Rhus microphylla - Gutierrezia sarothrae)

Description: This type is dominated by an overstory of mixed deciduous and evergreen shrubs 4 to 6 feet tall with a second shrub stratum composed of species 1 to 3 feet tall. Total shrub cover is variable and can be relatively dense, ranging from 25 to 50 percent. The patchy herbaceous understory consists of a diverse combination of perennial grasses and other herbaceous species.

Floristics:

Dominants and Codominants:

Mesquite
Desert Sumac
Snakeweed
Mariola

Prosopis glandulosa
Rhus microphylla
Gutierrezia sarothrae
Parthenium incanum

Other Common Associates:

Fairy Duster
Prickly-pear
Hairy Grama
Black Grama
Century Plant
Sotol
Ocotillo
Vine Mesquite
Tanglehead
Feather-plume Dalea
Gum-Bumelia

Calliandra eriophylla
Opuntia phaeacantha
Bouteloua hirsuta
B. eriopoda
Agave chrysantha
Dasilirion wheeleri
Fouquieria splendens
Hilaria belangeri
Heteropogon contortum
Dalea formosa
Bumelia lanuginosa

Distinguishing Features: This type is floristically similar to the Ocotillo - Mariola association, but differs substantially in aspect due to the dominance of larger shrubs such as Mesquite and Desert Sumac. This is the only association in the park in which Desert Sumac is a codominant, and its dark, dense, evergreen canopy stands out in contrast to all other Chihuahuan desert scrub species.

Distribution: This type is found on gentle to moderate south-facing slopes with very rocky soil from 4,600 up to 5,000 feet elevation. The parent rock is generally metamorphic, but occasionally limestone. It is restricted to the north-east portion of the park.

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10. Russian Thistle - Snakeweed - Mixed Grass Association

(Salsola iberica - Gutierrezia sarothrae - Mixed Grass)

Description: This type is a heavily disturbed disclimax dominated by weedy species that is located in the immediate vicinity of the old Fort Bowie site. It consists predominantly of herbaceous species, but many shrubs, such as Burroweed and Mesquite, are becoming well established. This area was almost totally stripped of plant cover at the time of occupation of the fort.

Floristics:

Dominants and Codominants:

Russian Thistle
Snakeweed
Burroweed
Threeawn

Salsola iberica
Gutierrezia sarothrae
Haplopappus tenuisectus
Aristida spp.

Other Common Associates:

Mesquite
Turpentine Bush

Horehound
Sideoats Grama
Hairy Grama
Cane Cholla
Plains Lovegrass

Prosopis glandulosa
Haplopappus laricifolius - *Ericameria*
H. spinulosus - *Haplopappus*
Marrubium vulgare
Bouteloua curtipendula
Bouteloua hirsuta
O. spinosior
Eragrostis intermedia

by what? { Distinguishing Features: This type is the most heavily disturbed of all the vegetation associations in the park, and consequently it has the greatest proportion of invasive herbaceous and woody species.

Distribution: This type is found only in the immediate vicinity of the old Fort Bowie site, and in scattered smaller patches along recent road and pipeline clearings that were not mapped.

Present disturbance is not livestock (you mention historic area fenced),
but human trampling

11. Creosotebush - Mesquite - Mariola Association

(Larrea tridentata - Prosopis glandulosa - Parthenium incanum)

Description: This desertscrub type is dominated by shrubs 2 to 4 feet tall and has a poorly developed herbaceous understory. Woody cover is 30 to 40 percent. Perennial grasses are sparse and total herbaceous cover is less than 10 percent.

Floristics:

Dominants and Codominants:

Creosotebush

Mesquite

Mariola

Desert Sumac

Larrea tridentata

Prosopis glandulosa

Parthenium incanum

Rhus microphylla

Black cholla

Other Common Associates:

Black Grama

Snakeweed

Wolfberry

Bush Muhly

Oreganillo

Prickly-pear

B. eriopoda

Gutierrezia sarothrae

Lycium sp.

Muhlenbergia porteri

Aloysia wrightii

Opuntia phaeacantha

Distinguishing Features: This is the only type in the park in which Creosotebush is a prominent member. It is one of only two types in the park that is a true desertscrub association without a prominent grass understory.

Distribution: This type is found only at the lowest elevations in the park in lower Siphon Canyon at 4,600 feet. It occurs on rocky south-west facing slopes. The landform on which it occurs is a remnant alluvial terrace with gravelly soil.

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This report should be, in my opinion,
made part of this report.

~~many~~ references
are NOT cited.
Other pertinent
references
are missing

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