

A FLORA OF LAVA BEDS NATIONAL MONUMENT

by

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ABSTRACT

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Lava Beds National Monument, CA, located near the junction of the Sierra, Klamath, Cascade, and Great Basin geological provinces, straddles the boundary between the Modoc Plateau region of the Great Basin floristic province and the Cascade Range region of the California floristic province. The resulting flora, while largely representative of the Great Basin floristic province, also reflects elements of the Cascade and Klamath/Siskiyou regions. Further adding to the floristic diversity are recent geologic phenomena such as cindercones, lava flows, and associated lava tubes, which provide unique topography, edaphic conditions, and microclimates facilitating the existence of disjunct plant populations and species range extensions within the Monument. My effort to inventory all vascular plants occurring in the Monument lasted three seasons (2005-2007). During the course of this project 91 species were added to the Lava Beds National Monument vascular plant list. In total, 368 vascular plant species (including subspecific taxa) have been collected from Lava Beds National Monument.

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INTRODUCTION

Lava Beds National Monument straddles the geologic boundary of the Modoc Plateau and Cascade Range. As a result, it contains two distinct physiographic regions. The Modoc region is vegetated by sagebrush steppe and the Cascade region by coniferous forest. Recent geologic phenomena such as cindercones, lava flows, and associated lava tubes, provide unique topography, edaphic conditions, and microclimates facilitating the existence of disjunct plant populations and species range extensions within the Monument. The resulting floral elements largely represent the Great Basin Floristic Province, but also include the Cascade, Sierra and Northwestern California regions of the California Floristic Province.

Past floristic studies of Lava Beds, while providing an extremely valuable baseline, have become out of date and difficult to obtain. The need for a current comprehensive floristic inventory and dichotomous key detailing species distribution, abundance, and habitat affinities at Lava Beds NM instigated this project. This flora will provide managers and seasonal staff with a comprehensive and professional tool to better identify and manage park resources in the foreseeable future.

This project was initiated when the Klamath Inventory and Monitoring Network provided funding to Dr. Steve Jessup to recruit a graduate student to develop a flora of Lava Beds National Monument as a partial fulfillment of MS degree requirements in Environmental Education at Southern Oregon University. Dr. Jessup and the Klamath

I&M Network selected me for this project. I initiated field work at Lava Beds in late May 2005. A second field season began April 2006. A third field season began in April 2007

Project Objectives:

- Thoroughly search Lava Beds and compile a list of all vascular plants occurring in the Monument.
- Locate existing voucher specimens and/or collect voucher specimens for each vascular plant species occurring at Lava Beds.
- Develop a dichotomous key for all vascular plants collected or known in the Monument.
- Provide descriptions of distribution, location, and habitat affinities of species within the Monument.

Geography and Topography

Lava Beds National Monument is located approximately 72km (45 mi) southeast of Klamath Falls, Oregon and 18 km (11 mi) south of the Oregon-California border (Figure 1). Most of the monument lies in Siskiyou Co, but a small portion of the Monument's north east corner and the disjunct Petroglyphs Section are in Modoc Co. The Monument, located near the junction of the Sierra, Klamath, Cascade, and Great Basin geological provinces, straddles the boundary between the Modoc Plateau and the Cascade Range. The Monument sits on the northern flank of the Medicine Lake Highlands, an eastern extension of the Cascade Range. The north boundary of the Monument lies at 1,230 m (4,040 ft) elevation and roughly follows the historic shoreline of Tule Lake. The Monument's highest elevation, Island Butte at 1685 m (5,529 ft), occurs along the southern boundary (Figure 2).

Lava Beds became a national monument in 1925 for cultural and geologic reasons, under the administration of the United States Forest Service. In 1933 the National Park Service assumed management of the National Monument. The Monument boundary is rectangular, encompassing 194 sq km (75 sq mi). On each side of the main Monument road lie designated wilderness areas, established in 1973. Combined, the Schonchin Wilderness and the Black Lava Flow Wilderness total 11,355 hectares (28,058 acres), 60% of the Monument. Federal lands border the monument on all sides. To the east, west, and south sides are the Modoc and the Klamath National Forests. The Klamath Basin National Wildlife Refuge manages the lands on the north side of the monument. The refuge leases much of the land for agriculture.



Figure 1. Location of Lava Beds National Monument. Used with the permission of the NPS.

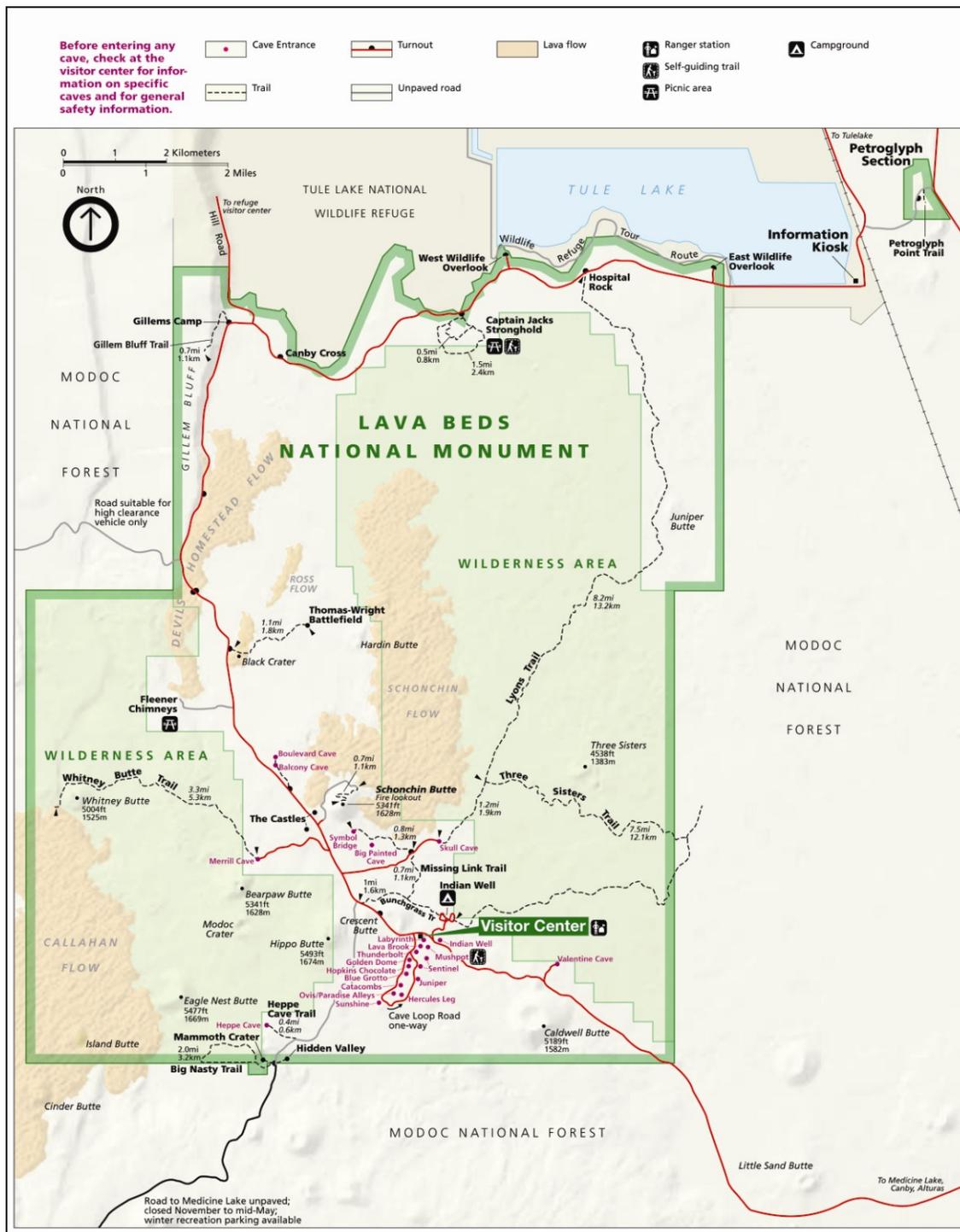


Figure 2. Map of Lava Beds National Monument. Used with the permission of the NPS.

Natural History

Lava Beds National Monument provides each visitor the unique opportunity to view a variety of geologic phenomena. The Lava Beds landscape has experienced two extremes on the geologic spectrum; from being an ancient seaway 80 million years ago (mya), to having molten lava flows and showers of pumice cover the ground only 1000 years ago. To fully appreciate the geologic complexity of the monument, and its underlying effects on plant life, we must begin our story nearly 150 mya (middle Cretaceous).

Oceanic plates colliding with the North American continent caused the accretion of the Klamath Mountains (Harden 2004), which are progressively younger from east to west. Evidence suggests that before the accretion was completed a volcanic island archipelago existed where the Klamath mountains now occur, and a seaway extended between that archipelago and the Sierra Nevada (Orr and Orr 2002), which were only a series of low foothills until the Miocene. The seaway has been called the Modoc Seaway (Alt and Hindman 2000); and it covered the northern portion of what is now the Modoc Plateau. High sea levels during the Cretaceous contributed to the existence of the Modoc Seaway and the epeiric sea which covered the middle of the North American continent (Graham 1993). Fossils of clams and ammonites revealed in the Hornbrook formation, coupled with other fossils in the Pacific Northwest give us an idea about life on earth at this time: Dinosaurs dominated the fauna and angiosperms were evolutionary infants at the feet of towering tree ferns and conifers. Near the end of the Cretaceous continued uplift and erosion of the Klamaths, and receding sea levels

eventually ended the ancient Modoc Seaway; and potential ocean view lots near Klamath Falls, OR would have disappeared by the Paleocene (Bishop 2003).

At the end of the Cretaceous (65mya), the Pacific Northwest most likely had subtropical climatic conditions (Detling 1968). During the Eocene, even with a mostly tropical global climate, arid regions most likely existed over the Tropics of Cancer and Capricorn because of the permanent high pressure ridges created by Hadley cells (Daubenmire 1978). Many of the xeromorphic species now found at Lava Beds may have originated in these areas. The first fossil evidence of grasses, a prominent taxon of arid regions, are from the Eocene (Crepet and Feldman 1991).

The volcanic activities that initiated the Modoc Plateau began as early as 30 mya (early Oligocene). The resulting volcanic substrata consisted of tuffs, tuff-breccias, mudflows, and, to a lesser extent, andesitic lava flows (MacDonald 1966). The Upper Cedarville series of northwest Nevada and adjacent California represent the early Modoc Plateau volcanism of 20mya (Miocene). Upper Cedarville fossils were established in a quiet body of water with high silica content, resulting from very active volcanism (LaMotte 1936). These fossils, along with other palaeontological evidence, begin to paint a picture of the climate and species composition on the early Modoc Plateau: the climate probably had little seasonality with moderate temperatures and an average rainfall of 90-127 cm (35-50 in) (Detling 1968), nearly triple current levels.

A period of cooling, drying, and increased seasonality began in the Oligocene, and persisted through the Miocene into the Pliocene. Miocene vegetation consisted of mostly broad-leaved deciduous trees, but conifers and broad-leaved evergreens were

present at higher elevations (Wolfe 1969), and are represented in the Upper Cedarville Series (LaMotte 1936). During the Miocene, eight to 12 species of conifers might have occurred in a Great Basin forest, versus 1-2 today (Axelrod 1976). By the close of the Miocene the major floristic elements of the Pacific Northwest were present, and fossils of woody species from this period closely resemble plants living today (Heusser and King 1988).

As early as the Miocene, tectonic movements ruptured most of the Cedarville formation, causing north-south trending block-faulting, characteristic of the Great Basin. Gillem Bluff in the northwest corner of the monument is a good example of a block-fault. Block-faulting results from the elongation or stretching of the earth's crust causing vertical displacement where cracks (faults) develop. These tectonic movements have continued on the Modoc Plateau to this day (MacDonald 1966). Around the time block-faulting processes began massive quantities of lava quickly poured from the earth and covered parts of northeastern California, eastern Oregon, eastern Washington, southern Idaho, and northwestern Nevada. These fluid basalts flowed into low lying areas covering hundreds of square miles up to hundreds of feet thick. The Modoc Plateau represents the southern extent of the Columbia flood basalts (Alt and Hyndman 2001). It is generally accepted that the outpouring of lava resulted, in part, from the extensional activities creating the Basin and Range Province (Glen and Ponce 2002). However, other geologists suggest that additional driving forces assisted the flood basalts. One theory suggests that an asteroid or comet struck central eastern Oregon around 17 mya with enough force to create a hole through which the massive flood

basalts erupted (Alt et al. 1988). However, the most accepted theory posits that the hot spot presently under Yellowstone was once under eastern Oregon and caused the flood basalts (Glen and Ponce 2002).

Active faulting and volcanism continued on the Modoc Plateau through the Miocene into the Pliocene. The rain shadow effect, caused by development of the Cascade Range during the Pliocene, created increased seasonality and decreased rainfall east of the Cascades (Detling 1968; Wolfe 1969). Fossil evidence from the Alturas Formation supports the theory of a transition from a warm and moist to a semiarid climate with cold winters and hot summers (Orr and Orr 2002). East of the Cascade and Sierra axis, the rain shadow effect allowed the advance of cold and drought tolerant species into the newly formed Great Basin during the Pliocene. These included *Artemesia*, *Atriplex*, *Festuca*, *Poa*, and *Agropyron* from the north, and *Chrysothamnus*, *Tetradymia* and *Purshia* from the south (Daubenmire 1978).

A very liquid Warner Basalt, flowed from fissures created by crustal extension 5-10mya, and covered a large area just east of Lava Beds (McKee et al. 1983), forming the Devils Garden lava field. Faulting in this region suggests crustal extension of 10-50 km (16-80 mi) on the Modoc Plateau since the Miocene (McKee et al. 1983). Faulting of the Warner Basalt allowed the formation of lakes on the low-lying basin side of some faults (MacDonald 1966). By at least 3 mya the formation of pluvial Lake Modoc had begun. At its largest, probably during the ice ages of the Pleistocene, Lake Modoc consisted of 400 mi (644 km) of shoreline in eight basins (Dicken 1980), and covered the northern portion of Lava Beds.

Core samples taken from Tulelake, CA, directly north of Lava Beds, show pollen and diatom accumulation from the Tule Lake arm of pluvial Lake Modoc, and allows an examination of climate and vegetation changes around 3 mya (Adam et al. 1990). The vegetation surrounding the Tule Lake arm 3 mya was primarily coniferous forest dominated by *Pinus* and *Calocedrus*. Around 2.4 mya the amount of *Artemisia* pollen began to increase. The advancing xerophytic species described by Daubenmire (1978) began to dominate the area near Lava Beds at this time.

The formation of massive pluvial lakes continued throughout the Great Basin during the Pleistocene. There is no evidence that increased rainfall contributed to the formation of lakes. Melting ice and reduced evapotranspiration are most likely responsible (Daubenmire 1978). Glacial and interglacial periods came and went throughout the Pleistocene, causing rearrangements of the already existing floral elements (Heusser and King 1988). Cold tolerant species responded to glacial periods with range expansions; conversely, species adapted to warm dry climates would experience range decreases during glacial periods (Thompson 1988). During interglacial periods the roles would be reversed, with warm dry adapted species expanding their range and cold wet adapted species decreasing their range. Species could also compensate for changing climate with shifts in elevational distributions (Thompson 1988).

Towards the end of the Pleistocene Ice Ages, the Medicine Lake Highlands began to form. About 500,000 years ago the Medicine Lake shield volcano, east of the main arc of the Cascades, became active and lava spilled and/or exploded onto the

western portion of the Modoc Plateau (Donnely-Nolan 1990; Donnely-Nolan FAQ,s). The Medicine Lake volcano has the largest volume of any Cascade volcano. Hovey Point, in the northern portion of Lava Beds NM, has lavas exposed from a Medicine Lake volcanic eruption 450,000 years ago. The lava likely flowed into Tule Lake (Figures 3 and 4). Eruptions and lava flows from the Medicine Lake volcano cover most of Lava Beds NM, except the northern portion of Gillem Bluff, which had been elevated above the basin due to block faulting sometime before 2 mya. One eruptive event dating to 30-40 thousand years ago from Mammoth Crater, in the south west portion of Lava Beds NM, covered 70% of what is now Lava Beds and created many of the monument's lava tubes.

Around 10,000 years ago a warming trend, initiating the Holocene period, ended the Ice Ages and dried the pluvial lakes, including Lake Modoc. The largest remaining lakes which contributed to ancient Lake Modoc are Upper Klamath, Lower Klamath, and Tule Lake. Humans were likely around to see the end of the pluvial lakes (see Modoc History). Floristic elements continued to make range adjustments as climate fluctuated during the Holocene. By 6000 years ago the current physiognomic structure of the Great Basin was established, but the full suite of modern woody dominants would not be present until around 2000 years ago (Thompson 1988).

Two thousand years ago the topography of Lava Beds had not yet taken its modern form. More recent geologic features dominate the landscape at Lava Beds including lava flows, lava tubes and caves, spatter vents, and cinder cones. The most recent eruptive events include the Callahan Lava flow ~1100 years ago, and the Glass

Mountain eruption ~885 years ago. Light colored pumice from the Glass Mountain eruption covers much of the ground at Lava Beds NM. Because of such recent geologic events the soils of Lava Beds are poorly developed, which influences the distribution of plant associations (See Vegetation Zones and Habitat Types).

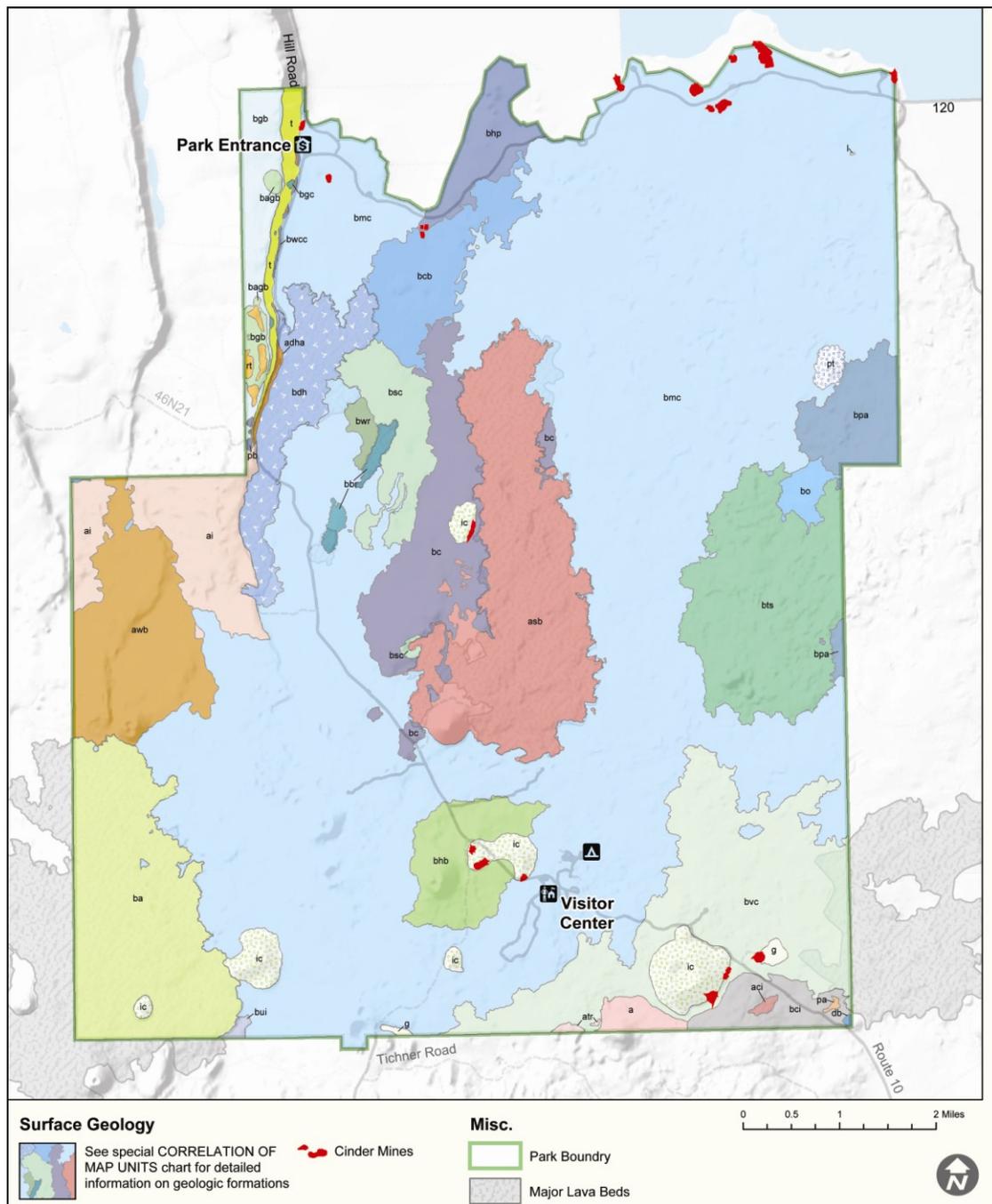


Figure 3. Geologic Map of Lava Beds National Monument. Used with the permission of the NPS.

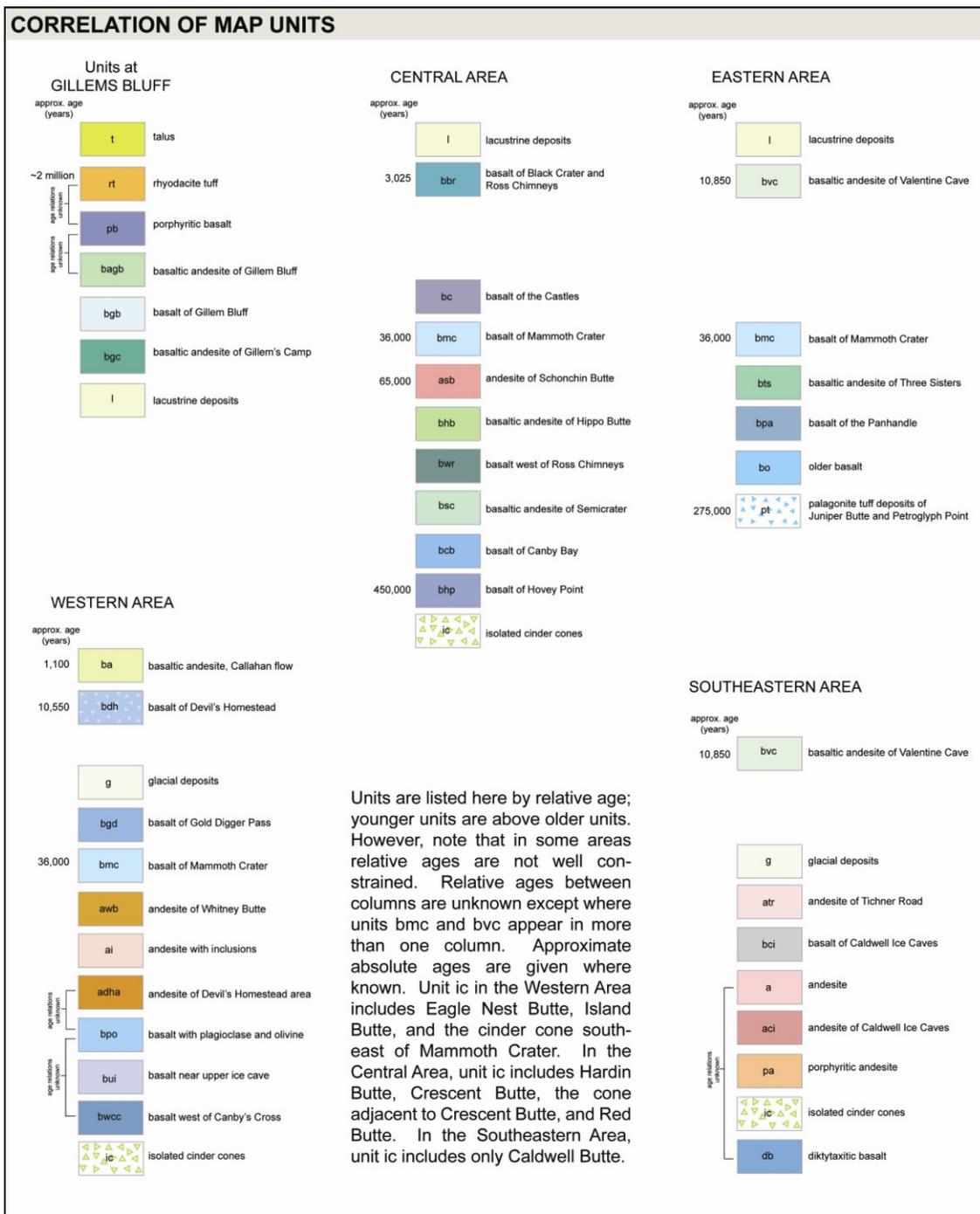


Figure 4. Correlation of map units in Figure 3.

Climate

Lava Beds sits in the rain shadow of the Klamaths/Cascades and precipitation levels are low: averaging 31 cm (12 in) per year. The weather data presented here are from December 1945 to September 2001 at Monument headquarters, located in the southern third of the Monument at 1450 m (4760 ft). Tulelake, CA at 1230 m (4035 ft) receives 25 cm (10 in). Thus, the precipitation gradient from north to south is near 6 cm (2 in). The precipitation gradient from Crescent City, CA (coastal) 170 cm (67 in) to Yreka CA (east of the Klamath Mountains, but west of the Cascades) 43 cm (17 in) and Alturas CA (east of Lava Beds) 32 cm (12 in) shows Lava Beds near the extreme dry side of the Klamath/Cascade rain shadow. Very little precipitation falls during July, August, or September and temperatures are warm (Figure 5); July and August have an average high of 28 °C (82 °F). The record high is 40 °C (102 °F). Summer nights can be cool: the record low for July and August are -3 °C (27 °F) and -1 °C (30 °F), respectively. Winter temperatures average above 5 °C (40 °F) during the day, but have gone into negative numbers at night; both January and February have a record low of -25 °C (13 °F). With the cool temperatures comes 112 cm (44 in) of snow annually.

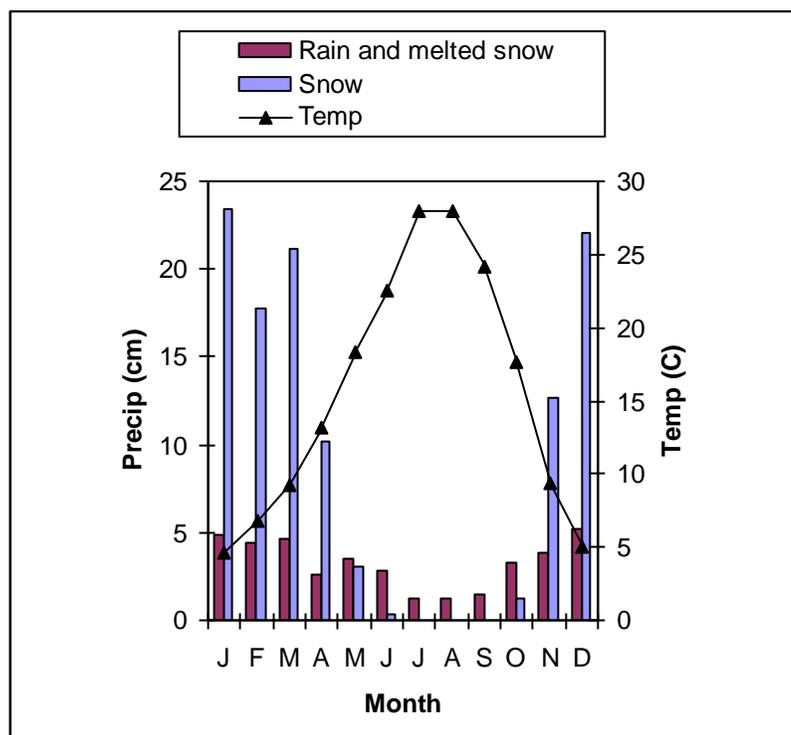


Figure 5. A Climograph of annual precipitation and temperature by month. Data from Lava Beds National Monument Weather Station, from Dec. 1945- Sept. 2001.

Modoc History

The ancient Modoc Indians, or their ancestors, were the first human inhabitants of the area in and around what is now Lava Beds NM. The Modoc homeland extended from the east side of Mt. Shasta, east to Goose Lake near the California Nevada border. They occurred northward to Lost River, and south to Medicine Lake (Faulk and Faulk 1988). A mostly nomadic people, they established winter camps on the shores of lakes and streams. Their seasonal migrations followed game animals or the harvest of native plants (Howe 1979, Faulk and Faulk 1988). Evidence suggests human occupation on the Modoc Plateau by 11,500 years ago (NPS brochure). However, Howe (1979) discusses the first solid evidence of humans near Lava Beds 7,000 years ago.

Limited food availability and harsh winters kept the Modoc population between 1200-2000 individuals during the mid 1800's (Faulk and Faulk 1988). The Modoc meat diet consisted largely of waterfowl; though they also hunted large and small game. Three native plants were eaten regularly by the Modoc: Camas (*Camassia quamash*), Ipo (*Perideridia oregana*), and Wocus (*Nuphar polysepala*) (Howe 1979). Of these three, only Ipo currently occurs at Lava Beds. These foods composed the Modoc diet before the mid 1800's.

European contact with the Modoc homeland date back to the mid 1800's (Dicken 1980; Faulk and Faulk 1988). As the number of settlers passing through the Modoc hunting lands increased, game became disturbed or eliminated, and the remaining animals moved to higher ground. Lack of game created friction between the Modoc and settlers. During the mid 1800's an epidemic, brought by settlers, killed off roughly 1/3rd of the Modoc population, reducing their numbers to approximately 900 (Faulk and Faulk 1988). Skirmishes between the Modoc and settlers caused relations to deteriorate drastically. In 1864 the Modoc signed a treaty relinquishing land rights and agreeing to move to the Klamath Indian Reservation (Odeneal 1966). Conflict between the Klamath and Modoc on the reservation caused some discontented Modocs to return to their homelands in 1870 (Odeneal 1966). They lived there until an attempt to return the Modocs to the reservation ended in gunfire, initiating the Modoc Indian War.

The small group of Modoc, lead by Captain Jack, retreated to a natural fortress of lava tubes, trenches, and rafted lava blocks now named Captain Jacks Stronghold, located at the northern portion of what is now Lava Beds NM (Waters 1981). Intimate

with the lay of the land, the sharp-shooting Modoc transformed the stronghold into a virtual hornets' nest, repelling several Army advances. Growing numbers of Army reinforcements caused Captain Jack and the Modoc to abandon the stronghold (Riddle 1974). After a disagreement among the tribesmen, several Modoc turned themselves over to the US Army, who subsequently hired them as scouts to aid in the capture of Captain Jack. The army, aided by Modoc scouts, succeeds in capturing Captain Jack, who was eventually hanged. The Modoc Indians who had not participated in the war remained on the Klamath Reservation. The Modoc who had participated were relocated to the Modoc Prairie in Oklahoma (Faulk and Faulk 1988).

Land Use History

The draining (or reclamation) of Tule Lake began in 1907 as part of a larger project to facilitate agriculture in the Klamath Basin. By 1910 the Clear Lake Dam prevented Lost River from draining into Tule Lake. The Lost River Diversion Canal, originally constructed 1910-1912, diverts water from Lost River into the Klamath River drainage. With its sole tributary cut off, Tule Lake shrank from 39,676 ha (98,000 acres) in 1907 to 5,263 ha (13,000 acres) by 1964 (Ely 1964). Because Tule Lake is shallow, minor fluctuations in depth result in drastic shoreline changes. The northern portion of Lava Beds was part of Tule Lake in the recent past. The parking lot at Captain Jack's Stronghold was a bay during the Modoc War 1871-1872.

Livestock grazed the Monument from the late 1800's until the 1970's (Brown 2006). The northern portion of the Monument in particular experienced livestock

disturbance. This disturbance likely facilitated the migration of many invasive species into the Monument. Terracing from livestock can still be observed on the north side of Hardin Butte.

Unnatural disturbance can change natural vegetation communities, and so can lack of natural disturbance. With fire suppression following grazing, *Juniperus occidentalis* distribution increased within the Monument. Photographs taken at Gillem's Camp during the Modoc War show almost no junipers growing there. As of 2007 enough junipers had invaded the Gillem's Camp area that the NPS had the trees manually removed, in an attempt to restore a Pre-Modoc War condition (David Larson, Natural Resources Chief, pers. com.). Prescribed burning occurs in the Monument, as a means to maintain natural vegetation communities (Rasmussen et al. 2004), but the junipers near Gillem's Camp were removed manually because disturbance from past grazing has created a delicate situation where more disturbance from fire could facilitate further expansion of non-native species, in particular non-native annuals (David Larson, Natural Resources Chief, pers. com.).

Past Vegetation Studies

Elmer Ivan Applegate (1938), A park ranger at Crater Lake National Park during the early 1900's, developed a key for, the vascular plants of Lava Beds NM. Applegate was a prolific botanist, with several plants named in his honor. For example, *Castilleja applegatei*, a common plant at Lava Beds, is named in his honor (Lang 2003). Robert Charles Wunner (1970) wrote a flora of Lava Beds NM for a Masters Thesis at Humboldt State College. Wunner vouchered several new species for the monument, but

overall added little to Applegate's work. Dean Hamilton Erhard (1979) mapped the habitat types and plant communities of Lava Beds NM for an MS at Oregon State University. He described 38 plant communities and 20 habitat types within the monument. Erhard's work also includes an appendix of all vascular plant species he encountered. Allan Smith (1993) conducted an inventory of ferns in the monument, adding five fern species to the monument list. Miller et al. (2003) examined fire history within the monument, and provided a brief list of the vascular plants encountered.

METHODS

Before I began surveying the vascular plants in the Monument, I obtained a species list from the Lava Beds staff, current as of 2004. I then referenced this list against all past vascular plant lists or studies for the Monument (see Past Vegetation Studies). Species listed in past works, but not listed on the 2004 Lava Beds species list were added to the list. Next, the location(s) of the voucher(s) for each of the species on the list were obtained. The Lava Beds herbarium contains voucher specimens for many of the species occurring on the Monument's vascular plant list, but omissions were found. Most of Robert Wunner's (1970) specimens are at Humboldt State University. Several other voucher specimens were located using the Jepson Interchange (California Consortium of Herbaria) (see Results). I attempted to collect any species lacking a voucher. Species previously undocumented in the monument were collected for vouchering. If a population had less than 20 individuals, a photovoucher was collected rather than a specimen.

Species I collected and could not positively identify were sent to an expert for a determination. Specimens identified by experts include *Camissonia parvula* by Warren L. Wagner, *Polystichum imbricans* subsp. *imbricans* by Alan R. Smith, *Calyptridium rosea* by Walter A. Kelley, *Perideridia oregana* by Stephen Downie, *Linanthus*

septentrionalis by Robert W. Patterson, and *Pinus washoensis* by Frank Callahan. Ron B. Kelley and Guy L. Nesom provided advice on *Cryptantha* and *Erigeron*, respectively, and updated keys.

Due to the size of Lava Beds NM and the limited habitat types (Erhard 1979), I used a variation of the timed meander search described by Goff et al. (1982). Using Erhard's habitat type map and aerial photographs, I developed a habitat type map using ArcGIS (Figure 6). With this map, I located a specific habitat type in the Monument and then walked within the boundary, guided by a GPS. My searches focused on, but were not limited to, microsites within each habitat type. Microclimates were targeted to locate rare or uncommon species, otherwise not found in the more common vegetation types within the Monument. Habitats were surveyed throughout the year (winter excluded), in an attempt to locate species with different phenology. I recorded the name of each vascular plant species encountered. Searches typically lasted until about an hour elapsed without the discovery of a new species for that day. Extensive habitats (i.e. *Artemisia tridentata* communities) were visited more frequently and for longer time periods. For some of the localized habitat types, I examined nearly every square meter.

During the 2007 field season, these protocols were followed in the early season. However, later in the season I was required to locate invasive weed plots for my duties as an NPS seasonal botanist. The location of the plots varied, but occurred mostly in the northern portion of the monument, in the sagebrush habitat type. I felt this allowed the largest habitat type in the monument to be thoroughly surveyed. Late in the summer, in the sagebrush habitat, I encountered *Pseudognaphalium thermale*, a new species for the

monument. A second sighting occurred a few weeks later, again in the sagebrush habitat, but 2 miles north of the first encounter. Observing a species, previously unknown in the monument, twice provides evidence that the northern portion of the Monument was surveyed thoroughly; and satisfies Goff et al.'s (1982) discussion of a plateau on a species/effort curve.

At the end of the 2007 field season species listed on the monument's vascular plant list without a voucher specimen were removed from the species list, and excluded from this flora (see Results).

I developed a dichotomous key to identify all species collected within the monument. The foundation for the key came from Applegate's 1938 work. However, this work is now out-of-date: multiple species and several plant families now found in the monument do not occur within Applegate's flora. Therefore, my synthesis of the key relied upon the Jepson Manual (Hickman 1993) (and the Jepson Online Interchange), Vascular Plants of the Pacific Northwest (Hitchcock et al. 1955-1969), the Intermountain Flora (Cronquist et al. 1972-1997), Flora of Steens Mountain (Mansfield 2000), and a California Flora (Munz and Keck 1959).

RESULTS

The Lava Beds National Monument current vascular plant species list stands at 369 species (Table 1), 19 of those are subspecies or varieties. Applegate (1938) reported 192 species, and the monument list in 2004 included ~280 species. The Asteraceae is the largest family represented, followed by the Poaceae (Table 2).

Table 1. Summary of vascular plants at Lava Beds NM.

Group	Families	Genera	Species
Pteridophyta	3	7	10
Coniferophyta	2	4	8
Magnoliophyta	47	197	351
Total	52	208	369

Table 2. Largest vascular plant families at Lava Beds NM.

Family	Genera	Species
Asteraceae	43	70
Poaceae	20	45
Brassicaceae	14	21
Rosaceae	10	15
Polemoniaceae	8	14
Scrophulariaceae	7	19

Seventy (19%) of the vascular plants at Lava Beds are non-native. Table 3 lists these species and their invasive status. Not all the non-native species listed in Table 3 currently occur at Lava Beds (see Discussion).

Table 3. List of non-native species at Lava Beds National Monument.. TNC= listed as invasive by The Nature Conservancy; Noxious= listed as Noxious by Hickman et al. (1993); Cal-IPC= listed as invasive by California Invasive Plant Council

Species Name	Common Name	Status
<i>Agropyron cristatum</i>	crested wheatgrass	TNC
<i>Agropyron desertorum</i>	desert wheatgrass	TNC
<i>Alyssum alyssoides</i>	pale madwort	
<i>Alyssum desertorum</i>	desert madwort	
<i>Alyssum minus</i>	alyssum	
<i>Amaranthus albus</i>	prostrate pigweed	TNC
<i>Amaranthus retroflexus</i>	redroot amaranth	
<i>Anthemis cotula</i>	stinking chamomile	TNC, Cal-IPC
<i>Atriplex rosea</i>	tumbling saltweed	
<i>Avena fatua</i>	wild oat	TNC, Cal-IPC
<i>Bromus inermis</i> subsp. <i>inermis</i>	smooth brome	TNC
<i>Bromus japonicus</i>	Japanese brome	TNC, Cal-IPC
<i>Bromus secalinus</i>	rye brome	

Table 3. Cont.

Species Name	Common Name	Status
<i>Bromus tectorum</i>	cheatgrass	TNC, Cal-IPC
<i>Camelina microcarpa</i>	littlepod false flax	
<i>Cardaria pubescens</i>	hairy whitetop	NOXIOUS, TNC, Cal-IPC
<i>Centaurea solstitialis</i>	yellow starthistle	TNC, Cal-IPC
<i>Chenopodium album</i>	lambsquarters	TNC
<i>Cirsium arvense</i>	Canada thistle	Noxious, TNC, Cal-IPC
<i>Cirsium vulgare</i>	bull thistle	TNC, Cal-IPC
<i>Convolvulus arvensis</i>	field bindweed	Noxious, TNC, Cal-IPC
<i>Descurainia sophia</i>	sophia herb, flix weed	Cal-IPC
<i>Dysphania ambrosioides</i>	Mexican tea	
<i>Dysphania botrys</i>	Jerusalem oak goosefoot	
<i>Elytrigia intermedia</i>	intermediate wheatgrass	
<i>Elytrigia pontica</i>	tall wheatgrass	
<i>Elytrigia repens</i>	quackgrass	Noxious, TNC
<i>Eragrostis cilianensis</i>	stinkgrass	
<i>Erodium cicutarium</i>	redstem stork's bill	TNC, Cal-IPC
<i>Holosteum umbellatum</i>	jagged chickweed	
<i>Hordeum murinum</i>	mouse barely	TNC, Cal-IPC
<i>Hordeum vulgare</i>	common barley	
<i>Isatis tinctoria</i>	Dyer's woad	TNC, Cal-IPC
<i>Kochia scoparia</i>	burning bush	TNC, Cal-IPC
<i>Lactuca serriola</i>	prickly lettuce	TNC, Cal-IPC
<i>Lamium amplexicaule</i>	henbit deadnettle	
<i>Lepidium latifolium</i>	perennial pepperweed	TNC, Cal-IPC
<i>Lepidium perfoliatum</i>	clasping pepperweed	
<i>Linaria genistifolia</i> subsp. <i>dalmatica</i>	dalmation toadflax	Noxious, TNC, Cal-IPC
<i>Lycium barbarum</i>	matrimony vine	
<i>Malva neglecta</i>	common mallow	
<i>Marrubium vulgare</i>	horehound	TNC, Cal-IPC
<i>Matricaria matricarioides</i>	disk mayweed	

Table 3. Cont.

Species Name	Common Name	Status
<i>Melilotus alba</i>	white sweetclover	TNC
<i>Melilotus officinalis</i>	yellow sweetclover	TNC, Cal-IPC
<i>Myosotis micrantha</i>	strict forget-me-not	
<i>Onopordum acanthium</i> subsp. <i>acanthium</i>	Scotch thistle	TNC, Cal-IPC
<i>Phleum pratense</i>	timothy	TNC
<i>Poa bulbosa</i>	bulbous bluegrass	TNC
<i>Poa compressa</i>	Canada bluegrass	TNC
<i>Poa pratensis</i>	Kentucky bluegrass	TNC, Cal-IPC
<i>Polygonum aviculare</i> subsp. <i>aviculare</i>	prostrate knotweed	
<i>Ranunculus testiculatus</i>	curvseed butterwort	
<i>Rumex crispus</i>	cury dock	TNC, Cal-IPC
<i>Salsola tragus</i>	prickly Russian thistle	Noxious, TNC, Cal-IPC
<i>Secale cereale</i>	cereal rye	
<i>Sisymbrium altissimum</i>	tall tumbled mustard	
<i>Solanum physalifolium</i> var. <i>nitidibaccatum</i>	hoe nightshade	
<i>Solanum rostratum</i>	buffalobur nightshade	
<i>Solanum triflorum</i>	cutleaf nightshade	
<i>Sonchus asper</i>	spiny sowthistle	Cal-IPC
<i>Taeniatherum caput-medusa</i>	medusahead	Noxious, TNC, Cal-IPC
<i>Taraxacum officinale</i>	common dandelion	Cal-IPC
<i>Thlaspi arvense</i>	field pennycress	
<i>Torilis arvensis</i>	spreading hedgeparsley	Cal-IPC
<i>Tragopogon dubius</i>	yellow salsify	TNC, Cal-IPC
<i>Verbascum blattaria</i>	moth mullein	TNC
<i>Verbascum thapsus</i>	common mullein	TNC, Cal-IPC
<i>Vulpia bromoides</i>	brome fescue	Cal-IPC
<i>Vulpia myuros</i>	rat-tail fescue	Cal-IPC

During this project I vouchered 103 species; 56 of them were new to the monument's vascular plant list (Table 4.). I was also able to locate 31 plant vouchers from Lava Beds now housed at herbaria throughout California (Table 4); most of these were new to the monument list. In total, 91 species (including subspecies and varieties) were added to the monument's vascular plant list (Table 4).

Eight plants from the Monument, or just outside the Monument's boundary, are listed by the California Native Plant Society (CNPS) as species of concern (Table 5). Two of these species have never been collected within the monument: *Hulsea nana* has been collected from Cinder Butte, just south of the Monument, and *Iliamna bakeri* has been collected just south of the Monument. The other six have all been collected within the Monument. Elmer Applegate collected *Penstemon cinereus* from Lava Beds, but the Jepson Manual currently treats the species as a minor variant of *Penstemon humilis* var. *humilis*. I follow that treatment, and consider *P. cinereus* a synonym of *P. humilis* var. *humilis*. Of the eight plants listed in Table 5, only five are currently found in the Monument.

A list of species excluded from the Lava Beds flora and the reasons for their exclusion are found in Table 6. Species I never observed in the Monument, but were vouchered during past studies and are included in the flora are listed in Table 7.

Table 4. Summary of new species and vouchers. Herbaria housing vouchers are also listed: LABE=Lava Beds, HSU=Humboldt State University, UC-Jep= Jepson Herbarium, RSA= Rancho Santa Ana Botanical Garden, SJSU= San Jose Sate University, SBBG= Santa Barbara Botanical Garden, CHSU= Chico State University.

Species Name	First Voucher for Monument	New to Monument List	First Collector: Vouchered During this Study
<i>Achnatherum hymenoides</i>	n	n	Erhard; 1978; n.s. (LABE): S.B.Smith; 2005; 1 (LABE)
<i>Achnatherum thurberianum</i>	y	n	S.B.Smith; 2007; 2 (LABE)
<i>Agoseris glauca</i> var. <i>laciniata</i>	n	n	Erhard; 1978; n.s. (LABE): S.B.Smith; 2006; 3 (LABE)
<i>Agoseris grandiflora</i>	n	n	Erhard; 1978; n.s. (LABE): S.B.Smith; 2006; 4 (LABE)
<i>Agoseris heterophylla</i>	y	y	S.B.Smith; 2006; 42 (LABE)
<i>Agoseris retrorsa</i>	y	y	S.B.Smith; 2006; 43 (LABE)
<i>Agropyron desertorum</i>	y	y	Wunner; 1965; 386 (HSU)
<i>Alyssum alyssoides</i>	y	n	S.B.Smith; 2007; 5 (LABE)
<i>Alyssum desertorum</i>	y	y	S.B.Smith; 2007; 44 (LABE)
<i>Alyssum minus</i> var. <i>micranthum</i>	y	y	S.B.Smith; 2007; 45 (LABE)
<i>Amaranthus albus</i>	y	y	Wunner; 1965; 490 (HSU): S.B. Smith; 2006: 98 (LABE)
<i>Amelanchier alnifolia</i> var. <i>semiintegrifolia</i>	y	n	S.B.Smith; 2006; 6 (LABE)
<i>Amsinckia menziesii</i> var. <i>intermedia</i>	y	y	S.B.Smith; 2007; 46 (LABE)
<i>Antennaria dimorpha</i>	n	n	Paetzel; 1989; n.s. (LABE): S.B.Smith; 2006; 7 (LABE)
<i>Apocynum androsaemifolium</i>	y	y	Erhard as <i>A. sibiricum</i> ; 1978; n.s. (LABE)
<i>Arabis sparsiflora</i> var. <i>arcuata</i>	y	y	M.H. Mitchell; 1936; 20 (UC-Jep)
<i>Arenaria kingii</i> var. <i>glabrescens</i>	y	y	S.B.Smith; 2007; 47 (LABE)
<i>Asclepias cordifolia</i>	y	y	S.B. Smith; 2008; 101 (LABE)
<i>Astragalus lentiginosus</i> var. <i>salinus</i>	y	y	Alice Eastwood, J. T. Howell; 1940; 8271 (RSA)

Table 4. Cont.

Species Name	First Voucher for Monument	New to Monument List	First Collector: Vouchered During this Study
<i>Astragalus obscurus</i>	n	n	Erhard; 1978; n.s. (LABE): S.B.Smith; 2006; 8 (LABE)
<i>Avena fatua</i>	y	y	S.B. Smith; 2006; 48 (LABE)
<i>Bidens frondosa</i>	y	y	Wunner; 1965; n.s. (HSU)
<i>Bromus carinatus</i> var. <i>carinatus</i>	n	n	Applegate; 1935; 9480 (LABE): S.B.Smith; 2006; 9 (LABE)
<i>Bromus inermis</i> subsp. <i>inermis</i>	y	y	Wunner; 1965; 419 (HSU): S.B. Smith; 2007; 49 (LABE)
<i>Bromus japonicus</i>	y	y	S.B.Smith; 2006; 50 (LABE)
<i>Calyptridium roseum</i>	y	y	S.B.Smith; 2006; 51 (LABE)
<i>Camelina microcarpa</i>	y	y	S.B.Smith; 2006; 52 (LABE)
<i>Camissonia parvula</i>	y	y	S.B.Smith; 2006; 53 (LABE)
<i>Cardaria pubescens</i>	y	y	S.B. Smith; 2008; 102 (LABE)
<i>Carex douglasii</i>	y	y	Wunner; 1965; 462 (HSU)
<i>Chamaesaracha nana</i>	y	y	S.B. Smith; 2006; 54 (LABE)
<i>Chamaesyce glyptosperma</i>	y	y	Wunner; 1965; 435 (HSU)
<i>Chamomilla suaveolens</i>	y	y	Wunner as <i>Matricaria matricariodes</i> ; 1965; 309 (HSU)
<i>Chenopodium ambrosioides</i>	y	y	C. W. Sharsmith; 1992; 9243 (SJSU)
<i>Chenopodium botrys</i>	y	y	Wunner; 1965; 496 (HSU): S.B. Smith; 2006; 55 (LABE)
<i>Chenopodium leptophyllum</i>	n	n	Applegate; 1935; 10521, 10529, 11060 (LABE): S.B.Smith; 2006; 10 (LABE)
<i>Chrysothamnus humilis</i>	y	y	Dean Wm. Taylor, Glenn L. Clifton, and R. Doug Stone; 1987; 9253 (UC-Jep)
<i>Cirsium arvense</i>	y	n	S.B.Smith; 2007; 11 (LABE)
<i>Cirsium cymosum</i>	y	y	Wunner; 1965; 308 (HSU)
<i>Claytonia rubra</i> subsp. <i>rubra</i>	n	n	Applegate as <i>Claytonia perfoliata</i> ; 1935; 9460 (LABE): S.B.Smith; 2007; 12 (LABE)
<i>Collomia linearis</i>	y	y	Wunner; 1965; 78 (HSU)

Table 4. Cont.

Species Name	First Voucher for Monument	New to Monument List	First Collector: Vouchered During this Study
<i>Convolvulus arvensis</i>	n	n	Erhard; 1978; n.s. (LABE): S.B.Smith 2007; 13 (LABE)
<i>Crepis bakeri</i>	y	y	S.B.Smith; 2007; 56 (LABE)
<i>Crepis intermedia</i>	y	y	Wunner; 1965; 258 (HSU)
<i>Crepis modocensis</i>	y	y	S.B.Smith; 2007; 57 (LABE)
<i>Crocidium multicaule</i>	n	y	Applegate as <i>Lastenia chrysostoma</i> ; 1936; 10316, 10320 (LABE): S.B. Smith; 2007; 58 (LABE)
<i>Cryptantha simulans</i>	y	y	Smith; 2007; photo voucher
<i>Cryptantha subretusa</i>	y	n	Applegate; 1935; 9486 (UC-Jep)
<i>Elymus elymoides</i> subsp. <i>brevifolius</i>	y	y	S.B.Smith; 2007; 59 (LABE)
<i>Elymus elymoides</i> subsp. <i>hordeoides</i>	y	y	S.B.Smith; 2007; 60 (LABE)
<i>Elymus lanceolatus</i> subsp. <i>lanceolatus</i>	n	n	Erhard as <i>Agropyron dasystachyum</i> ; 1978; n.s. (LABE): S.B.Smith; 2006; 15 (LABE)
<i>Elymus multisetus</i>	y	y	Wunner as <i>Sitanion jubatum</i> ; 1965; 334 (HSU): S.B. Smith; 2007; 61 (LABE)
<i>Elytrigia intermedia</i> subsp. <i>intermedia</i>	y	y	S.B. Smith; 2007; 62 (LABE)
<i>Elytrigia pontica</i> subsp. <i>pontica</i>	y	y	S.B.Smith; 2007; 63 (LABE)
<i>Elytrigia repens</i>	y	n	S.B.Smith; 2007; 16 (LABE)
<i>Epilobium angustifolium</i>	y	n	S.B.Smith; 2007; 17 (LABE)
<i>Eragrostis cilianensis</i>	y	y	S.B.Smith; 2006; 64 (LABE)
<i>Eremocarpus setigerus</i>	y	y	S.B.Smith; 2007; 65 (LABE)
<i>Erigeron aphanactis</i> var. <i>aphanactis</i>	y	n	S.B.Smith; 2007; 18 (LABE)

Table 4. Cont.

Species Name	First Voucher for Monument	New to Monument List	First Collector: Vouchered During this Study
<i>Erigeron bloomeri</i> var. <i>bloomeri</i>	y	y	S.B.Smith; 2006; 66 (LABE)
<i>Erigeron chrysopsidis</i> subsp. <i>austinae</i>	n	n	Applegate as <i>Erigeron chrysopsidis</i> var. <i>austinae</i> ; 1935; 9469 (LABE): S.B. Smith as <i>Erigeron austinae</i> ; 2006; 19 (LABE)
<i>Erigeron inornatus</i> var. <i>inornatus</i>	y	y	S.B.Smith; 2007; 67 (LABE)
<i>Erigeron linearis</i>	n	n	Applegate; 1935; 9494 (LABE): S.B.Smith; 2007; 20 (LABE)
<i>Eriogonum microthecum</i> var. <i>ambiguum</i>	y	y	Dean Wm. Taylor, Glenn L. Clifton, R. Doug Stone; 1987; 9254 (UC-Jep)
<i>Eriogonum strictum</i> var. <i>anserinum</i>	y	y	Dean Wm. Taylor; 1987; 9255 (UC-Jep)
<i>Eriogonum umbellatum</i> var. <i>nevadense</i>	y	y	Dean Wm. Taylor, Glenn L. Clifton, R. Doug Stone; 1987; 9265 (UC-Jep)
<i>Festuca rubra</i>	y	y	C. Bornstein; 1996; n.s. (SBBG)
<i>Gilia inconspicua</i>	y	y	S.B.Smith; 2006; 68 (LABE)
<i>Hackelia cusickii</i>	n	n	Applegate; 1936; 10330,10345 (LABE): S.B. Smith; 2006; 21 (LABE)
<i>Hesperolinon micranthum</i>	n	n	Erhard; 1978; n.s. (LABE): S.B.Smith; 2006; 22 (LABE)
<i>Hordeum murinum</i> subsp. <i>glaucum</i>	y	y	S.B.Smith; 2007; 70 (LABE)
<i>Iva axillaris</i> subsp. <i>robustior</i>	n	n	Erhard; 1978; n.s. (LABE): S.B.Smith; 2006; 23 (LABE)
<i>Kelloggia galioides</i>	y	y	S.B.Smith; 2006; 71 (LABE)
<i>Lactuca tatarica</i> subsp. <i>pulchella</i>	y	y	S.B.Smith; 2006; 72 (LABE)
<i>Lamium amplexicaule</i>	y	y	S.B.Smith; 2007; 73 (LABE)
<i>Lepidium latifolium</i>	y	n	S.B.Smith; 2007; 24 (LABE)

Table 4. Cont.

Species Name	First Voucher for Monument	New to Monument List	First Collector: Vouchered During this Study
<i>Lepidium perfoliatum</i>	n	n	Erhard; 1978; n.s. (LABE): S.B.Smith; 2006; 25 (LABE)
<i>Lewisia rediviva</i>	y	n	S.B.Smith; 2005; 26 (LABE)
<i>Leymus cinereus</i>	n	n	Applegate as <i>Elymus condensatus</i> ; 1935; 9302 (LABE): S.B.Smith; 2006; 27 (LABE)
<i>Linaria genistifolia</i> subsp. <i>dalmatica</i>	y	y	Lava Beds Geodatabase records
<i>Lithophragma glabrum</i>	y	y	S.B.Smith; 2006; 74 (LABE)
<i>Lomatium macrocarpum</i>	y	y	S.B.Smith; 2006; 75 (LABE)
<i>Lomatium vaginatum</i>	y	y	S.B.Smith; 2007; 99 (LABE)
<i>Lycium barbarum</i>	y	y	Wunner as <i>L. halimifolium</i> ; 1965; 380 (HSU)
<i>Melilotus alba</i>	n	n	Brown; 1959; n.s. (LABE): S.B.Smith; 2006; 28 (LABE)
<i>Melilotus officinalis</i>	n	n	Erhard; 1978; n.s. (LABE): S.B.Smith; 2006; 29 (LABE)
<i>Mentzelia congesta</i>	y	y	Wunner; 1965; 52 (HSU)
<i>Mentzelia montana</i>	y	y	M. H. Mitchell; 1936; 51 (UC-Jep)
<i>Mimulus suksdorfii</i>	y	y	Wunner; 1965; 306 (HSU)
<i>Monardella glauca</i>	y	y	Dean Wm. Taylor, Glenn L. Clifton, R. Doug Stone; 1987; 9264 (UC-Jep)
<i>Monardella odoratissima</i> subsp. <i>pallida</i>	n	n	Applegate; 1936; 10012 (LABE): S.B.Smith; 2006; 30 (LABE)
<i>Muhlenbergia minutissima</i>	y	y	S.B.Smith; 2007; 76 (LABE)
<i>Myosotis micrantha</i>	y	y	Morse; 2006; n.s. (LABE): S.B. Smith; 2007; 77 (LABE)
<i>Onopordum acanthium</i> subsp. <i>acanthium</i>	y	y	S.B.Smith; 2007; 79 (LABE)
<i>Pascopyrum smithii</i>	y	y	S.B.Smith; 2007; 80 (LABE)

Table 4. Cont.

Species Name	First Voucher for Monument	New to Monument List	First Collector: Vouchered During this Study
<i>Penstemon deustus</i> var. <i>suffrutescens</i>	y	n	Rose; 1940; 40586 (UC-Jep)
<i>Perideridia oregana</i>	y	y	S.B.Smith; 2007; 81 (LABE)
<i>Phacelia heterophylla</i> subsp. <i>virgata</i>	n	n	Erhard; No Date; n.s. (LABE): S.B.Smith; 2006; 31 (LABE)
<i>Phacelia mutabilis</i>	y	y	S.B. Smith; 2008; 103 (LABE)
<i>Phleum pratense</i>	y	y	S.B.Smith; 2007; 82 (LABE)
<i>Phlox diffusa</i>	y	y	S.B.Smith; 2006; 83 (LABE)
<i>Piperia unalascensis</i>	y	y	S.B.Smith; 2006; 84 (LABE)
<i>Pinus washoensis</i>	y	y	S.B. Smith; 2007; 100 (LABE)
<i>Poa bulbosa</i>	y	y	S.B.Smith; 2007; 85 (LABE)
<i>Poa compressa</i>	y	y	Wunner; 1965; 80 (HSU)
<i>Poa pratensis</i>	y	n	S.B.Smith; 2007; 32 (LABE)
<i>Polygonum aviculare</i>	y	y	S.B.Smith; 2007; 86 (LABE)
<i>Polystichum imbricans</i> subsp. <i>imbricans</i>	y	y	S.B.Smith; 2006; 87 (LABE)
<i>Potentilla biennis</i>	n	n	Erhard; 1977; n.s. (LABE): S.B.Smith; 2006; 33 (LABE)
<i>Potentilla glandulosa</i> subsp. <i>globosa</i>	n	n	Applegate as <i>Potentilla glandulosa</i> ; 1935; 9357 (LABE): S.B.Smith; 2006; 34 (LABE)
<i>Pseudognaphalium thermale</i>	y	y	S.B.Smith; 2007; 88 (LABE)
<i>Pterospora andromedea</i>	y	y	Erhard; 1977; n.s. (LABE)
<i>Ranunculus testiculatus</i>	y	n	S.B.Smith; 2007; 35 (LABE)
<i>Rhamnus rubra</i>	y	y	S.B.Smith; 2006; 89 (LABE)
<i>Rubus leucodermis</i>	y	y	Wunner; 1965; 289 (HSU)

Table 4. Cont.

Species Name	First Voucher for Monument	New to Monument List	First Collector: Vouchered During this Study
<i>Rumex crispus</i>	y	y	S.B.Smith; 2006; 90 (LABE)
<i>Rumex salicifolius</i> var. <i>triangulivalvis</i>	n	n	S.B.Smith; 2006; 36 (LABE)
<i>Salsola tragus</i>	n	n	Erhard as <i>Salsola kali</i> ; 1977; n.s. (LABE): S.B.Smith; 2006; 37 (LABE)
<i>Salvia dorrii</i> var. <i>dorrii</i>	y	y	M. H. Mitchell; 1936; 45 (UC-Jep)
<i>Salvia sonomensis</i>	y	y	K. R. Stern, D. B. Joley, J. G. Geschke; 1974; 5832 (CHSC)
<i>Scrophularia desertorum</i>	y	y	K. R. Stern, D. B. Joley, J. G. Geschke; 1974; 5832 (CHSC)
<i>Senecio integerrimus</i> var. <i>exaltatus</i>	y	y	S.B.Smith; 2006; 91 (LABE)
<i>Solanum rostratum</i>	y	y	S.B.Smith; 2007; 92 (LABE)
<i>Solanum triflorum</i>	y	y	S.B.Smith; 2007; 93 (LABE)
<i>Symphoricarpos rotundifolius</i> var. <i>rotundifolius</i>	n	n	Applgate as <i>Symphoricarpos vaccinioides</i> ; 1935; 9482 (LABE): S.B.Smith; 2006; 38 (LABE)
<i>Taraxacum officinale</i>	y	y	S.B.Smith; 2007; 94 (LABE)
<i>Thlaspi arvense</i>	y	n	S.B.Smith; 2006; 39 (LABE)
<i>Thysanocarpus curvipes</i>	y	y	S.B.Smith; 2006; 95 (LABE)
<i>Torilis arvensis</i>	y	y	S.B.Smith; 2006; 96 (LABE)
<i>Triodanis perfoliata</i>	y	y	S.B.Smith; 2006; 69 (LABE)
<i>Vulpia microstachys</i> var. <i>pauciflora</i>	y	n	S.B.Smith; 2007; 41 (LABE)
<i>Vulpia myuros</i> var. <i>myuros</i>	y	y	S.B.Smith; 2006; 97 (LABE)

Table 5. Rare plants listed by the California Native Plant Society (CNPS) from Lava Beds NM or the immediate vicinity.

Global Ranking

The global rank (G-rank) is a reflection of the overall condition of an element throughout its global range.

Species or Community Level

G1 = Less than 6 viable element occurrences (EOs) OR less than 1,000 individuals OR less than 2,000 acres; G2 = 6-20 EOs OR 1,000-3,000 individuals OR 2,000-10,000 acres; G3 = 21-80 EOs OR 3,000-10,000 individuals OR 10,000-50,000 acres; G4 = Apparently secure; this rank is clearly lower than G3 but factors exist to cause some concern; i.e., there is some threat, or somewhat narrow habitat; G5 = Population or stand demonstrably secure to ineradicable due to being commonly found in the world.

Subspecies Level

Subspecies receive a T-rank attached to the G-rank. With the subspecies, the G-rank reflects the condition of the entire species, whereas the T-rank reflects the global situation of just the subspecies or variety. For example: *Salvia dorrii* var. *incana*. This plant is ranked G5T5. The G-rank refers to the whole species range i.e., *Salvia dorrii*. The T-rank refers only to the global condition of var. *incana*.

State Ranking

The state rank (S-rank) is assigned much the same way as the global rank, except state ranks in California often also contain a threat designation attached to the S-rank.

S1 = Less than 6 EOs OR less than 1,000 individuals OR less than 2,000 acres; S1.1 = very threatened; S1.2 = threatened; S1.3 = no current threats known; S2 = 6-20 EOs OR 1,000-3,000 individuals OR 2,000-10,000 acres; S2.1 = very threatened; S2.2 = threatened; S2.3 = no current threats known; S3 = 21-80 EOs or 3,000-10,000 individuals OR 10,000-50,000 acres; S3.1 = very threatened; S3.2 = threatened; S3.3 = no current threats known; S4 = Apparently secure within California; this rank is clearly lower than S3 but factors exist to cause some concern; i.e. there is some threat, or somewhat narrow habitat. NO THREAT RANK; S5 = Demonstrably secure to ineradicable in California. NO THREAT RANK.

CNPS Ranking

1A = Presumed Extinct in CA; 1B = Rare or Endangered in CA and elsewhere; 2 = Rare and Endangered in CA, more common elsewhere; 3 = Need more information; 4 = Plants of Limited Distribution. The extension is added to the List rank following a decimal point: .1 = Seriously endangered in CA; .2 = Fairly endangered in CA; .3 = Not very endangered in CA.

Species Name	Global Rank	Sate Rank	CNPS List	Vouchered from monument
<i>Dimeresia howellii</i>	G4?	S2.3	2.3	Y
<i>Erigeron elegantulus</i>	G4G5	S3.3	4.3	Y
<i>Hackelia cusickii</i>	G5?	S3.3	4.3	Y
<i>Hulsea nana</i>	G4	S2.3	2.3	N
<i>Iliamna bakeri</i>	G4	S3.2	4.2	N
<i>Penstemon cinereus</i>	G4	S3.3	4.3	Y
<i>Rorippa columbiae</i>	G3	S1.1	1B.2	Y
<i>Salvia dorrii</i> var. <i>incana</i>	G5T5	S1S2	3	Y

Table 6. Species excluded from the Flora of Lava Beds. Herbaria housing vouchers are also listed: LABE=Lava Beds, HSU=Humboldt State University, RSA= Rancho Santa Ana Botanical Garden, UC-Jep= Jepson Herbarium

Name	Source	Reason for exclusion and notes
<i>Amaranthus hybridus</i>	Collector Unknown; 1940; n.s (LABE)	Misidentified.
<i>Ambrosia psilostachya</i>	LABE plant list	No specimen; no collections in Siskiyou or Modoc Co.
<i>Arabis drummondii</i>	Miller; 2003; no voucher	No specimen; Calcareous rock species; no collections from Siskiyou Co.
<i>Artemisia cana</i>	LABE plant list	No specimen; no collections from Siskiyou Co; Habitat: gravely soils, meadows, streambanks, no suitable habitat in the monument.
<i>Astragalus cusikii</i>	Miller; 2003; no voucher	No specimen; not in Hickman (1993); PLANTS database lists it as a WA, OR, ID species.
<i>Astragalus sinuatus</i>	Collector Unknown; 1940; n.s (LABE)	PLANTS database lists it as a WA species.
<i>Atriplex argentea</i>	Applegate; 1938; no voucher;	No specimen; Applegate noted it growing in "low ground along Tulelake"; no collections in Siskiyou Co.
<i>Camassia quamash</i>	LABE plant list	No specimen.
<i>Cardaria</i> sp.	Smith; 2008; no voucher	Occurs just out of monument to the north.
<i>Cercocarpus betuloides</i>	Erhard as <i>Cercocarpus montanus</i> ; 1978; n.s. (LABE)	Collection out of monument.
<i>Clarkia purpurea</i>	Applegate as <i>Clarkia purpurea</i> ssp. <i>quadrivulnera</i> ; 1935; 9438 (LABE)	Misidentified.
<i>Crataegus douglasii</i>	Wunner; 1967; no specimen	No specimen; no collections in Siskiyou Co.
<i>Crepis pleurocarpa</i>	Wunner; 1967; no specimen	No specimen.
<i>Cryptantha celosioides</i>	Erhard; no date; n.s no specimen?(LABE)	Ron Kelley identified this population as <i>C. subretusa</i> .

Table 6. Cont.

Name	Source	Reason for exclusion and notes
<i>Delphinium depauperatum</i>	Applegate; 1938; no voucher	Applegate expected it along southern boundary, a species of moist meadows, no suitable habitat in the monument.
<i>Distichlis spicata</i> var. <i>stricta</i>	Wunner; 1965; 339 (HSU)	Out of monument, collected from the east side of Petroglyph Point.
<i>Dryopteris austriaca</i>	Erhard; 1979; no voucher	No specimen, an eastern US species.
<i>Elodea</i> sp.	LABE plant list	No specimens; no suitable habitat in monument
<i>Eriogonum latifolium</i>	Applegate; 1935; 9534 (LABE)	Misidentified; a western California species; no collections from Siskiyou Co.
<i>Festuca californica</i>	LABE plant list	No specimens.
<i>Halogeton glomeratus</i> var. <i>tenuifolia</i>	Wunner; 1967; no specimen	No specimen; no collections from Siskiyou Co.
<i>Hesperocnide tenella</i>	LABE plant list	No specimen; a coastal and southern California species.
<i>Heuchera cylindrica</i> var. <i>ovalifolia</i>	Dean Wm. Taylor, Glenn L. Clifton, R. Doug Stone; 1987; 9266B (UC-Jep)	Variety not recognized in Hickman (1993).
<i>Hulsea nana</i>	Erhard; 1977; n.s. (LABE)	Out of monument, collected from Cinder Butte.
<i>Iliamna bakeri</i>	Wunner; 1965; 432 (HSU)	Out of monument, collected just south of monument.
<i>Ipomopsis congesta</i> subsp. <i>montana</i>	Paetzel; 1989; n.s. (LABE)	Misidentified.
<i>Lastenia californica</i>	Applegate as <i>Lastenia chrysostoma</i> ; 1936; 10316, 10320 (LABE)	Misidentified.

Table 6. Cont.

Name	Source	Reason for exclusion and notes
<i>Lathyrus</i> sp.	Smith; 2008; no voucher	No specimen; I observed this genus in 2006, but was unable to ID to species, returning to the site the following year it was not observed.
<i>Lepidium densiflorum</i>	Smith; 2008; no voucher	Occurs just out of monument to the north.
<i>Leymus condensatus</i>	Applegate as <i>Elymus condensatus</i> ; 1935; 9302 (LABE)	Misidentified; a southern California species
<i>Linanthus bicolor</i>	LABE plant list	No specimen; a central California species; no collections from Siskiyou Co.
<i>Linanthus ciliatus</i>	LABE plant list	<i>L. ciliatus</i> could occur at Lava Beds, several collections from Siskiyou Co.
<i>Lithospermum ruderale</i>	Miller; 2003; no voucher	No specimen; could occur at Lava Beds, several collections from Siskiyou Co.
<i>Lomatium canbyi</i>	Wunner; 1967; no specimen	No specimen; No collections from Siskiyou Co.
<i>Lomatium marginatum</i>	Applegate; 1935; 9290 (LABE)	Misidentified; leaf segments few, large; specimen is <i>L. triternatum</i>
<i>Lupinus argenteus</i>	Applegate; 1936; 10300 (LABE)	No specimen; species could occur at LABE, and is mentioned by Applegate as <i>L. corymbosus</i> near Petroglyph Pt. and the peninsula in his flora.
<i>Madia exigua</i>	Wunner; 1967; no specimen	No specimen.
<i>Montia linearis</i>	Applegate; 1937; 11091 (LABE)	Out of park, collected 1 mi west of Gillem Bluff; a species of moist grasslands, scrub, open woodlands, fields, no suitable habitat in monument.
<i>Nasturtium curvisiliqua</i>	LABE plant list	See <i>Rorippa</i> sp.
<i>Nothocalais alpestris</i>	Applegate; 1936; 10225 (LABE)	Misidentified.

Table 6. Cont.

Name	Source	Reason for exclusion and notes
<i>Parrya menziesii</i>	Applegate; 1936; no voucher	Applegate listed this species from the top of Fleeners Ranch. He was referring to <i>Phoenicaulis cheiranthoides</i>
<i>Penstemon cinereus</i>	Applegate; 1935; 9268 (RSA)	Hickman (1993) treats it as a minor variant of <i>P. humilis</i> var. <i>humilis</i>
<i>Penstemon davidsonii</i>	Applegate; 1935; 9513 (LABE)	Out of park, collected from the west edge of Callahan Flow.
<i>Phacelia californica</i>	Smathers; 1962; n.s. (LABE)	Misidentified. A coastal species. Noted by Applegate, but not collected. His description fits <i>P. heterophylla</i> .
<i>Phacelia glandulifera</i>	Wunner; 1967; no specimen	No specimen.
<i>Phoradendron juniperinum</i>	LABE plant list	No specimen; may occur in the southern portion of the monument.
<i>Pinus jefferyi</i>	Erhard; 1978; n.s. (LABE)	Misidentified; specimen is <i>P. washoensis</i> .
<i>Plectritis ciliosa</i>	LABE plant list	No specimen.
<i>Polycatenium fremontii</i>	Applegate; 1935; 2986 (LABE)	Out of park, collected from Fleeners Ranch as <i>Smelowskia fremontii</i> .
<i>Polypogon monspeliensis</i>	Wunner; 1965; 502 (HSU)	Out of monument, NW boundary. Plant of moist places.
<i>Pseudoroegneria spicata</i> <i>x Elymus elymoides</i>	Erhard; 1977; n.s. (LABE)	Not listed in Hickman (1993).
<i>Rhamnus crocea</i> subsp. <i>Ilicifolia</i>	Wunner; 1967; no specimen	No specimen; <i>R. rubra</i> grows at the site Wunner observed <i>R. crocea</i> .
<i>Rorippa calycina</i> var. <i>columbiae</i>	Wunner; 1967; no specimen	No specimen.
<i>Rorippa</i> sp.	Applegate; 1935; 9386 (LABE)	A rare plant from moist meadows, habitat likely extirpated from the monument.

Table 6. Cont.

Name	Source	Reason for exclusion and notes
<i>Solanum villosum</i>	Applegate; 1936; no voucher	No specimen; not naturalized in Northern California only collections from southern California.
<i>Scrophularia californica</i>	Applegate; 1935; 9312 (LABE)	Misidentified; species out of range.
<i>Stellaria longipes</i>	Erhard; 1978; n.s. (LABE)	Misidentified; no suitable habitat in Monument.
<i>Stephanomeria spinosa</i>	Miller as <i>Lygodesmia spinosa</i> ; 2003; no voucher	No specimen; no collections in Siskiyou Co.; possibly mistaken for <i>Leptodactylon pungens</i> .

Table 7. Species not observed at Lava Beds during this study and included in the flora.

Species name	Source
<i>Adiantum capillus-veneris</i>	Smith, A.R. & C. Richard; 1992; 2543 (LABE)
<i>Amaranthus retroflexus</i>	Collector Unknown; 1940; n.s (LABE)
<i>Anthemis cotula</i>	Collector Unknown; 1940; n.s (LABE)
<i>Apocynum cannabinum</i>	Erhard as <i>A. sibiricum</i> ; 1978; n.s. (LABE)
<i>Astragalus gibbsii</i>	Applegate; 1036; 10315 (LABE)
<i>Atriplex rosea</i>	Erhard; 1977; n.s. (LABE)
<i>Bidens frondosa</i>	Wunner; 1965; n.s. (HSU)
<i>Camissonia tanacetifolia</i>	Wunner; 1965; n.s. (HSU)
<i>Carex douglasii</i>	Wunner; 1965; 462 (HSU)
<i>Centaurea solstitialis</i>	Lava Beds Geodatabase records
<i>Chamaesyce glyptosperma</i>	Wunner; 1965; 435 (HSU)
<i>Chrysothamnus humilis</i>	Dean Wm. Taylor, Glenn L. Clifton, and R. Doug Stone; 1987; 9253 (UC-Jep)
<i>Collomia linearis</i>	Wunner; 1965; 78 (HSU)
<i>Crepis intermedia</i>	Wunner; 1965; 258 (HSU)
<i>Cryptantha ambigua</i>	Applegate; 1935; 9295 (LABE)
<i>Cryptantha watsonii</i>	Applegate; 1936; 10278 (LABE)
<i>Dryopteris expansa</i>	Smith, A.R. & C. Richard; 1992; 2533 (LABE)
<i>Dysphania ambrosioides</i>	C. W. Sharsmith; 1992; 9243 (SJSU)
<i>Euthamia occidentalis</i>	Applegate; no date; 10531 (LABE)
<i>Festuca rubra</i>	C. Bornstein; 1996; n.s. (SBBG)
<i>Kochia scoparia</i>	Erhard; 1977; n.s. (LABE)
<i>Lycium barbarum</i>	Wunner as <i>L. halimifolium</i> ; 1965; 380 (HSU)
<i>Matricaria matricarioides</i>	Wunner; 1965; 309 (HSU)
<i>Mentzelia congesta</i>	Wunner; 1965; 52 (HSU)
<i>Myuros apetalus</i>	Applegate; 1936; 10237 (LABE)
<i>Oenothera cespitosa</i>	Applegate; 1936; 10299 (LABE)
<i>Penstemon gracilentus</i>	Applegate; 1036; 10502 (LABE)
<i>Poa compressa</i>	Wunner; 1965; 80 (HSU)

Table 7. Cont

Species name	Source
<i>Poa cusickii</i> subsp. <i>cusickii</i>	Collector Unknown; n.s. (LABE)
<i>Rubus glaucifolius</i>	Erhard; 1978; n.s. (LABE)
<i>Rubus leucodermis</i>	Wunner; 1965; 289 (HSU)
<i>Thelypodium flexuosum</i>	Applegate; 1935; 9287 (LABE)
<i>Urtica urens</i>	Wunner; 1965; n.s. (HSU)

DISCUSSION

This section will address the categories of species encountered during this study, the phytogeographic significance of the Lava Beds flora, and the vegetation zones and habitat types occurring at Lava Beds NM.

Species Categories

During the course of this study 91 species were added to the Lava Beds National Monument vascular plant species list; and 58 species, previously listed as present at Lava Beds, were excluded. Though this survey was quite thorough, 33 species vouchered during previous studies were never observed; likewise, 56 of the species I vouchered are the only existing collections from the Monument. Ten species were misidentified by previous investigators. A discussion of these species will help sort out the reasons for additions, deletions, and why or how species can go unobserved.

Chance or Ephemeral Species

These species include unlikely occurrences in the monument; species observed once in disturbed or modified areas. For instance, *Camissonia tanacetifolia*, a plant of moist places, was only collected once near the car washing station at monument headquarters. There are no suitable natural habitats in the monument for this species

I collected a specimen of *Lamium amplexicaule* near the Gillem's Camp parking area, which seems to have been brought in during the construction of the Monument's febooth, as it was growing in fill left over from the construction. This species is listed by Hickman (1993) as occurring below 800m in the California floristic province. The two individuals, of this non-native species, I observed, both of which I collected, will likely not leave any progeny.

Misidentified Species

Species occasionally are misidentified, even by experienced botanists. These mistakes can result from measurement error or the botanist using a dichotomous key which lacks the species in hand, or other reasons. Two examples of species misidentified by past investigators are *Nothocalais alpestris* and *Phacelia californica*. Neither of these species occurs at Lava Beds, but, in defense of past investigators, both are difficult to identify.

Rare or Uncommon Species

Species with small populations or only one population can be difficult to locate. *Camissonia parvula* has only been collected from the south slope of Hardin Butte and the population consists of fewer than 25 individuals. *Collomia linearis* was only collected once in the monument from near Caldwell Ice Cave. I never observed this species in the monument, but because a voucher exists at Humboldt State University, it is included in the flora.

Extirpated Species

Lava Beds National Monument has an aggressive control policy for non-native species. Many invasive species previously reported in the monument have seemingly become extirpated (e.g. *Centaurea solstitialis* and *Linaria genistifolia* subsp. *dalmatica*). The absence of these species is likely due to the control procedures of monument staff.

Locally Extinct Species

In 1935 Elmer Applegate collected *Rorippa columbiae*, a moist meadow species, from near Captain Jack's Stronghold. In 1935 the area just north of Captain Jack's Stronghold was likely much moister than today; the reclamation of Tule Lake shrank the lake size and dried up the perimeter. This species is known from fewer than 15 occurrences in California and is threatened by grazing (CNPS online inventory). The Stronghold area, now dry and dominated by invasive species, has lost any moist meadow habitat, which may have occurred in the past. I never observed *Rorippa columbiae* in the monument and it is presumed locally extinct.

Lava Beds Phytogeography

Lava Beds National Monument, located near the junction of the Sierra, Klamath, Cascade, and Modoc Plateau regions, displays floristic elements of each. An examination of the monument's woody angiosperms, and their distribution shows

overlap of each region listed above; with the majority of the Monument's flora coming from the Modoc Plateau region, located in the Great Basin floristic province. *Artemisia tridentata*, *Purshia tridentata*, and *Cercocarpus ledifolius*, the Monument's three most common shrubs, are all Great Basin species, with *Artemisia tridentata* being an indicator of sagebrush steppe, a vegetation type synonymous with the Great Basin (Young et al. 1977). *Amelanchier alnifolia* var. *semiintegrifolia* occurs at Lava Beds. This species is more commonly found along the Pacific coast to the high Sierra Nevada, and from the northern Rocky Mountains to Alaska; it has only a patchy distribution in the Great Basin. Two species common in the Cascades and Sierra Nevada, *Prunus emarginata* and *Castanopsis sempervirens* occur sparsely at Lava Beds, and only on the western edge of the Great basin (Mozingo 1987). *Ribes roezlii* var. *roezlii* occurs on cinder cones in the southern portion of the Monument; this species, found mostly in California and some adjacent counties of Oregon and Nevada, is most common in the Sierra Nevada. Thus the flora of the monument largely reflects vegetation of the Great Basin floristic province, but species more commonly distributed in other nearby regions (Cascades, Sierra Nevada, Coastal, and Klamath Range) do occur.

Though the brief discussion above pertains only to woody angiosperms, any discussion of Lava Beds phytogeography would be incomplete without addressing the ferns growing in the monument, arguably one of the most interesting aspects of Lava Beds phytogeography. The caves within the monument support assemblages of locally rare or disjunct species. Cave openings act as cool air sinks, creating a consistently mild and moist microclimate. These cave-associated species persist around and within cave

openings, which serve as refugia from the otherwise extreme diurnal and seasonal weather and climate variation the rest of the monument experiences. *Polystichum munitum*, for example, grows in some cave openings at Lava Beds. A species more commonly found near the coast, the nearest known collection of *Polystichum munitum* is 120km (75mi) west of Lava Beds (Smith 1993). Several disjunct bryophytes species also occur at Lava Beds, again depending on the caves as refugia (Steven Jessup, Southern Oregon University, pers. com).

Vegetation Zones and Habitat Types

I will discuss habitat types and plant communities within the broader vegetation zones in which they occur at Lava Beds NM. Erhard (1979) mapped 20 habitat types and eight unclassified communities at Lava Beds. The habitat type map of Lava Beds NM (Figure 6) closely matches the plant community concepts described by Vasek et al. (1977). Variation in topography and edaphic conditions largely controls the local availability of nutrients, water, and energy available to plants, and drives community distribution throughout the Modoc Plateau and at Lava Beds NM. For instance, north facing slopes are wetter and experience less solar input than south facing slopes; and young geologic substrates such as lava flows, have reduced nutrient availability due to the lack of soil development.

As elsewhere in the western United States, elevational-driven changes in moisture and temperature yield marked zonation in vegetation at Lava Beds. Sagebrush communities dominate the lower elevation valleys and plateaus at Lava Beds. With

increasing elevation, *Artemisia* decreases in frequency while *Juniperus* increases. Woodlands dominated by *Juniperus* or mountain brush (*Cercocarpus* and *Purshia*) communities occupy the mid elevations. At higher elevations and more mesic sites (i.e., north facing slopes), *Pinus ponderosa* dominates. Sparsely vegetated sites occur throughout this landscape, as a result of recent volcanic activities. Edaphic conditions play a greater role than topography in the occurrence of these areas.

Elevation at Lava Beds increases from north to south. The following description of the vegetation zones will follow this elevation gradient.

Sagebrush Steppe Zone

Sagebrush steppe dominates the northern two thirds of the monument where elevations range from 1219-1524 m (4000-5000 ft). Sagebrush steppe consists of mostly treeless, shrub-dominated (*Artemisia* spp.) communities with perennial bunchgrasses characterizing the understory (Young et al. 1977). At Lava Beds the perennial grasses comprising the understory can sometimes equal the shrubs in height when in flower. With fire eliminating shrubs, perennial grasslands can become dominant within sagebrush steppe (Rasmussen et al. 2004). Erhard (1979) did not identify any perennial grassland communities, and that community type will not be discussed here. Though the presence of native bunchgrass communities should not be overlooked, especially in regards to fire; historically bunchgrass communities would have been common after fire. Conversely, today with the presence of cheatgrass and other invasive species,

shrubs may be replaced by non-native, mostly annual species, after fire, rather than native perennial bunchgrasses.

Artemisia tridentata communities

Open shrubland communities of *Artemisia tridentata* subsp. *tridentata* constitute most of the vegetation in the northern end of the monument. These plant communities occupy deep well-drained soils. Common woody associates include *Chrysothamnus nauseosus*, *Chrysothamnus viscidiflorus*, *Purshia tridentata*, and *Tetradymia canescens*. Common understory species include the perennial grasses, *Elymus elymoides*, *Achnatherum thurberianum*, *Pseudoroegneria spicata* subsp. *spicata*, *Poa secunda*, and the herbaceous species *Agoseris* spp., *Nothocalais troximoides*, and *Astragalus* spp. *Juniperus occidentalis* occasionally occurs in natural *Artemisia* communities, most often on rocky outcrops. Non-native species such as *Bromus tectorum*, *Descurainia sophia*, *Sisymbrium altissimum*, and *Verbascum thapsus* have become a threat to the ecological integrity of this community type, as a result of grazing and fire disturbance.

Other communities in the Sagebrush Steppe Zone

A *Ribes velutinum*\ *Leymus cinereus* community occurs in the northeast corner of the Monument. This seasonally moist community and other smaller unmapped communities, of the same species composition, (Erhard 1979) occur in areas with accumulations of erosionally deposited volcanic ash (Young et al. 1977). Associated species include the shrubby willow, *Salix lasiandra* subsp. *lasiandra*, and herbs such as *Persicaria amphibium* var. *emersum*, and *Urtica dioica* var. *holosericea*. Two *Chrysothamnus* spp. communities occur in the extreme northern portion of the

Monument; both of these communities have experienced disturbance: grazing and the draining of Tule Lake. The projected climax community on both sites is likely *Artemisia tridentata* subsp. *tridentata* (Erhard 1979). Communities of low-growing shrubs, *Artemisia arbuscula*, occur on Gillem Bluff at sites with shallow soils and include the perennial grass, *Festuca idahoensis*, as an under story dominant. The north sides of volcanic outcrops on Gillem Bluff support patchy communities of the deciduous subshrub, *Symphoricarpos rotundifolius* var. *rotundifolius*, with an understory of *Festuca idahoensis* and the blue-flowered herb, *Hackelia cusickii*.

Lava Flows, Caves, and Cindercones

Rocky outcrops created by recent volcanic activity occur throughout the Monument. At these sites, edaphic conditions largely control community distribution. Cinder cones provide edaphic and topographic extremes in the Monument, supporting assemblages of locally rare species. The southern slopes of cinder cones in the Monument are dry harsh environments: the combination of loose pumice, steep slopes, and a southern aspect cause water to percolate through the substrate quickly or evaporate in the direct midday sun, with little being absorbed and stored for use by plants. Communities of widely-spaced shrubs and subshrubs of *Salvia dorrii* var. *incana*, *Eriogonum microthecum* and *Monardella odoratissima* occur on south facing slopes in the monument with the distinctive, apocynaceous herb, *Cycladenia humilis*. Associated species include *Mimulus nanus*, *Dimeresia howellii* and *Ipomopsis congesta*.

The lava flows in the Monument are sparsely vegetated and bare volcanic rock composes much of the substratum. Large junipers with twisted trunks often occur on these rocky balds, which provide refuge from fires, to which junipers are sensitive. Lava flow communities include a distinctive shrub assemblage of the aromatic *Salvia dorrii* var. *incana* and *Chamaebatiaria millefolium*. Additional shrubs in this distinct and harsh habitat are: *Ribes cereum*, *Cercocarpus ledifolius* var. *intermontanus*, and *Holodiscus microphyllus* var. *glabrescens*. *Penstemon deustus*, *Scrophularia lanceolata*, and *Agastache parviflora* are the most common forbs.

The cave entrances within the monument support assemblages of locally rare or disjunct species (see Phytogeography).

Juniper and Mountain Brush Zone

The juniper and mountain brush communities occupy the southern third of the monument, at elevations ranging from 1310-1615 m (4300-5300 ft). The juniper and mountain brush vegetation zone represents a mid elevation ecotone between the warmer drier lower elevation sagebrush steppe vegetation and the cooler moister higher elevation coniferous forest vegetation. Three species dominate the mountain brush communities at Lava Beds: the tall *Cercocarpus ledifolius* var. *intermontanus*, the low-growing and deciduous *Purshia tridentata*, and to a lesser extent *Artemisia tridentata* subsp. *vaseyana*. Mountain brush communities are described as part of the Sagebrush Steppe zone by Young et al. (1977), but because: 1) mountain brush occurs in roughly the same elevation zone as *Juniperus* communities at Lava Beds (Erhard 1979) and 2)

juniper and mountain brush communities integrate at Lava Beds (Rasmussen et al. 2004); the classification here will follow that of Rasmussen et al. (2004), and group juniper and mountain brush communities into the same zone.

Purshia tridentata communities

Earhard (1979) noted one small community of *Purshia tridentata*, and the bunchgrass *Pseudoroegneria spicata* on the southern toe slope of Hippo Butte. The boundary of this community is undefined and it grades into the surrounding *Artemisia tridentata*/*Purshia tridentata*/*Festuca idahoensis*-*Pseudoroegneria spicata* community, making differentiation difficult. See the following *Artemisia tridentata* community for associated species.

Cercocarpus ledifolius communities

Cercocarpus ledifolius communities in the monument occur on undulating basalt with little soil development and little forb cover (Erhard 1979). Associated species include the deciduous shrubs, *Prunus emarginata* and *Ribes* spp., the bunchgrass, *Poa secunda*, the annual grass *Bromus tectorum*, the herb *Gayophytum* spp., and the delicate fern *Cystopteris fragilis*.

Artemisia tridentata communities

Artemisia tridentata subsp. *vaseyana* communities are present in the mountain brush and juniper woodland zone, but are much less frequent than in the sagebrush steppe zone. The *Artemisia tridentata* communities in this zone often have *Purshia tridentata* as a codominant and either *Achnatherum occidentale* or *Festuca idahoensis* as the understory dominant. These associations are the most mesic of the *Artemisia*

tridentata communities (Young et al. 1977). Associated species include the herbs *Fritillaria atropurpurea*, *Geum triflorum*, *Claytonia rubra* subsp. *rubra*, *Hesperolinon micranthum*, *Scutellaria nana*, *Erigeron* spp., *Gayophytum* spp., and *Linum lewisii* var. *lewisii*, and the widespread bunchgrass, *Koeleria macrantha* .

Juniperus occidentalis communities

The largest *Juniperus occidentalis* community at Lava Beds occurs on the Valentine flow, in the southeast corner of the Monument. The outline of the community roughly follows the outline of the Valentine flow (Figures 3 and 4). The flow created gently rolling terrain, with some exposed basaltic andesite remaining. Associated species include *Artemisia tridentata* subsp. *vaseyana*, *Achnatherum occidentale*, *Pseudoroegneria spicata*, and the showy herbs *Layia glandulosa*, *Penstemon* spp., and *Arabis* spp. Smaller juniper communities occur on the east, west, or south slopes of cinder cones in the Monument with *Cercocarpus ledifolius* often as a codominant at these sites.

Pine Forest Zone

Pinus ponderosa communities

Communities dominated by *Pinus ponderosa* occur in the southern portion of the monument, extending down to 1402 m (4600 ft) on the northern aspect of cinder cones, but mostly occurring above 1524 m (5000 ft). The shade tolerant trees *Abies concolor* and *Calocedrus decurrens* often occur in the understory of *Pinus ponderosa* woodlands and forests at Lava Beds. With the absence of fire *Abies concolor* and

Calocedrus decurrens may eventually dominate these sites (Erhard 1979). *Purshia tridentata* is the most common shrub in *Pinus ponderosa* communities at Lava Beds, with shrubs *Ribes roezlii* var. *roezlii*, *Arctostaphylos patula*, *Ceanothus velutinus*, *Prunus virginiana* var. *demissa*, *Haplopappus bloomeri*, and *Ribes cereum* occurring less commonly. The dominant grasses include *Achnatherum occidentale* and *Festuca idahoensis*.

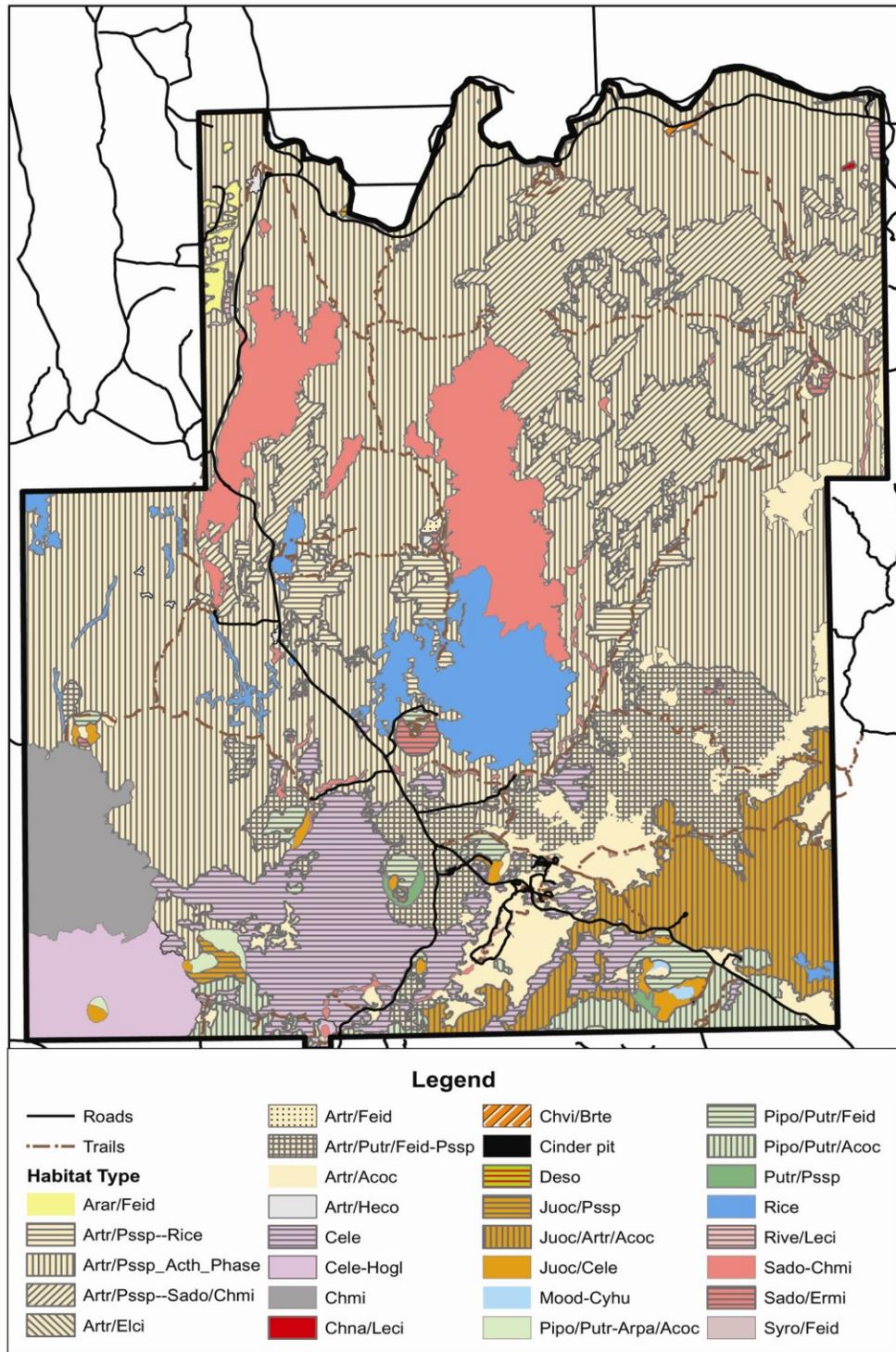


Figure 6. Habitat types of Lava Beds National Monument. Continued on next page.

Figure 6. Cont. Adapted from Erhard (1979) and aerial photographs. **Acoc**= *Achnatherum occidentale*, **Acth**= *Achnatherum thurberianum*, **Arar**= *Artemisia arbuscula*, **Arpa**= *Arctostaphylos patula*, **Artr**= *Artemisia tridentata*, **Brte**= *Bromus tectorum*, **Cele**= *Cercocarpus ledifolius*, **Chmi**= *Chamaebatiaria millefolium*, **Chna**= *Chrysothamnus nauseosus*, **Chvi**= *Chrysothamnus viscidiflorus*, **Cyhu**= *Cycladenia humilis*, **Deso**= *Descurainia sophia*, **Ermi**= *Eriogonum microthecum*, **Feid**= *Festuca idahoensis*, **Heco**= *Hesperostipa comata*, **Homi**= *Holodiscus microphyllus*, **Juoc**= *Juniperus occidentalis*, **Leci**= *Leymus cinereus*, **Mood**= *Monardella odoratissima*, **Pipo**= *Pinus ponderosa*, **Pssp**= *Pseudoroegneria spicata*, **Putr**= *Purshia tridentata*, **Rice**= *Ribes cereum*, **Rive**= *Ribes velutinum*, **Sado**= *Salvia dorrii*, **Syro**= *Symphoricarpos rotundifolius*.

SUMMARY

Ninety one vascular plant species were added to the Lava Beds NM vascular plant list during this study; the total number of vascular plants collected from the monument is 369 species, 19 of these are subspecies or varieties. In all likelihood, several species exist in the monument yet to be collected or observed. The flora of Lava Beds NM is not static but in flux.

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APPENDICES

Appendix A. Intended Use of Flora

This flora is intended as a field guide to the vascular plants of Lava Beds NM. Comprehensive works of the California flora (i.e. Hickman (1993) and Munz (1959)) provide excellent guides for the state of California as a whole, but can be cumbersome to carry in the field and contain dichotomous keys to many species that do not occur within the boundaries of Lava Beds. In addition, previous works, such as Applegate's 1938 flora, while an excellent historic work, are simply out-of-date or not readily available.

Plant identification, or any type of identification, can be aided by the use of a dichotomous key. This key contains many pairs of contrasting statements, each called a couplet. For example:

- 1a. Leaves opposite; flowers bilateral.....2a
 1b. Leaves alternate; flowers radial.....3a

Read the first statement (1a) until the first semicolon, and then do the same for the second statement (1b). You must decide which statement best describes the specimen. Proceed using the same method, until finished with each statement separated by semicolons. Then decide which statement overall best matches the specimen you are trying to identify, and proceed to that number. Once you reach a species name, read the species description and see if the specimen matches the description. If it doesn't match, you will need to back up and reconsider the last couplet decision you made. Keep in mind you may have made a mistake very early in your keying process. Possible sources of error include a poor specimen which lacks the structure(s) you need to examine in the couplet (no flowers,

fruits, seeds etc.), the species is not included in the key, or the key is poorly written. Be patient, back up until the species description you reach matches the specimen, or consult another reference. Species descriptions in this flora include physical measurements of the plants, their distribution in the park, habitat affinities, i.e. lava tube collapses and identification hints.

To use the dichotomous key within this work, you will need, at minimum, a metric ruler (all measurements are given in metric) and a 10X hand lens. Several species listed in this key will require the use of a dissecting scope for proper identification; these difficult identification features will be noted. To aid the user, efforts were taken to reduce the amount of botanical terminology and to use common language. However, this is not always possible as some plant families (i.e. *Asteraceae*) or genera have specialized terms to describe their reproductive structures, and the use of such terms cannot be avoided.

Appendix B. Taxonomy and Plant Names

Names aid us in describing and identifying objects. Since long ago we have categorized and given names to things. The taxonomic scheme developed by Carolus Linneaus (1707-1778), though much modified, is still widely used today. The taxonomic levels used today for plants are Kingdom (sometimes Subkingdom), Division, Class (sometimes Subclass), Order, Family, Genus, and Species (this taxonomic scheme comes from the USDA PLANTS database). All species contained in this flora are in the Kingdom Plantae (multicellular, photosynthetic organisms) and Subkingdom Tracheobionta (plants that conduct water and sugars through specialized tissues (i.e. vascular plants)). There are three divisions at Lava Beds: listed in their accepted evolutionary order they are Pteridophyta (Ferns), Coniferophyta (conifers), and Magnoliophyta (flowering plants). All ferns belong to the class Filicopsida, and all conifers to Pinopsida. At Lava Beds, only the Magnoliophyta has more than one class: dicotyledons in the class Magnoliopsida and the monocotyledons in the class Liliopsida. The last two taxonomic tiers, the genus and species name make up an organism's binomial: a unique name for that organism. Species can be given more than one binomial, but may have only one correct name. When this happens, unaccepted names are referred to as synonyms. Taxonomists regularly discover misinterpretations in genera or species definitions, or sometimes authors have different concepts of what is a species. Thus it is important to include the authority name with the binomial. The authority is the person first describing the species. An example would be: *Artemesia tridentata* Nutt. *Artemisia tridentata* is the binomial and Nutt. stands for Thomas Nuttall (1786-1859), a naturalist

who explored the early American frontier. He was the first person to scientifically describe this species. When two authority names are given and the first is in parentheses, as in the case of *Salvia dorrii* (Kellogg) Abrams, that means Kellogg first described the species and called it *Audibertia dorrii*. Later Abrams reclassified the species into the genus *Salvia*.

Using common names for plants can lead to confusion because they are not standardized. Unlike scientific names, many plants have more than one common name. Different common names often reflect regional influences. My favorite example is *Quercus garryana*, not found at Lava Beds. This tree is called Oregon White Oak in Oregon, but is referred to as Garry Oak in British Columbia, Canada. Common names are provided in this flora (from USDA PLANTS database), and an attempt was made to use the preferred name in the Lava Beds area. However, binomials are unique and remain the universal scientific language.

In an effort to stay current with the Jepson Manual 2nd Edition, scheduled for release in 2008, taxonomy in this flora follows the Jepson Online Interchange, as of 4/1/08. Note the family Scrophulariaceae will likely be split up for the 2nd edition of the Jepson Manual, but remains intact here. Some synonyms, reflecting recent taxonomic revisions or names used in previous studies of Lava Beds vegetation, are provided in the species descriptions of this work; but exhaustive lists of synonyms can be found in other work such as the Jepson Manual (Hickman 1993) (and the Jepson Online Interchange), Vascular Plants of the Pacific Northwest (Hitchcock et al. 1955-1969), the Intermountain

Flora (Cronquist et al. 1972-1997), USDA PLANTS database, and the partially completed Flora of North America (Flora of North America Editorial Committee 1993+).

Appendix C. Key to the Vascular Plants of Lava Beds National Monument

- 1a. Plants reproducing by one celled spores.....**Group 1 (Ferns) Pg. 77**
 1b. Plants reproducing by seeds.....2a
- 2a. Ovules not enclosed in an ovary, generally occurring on the surface of a cone scale;
 fruit a woody cone or cone-like berry; plants woody, trees or shrubs
**Group 2 (Gymnosperms) Pg. 80**
 2b. Ovules enclosed within an ovary; plants woody or not.....3a (**Angiosperms**)
- 3a. Floral parts, especially perianth) in 4's or 5's (rarely 3's) leaves mostly palmately or
 pinnately veined; 2 cotyledons.....**Group 4 (Dicots) Pg. 82**
 3b. Floral parts, especially perianth, in 3's (rarely 1,2, or 4's, never 5's); leaves mostly
 parallel veined; 1 cotyledon**Group 3 (Monocots) Pg. 155**

Group 1 Ferns

- 1a. Sori on or near the margin of the lower frond surface, covered by the inrolled
 margin.....**PTERIDACEAE**
 1b. Sori on lower surface of the frond, not covered by the margin.....2a
- 2a. Indusium with a central stalk; leaves evergreen, leaflets with sharp pointed
 teeth.....**DRYOPTERIDACEAE (Polystichum)**
 2b. Indusium without a central stalk; leaves various.....3a
- 3a. Indusium reniform, horseshoe-shaped; petiole > 1.5 mm
 wide..... **DRYOPTERIDACEAE (Dryopteris)**
 3b. Indusium hood-like, cup-like, or of hair-like segments; petiole <1.5mm
 wide.....**WOODSIACEAE**

DRYOPTERIDACEAE

- 1a. Indusium with a central stalk.....**Polystichum**
 1b. Indusium without a central stalk, reniform, or horseshoe-shaped**Dryopteris**

Dryopteris wood fern

- 1a. Blade mostly tripinnate, segments deeply pinnately lobed, ending with sharp short
 points; pinnule veins generally ending before margin..... ***D. expansa***
 1b. Blade 1-2 pinnate, segments deeply lobed or not; pinnule veins extending to teeth
 tips.....***D. arguta***

Dryopteris arguta (Kaulf.) Maxon – coastal wood fern

Lower pinnae largest, with above pinnae as large or just slightly smaller than lower. Only collected once in the monument at Jack William Cave.

Dryopteris expansa (C. Presl) C.R. Fraser-Jenkins & Jermy – spreading wood fern
Blade with broadly triangular bases, widest at base. Abundant in Fern Cave and Fossil Caves. [*Dryopteris dilatata*]

Polystichum sword fern

- 1a. Fronds 5-15dm long; petiole base scales ≥ 3 mm wide, ovate, and those near lowest primary pinnae mostly > 1 mm wide, persistent; indusium margin ciliate.....***P. munitum***
1b. Fronds 2-6dm long, petiole base scales 2-3mm wide, lanceolate, and those near lowest pinnae mostly < 1 mm wide; indusium mostly toothed.....***P imbricans***

Polystichum imbricans (D. Eaton) D.H. Wagner – narrowleaf sword fern
An evergreen fern with few scales. Pinnae abruptly tapered to a spinose tip, often overlapping, with a prominent auricle at the base. A single plant grows on a rock outcrop south of where the Gillem Bluff trail ends. Subspecies. ***imbricans*** occurs in the monument; defined by pinnae not in one plane, thus appearing to form a V.

Polystichum munitum (Kaulf.) C. Presl. – western sword fern
A large evergreen fern heavily covered by persistent scales. Pinnae long tapered to a spinose tip, not overlapping, and with a prominent auricle at the base. Abundant in Fossil Cave; also found in Chest Cave, and an unnamed cave discovered by the author.

PTERIDACEAE

- 1a. Pinnule margin generally not recurved and covering sporangia; sporangia occurring along veins **Pentagramma**
1b. Pinnule margin generally recurved, partially or wholly covering sporangia.....2a
2a. Sporangia borne on the underside of the reflexed pinnule margins; frond segments fan-shaped; frond lower surface glabrous.....**Adiantum**
2b. Sporangia occurring on pinnule segments and covered by the reflexed margin; frond segments oblong to round; frond lower surface with scales.....**Cheilanthes**

Adiantum maidenhair

Adiantum capillus-veneris L. – common maidenhair
Frond 20-40cm long. Blade light green 2-3 times pinnate. Pinnule segments often cut or lobed $\frac{1}{4}$ way to base. Stipe polished brownish-black to purple in color. Rare in monument, one plant observed in Fossil Cave.

Cheilanthes lipfern

Cheilanthes gracillima D. Eaton – lace lipfern

Fronde tufted 8-30cm long. Blade 1-3cm wide. Rare in monument, found at entrance to Blue Grotto, and near Gold Digger Pass.

Pentagramma -- goldback fern

Pentagramma triangularis (Kaulf.) G. Yatskievych, M.D. Windham & E.

Wollenweber– goldback fern

Fronde 15-30 cm long. Blade triangular to pentagonal in outline, dark green above with yellow-gold powder beneath. Stipe dark brown, about twice as long as blade. Subspecies *triangularis* occurs in the monument; defined by a mostly glabrous non-sticky upper frond surface. Uncommon in monument found at entrance to Fern, Fool Catcher, and Valentine Caves. [*Pityrogramma triangularis*]

WOODSIACEAE

[Recently segregated from Dryopteridaceae]

- 1a. Indusium hood-like, arched over sorus, lifting up as sorus expands; veins reaching margin.....**Cystopteris**
 1b. Indusium inferior, often hidden under sorus, a plate or cup-like structure with hair segments encircling sorus; veins not reaching margin.....**Woodsia**

Cystopteris bladderfern

Cystopteris fragilis (L.) Bernh. – brittle bladderfern

A small and ‘fragile’ fern with light green blades and brittle stipes. Blade generally twice as long as wide, 8-40cm long. Common in monument, found growing in rock crevices. Often confused with *Woodsia oregana*.

Woodsia cliff fern

- 1a. Lower blade surface glandular, with segmented whitish hairs.....***W. scopulina***
 1b. Lower blade surface glandular, lacking segmented hairs.....***W. oregana***

Woodsia oregana D. Eaton – Oregon cliff fern

Fronde up to 25cm long, blade 1-4 cm wide. Common from many of the larger cave entrances, occasionally seen on rock outcrops.

Woodsia scopulina D. Eaton – Rocky Mountain woodsia

Fronde 20-40 cm long, blade 5-8cm wide. Larger of the two *Woodsia* spp. in the monument. Uncommon in the monument, collected from Kirk White Cave and Lava Cliffs.

Group 2 Gymnosperms

- 1a. Leaves opposite or whorled, scale-like.....**CUPRESSACEAE**
 1b. Leaves in bundles or singular, needle-like**PINACEAE**

CUPRESSACEAE

- 1a. Seed cone fleshy, berry-like; scale-like leaves opposite.....**Juniperus**
 1b. Seed cone woody; scale-like leaves whorled.....**Calocedrus**

Calocedrus incense cedar

Calocedrus decurrens (Torrey) Florin – incense cedar

A widely conic or pyramidal tree, with flattened branches of overlapping yellow-green scales. The trees brownish-cinnamon fibrous bark fissures vertically into thick plates. This tree rarely forms pure stands, but is found mixed with other pines and white fir. Common only along the southern boundary of monument. [*Libocedrus decurrens*]

Juniperus juniper

Juniperus occidentalis Hook. – western juniper

At its maximum this tree can reach 12m in height and 1,000+ years of age. Western Juniper's can tolerate extreme drought. Berry dark blue, generally .8 cm in diameter and covered with a whitish bloom. The most common tree species in the monument. Subspecies *occidentalis* occurs in the monument; defined by brown bark; leaves whorled in 3's; and a generally monoecious habit.

PINACEAE

- 1a. Leaves in bundles , cones pendulous.....**Pinus**
 1b. Leaves not in bundles, cones erect.....**Abies**

Abies fir

A. concolor (Gordon & Glend.) Lindley ex Hildebr.– white fir

Tree shade tolerant. White fir keeps its lower branches well into maturity, giving the tree a top-to-bottom pyramidal shape that can act as a fire-ladder. The whitish blue-green needles are flat and rounded at the tips, tending to grow both upward and forward on the twigs, in a 'hockey stick' shape. Occasional on top of cinder cones, more common along southern border of the monument, at higher elevations.

Pinus pine

- 1a. Needles 5 per bundle; seed cone mostly > 20cm.....***P. lambertiana***
 1b. Needles <5 per bundle; seed cone <20cm.....2a
 2a. Needles 2 per bundle, green to yellow green with a stiff sharp point.....***P. contorta***
 2b. Needles 3 per bundle.....3a

- 3a. Cones closed at maturity, borne in whorls at the trunk and on larger branches, persistent for many years, opening with heat or old age.....*P. attenuata*
- 3b. Cones opening at maturity; borne near branch tips.....4a
- 4a. Seed cone generally 9–18 cm; lower scales of seed cones just prior to and after cone fall spreading and reflexed, thus well separated from adjacent scales.....*P. ponderosa*
- 4b. Seed cone generally 5–9 cm; lower scales of seed cones just prior to and after cone fall not so spreading and reflexed, thus not well separated from adjacent scales.....*P. washoensis*

Pinus attenuata Lemmon – knobcone pine

Knob cone pines grow quickly when young and often develop a forked top. Seed cones are closed, until opened by fire and 6-18cm long. One tree historically grew on Hippo Butte. The author was unable to relocate the individual. The tree may have been consumed by a fire.

Pinus contorta Loudon. – lodgepole pine

Mature seed cones oval and only about 6cm long, generally only opening with extreme heat (fire or intense sunlight). Two trees are known from Caldwell Butte and another young tree occurs near Power Line road. Subspecies *murrayana* (Grev & Balf.) Critchf occurs in the monument; defined by seed cones deciduous after opening.

Pinus lambertiana Douglas – sugar pine

Sugar pines can grow up to 70m, tall making them the world’s largest pines; they also have the longest cone of any pine (up to 53cm). Branches often droop under the weight of mature cones. Young bark is smooth and gray-green but becomes reddish to grey-brown and becomes irregularly fissured longitudinally with age. Uncommon in the monument, found on Crescent, Bear Paw, and Caldwell Minor Butte.

Pinus ponderosa Laws. – ponderosa pine

Growing tall and straight ponderosa pine trees often reach 40m in height and 1m in diameter. The egg shaped cones have prickles sticking straight out, most noticeable when squeezing a cone with your hand. Scattered throughout the southern half of the monument, occasionally forming dense stands.

Pinus washoensis H. Mason & Stockw. – Washoe pine

A straight growing tree up to 60m in height with a pyramidal crown. The cones have reflexed prickles and are short and squat compared to the more elongate *P. ponderosa* cones. This species resembles *P. jeffreyi*, and was misidentified by Erhard as *P. jeffreyi* during his work in the monument. Uncommon in the southern portion of the monument.

Group 4 Dicots

- 1a. Parasitic plants with stems attached to branches of trees or shrubs..... **VISCACEAE**
 1b. Plants not parasitic on branches, rooting in the soil.....2a
- 2a. Saprophytic plants without green color in leaves or stems.....3a
 2b. Plants with obvious green coloration in stems and/or leaves.....4a
- 3a. Plants greater than 20cm; corolla regular with 10
 stamens..... **ERICACEAE** (*Pterospora andromedea*)
 3b. Plants mostly less than 20cm tall; corolla irregular with 4
 stamens..... **OROBANCHACEAE**
- 4a. Shrubs or subshrubs, mostly woody throughout.....5a
 4b. Herbaceous plants, occasionally woody at the base.....18a

Woody Plants

- 5a. Flowers crowded into heads (like those of a dandelion or sunflower) and surrounded
 by an involucre..... **ASTERACEAE**
 5b. Flowers not in heads and surrounded by an involucre.....6a
- 6a. Leaves opposite.....7a
 6b. Leaves alternate.....10a
- 7a. Fruit of 4 nutlets; herbage fragrant; stem square in cross-section..... **LAMIACEAE**
 7a. Fruit capsule or berry-like; herbage non-fragrant; stems round.....8a
- 8a. Plants mat forming; leaf margin 3-9 toothed above
 middle..... **RHAMNACEAE** (*Ceanothus prostratus*)
 8b. Plants erect shrubs; leaves entire to serrate.....9a
- 9a. Leaf simple, elliptic to round, 8-20mm
 **CAPRIFOLIACEAE** (*Symphoricarpos rotundifolius*)
 9b. Leaf compound, leaflets elliptic to ovate, 3-20cm
 **ADOXACEAE** (*Sambucus nigra*)
- 10a. Staminate flowers in catkins.....11a
 10b. Staminate flowers not in catkins.....12a
- 11a. Fruit of 1-3 nuts enclosed by a spiny bur-like involucre..... **FAGACEAE**
 11b. Fruit a capsule not enclosed by bur-like involucre..... **SALICACEAE**
- 12a. Petals fused.....13a
 12b. Petals not fused or 0.....14a

- 13a. Corolla urn-like; leaves entire, not spine-like.....**ERICACEAE**
 13b. Corolla funnel shaped; leaves 3-7 lobed,
 spine-tipped.....**Polemoniaceae (*Leptodactylon pungens*)**
- 14a. Inflorescence head or umbel-like, with a 6-parted calyx; leaves tomentose, especially
 below.....**POLYGONACEAE**
 14b. Inflorescence not head-like; leaves mostly glabrous.....15a
- 15a. Plants dioecious; pistillate flowers enclosed by 2 tightly appressed round bracts,
 white to red in color.....**AMARANTHACEAE (*Grayia spinosa*)**
 15b. Plants not dioecious, Flowers bisexual.....16a
- 16a. Stamens greater than 5.....**ROSACEAE**
 16b. Stamens 5, sometimes 4.....17a
- 17a. Fruit a berry, sometimes with spines; leaves palmately 3-5 lobed; some plants with
 nodal spines.....**GROSSULARIACEAE**
 17b. Fruit a capsule or drupe, never with spines; leaves pinnately veined, often 1-3 ribbed
 from base; plants without spines.....**RHAMNACEAE**

Herbaceous Plants

- 18a. Flowers few to many, sessile and in heads; heads surrounded by involucre bracts;
 ovary inferior.....**ASTERACEAE**
 18b. Flowers one to several, not in heads; involucre bracts absent; ovary inferior or
 superior.....19a
- 19a. Petals absent (sepals sometimes petal-like).....20a
 19b. Petals and sepals present.....26a

Petals Absent

- 20a. Stem and leaves with milky sap; leaves opposite.....**EUPHORBIACEAE**
 20b. Stem and leaves without milky sap; leaves various.....21a
- 21a. Leaves basal, appearing sessile, thread-like; sepals
 spurred.....**RANUNCULACEAE (*Myosurus apetalus*)**
 21b. Leaves not basal, if basal not thread-like or sessile; sepals not spurred.....22a
- 22a. Leaves with stipules.....23a
 22b. Leaves without stipules.....24a

- 23a. Leaves opposite; stipules not sheathing stem; plants with stinging hairs.....**URTICACEAE**
- 23b. Leaves alternate; stipules sheathing stem; plants without stinging hairs.....**POLYGONACEAE**
- 24a. Flowers showy, colored; calyx 6 parted; stamens 9.....**POLYGONACEAE (Eriogonum)**
- 24b. Flowers showy or not; calyx 4-5 parted; stamens 5 or less or 10.....25a
- 25a. Flowers showy, white; stamens 10, connected to the calyx (hypanthium present).....**SAXIFRAGACEAE (*Heuchera cylindrica*)**
- 25b. Flowers not showy, mostly green; stamens 5 or less, not connected to the calyx (hypanthium absent).....**AMARANTHACEAE**

Petals Present

- 26a. Petals fused (sometimes only at base).....27a
- 26b. Petals separate.....40a

Petals Fused

- 27a. Ovary superior.....28a
- 27b. Ovary inferior.....38a
- 28a. Stamens 10 or more.....29a
- 28b. Stamens 5 or less.....30a
- 29a. Flowers irregular; stamens 10.....**FABACEAE**
- 29b. Flowers regular; stamens more than 10, fused into a tube surrounding the pistil.....**MALVACEAE**
- 30a. Corolla regular.....31a
- 30b. Corolla irregular.....37a
- 31a. Plants often with milky sap; ovaries 2, fused at top into a common stigma.....**APOCYNACEAE**
- 31b. Plants without milky sap; ovary 1, if lobed always fused at base.....32a
- 32a. Ovary lobes 4, developing into 4 nutlets (less if aborted), style emerging from between ovary lobes; plants often hairy.....**BORAGINACEAE**
- 32b. Ovary not 4-lobed; fruits other than nutlets; plants hairy or glabrous.....33a
- 33a. Stigma three lobed; ovary chambers three; calyx with membrane between sepals (except in *Collomia* and *Polemonium*).....**POLEMONIACEAE**
- 33b. Stigma lobes less than three; ovary with 1-2 chambers; calyx membrane absent.....34a

- 34a. Corolla 2-3cm long, white to pinkish, purplish on outside; leaves hastate; plants vine-like and creeping on the ground.....**CONVOLVULACEAE**
- 34b. Corolla <2cm, color various; leaves not hastate; plants not creeping.....35a
- 35a. Corolla lobes with fringed nectary pit near base
.....**GENTIANACEAE** (*Swertia albicaulis*)
- 35b. Corolla lobes lacking nectarines.....36a
- 36a. Styles 2, if one then two cleft; plants often densley hairy.....**BORAGINACEAE**
- 36b. Styles 1, unbranched.....**SOLANACEAE**
- 37a. Ovary deeply 4-lobed; herbage aromatic; stems square in cross section.....**LAMIACEAE**
- 37b. Ovary entire to shallowly lobed; herbage not aromatic; stems round in cross section.....**SCROPHULARIACEAE**
- 38a. Leaves opposite; stamens 3; flowers two lipped, pinkish white, with a spur at base.....**VALERIANACEAE**
- 38b. Leaves whorled, opposite, or alternate; stamens more than 3; flowers radial and without spur.....39a
- 39a. Leaves whorled or opposite oblanceolate to narrowly ovate.....**RUBIACEAE**
- 39b. Leaves alternate, round-cordate.....**CAMPANULACEAE** (*Triodanis*)
- Petals Separate**
- 40a. Stamens greater than double the number of petals.....41a
- 40b. Stamens not more than double the number of petals.....45a
- 41a. Stamens not connected to the calyx (hypanthium absent).....42a
- 41b. Stamens connected to the calyx (hypanthium present).....44a
- 42a. Filaments fused into a tube around the style.....**MALVACEAE**
- 42b. Filaments not fused into a tube around style.....43a
- 43a. Pistil more than one, each with one style; sepals generally 5, persistent.....**RANUNCULACEAE**
- 43b. Pistil one, style 0; sepals 2, shed as a unit when flower opens.....**PAPAVERACEAE**
- 44a. Leaves without stipules; flowers yellow; plants rough textured with rigid barbed hairs.....**LOASACEAE** (*Mentzelia*)
- 44b. Leaves with stipules; flowers various; plants mostly smooth to pubescent.....**ROSACEAE**

45a. Ovary superior.....	46a
45b. Ovary inferior.....	57a
46a. Pistil more than one, each one simple.....	47a
46b. Pistil one, simple or compound, styles one too many.....	48a
47a. Leaves with stipules.....	ROSACEAE
47b. Leaves without stipules.....	SAXIFRAGACEAE
48a. Pistil simple, one style, stigma, ovary, and ovule.....	49a
48b. Pistil compound.....	51a
49a. Flowers irregular; stamens 10, filaments (some) fused together; fruit a legume.....	FABACEAE
49b. Flowers mostly regular; stamens 10 or more, filaments not fused together; fruit not a legume.....	50a
50a. Stamens 10, filaments widest at base, anthers dehiscent by terminal pores; leaf veins white-bordered.....	ERICACEAE (<i>Pyrola picta</i>)
50b. Stamens more than 10, filaments and anthers not as above; leaves without white-bordered veins.....	ROSACEAE
51a. Corolla irregular, yellow with purple markings, the lower petal with a spur.....	VIOLACEAE
51b. Corolla regular, color various, not spurred.....	52a
52a. Sepals and petals 4.....	BRASSICAEAE
52b. Sepals and petals other than 4.....	53a
53a. Sepals 2 or 6-8.....	PORTULACACEAE
53b. Sepals 5.....	54a
54a. Ovary 1-celled; leaves opposite, simple, entire; plants with swollen nodes.....	CARYOPHLLYACEAE
54b. Ovary greater than 2 celled; leaves alternate, opposite, or basal; plants with or without swollen nodes.....	55a
55a. Leaves pinnately compound and dissected; fruit a schizocarp.....	GERANIACEAE
55b. Leaves not compound; fruit a capsule.....	56a
56a. Stamens not connected to the calyx (hypanthium absent); leaves linear, entire.....	LINACEAE
56b. Stamens connected to the calyx (hypanthium present); leaves palmately lobed.....	SAXIFRAGACEAE

- 57a. Flowers in umbles.....**APIACEAE**
 57b. Flowers not in umbles.....58a
- 58a. Style 1, undivided.....**ONAGRACEAE**
 58b. Style greater than 1, distinct or united towards base.....**SAXIFRAGACEAE**

ADOXACEAE

[*Sambucus* formerly in Caprifoliaceae]

Sambucus elderberry

Sambucus nigra L. subsp. ***canadensis*** (L.) Bolli -- blue elderberry

A shrub to 8m tall, highly branched, often lacking a main stem, with soft pithy twigs. Leaves opposite, pinnately compound with 3-9 leaflets. Inflorescence a flat-topped umble of white flowers, and black glaucous berries appearing light blue. Occasional throughout the monument, often associated with rocky outcrops. [*Sambucus caerulea*, *Sambucus mexicana*]

AMARANTHACEAE

[*Atriplex*, *Chenopodium*, *Grayia*, *Kochia*, and *Salsola* formerly in Chenopodiaceae]

- 1a. Bracts beneath the flowers scarious; leaves without a powdery or beaded surface.....**Amaranthus**
 1b. Bracts beneath flowers leaf-like or fleshy, not scarious; leaves with powdery or beaded surface.....2a
- 2a. Plants woody above base, twigs becoming spine-like.....**Grayia**
 2b. Plants not woody above base.....3a
- 3a. Bracts below inflorescence spine-tipped; leaves thread to awl-like, spiny; calyx lobes wing-like or dish-like in fruit.....**Salsola**
 3b. Bracts and leaves lacking spines; calyx winged or not.....4a
- 4a. Plant with long simple hairs, occasionally glabrous, except margins of perianth and foliage; calyx winged.....**Kochia scoparia**
 4b. Plants mostly glabrous or with granular-mealy powder on foliage; calyx wings lacking.....5a
- 5a. Flowers unisexual, pistillate flowers enclosed by two appressed bracts.....**Atriplex**
 5b. Flowers bisexual, sepals 3-5 often partially enclosing fruit.....6a
- 6a. Herbage conspicuously glandular, usually strong smelling.....**Dysphania**
 6b. Herbage not glandular, not strong smelling.....**Chenopodium**

Amaranthus pigweed

- 1a. Flowers in axillary clusters, not clearly terminal.....2a
 1b. Flowers clearly in terminal clusters, axillary clusters, if present, absent in lower ½ of plant.....3a
- 2a. Plants mostly erect, branches ascending; pistillate sepals 3, shorter than bracts.....*A. albus*
 2b. Plants prostrate, branches spreading; pistillate sepals 4-5, equal to or longer than bracts.....*A. blitoides*
- 3a. Pistillate sepals obtuse, rounded, or notched at tip; plants moderately to densely pubescent, especially on distal portions.....*A. retroflexus*
 3b. Pistillate sepals acute, acuminate, or bristle tipped; plants moderately pubescent, becoming glabrous with age.....*A. powellii*

Amaranthus albus L. – prostrate pigweed

An ascending to erect, highly branched, and bushy annual, <1m tall. Flowers tiny, <2mm, and in axillary clusters. Uncommon in disturbed areas of the monument.

Amaranthus blitoides S. Watson – mat amaranth

A prostrate annual. Flowers tiny, <3mm, and in axillary clusters. Uncommon in disturbed areas of the monument. [*Amaranthus graecizans*]

Amaranthus powellii S. Watson – Powell's amaranth

A erect annual up to 2m in height, occasionally pubescence below inflorescence, but becoming glabrous with age. Flowers inconspicuous, born in terminal clusters. Leaves, lower diamond shaped and 15-90mm long, upper generally lanceolate. Uncommon in disturbed areas of the monument.

Amaranthus retroflexus L. – redroot amaranth

An erect annual up to 3m in height, with moderate to dense crisped multicellular hairs. Collected once near the northern boundary of the monument.

Atriplex saltbush*Atriplex rosea* L. -- tumbling saltweed

A monoecious, erect and freely branching to simple annual. Leaves grayish, especially below, toothed, and often turning red. Inflorescences axillary and terminal, with diamond-shaped bracts. Collected once in the monument, between main Road and Merrill Ice Cave.

Chenopodium goosefoot

- 1a. Leaves mostly entire, lower leaves one veined from base, <3.5mm wide.....*C. leptophyllum*
 1b. Leaves toothed to lobed, lower leaves 3 veined from base, >15mm wide.....*C. album*

Chenopodium album L. -- lambsquarters

A branched annual green to grayish and often turning red with age. Leaves lanceolate to deltoid and toothed, dull green above and often powdery below. Inflorescences of large terminal clusters. Occasional in disturbed areas of the monument.

Chenopodium leptophyllum Moq. Nutt. Ex S. Watson -- narrowleaf goosefoot

An erect, simple or branched grayish-silvery annual. Leaves entire, lanceolate, densely powdery below. Uncommon in the monument in open gravelly areas.

Dysphania

- 1a. Sepals glabrous or lightly puberulent, sparsely sessile-glandular, mostly eglandular; inflorescence branches straight, flowers sessile.....*D. ambrosioides*
 1b. Sepals conspicuously stalked-glandular; inflorescence branches curved, flowers short pedicelled.....*D. botrys*

Dysphania ambrosioides (L.) Mosyakin & Clemants -- Mexican tea

A strongly aromatic annual or short-lived perennial. Leaves generally densely glandular, lanceolate-ovate, and pinnately lobed to undulate-dentate. Inflorescence branches straight, flowers tiny, <1mm, sessile. Rare in the northern portion of the monument, collected once from Devils Homestead Flow. [*Chenopodium ambrosioides*]

Dysphania botrys (L.) Mosyakin & Clemants -- Jerusalem oak goosefoot

A distinctive aromatic and glandular annual. Leaves pinnately lobed and reduced above. Inflorescence branches arched or curved with terminal clusters of tiny, <1mm, flowers. Rare in the northern portion of the monument. [*Chenopodium botrys*]

Grayia hopsage*Grayia spinosa* (Hook.) Moq. -- spiny hopsage

A dioecious grayish-barked shrub, <1m in height, the twigs becoming spine-like. Inflorescences in axillary and terminal clusters. Uncommon in the northern portion of the monument, and the Petroglyphs.

Kochia smotherweed*Kochia scoparia* (L.) Schrader -- burningbush

A glabrous to silky-hairy annual reaching over 1m in height. Leaves lanceolate and prominently 3-5 veined. Collected once in the monument, near the northern boundary.

Salsola Russian thistle*Salsola tragus* L. -- prickly Russian thistle

A branched annual, round in outline. Leaves linear and spine-tipped. Common in open disturbed areas of the monument. [*Salsola kali*]

APIACEAE

- 1a. Ovary and fruit with prickles or bristles; plants annual.....**Torilis**
 1b. Ovary and fruit glabrous to hairy but without prickles or bristles; plants perennial....2a
- 2a. Leaves once pinnately compound; flowers white; stem loosely attached to one-several clustered tubers.....**Perideridia**
 2b. Leaves mostly more than once pinnately compound or dissected; flowers yellow or white; stem firmly attached to stout taproot or caudex.....**Lomatium**

Lomatium desertparsley

- 1a. Leaf compound, divisions few, segments large.....***L. triternatum*** var. ***macrocarpum***
 1b. Leaf dissected, divisions many, segments small.....2a
- 2a. Herbage bright green and minutely scabrous to glabrous; stems reddish with a broad sheath at the base; flowers yellow.....***L. vaginatum***
 2b. Herbage gray-green and short-hairy; stems not reddish, lacking broad sheath at base; flowers white to purplish, rarely yellow.....3a
- 3a. Involucel one-sided, margins not scarious; mature fruits >10mm long, more than twice as long as wide.....***L. macrocarpum***
 3b. Involucel not one-sided, margins scarious; mature fruits <10mm long, less than twice as long as wide.....***L. nevadense***

Lomatium macrocarpum (Torrey & A. Gray) J. Coulter & Rose –
 bigseed biscuitroot

A variable perennial with white, purplish, or, less commonly, pale yellow flowers. Stems short, mostly <5dm. A more robust species than *L. nevadense*. Found on Gillem Bluff, and occasionally on the road shoulder below the bluff.

Lomatium nevadense (S. Watson) J. Coulter & Rose – Nevada biscuitroot

A perennial .5-4 dm in height. Variety *nevadense* occurs in the monument; defined by 2-3 pinnately dissected leaves and a densely finely hairy ovary, and often fruit. The most wide spread *Lomatium* in the monument, found commonly among sagebrush or in open woodlands.

Lomatium triternatum (Pursh) J. Coulter & Rose var. ***macrocarpum*** (J. Coulter & Rose) Mathias – nineleaf biscuitroot

A tall, up to 10dm, and stout species with yellow flowers and compound leaves. Involucel bractlets threadlike to linear. Rare in the monument, found near Canby's Cross. [*Lomatium alatum*]

Lomatium vaginatum (M.E. Jones) J. Coulter & Rose – broadsheath desertparsely

A perennial with bright yellow flowers that often dry whitish. Herbage bright green and glabrous to finely scabrous, the tips often have a reddish tint. The leaves emerging from a reddish stem with a sheathing base. Uncommon in the monument, found near Devils Homestead Parking area, on Gillem Bluff, and Hovey Point.

Perideridia yampah

Perideridia oregana (S. Watson) Mathias – Oregon yampah

A green to glaucous perennial, 1-9dm tall from a 2-6 clustered tuberous root. Basal leaves are 1-2 pinnate or ternate, the segments similar in size and shape. Fruits are oblong-ovate, longer than wide. Rare in the monument only found on top of Gillem Bluff. Tubers of this species were eaten by the Modoc Tribe.

Torilis hedgeparsley

Torilis arvensis (Hudson) Link – spreading hedgeparsely

An erect annual up to 1m tall. Lower leaves 2-3 times pinnate, leaflets 5-60mm; cauline leaves 1-pinnate. Fruits ovoid-oblong, 3-5mm long, with spreading prickles. Collected from Captain Jack's Stronghold, an invasive species, likely to spread.

APOCYNACEAE

[*Asclepias* formerly in Asclepiadaceae]

1a. Anthers fused with each other and with the style, forming one unit..... **Asclepias**

1b. Anthers fused around stigma, often touching but not attached to stigma or style..... 2a

2a. Plants fleshy; flowers >1cm, corolla funnel-shaped.....**Cycladenia**

2b. Plants not fleshy; flowers <1cm, corolla bell-shaped.....**Apocynum**

Apocynum dogbane

1a. Plants <3dm; leaves drooping to horizontal, dark green above paler below; corolla pinkish, mostly twice as long as calyx, lobes spreading to reflexed

.....***A. androsaemifolium***

1b. Plants >3dm; leaves ascending, yellow-green above and below; corolla green-white, less than twice as long as calyx, lobes erect to spreading.....***A. cannabinum***

Apocynum androsaemifolium L. -- spreading dogbane

A low growing diffusely branched perennial. Leaves opposite and dark green above and pale below. Flowers 4-8mm and bell-shaped. Uncommon in the southern portion of the monument.

Apocynum cannabinum L. – Indianhemp

A stout erect perennial branched above. Flowers 2-5mm in length and cylindric. Collected once near West Wildlife Overlook. [*Apocynum sibiricum*]

Asclepias milkweed

- 1a. Leaves whorled.....*A. fascicularis*
1b. Leaves opposite.....*A. cordifolia*

Asclepias cordifolia (Benth.) Jepson – purple milkweed

A ascending mostly glabrous perennial. Leaves opposite, base clasping-cordate. Collected once from Eagles Nest Butte.

Asclepias fascicularis Decne. -- narrowleaf milkweed

An erect to ascending perennial from a rhizomatous woody root stock. Leaves lanceolate and in whorls of 3-5. Common along the road shoulder throughout the monument.

Cycladenia waxydogbane*Cycladenia humilis* Benth. – Sacramento waxydogbane

A fleshy glaucous perennial from a large woody taproot. Leaves opposite and entire, ovate to rounded. The purple-rose corolla throat is 11-13mm long. Follicles paired, 5-7cm long. Variety *humilis* occurs in the monument; defined by a glabrous outer corolla, and a northern California distribution. Common on the southern slope of cindercones in the monument.

ASTERACEAE

- 1a. Flowers all ligulate (strap-shaped) and perfect; sap milky.....**Group 1**
1b. Flowers not all ligulate, some, or all, tubular; ligulate flowers marginal and either pistillate or neutral when present; sap watery.....2a
- 2a. Heads radiate, flowers of two kinds, disk flowers in the center with marginal ray flowers.....3a
2b. Heads discoid, flowers all tubular.....5a
- 3a. Ray flowers white, pinkish, red, or blue, never orange or yellow.....**Group 2**
3b. Ray flowers pale yellow to yellow or orange, sometimes purplish to red-brown at base.....4a

- 4a. Pappus of capillary, sometimes plumose, bristles; receptacle naked.....**Group 3**
 4b. Pappus chaffy, of firm awns, or none; receptacle chaffy, bristly or naked.....**Group 4**
- 5a. Pappus of capillary or plumose bristles.....**Group 5**
 5b. Pappus of short chaffy bristles, awns, scales, or none.....**Group 6**

Group 1

Flowers all Ligulate; Sap Milky

- 1a. Pappus of plumose bristles, awns, scales, or of some combination.....2a
 1b. Pappus simple capillary bristles, sometimes barbellate but never plumose.....5a
 2a. Flowers white, lavender, to pinkish-purplish; plants wiry in appearance; leaves inconspicuous.....**Stephanomeria**
 2b. Flowers yellow to orange; plants not wiry in appearance; leaves well developed.....3a
- 3a. Plants with well developed stem leaves; pappus plumose, the branches interwebbed.....**Tragopogon**
 3b. Plants with mostly basal leaves; pappus mostly of scales, scale tip may bear a plumose bristle.....4a
- 4a. Pappus of scales with a terminal plumose bristle; flowers nodding in bud; leaves entire to lobed.....**Microseris nutans**
 4b. Pappus wholly of scales; flowers erect in bud; leaves entire with a wavy, often ciliate margin.....**Nothocalais troximoides**
- 5a. Flowers blue; achenes flattened.....**Lactuca tatarica** subsp. **pulchella**
 5b. Flowers yellow, orange, or whitish; achenes flattened or not.....6a
- 6a. Achenes flattened; leaves with prickly margins and/or midribs.....7a
 6b. Achenes mostly cylindrical, not flattened; leaves without prickles.....8a
- 7a. Achenes beaked; heads 13-30 flowered.....**Lactuca**
 7b. Achenes beakless; heads >85 flowered.....**Sonchus**
- 8a. Achenes beaked; leaves all basal; heads solitary.....9a
 8b. Achenes beakless; leaves basal and cauline; heads >5.....10a
- 9a. Achenes with spine-like projections near top; outer involucre bracts reflexed to spreading.....**Taraxacum**
 9b. Achenes lacking spine-like projections on top; outer involucre bracts appressed.....**Agoseris**

- 10a. Leaves toothed to lobed, tomentose to glandular hairy, hairs not visible from arms length; plants with strong roots or taproot.....**Crepis**
 10b. Leaves entire, covered with dense long hairs, visible from arms length; plants with fibrous roots.....**Hieracium**

Group 2

Heads radiate; ray flowers white, pinkish, red, or blue, never orange or yellow

- 1a. Receptacle with chaff or bristles throughout but especially toward middle.....2a
 1b. Receptacle naked or with a row of bracts between disk and ray flowers.....4a
- 2a. Leaves entire and linear, <2 mm wide, margin generally rolled under.....**Blepharipappus**
 2b. Leaves pinnately dissected.....3a
- 3a. Heads solitary; rays 10 or more, >4mm long; disk flowers yellow; annual.....**Anthemis**
 3b. Heads many, crowded together; rays 3-5, <4mm long; disk flowers white to pink; perennial.....**Achillea**
- 4a. Receptacle with a single row of bracts between the disk and ray flowers.....5a
 4b. Receptacle totally naked.....6a
- 5a. Ray flowers yellow with purple veins, underside often purple; flowers often closing by midmorning.....**Lagophylla**
 5b. Ray flowers white; flowers open all day.....**Layia**
- 6a. Rays flowers white to pink, scarcely exceeding the disk flowers; plant annual.....**Conyza**
 6b. Ray flowers mostly blue, lavender, or pink (very infrequently white), exceeding the disk flowers; plants annual or perennial.....7a
- 7a. Involucral bracts mostly equal in 1-3 series, neither leafy nor with white-papery base and green tip.....**Erigeron**
 7b. Involucral bracts mostly unequal in 5-10 series, either leafy or with a white-papery base and a green tip.....**Dieteria**

Group 3

Heads radiate; ray flowers pale yellow to yellow or orange; disk flower pappus of capillary, sometimes plumose, bristles; receptacle naked

- 1a. Shrubs, 2-6dm tall.....**Ericameria**
 1b. Plants herbaceous, occasionally over 15dm.....2a

- 2a. Plants annual; phyllaries in one series, fused at base.....**Crocidium**
 2b. Plants perennial; phyllaries in > 1 series, free.....3a
- 3a. Plants tall, >1m, from a rhizome; leaves grass-like < 5mm wide.....**Euthamia**
 3b. Plants <1m tall, from a rhizome or branched caudex; leaves not grass-like.....4a
- 4b. Leaves thread-like <3mm wide; phyllaries in two series.....**Erigeron linearis**
 4a. Leaves not thread-like, lanceolate to ovate >>3mm wide; phyllaries in one series
 (often subtended by a few reduced outer phyllaries).....5a
- 5a. Herbage felty-gray-tomentose; lower leaves <5cm; plants from caudex or
 rhizome.....**Packera canus**
 5b. Herbage hairy to subglabrous, appearing green at arms length; lower leaves 6-25cm;
 plants from button-like caudex with fibrous-fleshy unbranched
 root.....**Senecio integerrimus**

Group 4

Heads radiate; Ray flowers pale yellow to yellow or orange; pappus chaffy, of firm awns, or none; receptacle chaffy, bristly or naked

- 1a. Receptacle chaff scales folded around disk ovaries.....2a
 1b. Receptacle chaff not folded around disk ovaries, receptacle naked or with a single
 row of chaff between the disk and ray flowers.....4a
- 2a. Ray flowers sterile, styles mostly zero; plants annual; cauline leaves many, well
 developed.....**Helianthus**
 2b. Ray flowers producing fruits, styles present; plants perennial; cauline leaves present
 but reduced.....3a
- 3a. Cauline leaves few, much reduced and inconspicuous.....**Balsamorhiza**
 3b. Cauline leaves common, slightly reduced, obvious.....**Wyethia**
- 4a. Receptacle chaffy throughout; leaves pinnately compound with 3-5 distinct leaflets;
 pappus of two stiff barbed awns.....**Bidens**
 4b. Receptacle naked or with a single row of chaff between the disk and ray flowers;
 leaves various but without 3-5 distinct leaflets; pappus 0, of awns, or scales.....5a
- 5b. Receptacle naked; involucre bracts not clasping achenes.....**Eriophyllum**
 5a. Receptacle with a single row of chaff between the disk and ray flowers; involucre
 bracts clasping achenes.....6a
- 6a. Involucre with silky, often bent, hairs, stalked glands also present; ray flowers yellow
 with purple veins, underside often purple.....**Lagophylla**
 6b. Involucre glandular, lacking hairs; rays yellow without purple veins or
 underside.....7a

- 7a. Disk flowers 1-2, rarely as many as 4; flowers small, involucre 2-4.5mm high, ligules <1mm.....*Hemizonella minima*
 7b. Disk flowers 2-12; flowers larger, involucre 6-10mm, ligules 2-8mm...*Madia gracilis*

Group 5

Heads discoid; pappus of capillary or plumose bristles

- 1a. Plants thistle-like, with spine-tipped phyllaries; leaves with or without stout spines.....2a
 1b. Plants not thistle like, phyllaries not spine tipped; leaves without stout spines.....4a
- 2a. Receptacle lacking dense bristles.....**Onopordum**
 2b. Receptacle with dense bristles.....3a
- 3a. Corollas purple or white; leaves spine-tipped.....**Cirsium**
 3b. Corollas yellow; leaves not spine-tipped.....**Centaurea**
- 4a. Plants woody +/- throughout, shrubs.....5a
 4b. Plants herbaceous, if woody only at base.....7a
- 5a. Corollas purple.....**Ageratina**
 5b. Corollas yellow to white.....6a
- 6a. Involucral bracts 4-6, in one series.....**Tetradymia**
 6b. Involucral bracts > 6, in more than one series, the series mostly aligned in vertical rows.....**Chrysothamnus**
- 7a. Herbage white-woolly; plants dioecious, flowering heads of individual plants either staminate or pistillate.....**Antennaria**
 7b. Herbage white-woolly or not; plants with at least some bisexual flowers.....8a
- 8a. Corollas white or purple.....9a
 8b. Corollas yellow.....11a
- 9a. Plants annual; < 5cm tall; corollas white, < 4 per head.....**Dimeresia**
 9b. Plants perennial; >15cm tall; corollas white or purple.....10a
- 10a. Plants not grey-tomentose throughout; corollas purple.....**Ageratina**
 10b. Plants grey-tomentose throughout; corollas white.....**Pseudognaphalium**

- 11a. Involucral bracts mostly equal in 1-3 series, neither leafy nor with white-papery base and green tip.....**Erigeron**
 11b. Involucral bracts mostly unequal in 3-5 series, either leafy or with a white-papery base and a green tip.....**Dieteria**

Group 6

Heads discoid; pappus of short chaffy bristles, awns, scales, or none

- 1a. Plants woody shrubs.....**Artemisia**
 1b. Plants herbaceous.....2a
 2a. Phyllaries spine-tipped; receptacle densely bristly.....**Centaurea**
 2b. Phyllaries not spine-tipped; receptacle chaffy or naked.....3a
 3a. Receptacle chaffy throughout.....4a
 3b. Receptacle naked.....5a
 4a. Flowers of two kinds, pistillate and staminate flowers in the same head; leaves entire; pappus none.....**Iva**
 4b. Flowers all bisexual; leaves pinnately compound with 3-5 distinct leaflets; pappus of two stiff barbed awns.....**Bidens**
 5a. Phyllary margins scarious; receptacle conic; flowers yellow-green.....**Matricaria**
 5b. Phyllary margins not scarious; receptacle flat to round; flowers white or less commonly pinkish.....**Chaenactis**

Achillea yarrow

Achillea millefolium L. -- common yarrow

An aromatic, rhizomatous, perennial, up to 10dm. Leaves narrow, tri-pinnate, the ultimate segments linear and short. Heads numerous, small, in a flat-topped inflorescence; rays 3-12, 2-3 mm long and wide, white or occasionally light pink. Common throughout the monument.

Ageratina snakeroot

Ageratina occidentalis (Hook.) R. King & H. Robinson -- western snakeroot

A erect perennial, up to 7dm in height, from a rhizomatous woody caudex. Leaves mostly alternate, occasionally opposite, deltoid to deltoid-ovate 1.5-7cm long, with sessile or subsessile glands, at least on the lower surface. Occasional among rocky outcrops or cave collapses. [*Eupatorium occidentale*]

Agoseris agoseris

- 1a. Plants annual; dense yellow to reddish hairs and glands at base of head and often phyllaries; beak 2-3 times as long as achene body.....***A. heterophylla***
- 1b. Plants perennial; hairs often present below head, usually not reddish or glandular; beak various lengths.....2a
- 2a. Beak < achene body.....***A. glauca***
- 2b. Beak >2x achene body.....3a
- 3a. Achene body tapering to beak; leaf lobes, if present, spreading or angled toward leaf tip.....***A. grandiflora***
- 3b. Achene body abruptly beaked, achene tip truncate; leaf lobes angled toward leaf base.....***A. retrorsa***

***Agoseris glauca* (Pursh) Raf. -- pale agoseris**

A various perennial 3-50cm tall. Flowers with yellow ligules; phyllaries glabrous to pubescent and often reddish-streaked. The fruit beak averages <2 times the fruit body. The leaves range from linear to oblanceolate, entire to toothed, glabrous to pubescent. Occasional among open areas in the monument. The two varieties occur in the monument:

A. glauca* (Pursh) Raf. var. *glauca

Leaves mostly glabrous, occasionally ciliate on petioles, mostly entire. Inflorescence glabrous. Open coniferous woodlands.

***A. glauca* (Pursh) Raf. var. *laciniata* (D. Eaton) F.J. Smiley**

Leaves densely woolly below and on petiole, not entire, teeth mostly present. The variety name *laciniata* comes from the word *laciniate*, which means cut into slender lobes, referring to the leaf teeth. Inflorescence pubescent, especially just below head. Found among sagebrush scrub.

***Agoseris grandiflora* (Nutt.) E. Greene -- bigflower agoseris**

A stout perennial 2-8dm tall. Leaves sparsely hairy on petiole, mostly lobed, rarely entire, the lobes mostly pointing towards tip, rarely pointing towards base. Fruit beak >2 times fruit body, the body tapering to beak. Common along road shoulder in northern portion of the monument, uncommon in open areas throughout.

***Agoseris heterophylla* (Nutt.) E. Greene -- annual agoseris**

An annual up to 50 cm tall. Leaves oblanceolate, entire to lobed. What best distinguishes this plant from its congeners, besides its annual habit, are the reddish-purple hairs on, and just below, the phyllaries. Commonly found in open areas throughout the monument.

Agoseris retrorsa (Benth.) E. Greene -- spearleaf agoseris

A stout perennial 1-6dm tall. Leaves soft-hairy with lobes pointing toward the base, the species name retrorsa comes from the word retrorse meaning bent backward or downward, referring to the leaf lobes. Fruit beak > 2 times the body, body abruptly tapered to beak. Rare in the monument, only collected from Eagle's Nest Butte.

Antennaria pussytoes

- 1a. Heads solitary; plants matted, mostly <4cm; plants without stolons.....***A. dimorpha***
 1b. Heads >1; plants matted or not, mostly >4cm; plants with or without stolons.....2a
 2a. Stolons present; plants mat-forming.....***A. rosea***
 2b. Stolons absent; plants not mat-forming.....***A. geyeri***

Antennaria dimorpha (Nutt.) Torrey & A. Gray -- low pussytoes

A matted prostrate perennial from a much branched caudex, lacking stolons. Leaves gray-tomentose and linear to narrowly spoon-shaped, up to 3cm long. Heads solitary, brownish to blackish-green, and terminating the short leafy stems. Occasional among sagebrush scrub in the monument.

Antennaria geyeri A. Gray -- pinewoods pussytoes

A non-mat forming perennial up to 14cm in height, lacking stolons. Leaves cauline, mostly equal, linear-lanceolate, and gray-tomentose. Occasional among ponderosa pine habitats in the southern portion of the monument.

Antennaria rosea E. Greene -- rosy pussytoes

A mat forming stoloniferous perennial. Leaves basal and cauline, green above and tomentose below. Occasional in open areas throughout the monument. There are two subspecies in California and both are likely at Lava Beds; they integrate extensively, and not treated here. [*Antennaria microphylla*]

Anthemis chamomile***Anthemis cotula*** L. -- stinking chamomile

An annual with ill-scented herbage and white ray flowers. Collected once from Gillem's Camp.

Artemisia sagebrush

- 1a. Plants <4dm; leaves <2cm.....***A. arbuscula***
 1b. Plants >4dm; leaves often >2cm.....***A. tridentata***

Artemisia arbuscula Nutt. -- little sagebrush

A low mounded and much branched shrub, <4dm. Leaves smaller than *A. tridentata*, mostly 3-9mm (rarely up to 2cm), wedge-shaped and 3-lobed. Inflorescences rarely wider than 1cm. Subspecies ***arbuscula*** occurs in the monument; defined by leaves of the flowering stem shallowly three lobed, and heads 3-4mm. Uncommon in the northern portion of the monument, easiest to view along the Gillem Bluff trail.

Artemisia tridentata Nutt. – sagebrush

A shrub over 3dm tall with gray 3-lobed leaves and inflorescences of panicles generally >1.5cm wide. A very common and abundant shrub on the eastside of the Cascades and throughout the Great Basin. Two subspecies occur in the monument.

A. tridentata Nutt. subsp. ***tridentata***

Mostly over 1m in height with a round irregular appearance. Inflorescences broad with the branches erect to spreading and rising to various heights. Commonly found at lower elevations in the monument.

A. tridentata Nutt. subsp. ***vaseyana*** (Rydb.) Beetle

Shorter than 1m with a flat topped appearance. Inflorescences narrow and erect and mostly rising to the same height (again a flat topped appearance). Commonly found at mid elevations in the monument.

Balsamorhiza balsamroot***Balsamorhiza sagittata*** (Pursh) Nutt. -- arrowleaf balsamroot

A robust perennial with large yellow rayed heads, ligules 2.5-4cm. Phyllaries tomentose as are the lowers surfaces of the heart shaped basal leaves. Occasional throughout the monument.

Bidens beggarticks***Bidens frondosa*** L. – devil's beggartick

A glabrous annual with pinnately compound leaves with 3-5 leaflets. Collected once in the monument from the northeast entrance near Tule Lake.

Blepharipappus Blepharipappus***Blepharipappus scaber*** Hook. -- rough eyelashweed

A slender annual 1-3 dm in height. Leaves alternate and entire <35mm long and <15mm wide, margin generally rolled under. Inflorescences with white 3-lobed rays and white disk flowers, nicely contrasted by purple anthers and styles. Uncommon in the monument in pine or juniper woodlands, also on cindercones.

Centaurea knapweed

Centaurea solstitialis L. -- yellow starthistle

A gray-tomentose thistle-like annual up to 10dm tall with yellow corollas. The phyllaries have obvious spines 11-22cm long. A noxious weed in fields and disturbed areas of the western US. Sightings should be reported to monument staff for control.

Chaenactis pincushion

Chaenactis douglasii (Hook.) Hook. & Arn. -- Douglas' dustymaiden

A perennial, occasionally flowering the first year, with cobwebby hairs, thinning with age. Lower leaves forming a mostly persistent rosette of bipinnately lobed leaves, the upper reduced. Inflorescence a leafy cyme of white discoid heads. Variety *douglasii* commonly occurs throughout the monument; defined by cauline leaves, an erect stem, and a below sub-alpine habit.

Chrysothamnus rabbitbrush

- 1a. Twigs covered with dense tomentose hairs (best observed by scratching twig surface and examining scratched area with 10x magnification).....*C. nauseosus*
 1b. Twigs mostly glabrous.....2a
- 2a. Flowering heads equaled or overtopped by leaves; flowers 2-4 per head; plants mostly <2dm.....*C. humilis*
 2. None of the flowering heads equaled or overtopped by leaves; flowers 3-8 per head; plants often >2dm.....*C. viscidiflorus*

Chrysothamnus humilis E. Greene -- Truckee rabbitbrush

A low shrub, <2dm, with several stems branching at the base. Leaves 1-3cm long, oblanceolate. Heads discoid, yellow, overtopped or equaled by leaves. Rare in the monument, collected once from Caldwell Butte.

Chrysothamnus nauseosus (Pallas) Britton -- rubber rabbitbrush

A tomentose shrub with flexible branches, a strong odor, and yellow corollas. Found throughout the monument. Two subspecies occur in the monument. [*Ericameria nauseosus*]

C. nauseosus (Pallas) Britton subsp. *albicaulis*

(Nutt.) H.M. Hall & Clements

Involucre tomentose. The stem whitish. Common among sagebrush scrub in the monument.

C. nauseosus (Pallas) Britton subsp. *consimilis*

(E. Greene) H.M. Hall & Clements

Involucre glabrous. Stem yellow-green. Common among sagebrush scrub in the monument.

Chrysothamnus viscidiflorus (Hook.) Nutt. -- yellow rabbitbrush

A glabrous, freely branching shrub. Leaves threadlike and occasionally with a ciliate margin. Subspecies. *viscidiflorus* occurs in the monument; defined by a glabrous upper stem; glabrous leaves, 1-10mm in width; >4 flowers per head. Common throughout the monument. [*Ericameria viscidiflorus*]

Cirsium thistle

- 1a. Flowering heads dioecious, either staminate or pistillate, 1-2cm wide.....*C. arvense*
 1b. Flowering heads bisexual, >2cm wide.....2a
 2a. Leaf upper surface with bristles; corollas purple.....*C. vulgare*
 2b. Leaf upper surface without bristles; corollas white.....*C. cymosum*

Cirsium arvense (L.) Scop. -- Canada thistle

A perennial from a deep creeping rootstock, forming dense colonial populations. Flowering heads many, 20+ per plant, small, and purple. A noxious weed of disturbed areas, found near NW entrance and Captain Jack's Stronghold.

Cirsium cymosum (E. Greene) Jepson -- peregrine thistle

A stout perennial from a branched rootstock, growing to 10dm in height. Leaves with cobwebby, multicellular, hairs on both surfaces, the upper surface becoming glabrous with age, the lower surface remaining hairy, at least on midrib. Flowering heads in flat-topped cymes, corollas dull white. Uncommon in sagebrush scrub and open areas in the northern half of the monument.

Cirsium vulgare (Savi) Ten. -- bull thistle

A biennial from a taproot, often with only one stem up to 20dm tall. The flowering heads large and purple. Uncommon in northern portion of the monument.

Conyza horseweed***Conyza canadensis*** (L.) Cronq. -- Canadian horseweed

An annual, unbranched below and highly branched above, with many white obscure radiate heads. Uncommon but highly clustered along the road shoulder between Gillem Bluff and Devils Homestead.

Crocidium spring-gold***Crocidium multicaule*** Hook. -- common spring-gold

A delicate annual, mostly less than 15cm occasionally up to 30cm. Flowers solitary, consisting of yellow disk and ray flowers. Basal leaves oblanceolate; cauline leaves alternate, reduced, and linear, with woolly tufts in their axis. Rare in the monument from open sandy or gravelly places. Collected from Gillem's Camp.

Crepis hawksbeard

- 1a. Phyllaries glabrous to lightly tomentose, inner phyllaries 5-8; heads 5-10 flowered.....*C. acuminata*
- 1b. Phyllaries mostly tomentose; inner phyllaries ≥ 7 ; heads > 8 flowered.....2a
- 2a. Herbage green, not densely tomentose; phyllaries with conspicuous glandular hairs.....*C. bakeri*
- 2b. Herbage gray-tomentose; phyllaries lacking glandular hairs, glandular hairs occasionally present in *C. intermedia*.....3a
- 3a. Phyllaries with dark hairs; heads 10 or $<$*C. modocensis*
- 3b. Phyllaries lacking dark hairs; heads 10 or $>$4a
- 4a. Plants > 3 dm tall; heads 10-60 with 7-12 flowers.....*C. intermedia*
- 4b. Plants < 4 dm tall; heads 10-30 with 10-40 flowers.....*C. occidentalis*

Crepis acuminata Nutt. -- tapertip hawksbeard

A perennial with 1-3 stems, < 7 dm tall, from a deep taproot. Flowering heads 20-100 with 5-10 yellow flowers. Commonly found in open rocky places among sagebrush in the monument.

Crepis bakeri E. Greene -- Baker's hawksbeard

A perennial with 1-4 stems, < 3 dm tall, from a deep taproot. Flowering heads 1-10 with 10-60 yellow flowers; phyllaries with glandular hairs. Herbage lightly tomentose often with glandular hairs, basal leaves deeply lobed. Rare in the monument, collected only from Gillem Bluff trail.

Crepis intermedia A. Gray -- intermediate hawksbeard

A perennial with 1-2 stems, < 7 dm tall, from a taproot. Flowering heads 10-60 with 7-12 flowers. As the name implies this species is an asexual intermediate form of *C. acuminata*, *C. bakeri*, *C. modocensis*, *C. occidentalis*, and *C. pleurocarpa* (a species not found in the monument). As pointed out by Hitchcock et al. (1955) this species often seems to blend rather than piece together characteristics of *C. acuminata* and *C. occidentalis*. Rare in the monument, collected once from the road shoulder adjacent to Canby Bay.

Crepis modocensis E. Greene -- Modoc hawksbeard

A perennial with 1-4 stems < 4.5 dm tall from a taproot. Flowering heads 1-10 with 10-60 yellow flowers. Dark hairs on lower stem and on phyllaries obvious with the naked eye. Rare in the monument, only collected from one location on top of Gillem Bluff.

Crepis occidentalis Nutt. -- largeflower hawksbeard

A perennial with 1-3 stems, < 4 dm, tall from a taproot. Flowering heads 10-30 with 10-40 yellow flowers. Common in the monument, found in open areas among sagebrush.

Dieteria tansyaster***Dieteria canescens*** (Pursh) Nutt. -- hoary tansyaster

A canescent-puberulent to occasionally glandular annual with 1- several stems <12dm. Leaves entire to toothed or minutely serrate, 3-10cm. Heads radiate with purple rays. Two varieties commonly occur throughout the monument. [*Machaeranthera canescens*]

D. canescens (Pursh) Nutt. var. ***canescens***

Ray flowers fertile, with style; involucre >8mm, in 5-10 series.

D. canescens (Pursh) A. Gray var. ***shastensis*** (A. Gray) D.R. Morgan & R.L. Hart.

Ray flowers sterile, lacking style; involucre <9mm, in 3-5 series.

Dimeresia dimeresia***Dimeresia howellii*** A. Gray -- doublet

A small, <4cm, tufted or cushion-like annual with cobwebby hairs at the base and glandular above. Leaves opposite, entire, ovate to obovate, 1-3cm long, and clustered at the base of the flowering heads. The name *Dimeresia* comes from the Greek dimeres, referring to the mostly paired white to purplish disk flowers; though occasionally there are three clustered flowers. Found on several Buttes in the monument. A CNPS list 2.3 plant.

Ericameria goldenbush***Ericameria bloomeri*** (A. Gray) J.F. Macbr. -- rabbitbrush

A freely branching shrub up to 6 dm in height with brittle twigs. Leaves linear, often twisted. Heads solitary or clustered at the ends of branches; disk flowers yellow; ligules yellow but occasionally absent. Found at higher elevations in the monument, common along the Big Nasty Trail. [*Chrysothamnus bloomeri*, *Haplopappus bloomeri*]

Erigeron fleabane

- 1a. Ligules purple, blue, pink or white.....2a
 1b. Ligules flowers yellow or none.....3a
- 2a. Plants mostly <15cm tall; base of leaf enlarged, shinny, hardened, straw-colored or purple, differentiated from the rest of the leaf, leaves mostly basal..***E. elegantulus***
 2b. Plants mostly >15cm tall; base of leaf not differentiated from the rest of the leaf; leaves basal and cauline.....***E. filifolius***
- 3a. Heads radiate, ligules obvious and yellow.....***E. linearis***
 3b. Heads discoid or ligules much less than involucre.....4a

- 4a. Heads discoid, pistillate flowers none, ligules absent.....5a
 4b. Heads disciform, pistillate flowers present, ligules often minute.....6a
- 5a. Basal leaves present at flowering, cauline leaves reduced or 0; stem 5-15cm..... *E. bloomeri*
 5b. Basal leaves absent at flowering, cauline leaves not reduces often many; stem 30-90cm.....*E. inornatus*
- 6a. Stems unbranched; heads 1; disk corolla throats not indurate or inflated; pappus bristles 15—25; outer pappus of inconspicuous bristles
*E. chrysopsidis* var. *austiniae*
 6b. Stems branched or not; heads 1-4; disk corolla throats white-indurate and somewhat inflated; pappus bristles 7—20; outer pappus short, narrow or broad scales.....*E. aphanactis*

Erigeron aphanactis (A. Gray) E. Greene -- rayless shaggy fleabane

A caespitose perennial from a taproot and short caudex with minute, or inconspicuous, ligules. Stems solitary or branched below middle, 8-30cm tall, densely spreading-hairy, with minute sessile-glands. Leaves mostly basal, linear to oblanceolate; cauline leaves reduced upwards and mostly sessile. Variety **aphanactis** occurs in the monument; defined by 2-many heads and stems branched below middle. Rare in the monument, collected along the Gillem Bluff Trail. [*Erigeron concinnus*]

Erigeron bloomeri A. Gray -- scabland fleabane

A caespitose perennial from a taproot and much branched caudex. Leaves chiefly basal; cauline few, low on stem. Flowering heads solitary and completely lacking ligules. Variety **bloomeri** occurs in the monument; defined by dense white rough, stiff, and appressed hairs on the stem. Occasional among lava outcrops in the monument.

Erigeron chrysopsidis A. Gray var. ***austiniae*** (Greene) G.L. Nesom – dwarf yellow fleabane

A 3-15 cm tall perennial with spreading hairs from a taproot and branched caudex. Flowers born singly on unbranched, mostly scapose stems, bracts occasionally present; pistillate ray corollas yellow and inconspicuous. Uncommon in the monument. Collected from the Schonchin Butte trail and the top of Gillem Bluff, but expected to occur elsewhere in rocky areas. [*Erigeron austiniae*]

Erigeron elegantulus E. Greene -- blue dwarf fleabane

A 3-15 cm tall perennial with chiefly or wholly basal leaves from a taproot and branched caudex. Ray flowers 15-25, blue or pink, 6-9mm long. Uncommon in the monument collected from south of Eagle's Nest Butte, near the monument boundary.

Erigeron filifolius Nutt. -- threadleaf fleabane

A 15-30 cm tall perennial, often branched at midstem, from a taproot and branched woody caudex. Leaves basal and cauline linear to thread-like. Ray flowers 20-45, mostly blue, less often white or pink, 3-13mm long. Common among sagebrush scrub in the monument.

Erigeron inornatus (A. Gray) A. Gray -- California rayless fleabane

A tall perennial from a taproot. Leaves all cauline, oblong, generally ciliate. Discoid heads in flat-topped clusters. Variety *inornatus* occurs in the monument; defined by stems 30-90cm and hairs below middle appressed. Rare in the monument, collected once in the northern portion of the monument among sagebrush scrub.

Erigeron linearis (Hook.) Piper -- desert yellow fleabane

A 5-30 cm tall perennial from a stout taproot and thick-branched caudex. Leaves mostly basal; cauline leaves reduced above and with an enlarged, hardened, white-shiny base. Ray flowers yellow, 4-11mm long. Uncommon in the monument. Collected from Fleener Chimney and near the junction of Medicine Lake Road and Main Monument Road.

Eriophyllum woolly sunflower***Eriophyllum lanatum*** (Pursh) James Forbes -- common woolly sunflower

A tomentose perennial with several to many stems, occasionally woody at the base, from a taproot. Two varieties are occasional to uncommon in the monument.

E. lanatum (Pursh) James Forbes var. ***achillaeoides*** (DC.) Jepson

Plants 1.5-5dm in height. Most leaves ternate-pinnatifid, opposite to subopposite. Ray flowers 9-13. Occasional, rocky sites among sagebrush scrub.

E. lanatum (Pursh) James Forbes var. ***integrifolium***

(Hook.) F.J. Smiley

Plant 1-2.5 dm in height. Leaves entire or 3-lobed at tip, mostly alternate. Ray flowers 5-10. Uncommon, coniferous forest habitats in the southern portion of the monument.

Euthamia goldentop***Euthamia occidentalis*** Nutt. -- western goldentop

A perennial often branched above from a creeping rhizome. Leaves linear and sessile, deciduous below, largest at midstem. Heads radiate, yellow. Collected once from Captain Jack's Stronghold. [*Solidago occidentalis*]

Helianthus sunflower***Helianthus annuus*** L. -- common sunflower

A tall, <3m, annual with rough-hairy herbage. Leaves cordate at the base and long-petioled. Ray flowers yellow. Rare to uncommon among disturbed areas in the northern portion of the monument.

Hemizonella

Hemizonella minima (A. Gray) A. Gray -- opposite-leaved tarweed

A small slender and openly branched annual, rarely larger than 15dm in height. Leaves mostly opposite, linear to oblong, 1-2.5cm. Heads minute <4mm wide when pressed. Common in open areas throughout the monument. [*Madia minima*]

Hieracium hawkweed

Hieracium scouleri Hook. -- Scouler's woollyweed

A perennial with one to several stems and milky sap. Leaves entire, alternate, and moderately hairy. Heads yellow-ligulate and often with a glandular involucre. Occasional in the monument at the base of cindercones. [*Hieracium cynoglossoides*]

Iva marsh elder

Iva axillaris Pursh subsp. **robustior** (Hook.) Bassett -- povertyweed

A rhizomatous perennial. Leaves entire, opposite below and alternate above. Heads discoid, axillary, and nodding. Rare in the monument, known only from East Wildlife Overlook.

Lactuca lettuce

- 1a. Corolla blue; plants without prickles; plants perennial.....***L. tatarica*** subsp. ***pulchella***
1b. Corolla yellow to pale yellow; plants with prickles; plants annual.....***L. serriola***

Lactuca serriola L. -- prickly lettuce

An annual with milky sap. Leaves lobed and the midvein prickly. Common to abundant in disturbed areas of the monument.

Lactuca tatarica (L.) C. Meyer subsp. (Pursh) Stebb. ***pulchella*** -- blue lettuce

A rhizomatous perennial with purple ligules and milky sap. Rare in the monument, known only from the extreme northern portion of the monument, adjacent to agricultural land.

Lagophylla hareleaf

Lagophylla ramosissima Nutt. -- branched lagophylla

A simple to much branched canescent, especially above, annual. Inflorescence head- to panicle-like and glandular. Heads yellow, often closing by midmorning. Common to abundant in the monument, especially along the road shoulder.

Layia tidytips

Layia glandulosa (Hook.) Hook. & Arn. -- whitedaisy tidytips

A glandular and spreading hairy annual, often branched above. Leaves linear and irregularly lobed below, entire above. Heads of yellow disk flowers and lobed white rays. Occasional in the monument, usually in open areas among juniper.

Madia tarweed

Madia gracilis (Smith) D.D. Keck & J.C. Clausen ex Applegate -- grassy tarweed
A fragrant annual, often glandular above middle. Side branches generally not exceeding main stem. Heads sessile, over 5mm wide when pressed with more than 5 yellow rays. Uncommon in open areas in the southern portion of the monument.

Matricaria mayweed

Matricaria matricarioides (Less.) Porter -- disk mayweed
A leafy pineapple-scented annual, branched from the base and up to 4dm tall. Heads with yellow discoid flowers. Collected once in the monument from Indian Well Campground. [*Chamomilla suaveolens*]

Microseris silverpuffs

Microseris nutans (Hook.) Sch. Bip. -- nodding microseris
A perennial with 1-several stems, leafy toward the base. Heads nodding in bud, developing into yellow ligules after opening. Uncommon in sagebrush and mountain mahogany scrub near cindercones.

Nothocalais false dandelion

Nothocalais troximoides (A. Gray) E. Greene -- weevil prairie-dandelion
A scapose perennial with milky sap. Leaves basal with a distinctive wavy, often ciliate, margin. Heads solitary with yellow ligules. Occasional in open areas among sagebrush scrub. [*Microseris troximoides*]

Onopordum cottonthistle

Onopordum acanthium L. subsp. *acanthium* -- Scotch cottonthistle
A stout perennial <3m in height with broadly winged stems. Leaves shallowly lobed and 1-5dm. Heads cobwebby tomentose with spines <5mm. Rare in the monument, from the northern portion. Sightings of this noxious weed should be reported to park staff.

Packera ragwort

Packera cana (Hook.) W. A. Weber & Á. Löve -- woolly groundsel
A 1-many stemmed, felty gray-tomentose, when young, perennial from a branched caudex or rhizome. Leaves lanceolate to ovate, often weakly dentate, reduced above. Common in open areas throughout the monument. [*Senecio canus*]

Pseudognaphalium cudweed

Pseudognaphalium thermale (E.E. Nelson) G.L. Nesom -- cudweed
An often scented, grey-tomentose, perennial with several stems. Leaves linear to spoon-shaped with basal tufts; cauline leaves ascending, and upper most decurrent. Inflorescence a panicle with straw to pale colored phyllaries. Uncommon among sagebrush scrub. [*Gnaphalium canescens* subsp. *thermale*]

Senecio ragwort*Senecio integerrimus* Nutt. -- Columbia ragwort

A single stemmed perennial from a fibrous root. Leaves with cobwebby hairs when young, petioled at base and much reduced above. Variety *exaltus* (Nutt.) Cronq. occurs in the monument; defined by phyllaries 5-10mm with obvious black tips. Rare to uncommon in the monument, collected from Gillem Bluff and near the southern boundary.

Sonchus sowthistle*Sonchus asper* (L.) Hill subsp. *asper* -- spiny sowthistle

An annual with milky sap. Leaves toothed or lobed, clasping stem. Heads ligulate <3cm wide in flower. Collected once in the monument at Captain Jack's Stronghold.

Stephanomeria wirelettuce

- 1a. Plants perennial, from a caudex; branches many, central axis absent.....*S. tenuifolia*
 1b. Plants annual from a taproot; branched from a central axis.....*S. virgata*

Stephanomeria tenuifolia (Raf.) H.M. Hall -- narrowleaf wirelettuce

A several stemmed glabrous perennial. Leaves thread-like. Heads solitary with purple ray flowers. Occasional among sagebrush scrub in the monument.

Stephanomeria virgata Benth. -- wand wirelettuce

A branched annual with a basal rosette withering with age. Heads solitary or clustered. Variety *pleurocarpa* (Greene) Gottlieb occurs among sagebrush scrub in the monument; defined by appressed outer phyllaries.

Taraxacum dandelion*Taraxacum officinale* Wigg.—Common dandelion

A non-native perennial from a tap root. Leaves variously lobed or toothed, the terminal lobe the widest. Achene body bares tubercles near the top, pale gray brown to olive-brown. Occasionally found in disturbed areas of the monument, more common as a roadside weed in the extreme northern portion.

Tetradymia horsebrush*Tetradymia canescens* DC. -- spineless horsebrush

A shrub, mostly 2-8dm tall, unevenly tomentose, becoming glabrous in stripes below nodes. Leaves tomentose to silvery, linear to oblanceolate. Heads in flat-topped clusters of yellow to cream discoid flowers. Occasional in the northern portion of the monument.

Tragopogon goatsbeard*Tragopogon dubius* Scop. -- yellow salsify

An annual with grass-like leaves and heads of pale yellow ligules on peduncles enlarged toward the tip. Common to occasional in disturbed areas of the monument, especially the northern portion.

Wyethia mule-ears***Wyethia mollis*** A. Gray -- woolly mule-ears

A tomentose, becoming glabrous with age, perennial from a stout woody taproot. Basal leaves, larger than cauline, elliptic to ovate. Heads with yellow ray flowers. Uncommon in the monument along the southern boundary.

BORAGINACEAE

- 1a. Ovary lobes shallow; fruit a capsule.....2a
 1b. Ovary deeply 2-4lobed; fruit mostly 4 nutlets (less if aborted).....3a
- 2a. Flowers mostly solitary, if clustered each subtended by a leaf; stems prostrate and forked.....**Nama**
 2b. Flowers in open to dense cymes, often coiled in bud and uncoiling as they develop; stems erect to spreading.....**Phacelia**
- 3a. Flowers orange or yellow.....**Amsinckia**
 3b. Flowers blue, pinkish, or white (some white flowers have a yellow disk on corolla limb).....4a
- 4a. Receptacle flat, nutlet scar mostly basal.....**Myosotis**
 4b. Receptacle elongate, nutlet scar mostly lateral.....5a
- 5a. Margin of nutlet with barbed prickles.....6a
 5b. Margin of nutlet without barbed prickles.....7a
- 6a. Perennial; pedicel recurved or reflexed in fruit; corolla limb 7-10mm wide...**Hackelia**
 6b. Annual; pedicel erect in fruit; corolla limb 1.5-2.5mm wide.....**Lappula**
- 7a. Nutlet scar mostly elevated, scar keel extending to middle or to near base.....**Plagiobothrys**
 7b. Nutlet scar depressed, scar groove running mostly entire length.....**Cryptantha**

Amsinckia fiddleneck

- 1a. Calyx lobes 2-4, often unequal.....***A. tessellata***
 1b. Calyx lobes 5, mostly equal.....***A. menziesii***

Amsinckia menziesii (Lehm.) Nelson & J.F. Macbr. -- common fiddleneck

A hairy annual with scorpion-like inflorescences, uncurling with maturity. Corolla and 5-lobed. Variety ***intermedia*** (Fischer & C. Meyer) Ganders occurs in the monument; defined by orange corollas >7mm long and >4mm wide. Uncommon in disturbed areas in the northern portion of the monument.

Amsinckia tessellata A. Gray -- bristly fiddleneck

A hairy annual with scorpion-like inflorescences, uncurling with maturity. Corolla ≤ 4 -lobed. Variety *tessellata* occurs in the monument; defined by corollas 8-12mm long and 2-6mm wide; anthers appressed to stigma. Occasional in disturbed areas in the northern portion of the monument.

Cryptantha cryptantha

- 1a. Plants perennial.....*C. humilis*
 1b. Plants annual.....2a
- 2a. Plants wider than tall, rounded and cushion-like.....*C. circumscissa*
 2b. Plants taller than wide, not rounded or cushion-like.....3a
- 3a. Corolla limb > 3 mm wide.....*C. intermedia*
 3b. Corolla limb < 3 mm wide.....4a
- 4a. Nutlet back without tubercles, smooth (at 10X).....5a
 4b. Nutlet back with tubercles, rough and bumpy (at 10X).....6a
- 5a. Nutlet with a prominent sharp angled margin (observed in x-section), especially towards tip.....*C. watsonii*
 5b. Nutlet with a rounded to obtuse margin (observed in x-section).....*C. torreyana*
- 6a. Stem hairs appressed to ascending, 0 to few spreading.....*C. simulans*
 6b. Stem hairs mostly spreading.....*C. ambigua*

Cryptantha ambigua (A. Gray) E. Greene -- basin cryptantha

An erect and branched annual with spreading hairs throughout. Nutlets 1.5-2.5mm long with a tubercled back. Occasional to uncommon in open areas among sagebrush scrub.

Cryptantha circumscissa (Hook. & Arn.) I.M. Johnson -- cushion cryptantha

A dwarf cushion-like annual, much branched below, from a red taproot. Flowers difficult to distinguish at arms length; calyx circumsessile, the upper portion falling off like a lid. Occasional in open areas of the monument.

Cryptantha intermedia (A. Gray) E. Greene -- Clearwater cryptantha

An erect annual branched throughout, with rough to bristly spreading hairs. Corolla larger than other annual *Cryptantha*. Nutlet 1.5-2mm, back sparsely low tubercled to rough granular. Uncommon in the monument, collected several times from Gillem Bluff.

Cryptantha simulans E. Greene -- pinewoods cryptantha

An erect branching annual with rough ascending hairs. Nutlet +/- 2mm, back densely granular and sparsely tubercled. Occasional in open ponderosa pine habitats in the southern portion of the monument.

Cryptantha subretusa I.M. Johnst. – Crater Lake cryptantha

A many stemmed perennial, from a woody caudex. Stems gray-green, subtomentose, rarely with sparse, stiff spreading hairs, especially below. Inflorescence +/- cylindrical initially, branches commonly elongating. Basal leaves spatulate, subretuse or obtuse at tip, strigose to subtomentose. Rare in the monument, collected from the south slope of Caldwell Butt.

Cryptantha torreyana (A. Gray) E. Greene -- Torrey's cryptantha

A erect, often lax, annual with ascending to spreading rough hairs. Nutlets 1-2mm, ovate, back smooth and shiny. Uncommon in the monument collected several times from Caldwell Butte; a plant of open wooded slopes.

Cryptantha watsonii (A. Gray) E. Greene -- Watson's cryptantha

An erect branched throughout annual with rough-spreading hairs. Nutlets 1.5-2mm, black and smooth with sharp-angled margins. Rare in the monument; collected from Petroglyph Point and Devils Homestead Flow.

Hackelia stickseed***Hackelia cusickii*** (Piper) Brand -- Cusick's stickseed

A slender perennial with several stems <5dm in height; stem hairs strongly appressed. Leaves oblanceolate to elliptic, tapering to the petiole. Corollas blue with a whitish or yellow eye. Uncommon in the monument, collected from protected ledges on Gillem Bluff.

Lappula stickseed***Lappula redowski*** (Hornem.) E. Greene -- flatspine stickseed

A hairy annual simple to variously branched. Corolla inconspicuous, blue to white, 1.5-2.5mm wide. Nutlets 2-3mm with barbed prickles in one row. Variety *cupulata* (A. Gray) M.E. Jones occurs in the monument; defined by the marginal nutlet prickles wider at the base, fused and forming a crown. Uncommon in moist disturbed areas of the monument.

Myosotis forget-me-not***Myosotis micrantha*** Lehm. -- strict forget-me-not

An annual, branched near the base, with short-hairy foliage. Inflorescence mostly one sided, with inconspicuous blue corollas, 1-2mm in diameter. Rare in the monument, only collected from a cliff band south of the Gillem Bluff trail.

Nama fiddleleaf***Nama densum*** Lemmon -- leafy fiddleleaf

A prostrate dichotomously branched annual with dense, stiff, and appressed hairs. Flowers axillary, and inconspicuous; corolla white to lavender. Occasional to uncommon in disturbed gravel areas in the monument.

Phacelia phacelia

- 1a. Plants annual.....2a
 1b. Plants perennial.....3a
- 2a. Leaves mostly cauline, entire or lobed near base; corolla 8-18mm wide, tube blue to white, limb violet.....*P. linearis*
 2b. Leaves basal and cauline, basal 1-2 times compound; corolla 5-10mm wide, tube yellow, limb pink- to blue-lavender.....*P. bicolor*
- 3a. Leaves pinnately compound or dissected, mostly cauline; stem prostrate to weakly ascending, multi-branched.....*P. ramosissima*
 3b. Leaves entire to lobed, mostly basal; stems erect to ascending.....4a
- 4a. Stem mostly 1, main/central stem erect, lateral ascending; basal leaves dissected often with 1-2 pairs of lobes at base, upper often simple.....*P. heterophylla*
 4b. Stem >1, ascending to erect; basal leaves entire or compound.....5a
- 5a. Plants perennial; basal leaves mostly entire, rarely with lobes at base.....*P. hastata*
 5b. Plants biennial or short lived perennial; basal leaves compound, occasionally entire above.....*P. mutabilis*

Phacelia bicolor S. Watson var. *bicolor* -- twocolor phacelia

A decumbent to erect, often branched at the base, short-hairy to glandular-puberulent annual. Collected from Petroglyph Point.

Phacelia hastata Lehm. -- silverleaf phacelia

A perennial from a branched caudex. Stems mostly >1, +/- stiff hairy, non-glandular. Leaves mostly basal, mostly entire, rarely with leaflets at leaf base. Two subspecies occur in the monument. [*Phacelia leucophylla*]

P. hastata Lehm. subsp. *compacta* (Brand) Heckard

Stems decumbent to ascending, hairs mostly spreading. Calyx lobes often glandular. Rare in the monument, collected from the south slope of Caldwell Butte.

P. hastata Lehm. subsp. *hastata*

Stems ascending to erect, hairs mostly appressed. Calyx lobes non-glandular. Rare in the monument, collect from the Big Nasty Trail.

Phacelia heterophylla Pursh subsp. *virgata* (E. Greene) Heckard – varileaf phacelia

A pubescent green-gray biennial or weak perennial with the central stem exceeding the lateral stems. Flowers white, stamens exerted. Common throughout the monument.

Phacelia linearis (Pursh) Holzinger -- threadleaf phacelia

An erect, often branched above, short hairy annual. Corolla bell-shaped, tube blue to white, limb violet. Common throughout the monument.

Phacelia mutabilis E. Greene – variable phacelia

A decumbent to erect biennial or short lived perennial with stiff hairs. Leaves compound to entire. Plants often with a reddish hue. Occasional among open forests in the southern portion of the monument.

Phacelia ramosissima Lehm. -- branching phacelia

A prostrate to ascending, or clambering, many branched, the branches coarse and brittle, perennial. Densely hairy, at least in the inflorescence, and often glandular, the more glandular plants being strongly aromatic. Inflorescences terminal coils; corollas lavender, funnel to bell-shaped. Occasional through out the monument, often on slopes and in partial shade of small junipers or shrubs. Variety *ramosissima* occurs in the monument; defined by glandular herbage and stems with soft spreading hairs below the inflorescence.

Plagiobothrys popcornflower***Plagiobothrys tenellus*** (Nutt.) A. Gray -- Pacific popcornflower

An annual up to 2.5dm in height with spreading bristly hairs. Nutlet 1-2mm cross-shaped. Occasional to common in the monument.

BRASSICACEAE

- 1a. Petals < 3mm, divided > ¼ to the base, white; leaves basal, <30mm, with simple, branched, or stellate hairs; fruits elliptic to obovate, averaging 7mm long and 2mm broad, glabrous.....***Draba verna***
- 1b. Plants not matching above characters.....2a
- 2a. Fruits 3-4 times as long as wide, linear, more than 1-seeded (mostly more than 2 seeded).....3a
- 2b. Fruits less than 3-4 times as long as wide, cordate to oval, or oblong, 1-seeded or seeds in pairs.....8a
- 3a. Flowers yellow, pale yellow to cream, or orange.....4a
- 3b. Flowers purple, pinkish, or white.....6a
- 4a. Leaves entire to toothed; hairs appressed, forked to multibranched.....***Erysimum***
- 4b. Leaves lobed or compound; hairs branched to simple.....5a
- 5a. Hairs (at least some) branched (examine both leaf surfaces).....***Descurainia***
- 5b. Hairs unbranched.....***Sisymbrium***

- 6a. Plants glabrous.....**Thelypodium**
 6b. Plants hairy.....7a
- 7a. Plant caespitose and +/- scapose; taproot thick and branched; basal leaves entire, grayish with branched hairs; fruit long tapered to tip, strongly compressed.....**Phoenicaulis**
 7b. Plants not caespitose or scapose; taproot slender, branched or not; basal leaves with branched hairs, without grayish tint; fruit not long tapered.....**Arabis**
- 8a. Fruit round or inflated in x-section.....9a
 8b. Fruits flat in x-section.....10a
- 9a. Fruits glabrous; lower stem hairs forked or stellate.....**Camelina microcarpa**
 9b. Fruits pubescent; lower stem hairs simple.....**Cardaria pubescens**
- 10a. Fruit with 1 chamber, 1 seed per chamber.....11a
 10b. Fruit with 2 chambers, >1 seeds per chamber.....12a
- 11a. Fruit 2-3 times longer than wide, wing without perforations.....**Isatis**
 11b. Fruit round, wing often with perforations.....**Thysanocarpus**
- 12a. Septum parallel to flattening of fruit.....**Alyssum**
 12b. Septum perpendicular to flattening of fruit.....13a
- 13a. Seed 1 per chamber; mature fruit <10mm wide.....**Lepidium**
 13b. Seeds 2 per chamber; mature fruit >10mm wide.....**Thlaspi arvense**

Alyssum madwort

- 1a. Fruits glabrous.....**A. desertorum**
 1b. Fruits hairy.....2a
- 2a. Sepals +/- persistent until fruit matures; filaments not winged or appendaged.....**A. alyssoides**
 2b. Sepals deciduous early in fruit; filaments winged and appendaged.....**A. minus** subsp. **micranthum**

Alyssum alyssoides L. -- pale madwort

Annual or biennial, 1-3dm tall, with appressed stellate hairs. Leaves narrowly oblanceolate. Sepals persistent until fruit reaches maturity. Petals cream color fading to white, 3-4mm. Rare in the monument, collected from the Gillem Bluff trail.

Alyssum desertorum Stapf -- desert madwort

Annual, 1-2 dm tall, with appressed stellate hairs. Fruits glabrous. Leaves linear to oblanceolate. Petals light yellow, 2-3mm. Found in abundance at Indian Well Campground.

Alyssum minus (L.) Roth subsp. *micranthum* (C. Meyer) Dudley -- alyssum

Annual 1-3dm tall with coarse stellate hairs. Similar to *A. alyssoides* but the sepals are shed early in fruit, and the filaments winged and appendaged. Common non-native along road shoulder.

Arabis rockcress

- 1a. Pedicel in fruit erect to spreading; fruits erect to spreading, often curved.....*A. sparsiflora*
 1b. Pedicel in fruit spreading to reflexed-appressed; fruits pendulous, often tightly appressed to stem, straight or curved.....*A. holeboellii*

Arabis holeboellii Hornem. -- Holboell's rockcress

A biennial or perennial from a caudex. Stem simple or branched, mostly above, and generally with multibranched hairs. Corolla purple to white. Two varieties occur in the monument:

A. holeboellii Hornem. var. *pinetorum* (Tidestrom) Rollins

Pedicle arched to recurved; fruit pendent to drooping, often incurved at tip. Occasional in the monument on rocky slopes or open areas.

A. holeboellii Hornem. var. *retrofracta* (Graham) Rydb.

Pedicle reflexed, mostly straight; fruit straight. Occasional in the monument on rocky slopes or open areas.

Arabis sparsiflora Nutt. -- sicklepod rockcress

A perennial from an often branched caudex. Stem simple or branched, mostly above, with simple to branched hairs, occasional glabrous above. Petals spoon-shaped, pink to purple. Three varieties occur in the monument:

A. sparsiflora Nutt. var. *arcuta* (Nutt.) Rollins

Basal leaves entire to toothed; hairs of upper leaves and upper stem dense; pedicles ascending hairs dense and spreading. Collected once near Canby's Cross

A. sparsiflora Nutt. var. *sparsiflora*

Basal leaves entire; hairs of upper leaves and upper stem 0; pedicles ascending, sparsely or not hairy. Occasional throughout the monument in sagebrush scrub.

A. sparsiflora Nutt. var. ***subvillosa*** (S. Watson) Rollins

Basal leaves toothed; hairs of upper leaves and upper stem 0; pedicles spreading, usually conspicuously hairy. Occasional throughout the monument in sagebrush scrub.

Camelina false flax***Camelina microcarpa*** Andr. -- littlepod false flax

An annual with mostly simple stems, clasping stem leaves, and simple, forked or stellate hairs, though often glabrous above. Fruits 5-8mm, obovate, plump. Only collected once in the monument.

Cardaria white-top***Cardaria pubescens*** (C. Meyer) Jarmol.—white-top

A hairy 1-4 dm tall perennial from a long rhizome. Leaves, lower short petioled, cauline sessile with a lobed base. Sepals and fruits hairy. Uncommon in the extreme northern portion of the monument.

Descurainia tansymustard

- 1a. Fruit oblong to club-shaped, widest at middle, 4-20mm long, seeds mostly in two rows per chamber.....***D. pinnata***
 1b. Fruit linear, uniform width, 10-35mm long, seeds mostly in one row per chamber.....***D. sophia***

Descurainia pinnata (Walter) Britton -- western tansymustard

An annual with inconspicuous, pale yellow to white flowers and club-shaped fruits. Stems often glandular hairy. Leaves, basal rosette soon withering; cauline deeply 2-pinnately lobed leaves. Subspecies. ***halictorum*** (Cockerell) Detl. occurs in the monument; defined by fruit pedicles 60-110 deg from axis; herbage densely hairy, canescent; petals 1-2mm pale yellow. A weedy native, common to occasional throughout the monument.

Descurainia sophia (L.) Webb—flix weed

An annual or biennial. Petals yellow, < greenish-yellow sepals. Leaves; cauline 2-3-pinnately lobed to 2-3-compound; basal leaves early withering. Stems often densely hairy and nonglandular, with a grayish tone. An aggressive non-native species in disturbed areas of the monument, especially the northern portion. [*Sisymbrium sophia*]

Draba draba***Draba verna*** L. -- Spring draba

An inconspicuous annual often less than 10cm tall, but up to 25cm. Petals white and bilobed, often present when the silicle emerges. Commonly found throughout the monument. An early spring bloomer.

Erysimum wallflower

Erysimum capitatum (Douglas) E. Greene -- sanddune wallflower

A biennial or short lived perennial, with 1-few stems, from a short caudex. Leaves in basal rosettes and cauline; cauline linear to spoon-shaped, entire to dentate, and often with branched hairs. Flowers showy, borne in crowded racemes, petals yellow to orange. Subspecies *capitatum* occurs in the monument; defined by acutely tipped basal leaves, often <10cm long, and fruits not constricted between seeds. Uncommon in the monument, ponderosa pine habitats.

Isatis woad

Isatis tinctoria L. -- Dyer's woad

A biennial or perennial, glabrous to glaucous. Leaves clustered at the base, oblanceolate, somewhat toothed or wavy margined, sparsely hairy; cauline leaves sessile, sagittate, and partially clasping. Pedicle usually reflexed and the fruits spoon-shaped, flat. Rare in the monument from disturbed areas.

Lepidium pepperweed

- 1a. Upper stem leaves surrounding stem.....*L. perfoliatum*
 1b. Upper stem leaves not clasping stem.....*L. latifolium*

Lepidium latifolium L. -- perennial pepperweed

A glabrous perennial over 4dm in height from a well developed rhizome. Leaves entire to toothed; basal blades to 30cm; cauline leaves reduced and often sessile. Inflorescence a panicle of tiny white flowers. Uncommon to rare in the monument, only found along the northern border adjacent to agricultural lands. *Lepidium densiflorum* Schrader would also key here: much smaller than *L. latifolium* and an annual or biennial, also expected along northern boundary.

Lepidium perfoliatum L. -- clasping pepperweed

A simple or branched annual or biennial, glabrous above and puberulent below. Leaves dimorphic, lower 2-3 times pinnately lobed, upper cordate-clasping. Uncommon in the extreme northern portion of the monument.

Phoenicaulis phoenicaulis

Phoenicaulis cheiranthoides Nutt. -- wallflower phoenicaulis

A somewhat caespitose perennial with old leaf bases covering the caudex branches. The thick basal rosette consists of entire oblanceolate leaves, 3-15cm long, with a grayish-white hue and multibranching hairs. Siliques glabrous, widely divergent, 2-8cm long, tapered at both ends, and sickle-shaped. Uncommon in the monument; collected from Gillem Bluff.

Sisymbrium hedgemustard

Sisymbrium altissimum L. -- tall tumbledustard

An erect highly branched, especially above, annual. Lower leaves pinnately lobed to 1-pinnate; upper with pinnatifid linear segments. Flowers yellow. Fruits linear 5-10cm in length, spreading. Common in disturbed areas of the monument, forming dense patches in the northern portion of the monument.

Thelypodium thelypody

Thelypodium flexuosum Robinson -- nodding thelypody

A taprooted perennial from a thick woody caudex covered with old petiole bases. Stems 1-several weak, slender, erect to subdecumbent. Leaves glaucous and entire, oblanceolate. Fruit cylindrical, narrowed between seeds. Uncommon in the monument.

Thlaspi pennycress

Thlaspi arvense L. -- field pennycress

A glabrous annual with simple or branched stems. Basal leaves oblanceolate with a short petiole, early withering; cauline similar to basal but becoming clasping above. Fruits large, 10-15mm wide, oblong to round. Rare in the monument, collected near the Cave Research Center.

Thysanocarpus fringe-pod

Thysanocarpus curvipes Hook. -- sand fringe-pod

An annual with simple to branched stems, often hairy below. Fruits, elliptic to round, the wing margin often wavy and/or perforated. Uncommon on open rocky slopes in the monument.

CAMPANULACEAE**Triodanis** Venus' looking-glass

Triodanis perfoliata (L.) Nieuwl. -- Clasping Venus' looking-glass

An annual, often 1-6dm tall. Leaves sessile, round, cordate-clasping, and toothed. Flowers deep purple to pale lavender, the lower never opening. Rare in the monument, two individuals observed near the entrance to Post Office Cave.

CAPRIFOLIACEAE**Symphoricarpos** snowberry

Symphoricarpos rotundifolius A. Gray -- roundleaf snowberry

A low growing shrub, <1.2m, with finely pubescent twigs and opposite leaves. Flowers bell-shaped, pink to white. Variety *rotundifolius* occurs in the monument; defined by the inside of the corolla tube being hairy the middle 1/3, and an erect growth form. Uncommon on rocky slopes or coniferous forests in the monument. [*Symphoricarpos oreophilus*, *Symphoricarpos vaccinoides*]

CARYOPHYLLACEAE

- 1a. Sepals united, tube prominent; petals long clawed, appendage present.....**Silene**
 1b. Sepals distinct; petals not long clawed, appendage absent.....2a
- 2a. Inflorescence umbel-like; plants not mat forming; petals irregularly
 toothed.....**Holosteum**
 2b. Inflorescence not umbel-like; plants mat forming; petals entire or notched.....3a
- 3a. Capsule dehiscent by 3 valves.....**Minuartia**
 3b. Capsule dehiscent by 6 valves.....**Eremogone**

Eremogone

Eremogone kingii (S. Watson) Ikonn. var. *glabrescens* (S. Watson) Dorn –
 King's compact sandwort

A tufted, or loosely matted, hairy, occasionally glandular above, perennial up to 20cm in height. Leaves opposite and linear to needle-like. Rare in the monument, collected from Fleener's Chimney. [*Arenaria kingii* var. *glabrescens*]

Holosteum holosteum

Holosteum umbellatum L. spp. *umbellatum* -- jagged chickweed

An annual with 1-several glandular-hairy stems, up to 30cm. Basal rosette 1-2cm wide; cauline leaves of 1-4 pairs. Petals white, slightly > sepals, and with minute teeth at the tips. An early season bloomer common in disturbed areas and among sagebrush in the northern portion of the monument.

Minuartia stitchwort

Minuartia nuttallii (Pax) Briq. -- brittle sandwort

A mat-forming densely glandular-hairy perennial with trailing stems, <20cm in height. Variety *gregaria* (A.A. Heller) McNeill occurs in the monument; defined by slightly recurved, needle-like, leaves; petals 1.1-1.6 times the sepals. Rare in the monument, collected from Gillem Bluff. [*Arenaria nuttallii*]

Silene catchfly

Silene douglasii Hook. -- seabluff catchfly

A few to many stemmed perennial, densely to finely hairy, from a branched caudex. Inflorescences showy with creamy white bilobed petals and two appendages. Occasional among rocky outcrops in the monument.

CONVOLVULACEAE

Convolvulus bindweed

Convolvulus arvensis L. -- field bindweed

A prostrate to twining perennial from a deep taproot. Leaves 2-3cm, oblong to ovate, and hastate at the base. Flowers showy, funnel-shaped, and white. An invasive species, uncommon in the northern portion of the monument.

ERICACEAE

- 1a. Shrubs, woody throughout.....**Arctostaphylos**
 1b. Herbs, not woody.....2a
- 2a. Plants pinkish, without green leaves, parasitic; leaves scale-like.....**Pterospora**
 2b. Plants with green leaves; leaves basal, round > 4cm.....**Pyrola**

Arctostaphylos manzanita

Arctostaphylos patula E. Greene -- greenleaf manzanita

Evergreen shrub with smooth reddish-brown bark, young twigs puberulent to glandular. Leaves ovate to round, leathery, shiny-green. Inflorescence open, consisting of urn-shaped pinkish-white flowers, and brownish berries. Occasional on cindercones in the monument and along the southern boundary.

Pterospora pinedrops

Pterospora andromedea Nutt. -- woodland pinedrops

An unbranched, reddish-brown, sticky-glandular perennial. Inflorescence a raceme of urn-shaped flowers. Dried stems and inflorescences often visible for 1+ years. Observed from Island Butte, to be expected in the coniferous forest habitat along the southern boundary.

Pyrola wintergreen

Pyrola picta Smith -- whiteveined wintergreen

A perennial with a single reddish-brown flowering stem and 10-25 flowers. Leaves waxy, occasionally lacking, the upper surface with white-bordered veins, lower surface often purple. Uncommon along the southern boundary of the monument.

EUPHORBIACEAE

- 1a. Plants silvery-hairy, with stellate hairs; leaves alternate.....**Croton**
 1b. Plants not silvery-hairy, glabrous; leaves opposite.....**Chamaesyce**

Chamaesyce sandmat

- 1a. Seeds with transverse ridges; leaves thick-margined, entire to finely dentate.....**C. glyptosperma**
 1b. Seeds wrinkled to smooth, lacking transverse ridges; leaves without thickened margins, serrated.....**C. serpyllifolia** subsp. **serpyllifolia**

Chamaesyce glyptosperma (Engelm.) Small -- ribseed sandmat

A glabrous monoecious annual with milky sap, and prostrate freely branching stems. Leaves 3-15mm entire to finely toothed. Stipules thread-like. Flowers minute ~1mm, with 5 glands, 4 pinkish; appendages white, wider than the gland. Collected near the northwest entrance.

Chamaesyce serpyllifolia (Pers.) Small -- thymeleaf sandmat

A glabrous monoecious annual with milky sap. Stems mostly prostrate, occasionally ascending stems. Leaves 3-14mm, serrulate near tips; stipules linear and separate. Flowers minute <2mm, with 4 oblong glands; appendages white and narrower than glands. Subspecies **serpyllifolia** occurs in the monument; defined by glabrous leaves stems, and involucre. Common in disturbed areas of the monument, especially the road shoulder.

Croton croton**Croton setigerus** Hook. -- turkey mullein

A matted or mounded, monoecious, densely stellate-hairy throughout, annual, with a sub dichotomous branching pattern. Rare in the monument from dry, open, rocky areas; one collection from road shoulder near West Wildlife Overlook. [*Eremocarps setigerus*]

FABACEAE

- 1a. Leaf palmate.....**Lupinus**
 1b. Leaf pinnate, or pinnate trifoliate.....2a
 2a. Leaf pinnate trifoliate.....**Melilotus**
 2b. Leaf pinnate, leaflets >3.....3a
 3a. Leaves odd-pinnately compound; terminal leaflet present, not replaced by tendrils.....**Astragalus**
 3b. Leaves even-pinnately compound; terminal leaflet replaced by tendrils or short bristle.....**Vicia**

Astragalus milkvetch

- 1a. Pods inflated, >5mm wide, bladder- or paper-like, mostly glabrous, if curved then only at tip.....**A. lentiginosus**
 1b. Pods not inflated, not bladder- or paper-like, pods curved or straight.....2a

- 2a. Pods with dense white-woolly hairs covering outer surface or pod, resembling a cotton ball; leaves with fine cotton-like hairs, 1-2mm long.....*A. purshii*
 2b. Pods without dense white-woolly hairs; leaves without long cotton-like hairs.....3a
- 3a. Pods mostly straight.....4a
 3b. Pods curved >1/4 circle.....5a
- 4a. Plants prostrate and open, <15cm; pods erect, sessile.....*A. obscurus*
 4b. Plants with erect clumped stems, 30-90cm; pods spreading to pendent, stipiate, the stipe 6-16mm long.....*A. filipes*
- 5a. Lowest stipules fused into a papery-membranous sheath; petals yellow.....*A. gibbsii*
 5b. Lowest stipules not fused; petals white to pale yellow
*A. curvicaarpus* var. *curvicaarpus*

Astragalus curvicaarpus (A.A. Heller) Macbr. var. *curvicaarpus* –
 curvepod milkvetch

A loosely cespitose, many-stemmed, perennial, often minutely puberulent, grayish or glabrous and green. Leaves 4-10cm long with 7-21 ovate to elliptic leaflets, tips blunt and shallowly toothed; stipules not fused. Pods pendulous, long-stalked (10-20mm), compressed, and incurved +/- a half circle. Occasional among sagebrush scrub in the monument. [*Astragalus whitedii*]

Astragalus filipes Torr. ex A. Gray -- basalt milkvetch

An often strigose erect perennial. Lower stipules fused into papery sheaths. Leaf 5-10 cm; leaflets 5-23, linear to narrowly oblong and well separated. Pods flat, stalked. Occasional among sagebrush scrub in the monument.

Astragalus gibbsii Kellogg -- Gibbs' milkvetch

A many-stemmed perennial with spreading, wavy, hairs, giving it a grayish appearance. Leaves 1.5-9.5cm; leaflets 7-19 obovate to oblong. Stipules, especially lower, fused. Pods pendent, slightly compressed, and incurved 1/4-1/2 a circle. Uncommon in the northern end of the monument.

Astragalus lentiginosus Douglas -- freckled milkvetch

A glabrous to silvery-strigose perennial with decumbent to sub-erect stems. Pods inflated, bladdery, papery, beaked, and often red-spotted. Occasional, mostly along the road shoulder in the monument. Several varieties might be expected.

Astragalus obscurus S. Watson -- arcane milkvetch

A prostrate, slender stemmed, minutely strigose, perennial. Leaf 2.5-10cm; leaflets 5-15 elliptic to oblong, well separated. Pods erect, subsessile, terete-cordate in x-section. Rare in the monument, only known from the northern end of Gillem Bluff.

Astragalus purshii Hook. -- woollypod milkvetch

A prostrate to matted perennial with fine, cottony, entangled hairs. Pods ascending and covered with dense hairs, pods often resembling cotton balls. Occasional among sagebrush scrub in the monument.

Lupinus lupine***Lupinus microcarpus*** Sims -- valley lupine

A spreading to erect, well branched, annual sparsely to densely hairy. Leaves palmately compound. Inflorescence a raceme of whorled blue flowers and pilose pods. Occasional in the monument, mostly along the road shoulder in the northern portion of the monument. [*Lupinus subvexus*]

Melilotus sweetclover

- 1a. Petals yellow, wings usually as long as banner.....***M. officinalis***
 1b. Petals white, banner obviously longer than wings.....***M. alba***

Melilotus alba Medikus -- white sweetclover

Annual to biennial up to 2m in height, freely branched above. Leaves compound; leaflets 3, often toothed. Inflorescence a raceme of white flowers; pods, ovoid, 3-5mm wide. Uncommon along road shoulder.

Melilotus officinalis (L.) Pall. -- yellow sweetclover

Annual to biennial up to 2m in height, freely branched above, Leaves compound; leaflets 3, often toothed. Inflorescence a raceme of yellow flowers; pods, ovoid, 3-5mm wide. Slightly more common than *M. alba* in the monument, same habitats.

Vicia vetch***Vicia americana*** Willd. var. ***americana*** -- American vetch

A sprawling to clambering weak stemmed perennial. Leaves pinnately compound with a tendril replacing the terminal leaflet. Inflorescence an axillary raceme of purple flowers, subtending a leaf. Uncommon in the extreme northern portion of the monument.

FAGACEAE**Chrysolepis** chinquapin***Chrysolepis sempervirens*** (Kellogg) Hjelmq. -- bush chinquapin

A monoecious, evergreen, upright to spreading, +/- round topped, shrub <3m in height. Leaf elliptic, upper surface dull green, lower golden to rusty. Inflorescence catkins; male catkins produced on terminal or side branches; female catkins often at the base of male catkins or separate; nut covered by a densely burred involucre. Rare in the monument, collected once from Red Butte, expected along southern boundary.

GENTIANACEAE

Swertia Swertia***Swertia albicaulis*** (Griseb.) Kuntze -- whitestem swertia

A 1-several stemmed perennial from a branched caudex. Leaves white margined; basal in a rosette; cauline opposite and reduced above. Inflorescence a narrow, often interrupted, cluster of cymes; flowers white to pale blue with 1 nectary pit per corolla lobe. Two varieties are occasional among sagebrush scrub in the monument. [*Frasera albicaulis*]

S. albicaulis (Griseb.) Kuntze var. ***nitida*** (Benth.) Jeps.

Stem and leaf glabrous; larger leaves acute at tip.

S. albicaulis (Griseb.) Kuntze var. ***modocensis*** (H. St. John) J.S. Pringle

Stem and lower leaf surface puberulent; large leaves obtuse or rounded at tip.

GERANIACEAE

Erodium stork's bill***Erodium cicutarium*** (L.) L'Her -- redstem stork's bill

An annual with compound, mostly basal, leaves 3-10cm in length; the petioles being < the blade. Flowers 10-15mm broad; petals 5, pinkish-lavender, ciliate at the base. Style column elongates to 2-5 cm in fruit; drying and wetting causes the styles to coil and uncoil, screwing themselves into the ground. Frequent in disturbed areas throughout the monument.

GROSSULARIACEAE

Ribes currant

- 1a. Nodal spines absent.....***R. cereum***
 1b. Nodal spines present.....2a

- 2a. Anthers exerted; sepals reflexed, purplish; ovary and mature fruit with
 spines.....***R. roezlii***
 2b. Anthers not exerted; sepals spreading, white; ovary and mature fruit pubescent, often
 glandular.....***R. velutinum***

Ribes cereum Douglas -- wax currant

An erect to spreading unarmed aromatic shrub, to 2m in height. Leaves round to reniform, shallowly 3-5 lobed, often glandular above. Inflorescence a 3-7 flowered raceme; flowers white to pink; berries red, edible, bland tasting. Variety ***cereum*** occurs in the monument; defined by hairy styles and densely hairy glandular leaves. Common in the monument.

Ribes roezlii Regel -- Sierra gooseberry

An armed shrub up to 1m in height. Leaves round and toothed. Inflorescence a 1-3 flowered raceme; sepals purple, reflexed; anthers exerted from white petals, < style; berry red, armed with stout prickles. Variety *roezlii* occurs in the monument; defined by hairy hypanthium, sepals, and lower leaf surfaces. Uncommon on forested slopes in the southern portion of the monument.

Ribes velutinum E. Greene -- desert gooseberry

An armed shrub with arched branches. Leaves crenate, round to reniform, shallowly 3-5 lobed. Inflorescence a 1-2 flowered raceme; sepals and petals yellow to pinkish; berry dark red to purple, edible, slightly sweeter than those of *R. cereum*.

LAMIACEAE

- 1a. Fertile stamens 2.....**Salvia**
 1b. Fertile stamens 4.....2a
- 2a. Corolla mostly radial, five lobed; inflorescence head-like, terminal, subtended by a whorl of bracts.....**Monardella**
 2b. Corolla clearly bilateral; inflorescence head-like or not, not subtended by a whorl of bracts.....3a
- 3a. Calyx 2-lobed, upper side with a prominent transverse ridge; flowers axillary, mostly in pairs.....**Scutellaria**
 3b. Calyx 5 or 10-lobed, without transverse ridge; flowers not paired.....4a
- 4a. Inflorescence a terminal head, often with 1-3 interruptions.....**Agastache**
 4b. Inflorescence axillary.....5a
- 5a. Calyx lobes 10, recurved at tip; stamens included; plants densely white-woolly.....**Marrubium**
 5b. Calyx lobes 5, not recurved; stamens partially exerted; plants not densely white-woolly.....**Lamium**

Agastache giant hyssop

- 1a. Leaves +/- lanceolate, 3-8cm long x 1.5-7cm wide.....**A. urticifolia**
 1b. Leave triangular, <5cm long and <3.5cm wide.....**A parvifolia**

Agastache parvifolia Eastw. -- small leaf giant hyssop

A erect aromatic perennial with 1-several stems up to 1m in height. Leaves opposite, triangular <5cm long and <3.5cm wide, toothed. Inflorescence a terminal cluster, often with several interruptions; corollas 5-lobed rose to purple. Common among rocky outcrops in the monument.

Agastache urticifolia (Benth.) Kuntze -- nettleleaf giant hyssop

Much like *A. parvifolia* with larger lanceolate leaves, less common and among the same habitats at Lava Beds.

Lamium deadnettle*Lamium amplexicaule* L. -- henbit deadnettle

An annual with several stems, decumbent at the base. Leaves ovate to round, crenate to lobed, becoming sessile and clasping above. Inflorescence terminal and axillary, corolla red-purple, glabrous inside. Collected once in the monument south of Gillem Camp parking area.

Marrubium horehound*Marrubium vulgare* L. -- horehound

A ascending to erect white-woolly perennial. Leaves ovate to round, lobed at the base, conspicuously veiny, the margin crenate. Inflorescences axillary in the upper nodes. Occasional in disturbed areas of the monument, known populations aggressively controlled by monument staff.

Monardella monardella

- 1a. Outer bract series absent; stems dark gray to green, often appearing
glaucous.....*M glauca*
- 1b. Outer bract series present, spreading or reflexed; stems green,
hairy.....*M. odoratissima*

Monardella glauca E. Greene -- pale monardella

A perennial with several, mostly simple stems, often appearing glaucous. Leaves entire, elliptic to ovate. Inflorescence a terminal head of purple to red-purple flowers, subtended by conspicuous bracts. Uncommon in the monument, collected from Caldwell Butte and Bear Paw Cave.

Monardella odoratissima Benth. -- mountain monardella

A strongly aromatic perennial with several, mostly simple stems, often woody at the base. Leaves lanceolate to entire, often hairy, green to ash-gray, sometimes purple tinged. Inflorescence a terminal head of purplish-rose or white flowers, subtended by conspicuous bracts. Two varieties occur in the southern portion of the monument:

M. odoratissima Benth subsp. *odoratissima*

Outer bracts spreading, ovate, <25mm; corolla purple, occasionally lavender-white.

M. odoratissima Benth subsp. *pallida* (A. Heller) Epling

Outer bracts reflexed, linear-lanceolate, 25-40mm; corolla mostly whitish.

Salvia sage

- 1a. Subshrub, prostrate, often mat-forming; lower corolla lip >2x upper.....***S. sonomensis***
 1b. Shrub, spreading to somewhat erect; lower corolla lip <2x upper.....***S. dorrii***

Salvia dorrii (Kellogg) Abrams -- purple sage

A much branched aromatic shrub, often broader than high. Leaves linear to spoon-shaped, entire, covered with a mealy pubescence and often glandular. Inflorescence terminal whorls of blue-violet flowers, stamens long-exserted. Two varieties occur in the monument.

S. dorrii (Kellogg) Abrams var. ***dorrii***

Leaves 6-20mm long x 2-13mm wide with the leaf base abruptly narrowed to the petiole. Less common in the monument than variety ***incana***, collected from Frozen River Cave and Black Crater Trail.

S. dorrii (Kellogg) Abrams var. ***incana*** (A. Gray) J.L. Strachan

Leaves 10-40mm long x 6-28mm wide with the leaf base tapered to the petiole. Occasional throughout the monument, mostly associated with rocky outcrops.

Salvia sonomensis E. Greene -- creeping sage

A mat-forming, low growing, <4dm, subshrub. Leaves elliptic to obovate, upper surface minutely hairy, lower surface densely hairy with recurved hairs. Rare in the monument, collected once near Blue Grotto Cave.

Scutellaria skullcap***Scutellaria nana*** A. Gray -- dwarf skullcap

A low growing rhizomatous perennial, branched from near the ground. Leaves obovate to diamond-shaped, densely ash-gray puberulent, crowded, entire. Flowers bilateral, cream to white colored, often paired. Uncommon in open areas in the southern half of the monument.

LINACEAE

- 1a. Petals white to pink, 0.5-4mm; styles 3.....**Hesperolinon**
 1b. Petals blue, 8-25mm; styles 5.....**Linum**

Hesperolinon dwarf-flax***Hesperolinon micranthum*** (A. Gray) Small -- smallflower dwarf-flax

A dichotomously branched annual up to 3dm in height. Leaves alternate, linear, 1-nerved. Inflorescence an open cyme; pedicels 5-15mm; sepals often glandular-ciliate; petals 5, <4mm, white with pink to rose streaking. Occasional to uncommon in open areas of the monument.

Linum flax***Linum lewisii*** Pursh -- prairie flax

An erect several stemmed, stems branched above, perennial. Leaves glabrous, linear to lanceolate. Flowers showy; petals light blue 6-15mm, falling off the same day they open. Variety *lewisii* occurs in the monument; defined by 10-15mm petals and a style >6mm. Occasional among sagebrush scrub in the monument. [*Linum perenne*]

LOASACEAE**Mentzelia** blazingstar

- 1a. Biennial or perennial; flowers showy, petals 3-8cm.....***M. laevicaulis***
 1a. Annual; petals <1cm.....2a
- 2a. Inflorescence dense; bract lobed at tip, widely wedge-shaped, concealing flowers, white-scarious in lower $\frac{3}{4}$; axillary fruits straight.....***M. congesta***
 2b. Plant lacking combination of characters above.....3a
- 3a. Bracts not toothed, lanceolate to ovate, not whitish at base; axillary fruits curved >90 deg.....***M. albicaulis***
 3b. Bracts 2-6 toothed, obovate to ovate, whitish at base; axillary fruits straight, erect.....***M. montana***

Mentzelia albicaulis (Douglas) Douglas ex Torrey & A Gray – whitestem blazingstar

A simple to branched, decumbent to erect annual with barbed hairs. Leaves linear entire to shallowly-lobed, with a sandpaper texture. Inflorescence a +/- open cyme; petals yellow. Common in disturbed areas of the monument.

Mentzelia congesta Torrey & A. Gray -- united blazingstar

An erect annual branched from below with barbed hairs. Leaves entire to lobed, with a sandpapery texture. Inflorescence a dense congested cyme; petals yellow, often with an orange spot at the base. Collected once from Indian Well Campground.

Mentzelia laevicaulis (Hook.) Torrey & A. Gray -- smoothstem blazingstar

An erect branched, often above less often below, biennial to perennial with barbed hairs. Leaves lobed, petioled below, sessile above, with a sandpapery texture. Flowers large, showy; petals yellow. Common along the road shoulder in the monument, also found in open rocky areas.

Mentzelia montana (Davidson) Davidson -- variegated-bract blazingstar

An erect annual with barbed hairs. Leaves entire or 2-lobed at the base, with a sandpapery texture. Inflorescence a +/- open cyme; petals yellow sometimes with an orange spot at base. Collected once from Hospital Rock.

MALVACEAE**Malva** mallow

Malva neglecta Wallr. -- common mallow

A densely stiff-hairy annual or biennial. Leaves long petioled, reniform to cordate and slightly palmately lobed. Inflorescence axillary clusters of 3-6 lilac to white flowers. Uncommon to rare in disturbed areas of the monument. [*Malva rotundifolia*]

ONAGRACEAE

- 1a. Ovary chambers 2; petals small, mostly <3cm; stem branches hair-like.....**Gayophytum**
 1b. Ovary chambers 4; petals often >3cm; stem branches not hair-like.....2a
- 2a. Seeds with a small hair tuft; sepals erect in flower.....3a
 2b. Seeds without a hair tuft; sepals (at least one) reflexed in flower.....4a
- 3a. Stigma 4-lobed; inflorescence a raceme, >15 flowered; plants robust, up to 3m; leaves mostly >10cm.....**Chamerion angustifolium**
 3b. Stigma mostly entire; inflorescence a panicle; plants short, mostly <1m; leaves <5cm.....**Epilobium**
- 4a. Stigma head-like or globular; flowers yellow.....**Camissonia**
 4b. Stigma 4-lobed; flowers white to pink.....5a
- 5a. Perennial; anthers attached at middle; petals >2cm.....**Oenothera**
 5b. Annual; anthers attached at base; petals <2cm.....**Clarkia**

Camissonia suncup

- 1a. Stem absent, hidden by leaves; leaves deeply pinnately lobed.....**C. tanacetifolia**
 1b. Stem present; leaves subentire.....**C. parvula**

Camissonia parvula (Torrey & A. Gray) Raven -- Lewis River suncup

A branched, low growing annual. Leaves subentire, linear, well distributed along the stem, often 0 on lower stem. Flowers sessile, yellow, maturing into linear subsessile fruits 2-3cm in length. Rare in the monument, only collected once from open pumice on the south slope of Hardin Butte.

Camissonia tanacetifolia (Torrey & A. Gray) Raven -- tansyleaf evening primrose

A stemless perennial. Leaves and flowers all basal. Rare in the monument, a plant of moist places; only collected once near the car washing station at monument headquarters.

Chamerion fireweed***Chamerion angustifolium*** (L.) Holub -- fireweed

A tall, up to 3m, perennial from a running rhizome, often forming colonial stands. Leaves, alternate, all cauline, numerous and crowded, lanceolate. Inflorescence a terminal raceme of crowded, spreading flowers; petals short, clawed pink-purple. Uncommon to rare in the monument, known from Hidden Valley. [*Epilobium angustifolium*]

Clarkia clarkia

- 1a. Petals not clawed; flowers closing at night; ovary 8 grooved.....***C. lassenensis***
 1b. Petals clawed (base narrowed to stalk-like base); flowers not closing at night; ovary 4 grooved.....***C. rhomboidea***

Clarkia lassenensis (Eastw.) Harlan Lewis & M. Lewis -- Mt. Lassen clarkia

An erect simple to much branched annual. Leaves linear, alternate to subopposite below. Buds pendent, the pedicels <3mm. Corolla bowl-shaped, petals not clawed, pink. Common in sagebrush and juniper scrub in the southern half of the monument.

Clarkia rhomboidea Douglas -- diamond clarkia

An erect, simple to few branched, annual. Leaves elliptic to ovate, opposite below, mostly alternate above. Buds pendent. Petals clawed, 2-lobed, pink to lavender. Occasional among woodlands in the southern portion of the monument.

Epilobium willowherb

- 1a. Plants 2-20dm; leaves mostly, or all, alternate; hypanthium >1mm; petals 2-15mm.....***E. brachycarpum***
 1b. Plants <4dm; leaves opposite below, often alternate above; hypanthium <1mm; petals 2-5mm.....***E. minutum***

Epilobium brachycarpum C. Presl -- tall annual willowherb

A freely branched, especially above when well developed, annual with an exfoliating epidermis. Leaves narrowly elliptic to linear, folded along midrib, clusters of reduced leaves often present in axis. Inflorescence a raceme terminating the many lax branches; petals small, pink to white. Common to abundant in disturbed areas of the monument. [*Epilobium paniculatum*]

Epilobium minutum Lehm. -- chaparral willowherb

A simple to few branched, mostly below, annual. Leaves opposite below alternate above, elliptic to spoon-shaped. Inflorescence a few flowered raceme terminating the branches; corolla pink to white, 2-5mm. Occasional in the monument, especially disturbed areas.

Gayophytum groundsmoke

- 1a. Flowers and fruits sessile, or pedicel <2mm; fruit flat, not, or barely, constricted between seeds; capsule separating into 4 valves at maturity.....***G. racemosum***
 1b. Flowers and fruits pedicellate, pedicel >2mm; fruit not flat, constricted between seeds at maturity.....2a
- 2a. Pedicel longer than fruit; fruit mostly 3-6mm; petals mostly <1mm.....***G. ramosissimum***
 2b. Pedicel shorter than fruit; fruit 5-15mm; petals mostly >1mm.....***G. diffusum***

Gayophytum diffusum Torrey & A. Gray -- spreading groundsmoke

A branched, below or not, to highly forked above annual with linear leaves. Variety ***parviflorum*** Harlan Lewis & J. Szweykowski occurs in the monument; defined by slightly knobby, fruits, often with 1 row of seeds, longer than their pedicels; and a highly branched habit. Occasional in the monument.

Gayophytum racemosum Torrey & A. Gray -- blackfoot groundsmoke

A branched below, much less above, annual with linear leaves. Flowers sessile, inconspicuous, often hidden by floral bracts. Rare in the monument, one collection from Bearpaw Butte.

Gayophytum ramosissimum Torrey & A. Gray -- pinyon groundsmoke

A diffusely branched above annual with linear leaves, becoming reduced above. Fruits shorter than pedicels, seeds in two rows, crowded. Occasional in the monument.

Oenothera evening primrose***Oenothera cespitosa*** Nutt. -- tufted evening-primrose

A caespitose perennial with an absent or inconspicuous stem. Leaves pinnately lobed and in basal rosettes. Flowers white, borne singly, and developing into fruits with rows of tubercles. Subspecies ***marginata*** (Hook. & Arn.) Munz occurs in the monument; defined by straight fruits, 25-68mm. Only collected from the peninsula in the northern portion of the monument.

OROBANCHACEAE**Orobanche** broomrape

- 1a. Pedicels >3cm; bractlets absent; 5-20 flowers.....***O. fasciculata***
 1b. Pedicels absent or <3cm; bractlets present; >20 flowers.....***O. corymbosa***

Orobanche corymbosa (Rydb.) Ferris -- flat-top broomrape

A pale yellow to reddish-purple root parasite of big sagebrush. Stems clustered, glandular puberulent, ending in a flat-topped cluster of many purple to light pink, short pedicled, flowers. Uncommon among sagebrush scrub in the monument.

Orobanche fasciculata Nutt. -- clustered broomrape

A light brown to reddish-purple root parasite, probably on sagebrush. Stems singular or clustered, puberulent glandular. Flowers purplish, long pedicled, the lower pedicles often the longest. Uncommon among sagebrush scrub in the monument.

PAPAVERACEAE***Eschscholzia*** California poppy***Eschscholzia californica*** Cham. -- California poppy

A perennial, or less commonly an annual, 1-5dm in height from a taproot. Leaves basal and cauline, glabrous, glaucous, and with the ultimate segments obtuse to acute. Sepals 2, fused and falling as a unit as the flower opens. A highly variable species, not just within populations, but within individual plants over the course of the season. Common throughout the monument in gravel or pumice areas.

POLEMONIACEAE

- 1a. Calyx tube uniform in color and texture, lacking white-papery membrane between lobes.....2a
 1b. Calyx tube not uniform in color and texture, white-papery membrane present between lobes.....3a
- 2a. Leaves entire (sometimes toothed).....**Collomia**
 2b. Leaves pinnately compound with definite leaflets.....**Polemonium**
- 3a. Filaments attached at different levels; leaves opposite and entire (upper sometimes alternate).....**Phlox**
 3b. Filaments attached at same level; leaves not both opposite and entire.....4a
- 4a. Inflorescence a leafy-bracted tomentose head, with cobwebby hairs; calyx lobes mostly unequal.....**Eriastrum**
 4b. Inflorescence not a leafy-bracted tomentose head; calyx lobes equal.....5a
- 5a. Leaves opposite (appearing whorled).....**Leptosiphon**
 5b. Leaves alternate, or mostly basal.....6a
- 6a. Plants annual, plants often delicate; corolla throat yellow, lobes violet-purple.....**Gilia**
 6a. Plants perennial, stout; corolla not as above.....7a
- 7a. Erect shrub or subshrub; leaves firm and prickly; flowers 15-25mm, solitary, mostly open at night and closing during the day (nocturnal).....**Leptodactylon pungens**
 7b. Low growing perennial; leaves not prickly; flowers 3-5mm, in heads, not nocturnal.....**Ipomopsis congesta**

Collomia trumpet

- 1a. Flowers salmon-colored, often >2cm long.....*C. grandiflora*
 1b. Flowers light blue, violet, white, or pink <2cm long.....2a
- 2a. Stems branched throughout; flowers axillary and terminal; stamens equally inserted.....*C. tinctoria*
 2b. Stems simple, or branched above; flowers in terminal head; stamens unequally inserted.....*C. linearis*

Collomia grandiflora Douglas ex Lindley -- grand collomia

An erect, sparsely branched above, annual, up to 1m in height. Leaves alternate, lanceolate and toothed below, lanceolate to linear and entire above. Inflorescence a terminal head of sessile salmon colored flowers. Uncommon to occasional in open areas of the monument, mostly the northern portion.

Collomia linearis Nutt. -- tiny trumpet

A simple, or branched above, perennial, <6dm in height. Leaves lanceolate to linear 1-7cm long. Heads terminal clusters of sessile flowers. Collected once near Caldwell Ice Cave.

Collomia tinctoria Kellogg -- staining collomia

A diffusely branched, glandular hairy, annual, <1.5dm in height. Leaves linear, opposite below, alternate above. Inflorescence often both axillary and terminal clusters of pinkish flowers with exerted anthers. Common in open areas and on pumice slopes of cindercones in the monument.

Eriastrum woollystar***Eriastrum sparsiflorum*** (Eastw.) H. Mason -- Great Basin woollystar

An erect branched, the branches ascending, annual, up to 3dm in height. Leaves thread-like, white-woolly, entire or two lobed. Inflorescence, white-woolly, terminal heads of inconspicuous flowers; corolla blue to light pink with yellow throat. Uncommon to occasional in sagebrush scrub in the monument, easily seen along the Whitney Butte Trail.

Gilia gilia***Gilia inconspicua*** (Smith) Sweet -- shy gilia

A branched annual with cobwebby hairs below and stalked glands throughout. Leaves chiefly basal, 1-pinnate, reduced above. Inflorescence often openly branched with 2-4 flowers per pedicle; calyx gland-dotted and often cobwebby early, becoming glabrous; corolla lobes lavender with yellow throat. Uncommon to occasional on loose pumice of cindercones in the monument.

Ipomopsis ipomopsis***Ipomopsis congesta*** (Hook.) V. Grant -- ballhead ipomopsis

A decumbent to erect, many stemmed perennial glabrous to densely puberulent. Leaves hairy, mostly palmately 3-5 lobed, occasionally entire. Inflorescence a dense terminal cymose head of white flowers. Subspecies ***palmifrons*** (Brand) A.G. Day occurs in the monument; defined by palmately 5 lobed leaves. Occasional on top of cindercones in the monument.

Leptodactylon pricklyphlox***Leptodactylon pungens*** (Torrey) Nutt. ex Rydb. -- granite prickly phlox

An erect branched shrub, mostly less than 6dm in height. Leaves opposite below, becoming alternate above, with 3-9, rigid, spined lobed. Flowers sweet scented; corolla >1.5cm, white, and often closing by mid day. Common among rocky outcrops throughout the monument.

Leptosiphon

- 1a. Corolla tube glabrous inside (at 20X); seeds 1 per chamber.....***L. harknessii***
 1b. Corolla tube hairy at filament attachment (at 20X); seeds 2 per chamber.....***L. septentrionalis***

Leptosiphon harknessii (Curran) J.M. Porter & L.A. Johnson –
Harkness' flaxflower

A thread-like annual with palmately lobed leaves which appear whorled. Very similar to ***L. septentrionalis*** but differing by, including key break above, a corolla up to 2.5mm long and <1.5 times the calyx. Uncommon in sagebrush scrub in the monument.
 [*Linanthus harknessii*]

Leptosiphon septentrionalis (H. Mason) J.M. Porter & L.A. Johnson –
northern linanthus

A thread-like annual with palmately lobed leaves which appear whorled. Corolla mostly >2.5mm long and 1.5-2 times the calyx. Uncommon in sagebrush scrub in the monument.
 [*Linanthus septentrionalis*]

Phlox phlox

- 1a. Plants annual.....***P. gracilis***
 1b. Plants perennial.....2a
 2a. Herbage with dense spider web-like hairs throughout.....***P. hoodii***
 2b. Herbage lacking dense spider web-like hairs throughout, occasionally present only at leaf base.....3a
 3a. Herbage glandular.....***P. caespitosa***
 3b. Herbage not glandular.....***P. diffusa***

Phlox caespitosa Nutt. -- tufted phlox

A loosely erect perennial, up to 15cm tall, resembling a small *Leptodactylon*. Leaves 5-13mm long, firm, and spine-tipped. The glandular herbage distinctly differentiates this species from the other perennial *Phlox* sp. occurring in the monument. Collected once from Little Crescent Butte. [*Phlox douglasii*]

Phlox diffusa Benth. -- spreading phlox

A loosely matted perennial with leaves 10-15mm long, glabrous (except at the base), and lacking sharp tips. Common in the northern portion of the park. Early season bloomer.

Phlox gracilis (Hook.) E. Greene -- slender phlox

A simple and erect, highly branched, decumbent annual, less than 20cm tall. Leaves opposite below, becoming alternate above. Corolla tube 8-12mm, yellow to white, sometimes with pinkish streaking; lobes bright pink to lavender, 1-2mm. Common among sagebrush in the monument. Early season bloomer.

Phlox hoodii Richardson subsp. *canescens* (Torrey & A. Gray) Wherry – carpet phlox

A cushion forming perennial with arachnoid hairy leaves, and spine tips. Uncommon in the monument, tending to occur in the western portion of the monument. Found on Gillem Bluff and near Whitney Butte.

Polemonium Jacob's-ladder***Polemonium micranthum*** Benth. -- annual polemonium

A slender annual erect when young, becoming ascending to prostrate with age. Flowers solitary, axillary, white, and <5mm. Rare in the monument, known only from the extreme northern portion of the monument.

POLYGONACEAE

- 1a. Leaves without sheathing stipules.....**Eriogonum**
 1b. Leaves with sheathing, often papery, stipules.....2a
- 2b. Perianth lobes 6, rarely 4, outer lobes smaller and often inconspicuous in fruit, inner lobes, at least one, with a tubercle.....**Rumex**
 2b. Perianth lobes 5, inner and outer similar, tubercle absent.....3a
- 3a. Sheath at leaf node silvery-transparent, 2-lobed distally, disintegrating into fibers with age; plants annual, decumbent or ascending to erect; largest leaves <5cm.....**Polygonum aviculare** subsp. *aviculare*
 3b. Sheath at leaf node tan to dark brown, never 2-lobed distally, often tearing with age; plants perennial, erect; leaf >5cm.....**Persicaria amphibian**

Eriogonum buckwheat

- 1a. Plants annual.....*E. vimineum*
 1b. Plants perennial.....2a
- 2a. Perianth narrowed at base, base stalk-like; bracts beneath the inflorescence leaf-like and >3.....*E. umbellatum*
 2b. Perianth base rounded to acute, base not stalk-like; bracts beneath the inflorescence bract-like and mostly 3.....3a
- 3a. Plants erect, not mat forming, not cushion-like.....4a
 3b. Plants caespitose, mat forming, cushion-like.....5a
- 4a. Plants shrubby; leaves cauline.....*E. microthecum*
 4b. Plants herbaceous; leaves basal.....*E. nudum*
- 5a. Inflorescence head-like, unbranched.....*E. ovalifolium*
 5b. Inflorescence branched, umbel or cyme-like.....*E. strictum*

***Eriogonum microthecum* Nutt. -- slender buckwheat**

A branched, woody, at least below, subshrub or shrub, <1.5m in height. Leaves oblanceolate, margins often rolled under, +/- tomentose below. Inflorescence a much branched, cyme-like, flat-topped cluster of white, rose, or yellow flowers. Two varieties occur, mostly on cindercones in the monument:

***E. microthecum* Nutt. var. *ambiguum* (M.E. Jones) Rev.**

Perianth yellow; hairs white to gray. Uncommon, collected from Caldwell and Schonchin Buttes.

***E. microthecum* Nutt. var. *laxiflorum* Hook.**

Perianth white to pink; hairs reddish. Occasional on cindercones in the monument.

***Eriogonum nudum* Douglas ex Benth. -- naked buckwheat**

A nearly simple, to much branched, perennial. Leaves strictly in a basal rosette, oblanceolate to ovate, often crisped margined, and tomentose below. Variety *pubiflorum* Benth. occurs in the monument; defined by a hairy white to pale yellow perianth and a glabrous upper leaf.

***Eriogonum ovalifolium* Nutt. -- cushion buckwheat**

A mat forming perennial. Leaves basal; blade round, often with a brown margin. Inflorescence head-like. Variety *purpureum* (Nelson) Durand occurs in the monument; defined by white to cream flowers and leaf blades 5-20mm without a distinct brown margin.

Eriogonum strictum Benth. -- Blue Mountain buckwheat

A mat forming perennial, with prostrate-ascending stems. Leaves mostly basal, elliptic to ovate, woolly, especially below. Inflorescence umbel- to cyme-like with white to yellow flowers, becoming reddish with age. Two varieties occur in the monument:

E. strictum Benth. var. ***anserinum*** (E. Greene) S. Stokes

Generally smaller than variety ***proliferum***. Perianth yellow. Occasional in the monument among sagebrush scrub.

E. strictum Benth. var. ***proliferum*** (Torrey & A. Gray) C.L. Hitchc.

Leaf blades elliptic 10-30mm. Inflorescence 5-15mm; perianth rose to purple. Occasional in the monument among sagebrush scrub.

Eriogonum umbellatum Torrey -- sulphur-flower buckwheat

A mat forming to ascending perennial or subshrub, woody at the base. Leaves clustered on the stem, variable though mostly elliptic, often narrowed to a slender petiole, hairy especially below. Inflorescence an open umbel subtended by a whorl of leaf-like bracts; perianth yellow, becoming reddish-brown when dry. Two varieties occur in the monument:

E. umbellatum Torrey var. ***nevadense*** Gand.

Subshrub; leaf sparsely tomentose below. Rare in the monument, only collected from Caldwell Butte.

E. umbellatum Torrey var. ***polyanthum*** (Benth.) M.E. Jones

Spreading mat; leaf densely tomentose below. Common in southern portion of the monument.

Eriogonum vimineum Douglas ex Benth. -- wickerstem buckwheat

A slender branched annual with a cymose inflorescence and white to rose perianth, borne on sessile involucre. Leaves basal, round to ovate, tomentose, especially below. Common in disturbed areas of the monument.

Persicaria

Persicaria amphibia (L.) A. Gray -- longroot smartweed

A mostly erect perennial, up to 12dm, from a rhizome. Leaf blades <35cm, with appressed-pubescence, tips acute to acuminate. Flowers pink, borne in a terminal, dense, conic to cylindric raceme. Found in the northern portion of the monument, most easily observed on the northern road shoulder across from Captain Jack's Stronghold. This native species is considered a noxious weed by the California Department of Agriculture. [*Polygonum amphibia* var. *emersa*, *Polygonum coccineum*]

Polygonum knotweed

Polygonum aviculare L. subsp. *aviculare* -- prostrate knotweed

A low growing annual with mostly decumbent stems up to 75cm in length. Leaves 2-4.5 times as long as wide, with papery sheaths at each node. Flowers inconspicuous, <5mm, clustered in the leaf axils, 3-8 per cluster. Rare, one collection along the road shoulder near Gillem Camp.

Rumex dock

- 1a. Stem with axillary branches below inflorescence; leaves cauline, not strongly crisp-margined.....*R. salicifolius*
 1b. Stem without axillary branches; leaves basal and cauline, strongly crisp-margined.....*R. crispus*

Rumex crispus L. -- curly dock

An erect, unbranched, perennial with a stout stem. Inflorescence a dense narrowed panicle; inner perianth lobes ovate to round and cordate at the base, with an elliptic tubercle on each lobe when mature. Uncommon to rare, disturbed areas in the northern portion of the monument.

Rumex salicifolius Weinm -- willow dock

A mostly erect branched perennial. Inflorescence a dense panicle. Variety *triangulivalis* (Danser) J.C. Hickman occurs in the monument; defined by linear to lanceolate leaves and lanceolate tubercles, one per lobe, <<1/3 the inner perianth lobe. Uncommon to rare in the northern portion of the monument.

PORTULACACEAE

- 1a. Flowers showy, petals 10-19, 12-25mm.....*Lewisia rediviva*
 1b. Flowers not showy, petals 5 or less, <<10mm.....2a

- 2a. Stigmas 2, sessile; petals 2, 1mm; cauline leaves not fused.....*Calyptidium roseum*
 2b. Stigmas 3; petals 5, >2mm; cauline leaves +/- fused.....*Claytonia*

Calyptidium pussypaws

Calyptidium roseum S. Watson -- rosy pussypaws

A small, reddish, annual <10 cm in height. Leaves both cauline and basal; basal in a prostrate rosette. Inflorescence an open raceme or panicle; flowers pedicelled with two white petals. Collected once in the monument from pumice on the western side of Eagles Nest Butte.

Claytonia springbeauty

- 1a. Basal leaves prostrate to suberect, blades diamond-shaped to ovate; cauline leaves perfoliate to +/- distinct; plant red tinged to wholly red.....*C. rubra* subsp. *rubra*
 1b. Basal leaves spreading to erect, blades rhombic to deltoid; cauline leaves perfoliate; plant with weak red pigmentation.....*C. perfoliata*

Claytonia perfoliata Willd. -- miner's lettuce

The largest *Claytonia* in the monument, 5-50cm tall. Cauline leaves +/- fused or saucer-like, often with short points. Occasionally found among rocky outcrops in the monument, more commonly encountered along the east face of Gillem Bluff. [*Montia perfoliata*]

Claytonia rubra (Howell) Tidestrom -- redstem springbeauty

A various sized annual with stems 1-10cm in length. The plant often appears totally red. The cauline leaves are usually only fused wholly to one side. Common in coniferous forests, sagebrush, or rocky areas in the monument. Subspecies. *rubra* occurs in the monument; defined by whole plant reddish in color and diamond-shaped to deltoid basal leaves.

Lewisia lewisia*Lewisia rediviva* Pursh -- bitter root

A perennial with a thick expanded and fleshy root and caudex. Basal leaves early withering. Flowers born singly, showy, pink, lavender to white. The genus is named for Meriwether Lewis, 1774-1809, American explorer. Rare in the monument.

RANUNCULACEAE

- 1a. Flowers bilateral and showy, purple, blue or red; sepals not alike, upper sepal with a spur.....**Delphinium**
 1b. Flowers radial, showy or not, yellow to greenish; sepals mostly alike, spurred or not.....2a
 2a. Sepals spurred, spurs 1-3mm; leaves all basal, linear; petals lacking or 5.....*Myosurus apetalus*
 2b. Sepals nor spurred; leaves basal and cauline, lobed or dissected; petals 2-5.....**Ranunculus**

Delphinium larkspur

- 1a. Flowers red.....*D. nudicaule*
 1b. Flowers blue to purple.....*D. andersonii*

Delphinium andersonii A. Gray -- Anderson's larkspur

A glabrous, below the inflorescence, perennial from a thick much branched woody root. Leaves mostly basal, long petioled, lobes 7-30; cauline much reduced or 0. Inflorescence a lax to open raceme of 3-15 purple blue to dark blue flowers. Common throughout the monument.

Delphinium nudicaule Torrey & A. Gray -- red larkspur

A perennial up to 100cm in height with a glabrous stem, narrowed at attachment to a branched rootstock. Leaves mostly on the lower 1/3 of the stem, lobes 3-10. Inflorescence an open raceme or panicle of scarlet-red to orange flowers. Rare in the monument, growing among mountain mahogany on the southern slope of Caldwell Butte.

Myosurus mousetail***Myosurus apetalus*** C. Gay -- bristly mousetail

A mostly erect annual, up to 12cm. Leaves linear to thread-like. Inflorescence born on a leafless stem, terminal, exceeding the leaves in fruit; flowers greenish; petals often 0. Only collected once in the monument from Hospital Rock, found in moist areas among sagebrush. [*Myosurus aristatus*]

Ranunculus buttercup

- 1a. Basal leaves lobed $>1/2$ way to base, woolly; plants annual.....***R. testiculatus***
 1b. Basal leaves lobed $<1/2$ way to base, glabrous; plants perennial.....***R. glaberrimus***

Ranunculus glaberrimus Hook. – sagebrush buttercup

An erect to prostrate perennial up to 25cm tall. Flowers large, ~1.5cm wide; petals yellow. Associated with sagebrush scrub or woodlands. Found most commonly in the middle of the monument, especially near Schonchin Butte.

Ranunculus testiculatus Crantz -- male Buttercup

A small, <10cm tall, scapose annual with minute flowers (<.5cm wide), and tomentose herbage. Often dominating highly disturbed areas, such as Indian well campground.

RHAMNACEAE

- 1a. Fruit a drupe with 2 stones; flowers inconspicuous; leaves deciduous.....***Rhamnus rubra***
 1b. Fruit a 3-lobed capsule; flowers showy; leaves evergreen.....***Ceanothus***

Ceanothus ceanothus

- 1a. Plant mat-forming; flowers blue; leaves, opposite, margin 3-9 toothed.....***C. prostratus***
 1b. Plant an erect shrub; flowers white; leaves alternate, +/- entire.....***C. velutinus***

Ceanothus prostratus Benth. -- prostrate ceanothus

A prostrate, mat forming, evergreen shrub. Leaves opposite, thick, margin 3-9 toothed. Inflorescence a raceme, <2cm long, of purple to lilac flowers. Uncommon in the extreme southern portion of the monument.

Ceanothus velutinus Douglas -- snowbrush ceanothus

A spreading, aromatic, evergreen shrub. Leaves alternate, elliptic to ovate, distinctly 3-veined, with a finely serrate and glandular margin. Inflorescence an open panicle-like cluster of white flowers. Uncommon, coniferous habitats in the southern portion of the monument. The inland variety *velutinus* occurs in the monument

Rhamnus buckthorn***Rhamnus rubra*** E. Greene -- Sierra coffeeberry

A deciduous shrub with reddish or grey bark. Leaves alternate, entire or finely toothed, elliptic to obovate, 15-80mm in length. Inflorescence a loose umbel of 6-15 small flowers developing into 2-stoned black fruits. Rare in the monument, a small population on the southern slope of Caldwell Butte.

ROSACEAE

- | | |
|---|-----------------------|
| 1a. Shrub or subshrub, woody throughout..... | 2a |
| 1b. Annual or perennial, not woody or woody only at base..... | 9a |
| 2a. Leaves compound..... | 3a |
| 2b. Leaves simple..... | 5a |
| 3a. Fruits a dry follicle; leaves and leaflets pinnate, fern-like; pistil 4-5; plants without prickles..... | Chamaebatiaria |
| 3b. Fruits fleshy; leaves pinnately or palmately compound, leaflets serrate, not fern-like; pistils >10; plants with prickles..... | 4a |
| 4a. Fruit enclosed in a fleshy hypanthium, a hip; leaves pinnately compound..... | Rosa |
| 4b. Fruit a berry; leaves palmately compound..... | Rubus |
| 5a. Petals absent; style long exserted and plumose in fruit..... | Cercocarpus |
| 5b. Petals present; style not long exserted and plumose in fruit..... | 6a |
| 6a. Fruits dry, achenes..... | 7a |
| 6b. Fruits fleshy, drupes or pomes..... | 8a |
| 7a. Flowers solitary, yellow to cream; leaves 3-, sometimes 5-, lobed above middle, margins inrolled; ovary superior, pistil 1..... | Purshia |
| 7b. Flowers in panicles, white; leaves (some) on peg-like stems, toothed above middle, teeth <15; pistils 5..... | Holodiscus |

- 8a. Ovary superior, calyx free of ovary; fruit a one-seeded drupe; lower leaf blade or petiole with glands.....**Prunus**
 8b. Ovary inferior, calyx fused to ovary; fruit a many seeded pome; lower leaf and petiole without glands.....**Amelanchier**
- 9a. Plants with prickles.....**Rubus**
 9b. Plants without prickles.....10a
- 10a. Style glabrous, attached below middle of fruit.....**Potentilla**
 10b. Style plumose, tapered from tip of fruit.....**Geum**

Amelanchier serviceberry

- 1a. Styles mostly 2-4, very rarely 5; petals 5-10mm long; leaves permanently hairy.....**A. utahensis**
 1b. Styles mostly 5, occasionally 4; petals 10-20mm long; leaves sparsely hairy to glabrous with age.....**A. alnifolia**

Amelanchier alnifolia (Nutt.) Nutt. ex Roem. -- Saskatoon serviceberry

A subshrub, shrub, or small tree, up to 8m tall, with reddish young twigs eventually becoming grayish. Leaves elliptic to oval, 1-5cm long and +/- half as wide, serrated above middle, and sparsely hairy becoming nearly glabrous with age. Flowers in short racemes of 2-30, with white petals 10-20mm long. Variety *semiintegrifolia* (Hook.) C. Hitchcock occurs in the monument; defined by conspicuous pubescence concealing the top of the ovary. Found occasionally throughout the monument in rocky habitats, very abundant near Captain Jack's Stronghold.

Amelanchier utahensis Koehne -- Utah serviceberry

A low growing, >4m, irregularly branched shrub, with red-brown tomentose young growth, becoming glabrous within 1-2 years and eventually ashy-gray with brown streaking. Inflorescence 3-10 flowered racemes; petals 5-10mm long. Leaves much like *A. alnifolia* but shorter, thicker, and more tomentose both above and below. Occurring throughout the monument, less common than *A. alnifolia*. [*Amelanchier pallida*]

Cercocarpus mountain mahogany

Cercocarpus ledifolius Nutt. -- curl-leaf mountain mahogany

A much branched, the branches quite stiff, evergreen shrub or small tree. Leaves narrowly oblanceolate to linear, leathery, the margin curled under. Inflorescence axillary with 1-3 sessile or subsessile flowers, which produce long-feathery achenes as they mature. Common to abundant in the monument; this shrub forms a dense, virtually impenetrable, thicket in the SW portion of the monument termed the Big Nasty. Variety *intermontanus* N. Holmgren occurs in the monument; defined by the principle leaves oblanceolate or elliptic-lanceolate, 6-10mm wide, with easily seen veins; hypanthium 6-9mm wide. *C. betuloides* was collected just south of the monument; distinguished from *C. ledifolius* by toothed or crenate leaves.

Chamaebatiaria desert sweet*Chamaebatiaria millefolium* (Torrey) Maxim. -- desert sweet

A densely branched, stellate-pubescent, glandular, and aromatic shrub, <3m in height. Leaves 1-2-pinnate, lanceolate, 2-8cm in length. Inflorescence terminal panicles of white to pink flowers. Common among rocky areas in the monument.

Geum avens*Geum triflorum* Pursh. -- old man's whiskers

A clumped, mostly erect, gray-green perennial from a scaly caudex. Leaves; basal odd-pinnatifid, 6-20cm, oblanceolate; cauline reduced, often only two opposite leaves near midstem. Inflorescence a 1-3 flowered cyme of nodding white to pink flowers, producing achenes with long hairy styles. Uncommon among sagebrush scrub in the monument, occurring mostly in the vicinity of Bearpaw and Hippo Buttes. [*Geum ciliatum*]

Holodiscus oceanspray*Holodiscus microphyllus* Rydb. -- oceanspray

A dense shrub, the older branches often becoming spine-like. Leaves short petiolate simple, oblanceolate to obovate, saw-toothed above middle. Inflorescence a terminal panicle of tiny white flowers. Occasional among rocky areas in the monument. Variety *glabrescens* (Greenman) Ley occurs in the monument; defined by mostly glabrous leaves, with long hairs on the margins and veins.

Potentilla cinquefoil

- 1a. Plants distinctly perennial; leaves cauline and basal, basal 5-9 foliate; styles attached below middle of fruit.....*P. glandulosa*
 1b. Plants annual to biennial; leaves mostly cauline 3-foliate; styles attached near tip of fruit.....*P. biennis*

Potentilla biennis E. Greene -- biennial cinquefoil

An ascending to erect, soft-hairy, glandular annual to biennial. Leaves mostly cauline, 3-foliate; leaflets obovate and toothed. Inflorescence a few- to many-flowered leafy cyme; petals yellow +/- inconspicuous. Rare in the monument, known only from Post Office Cave.

Potentilla glandulosa Lindley -- sticky cinquefoil

An erect glandular hairy perennial from a branched caudex or short rhizome. Leaves mostly basal, 5-9 foliate; leaflets ovate to lanceolate and toothed. Inflorescence an open cyme; petals pale yellow. Two varieties are occasional in the monument:

P. glandulosa Lindley subsp. *pseudorupestris* (Rydb.) Keck

Styles <1.5mm; flowers fully opening; leaf sheath glabrous. Occasional to uncommon in rocky areas of the monument.

P. glandulosa Lindley subsp. *globosa* Keck Styles >1.5mm; flowers not fully opening; leaf sheath hairy. Uncommon on open slopes in the southern portion of the monument.

Prunus plum

- 1a. Raceme flat-topped, wider than long, <15 flowered.....*P emarginata*
 1b. Raceme elongate, longer than wide, >15 flowered..... *P. virginiana*

Prunus emarginata (Douglas) Walp. -- bitter cherry

An erect to spreading shrub, the young branches with smooth reddish bark. Leaves alternate, oblanceolate to ovate, 2-6.5cm in length, simple, finely crenulate-serrate. Inflorescence a flat-topped raceme of 3-12 white flowers, developing into reddish-purple drupes. Common to occasional among rocky areas in the monument.

Prunus virginiana L. var. *demissa* (Nutt.) Torrey -- western chokecherry

A small tree or shrub, <8m in height, with greenish twigs becoming reddish to ash-gray with age. Leaves alternate, ovate to elliptic, 5-10cm in length, finely serrate. Inflorescence an elongated raceme of >15 flowers, developing into dark red to bluish-purple drupes. Occasional among shrublands in the monument.

Purshia bitterbrush

Purshia tridentata (Pursh) DC. -- antelope bitterbrush

An upright to prostrate shrub, the trailing branches often rooting into the ground, when in contact with it. Leaves trilobed at the tip, white-tomentose. Flowers yellow, solitary, on side-branch tips. Common throughout the monument. Variety *tridentata* occurs in the monument; defined by a densely nonglandular-hairy upper leaf surface and nonglandular twig hairs.

Rosa rose

Rosa woodsii Lindley var. *ultramontana* (S. Watson) Jepson -- Woods' rose

A prickly often thicket-forming shrub. Leaves pinnately compound; leaflets 5-9, elliptic to ovate, and serrate. Inflorescence a 1-5 flowered cyme of pink to red flowers. Uncommon in the monument, only from the extreme northern portion.

Rubus blackberry

- 1a. Plant prostrate to decumbent; pistils <10; inflorescence prickles straight.....*R. glaucifolius*
 1b. Plant arched to erect; pistils mostly >15; inflorescence prickles curved.....*R. leucodermis*

Rubus glaucifolius Kellogg -- San Diego raspberry

A prostrate to decumbent, prickly, shrub with a slender stem, 2-3mm in diameter. Leaves compound; leaflets 3, irregularly toothed. Fruit raspberry-like. Collected once from Caldwell Ice Cave.

Rubus leucodermis Douglas ex Torrey & A. Gray -- whitebark raspberry

An arched to erect prickly shrub with a stout stem, 4-10mm in diameter. Leaves compound; leaflet 3, irregularly toothed. Fruit raspberry-like. Collected once from the vicinity of Mammoth Crater.

RUBIACEAE

- 1a. Leaves opposite, >2cm long.....**Kelloggia**
 1b. Leaves whorled, <2cm long.....**Galium**

Galium bedstraw***Galium aparine*** L. -- stickywilly

A prostrate or scrambling annual with small hooked bristles giving the herbage an adhesive quality. Leaves narrowly oblanceolate, in whorls of 6-8. Inflorescence axillary; flowers small, 1-2mm wide, white; fruit covered with hooked bristles. Occasional throughout the monument.

Kelloggia kelloggia***Kelloggia galioides*** Torrey -- milk kelloggia

A somewhat clustered, erect to spreading, perennial from a creeping rhizome. Leaves opposite, often clustered in the axis, lanceolate. Inflorescence an open cyme of long pedicled white to pink flowers. Rare in the monument, only known from the ponderosa pine habitat on the west side of Eagles Nest Butte.

SALICACEAE

- 1a. Flower with a cup-shaped disk below; stamens >6; catkins pendent.....**Populus**
 1b. Flower without disk, but with 1-2 basal glands; stamens 5 or less; catkins
 erect.....**Salix**

Populus cottonwood***Populus tremuloides*** Michaux -- quaking aspen

A highly clonal tree with smooth white bark, becoming black and roughened with age or injury. Leaves ovate often with a cordate base, green above and white-glaucous below, petiole flattened. Rare in the monument, only known from near the Heppe Cave parking area. [*Populus tremula* subsp. *tremuloides*]

Salix willow

- 1a. Stamens 2; inflorescence appearing before leaves.....***S. scouleriana***
 1b. Stamens 3-5; inflorescence appearing with leaves.....***S. lasiandra***

Salix lasiandra Benth. -- Pacific willow

A shrub or small tree, <10m in height, with smooth gray bark when young, becoming dark and fissured with age. Leaf lanceolate and long acuminate, the petiole with 2 or more glands; stipules glandular and well developed +/- leafy. Uncommon in the monument, known only from the extreme northern portion. Subspecies *lasiandra* occurs in the monument; defined by a glaucous leaf underside. [*Salix lucida* subsp. *lasiandra*]

Salix scouleriana Barratt ex Hook. -- Scouler's willow

A tall shrub with brownish twigs. Leaves oblanceolate to narrowly elliptic, glaucous below, the petioles often velvety. Rare in the monument, known only from the extreme southern portion of the monument near Hidden Valley.

SAXIFRAGACEAE

- 1a. Petals mostly 0, or entire; stamens 5; basal leaves shallowly lobed, < 1/2 way to base.....***Heuchera cylindrica***
 1b. Petals 5, lobed; stamens 10; basal leaves deeply lobed, > 1/2 way to base.....**Lithophragma**

Heuchera alumroot***Heuchera cylindrica*** Douglas ex Hook. var. *alpina* S. Watson -- alpine alumroot

A glandular-hairy perennial from a caudex. Leaves basal and palmately veined. Inflorescence a dense spike of petalless cream-white to greenish flowers. Occasional among rocky areas in the monument, mostly on rocky slopes of cindercones. ***Heuchera cylindrica*** Douglas ex Hook. var. *ovalifolia* (Nutt. Ex Torr. & A.Gray) Wheelock was collected at Caldwell Butte, variety not treated by Hickman (1993) and not treated here.

Lithophragma woodland-star

- 1a. Bulblets present in axis of some stem leaves; seeds spiny.....***L. glabrum***
 1b. Bulblets absent in axis of stem leaves; seeds smooth.....***L. tenellum***

Lithophragma glabrum Nutt. -- bulbous woodland-star

A greenish to purplish perennial with white, 3-7mm, deeply 4-5 lobed petals. Most common in the monument among sagebrush scrub. Early season bloomer.

Lithophragma tenellum Nutt. -- slender woodland-star

A mostly purplish, above, perennial with dark purple bulblets in the leaf axes. Petals white with 5-7 shallow lobes. Uncommon in the monument, from the Gillem Bluff and the Schonchin Butte trails. [*Lithophragma rupicola*]

SCROPHULARIACEAE

- 1a. Leaves alternate, at least above.....2a
 1b. Leaves opposite, or all basal.....4a

- 2a. Corolla five lobed, radial to bilateral; stamens 5.....**Verbascum**
 2b. Corolla not five lobed; stamens 4.....3a
- 3a. Upper corolla lip beak or hood-like.....**Castilleja**
 3b. Upper corolla lip without a beak or hood, but corolla with a spur at the base....**Linaria**
- 4a. Sepals fused into a tube.....5a
 4b. Sepals not fused into a tube, free most of their length.....6a
- 5a. Style 2-lobed, lobes flat; corolla lacking a pouch.....**Mimulus**
 5b. Style mostly entire, or slightly 2-lobed; dorsal side of corolla with a pouch
 at the base.....**Collinsia**
- 6a. Stem 4-angled, square in x-section; staminode reduced to a knob, attached at base of
 upper corolla lip.....**Scrophularia**
 6b. Stem not 4-angled, round in x-section; staminode not reduced, elongate, attached at
 base of corolla tube.....**Penstemon**

Castilleja Indian paintbrush

- 1a. Inflorescence mostly yellow-green; galea (upper corolla lip) <7mm.....**C. pilosa**
 1b. Inflorescence mostly red; galea (upper corolla lip) >7mm.....2a
- 2a. Calyx division greater in the front than in the back; plants not
 glandular-sticky.....**C. linariifolia**
 2b. Calyx nearly equally divided; plants glandular sticky.....**C. applegatei**

Castilleja applegatei Fern. -- wavyleaf Indian paintbrush

A sticky, glandular perennial with clustered stems, +/- woody at the base. Leaves wavy-margined entire linear-lanceolate below; upper broader, with a pair of lateral lobes. Inflorescence conspicuously red, less often yellow. Occasional throughout the monument. Variety **pinetorum** (Fern.) Chuang & Heckard occurs in the monument; defined by stems 30-60 cm; calyx lobes acute, 16-25mm in length. [*Castilleja pinetorum*]

Castilleja linariifolia Benth. -- Wyoming Indian paintbrush

An erect to ascending, often branched, perennial 3-10dm tall. Leaves linear entire to lobed above. Inflorescence open; calyx red; corollas large, 30-45mm, yellow-green. Occasional throughout the monument.

Castilleja pilosa (S. Watson) Rydb. -- parrothead Indian paintbrush

A multistemmed perennial with spreading-hairy herbage. Inflorescence yellow-green. Occasional among sagebrush scrub in the monument. [*Castilleja longispica*]

Collinsia blue eyed Mary

- 1a. Inflorescence densely glandular.....*C. torreyi*
 1b. Inflorescence mostly glabrous.....*C. parviflora*

Collinsia parviflora Lindley -- maiden blue eyed Mary

A simple to branched annual less than 40cm tall, mostly ~10cm. Leaves elliptic to linear, +/- glabrous, greenish above and purplish below, the upper becoming whorled. Flower pedicels > calyx and often reflexed; corolla blue with a white to bluish-white upper lip. Common throughout the monument among sagebrush or mixed conifer forests.

Collinsia torreyi A. Gray -- Torrey's blue eyed Mary

A simple or sparsely branched annual. Leaves linear to ovate, entire or finely serrate, finely pubescent beneath. Inflorescence glandular; flowers in +/- congested whorls. Occasional in the monument among rocky outcrops or loose pumice of cindercones. Variety *torreyi* occurs in the monument; defined by some corollas >7mm, middle corolla lobe =lateral, and linear leaves >6x longer than wide.

Linaria toadflax

Linaria genistifolia (L.) Miller subsp. *dalmatica* (L.) Maire & Petim. –
 dalmation toadflax

A stout perennial 20-120cm, branched above. Leaves bluegreen, waxy, entire, <5.5cm, +/- opposite below and alternate above, crowded and partially clasping the stem. Inflorescence an elongate racemes; flowers 2-4cm long, yellow with orange hairy throats and a prominent spur. This noxious weed can spread by creeping roots or seeds. Due to an aggressive control program this plant is rare in the monument. Sightings should be reported to park staff for documentation and control.

Mimulus monkeyflower

- 1a. Corolla purple.....*M. nanus*
 1b. Corolla yellow.....2a
- 2a. Calyx lobes ciliate (at 20X); pedicels mostly >7mm, arched in fruit.....*M. rubellus*
 2b. Calyx lobes not ciliate (at 20X); pedicels mostly <7mm, S-shaped in
 fruit.....*M. suksdorfii*

Mimulus nanus Hook. & Arn. -- dwarf purple monkeyflower

An annual 1-10cm, much-branched when developed. Leaves oblanceolate to obovate <3 cm long and <1cm wide, entire. Corollas purple-magenta with two gold streaks and dark purple spots on the throat floor. Commonly found in loose pumice throughout the park.

Mimulus rubellus A. Gray little redstem monkeyflower

Very similar to *M. suksdorfii* but with ciliate calyx lobes, best observed at 20X. Many collections from the monument; however, I have never observed this species at Lava Beds, but consistently observe *M. suksdorfii*. *M. rubellus* has been collected in Modoc county and could occur at Lava Beds.

Mimulus suksdorfii A. Gray -- Suksdorf's monkeyflower

A finely glandular-puberulent annual. Stem reddish 1-10 cm tall, often much-branched when developed. Leaves linear to oblanceolate, numerous, sessile, narrowly sheathing, or on a short petiole. Pedicels 2-8mm and S-shaped in fruit; corolla 4-6mm, yellow with red spotting on throat floor. Common throughout the monument in open dry areas or rocky outcrops.

Penstemon beardtongue

- 1a. Anthers dehiscent across confluent apices (near filament attachment), free tips remaining indehiscent.....2a
 1b. Anthers dehiscent full length and widely divergent, or only at free tips, the apex (near filament attachment) remaining indehiscent.....3a
- 2a. Staminode hairy.....***P. gracilentus***
 2b. Staminode glabrous.....***P. laetus***
- 3a. Flowers white to yellow; leaves toothed.....***P. deustus***
 3b. Flowers blue; leaves entire.....4a
- 4a. Anthers dehiscent at free tips, remaining U-shaped; corolla >2cm long.....***P. speciosus***
 4b. Anthers dehiscent full length, losing U-shape; corolla <2cm long.....***P. humilis***

Penstemon deustus Lindley -- scabland penstemon

A perennial <40cm tall with many stems, +/- woody at the base. Leaves toothed 1-5cm long. Inflorescence mostly glandular with white corollas, 8-15mm, and purple streaking on the throat. Common throughout the monument, most often growing among rocky outcrops. Two varieties occur in the monument:

P. deustus Lindley var. ***pedicellatus*** M.E. Jones

Leaves lanceolate, mostly <8mm wide. The more common variety in the monument.

P. deustus Lindley var. ***suffrutescens*** L.F. Hend

Leaves ovate to round, mostly >7mm wide. The less common variety in the monument.

Penstemon gracilentus A. Gray -- slender penstemon

A glabrous perennial 25-65cm in height, often woody below. Leaves mostly cauline, oblanceolate to spatulate and petiolate below, becoming lanceolate and sessile above. Inflorescence glandular pubescent; corolla 15-20mm red- to blue-purple. Uncommon in the monument, often associated with *Artemisia-Symphoricarpos* vegetation.

Penstemon humilis A. Gray var. *humilis* -- low beardtongue

A somewhat mat forming perennial 5-40cm tall. Leaves; basal entire, persistent, petiolate, and generally tufted; cauline mostly sessile, clasping, and reduced upwards. Inflorescence glandular; corolla blue, 11-17mm, glandular-hairy on the outside; staminode a with dense gold beard towards tip. Common throughout monument. [*Penstemon cinereus*]

Penstemon laetus A. Gray -- mountain blue penstemon

A perennial 15-75cm tall, with several stems +/- woody at the base. Leaves mostly cauline <100mm long and 1.5-8.5mm wide, entire, and linear to lanceolate. Occasional among sagebrush scrub in the monument. Variety *sagittatus* occurs in the monument; defined by a corolla throat somewhat closed at mouth; and anther sacs dehiscent 3/5-4/5 their length.

Penstemon speciosus Lindely -- royal penstemon

A perennial 4-60cm in height. Leaves; basal lanceolate to ovate, petiolate, 5-9cm long x 10-20mm wide; cauline somewhat reduced, lanceolate to subcordate, clasping, and flat to folded. Inflorescence glabrous to puberulent, rarely glandular; corolla sky-blue to purple abruptly expanded at throat. Occasional in the southern portion of the monument.

Scrophularia figwort

- 1a. Staminode wider than long.....***S. lanceolata***
 1b. Staminode longer than wide.....***S. desertorum***

Scrophularia desertorum (Munz) R.J. Shaw -- desert figwort

A minutely glandular perennial with clustered stems, 7-12dm tall. Leaves opposite, cauline, lanceolate, base wedge shaped; petiole 7-10cm. Corolla distinctly 2-colored, upper half maroon, lower half cream. Collected once from the vicinity of Blue Grotto Cave.

Scrophularia lanceolata Pursh -- lanceleaf figwort

A tall, >8dm, minutely glandular, especially above, perennial with clustered stems. Leaves opposite, cauline, wedge-shaped, and irregularly toothed; petiolate 1-3cm. Inflorescence a terminal panicle of brownish-red urn-shaped flowers. Common among rocky areas and cave collapses in the monument.

Verbascum mullein

- 1a. Leaves woolly-tomentose throughout.....*V. thapsus*
 1b. Leaves glabrous, especially below.....*V. blattaria*

Verbascum blattaria L. -- moth mullein

A +/- glabrous biennial producing a rosette the first year and a flowering stem, 3-15dm in height, the second. Basal leaves oblanceolate, toothed, often shallowly lobed; cauline reduced above becoming clasping and sessile, toothed, but rarely lobed. Inflorescence a terminal glandular raceme of yellow to white flowers with purple filaments. Rare in disturbed areas of the monument.

Verbascum thapsus L. -- common mullein

A densely tomentose biennial producing a rosette the first year and a flowering stem, 3-20dm in height (vigorous plants slightly larger), the second. Leaves oblanceolate below; cauline reduce above, lanceolate, and +/- clasping sessile. Inflorescence a very dense raceme of yellow flowers. Common to abundant in the monument, forming dense patches in the northern portion of the monument. Monument staff devotes more time to the control of this non-native than any other species at Lava Beds.

SOLANACEAE

- 1a. Fruit a capsule, dehiscent; corolla salverform, tube >2cm.....**Nicotiana**
 1b. Fruit a berry, indehiscent; corolla rotate, or if salverform, plant a shrub.....2a
 2a. Shrub; corolla salverform; plant occasionally with short thorns.....**Lycium**
 2b. Annual; corolla rotate; thorns present or not.....**Solanum**

Lycium desert-thorn*Lycium barbarum* L. -- matrimony vine

A glabrous, spineless, or short spined shrub, with curved or arched branches. Leaves oblanceolate and tapered at the base. Inflorescence axillary clusters of pink to lavender funnel shaped flowers. Collected once in the monument from staff housing. [*Lycium halimifolium*]

Nicotiana tobacco*Nicotiana attenuata* Torrey ex S. Watson -- coyote tobacco

A densely glandular annual up to 15dm in height, often branched above. Inflorescence a simple to compound raceme with white to greenish-white corollas, 20-27mm long. Common in disturbed areas of the monument.

Solanum nightshade

- 1a. Plants and fruits with spines.....*S. rostratum*
 1b. Plants and fruits without spines.....2a

- 2a. Leaves deeply lobed.....***S. triflorum***
 2b. Leaves toothed, shallowly lobed, or entire.....***S. physalifolium* var. *nitidibaccatum***

Solanum rostratum Dunal -- buffalobur nightshade

An annual 1-7dm tall with dense yellow spines and stellate hairs. Inflorescence 3-15 flowered racemes; petals light yellow; fruits 9-12mm in diameter, covered with spines. Rare in the monument, collected only from the housing area.

Solanum physalifolium Rusby var. *nitidibaccatum* (Bitter) Edmonds –
hoe nightshade

An annual 1-9dm tall with spreading often glandular sticky hairs. Leaves evidently hairy on lower surface and along veins, entire, irregularly toothed or shallowly lobed. Fruits 6-7mm and yellowish. Collected from the northern portin of the monument; also occurring on the lawn between the seasonal staff apartments. [*Solanum sarrachoides*]

Solanum triflorum Nutt. -- cutleaf nightshade

An annual branched from the base, 1-5dm tall, with spreading, +/- curved, sometimes glandular hairs. Leaves 2-5 cm long and deeply lobed. Flowers borne in umble-like clusters of 2-3. Rare in the monument, only collected from the lawn between the seasonal housing apartments.

URTICACEAE

- 1a. Tepals of pistillate flower equal, fused to near tip, forming a saclike structure surrounding the achene.....**Hesperocnide**
 1b. Tepals of pistillate flower not equal, outer 2 < inner 2, not fused, not forming a saclike structure around the achene.....**Urtica**

Hesperocnide western stinging nettle

Hesperocnide tenella Torrey -- western stinging nettle

A taprooted annual <6dm in height. Leaf 4-40mm, bluntly serrate, rounded, or cordate, apex acute or short-acuminate, base broadly cuneate. Inflorescence head-like, < petiole. Collected once from Valentine Cave.

Urtica nettle

- 1a. Annual, 1-6dm; leaf blade mostly <40mm, elliptic to ovate; inflorescence head-like.....***U. urens***
 1b. Perennial, 10-30dm; leaf blade mostly >40mm, lanceolate, 3 times as long as broad; inflorescence spike- or raceme-like.....***U. dioica***

Urtica dioica L. -- stinging nettle

A rhizomatous perennial up to 3m in height with stinging hairs. Leaves opposite lanceolate to widely ovate, serrate. Inflorescence long axillary clusters of tiny flowers. Restricted to moist soils in the northern portion of the monument, where it is common. Subspecies *holosericea* (Nutt.) Thorne occurs in the monument; defined by moderate to dense stinging hairs on the lower leaf surface. [*Urtica holosericea*]

Urtica urens L. -- dwarf nettle

A taprooted annual up to 6dm in height with stinging hairs. Leaves opposite elliptic to ovate, serrate. Inflorescence head-like clusters of tiny greenish flowers. Collected once in the monument, from Fern Cave.

VALERIANACEAE

Plectritis seablush*Plectritis macrocera* Torrey & A.Gray -- longhorn plectritis

An annual with opposite, sessile, oblong to elliptic, cauline leaves. Inflorescence head-like clusters of white to pink spurred flowers. Common in mesic areas among sagebrush scrub in the monument.

VIOLACEAE

Viola violet*Viola purpurea* Kellogg -- goosefoot violet

A perennial violet. Leaves coarsely veined, few toothed to lobed, >5cm, purple on lower side. Petals yellow with 3 purplish-brown veins, upper two petals often deep purple on back. Subspecies *venosa* (S.Watson) M. Baker & J. Clausen occurs in the monument; defined by a mostly buried stem, and crenate to lobed cauline leaves. [*Viola venosa*]

VISCACEAE

- 1a. Pistillate flower parts 2; stems mostly <20cm, angled, especially when young;
berry 2- colored; parasitic on *Pinus* at Lava Beds.....**Arceuthobium**
1b. Pistillate flower parts mostly 3, occasionally 4; stem >20cm, rounded;
berry 1-colored; parasitic on *Juniperus*, and *Calocedrus***Phoradendron**

Arceuthobium dwarf mistletoe

- 1a. Secondary stem branches whorled; parasitic on *Pinus contorta* subsp. *murrayana* or less commonly *Pinus ponderosa*.....**A. americanum**
1b. Secondary stem branches not whorled; parasitic on *Pinus ponderosa* or *Pinus jeffreyi*.....**A. campylopodum**

Arceuthobium americanum Nutt. ex Engelm. -- American dwarf mistletoe
A parasitic perennial with scale-like leaves. Shoots 4-10cm long, olive-green to yellowish. Uncommon in the monument associated with *Pinus contorta* subsp. *murrayana* or *Pinus* sp..

Arceuthobium campylopodum Engelm. -- western dwarf mistletoe
A parasitic perennial with scale-like leaves. Shoots 5-10cm long, olive-green to yellowish. Uncommon in the monument associated with *Pinus ponderosa* or *Pinus jeffreyi*, less often *Pinus contorta*.

Phoradendron mistletoe

Phoradendron bolleanum (Seem.) Eichler -- dense mistletoe
A parasitic perennial often forming large clumps, up to 1m in diameter. Leaves well developed oblanceolate, 10-15mm. Occasional among Junipers in the monument, thought very abundant on Junipers at Indian Well Campground. [*Phoradendron densum*]

Group 3 Monocots

- 1a. Perianth petaloid, showy; plants not grass-like.....2a
1b. Perianth inconspicuous; plants grass-like.....5a
- 2a. Flowers irregular, with a prominent spur; perianth greenish white.....**ORCHIDACEAE** (*Piperia unalascensis*)
2b. Flowers regular, without a spur; perianth not greenish-white.....3a
- 3a. Plants from a deep caudex, apparently lacking a stem; flowers white.....**AGAVACEAE** (*Leucocrinum montanum*)
3b. Plants from a bulb, stems obvious; flowers various.....4a
- 4a. Inflorescence a panicle..... **MELANTHIACEAE** (*Zigadenus paniculatus*)
4a. Inflorescence a raceme or umbel.....**LILIACEAE**
- 5a. Fruit a capsule; perianth with 6 tepals.....**JUNCACEAE**
5b. Fruit an achene or an achene-like grain; perianth lacking tepals.....6a
- 6a. Stems triangular, solid or with pith, nodes not swollen; leaves 3 ranked.....**CYPERACEAE**
6b. Stems round, hollow, with swollen nodes; leaves 2 ranked.....**POACEAE**

AGAVACEAE[*Leucocrinum* formerly in Liliaceae]**Leucocrinum** starlily*Leucocrinum montanum* Nutt. ex A. Gray – common starlily

A caespitose or acaulescent perennial. Leaves tufted, linear, and basal with a whitish-membranous margin, sheathing bracts at base. Petals white, showy, fused into a tube 5-10cm long, terminating with 6 oblong spreading lobes. This early season flower offers an inviting fragrance. Occasionally found in open areas on Gillem Bluff and several Buttes (i.e. Eagles Nest and Caldwell).

CYPERACEAE**Carex** Sedge

- 1a. Stigmas 3.....*C. rossii*
 1b. Stigmas 2.....2a

- 2a. Rhizome >2mm thick; spikes usually bisexual, plants occasionally dioecious.....*C. praegracilis*
 2b. Rhizome 1-2mm thick; spikes usually unisexual, plants dioecious.....*C. douglasii*

Carex douglasii Boott – Douglas' sedge

A rhizomatous sedge. Spikes mostly unisexual, plants dioecious. Uncommon in open dry areas in the southern portion of the monument.

Carex praegracilis W. Boott – clustered field sedge

Spikes sometimes dioecious; if monoecious, spikelets staminate at tip and pistillate below, in a dense inflorescence. Uncommon in the monument, occurs in alkaline moist places, mostly in the northern portion of the monument.

Carex rossii Boott – Ross' sedge

A rhizomatous sedge. Plants monoecious and caespitose. Spikelets often near the very base of the plant, and obscured by the leaves. Occasional throughout the monument in open forests and meadows.

JUNCACEAE**Juncus** rush

- 1a. Stem compressed/flattened; blade obvious and spirally twisted.....*J. mexicanus*
 1b. Stem rounded; blade not obvious not twisted.....*J. balticus*

Juncus balticus – Baltic rush

Uncommon in the monument; found in the northern portion of the park, associated with seasonally moist, often alkaline, areas.

Juncus mexicanus – Mexican rush
Uncommon in the monument; found along the old shore of Tule Lake.

LILIACEAE lily

- 1a. Perianth parts differentiated into sepals and petals, petals bearded above
nectary.....**Calochortus**
1b. Perianth parts similar.....**Fritillaria**

Calochortus mariposa lily

Calochortus macrocarpus Douglas – sagebrush mariposa lily
A 20-50cm tall plant with 1-6 whitish to purple flowers. Petal with a green stripe on the border, and an oblong-ovate slightly depressed nectary with a sagittate base, bordered by a fringed membrane, occurs at the proximal end. Leaves; basal often withering; cauline leaves inrolled and curled at the tip. Common in sagebrush scrub throughout the monument.

Fritillaria fritillary

- 1a. Flowers purplish mottled whitish or yellow; styles branched.....***F. atropurpurea***
1b. Flowers yellow, aging brick-red; styles unbranched.....***F. pudica***

Fritillaria atropurpurea Nutt. – spotted fritillary
Perennial plants up to 6dm in height. Leaves alternate or whorled 2-3 per node, scattered on upper stem. Found near the base of Schonchin, Hippo, and Bearpaw Buttes.

Fritillaria pudica (Pursh) Sprengel – yellow fritillary
Perennial plants up to 3 dm in height. Leaves of plants mostly 2 and subopposite, if > 2 then alternate. Found most commonly during early spring near the top of the Gillem Bluff trail.

MELANTHIACEAE

[*Zigadenus* formerly in Liliaceae]

Zigadenus deathcamas

Zigadenus paniculatus (Nutt.) S. Watson – foothill deathcamas
Plants up to 70cm with scabrous-ciliate leaves as large as 50cmx16mm. Inflorescence a panicle, and often dense near tip; flowers often polygamous, those on the main axis bisexual, those on the lower branches often staminate; stamens 1-2mm and larger than perianth segments. Found throughout the monument.

ORCHIDACEAE

Piperia unalascensis (Sprengel) Rydb. – slender-spire orchid
Basal leaves up to 40mm wide. Inflorescence a spike of green flowers each with an upcurved lip (2-5mm). Found only on top of Island Butte.

POACEAE

- 1a. Spikelets sessile or nearly so, inflorescence seemingly 1 unit.....2a
 1b. Spikelets with distinct pedicles, inflorescence appearing as an open panicle-, raceme-,
 or umbel-like unit.....15a
- 2a. Spikelets mostly 1 per node, rarely 2.....3a
 2b. Spikelets 2 or more per node.....11a
- 3a. Floret 1 per spikelet; stems often bulbous based; glumes ciliate on keel.....**Phleum**
 3b. Florets 2+ per spikelet; stems not bulbous based; glume not ciliate on keel.....4a
- 4a. Plants annual; lemma keel and margin ciliate.....**Secale**
 4b. Plants perennial; lemma not ciliate.....5a
- 5a. Spikelets strongly overlapping, some spikelets >4X the internode length
**Agropyron**
 5b. Spikelets not strongly overlapping, spikelets <3X the internode
 length.....6a
 6a. Plants without long creeping rhizomes, sometimes short rhizomes present; a densely
 tufted bunchgrass.....7a
 6b. Plants with long creeping rhizomes; not a bunchgrass.....8a
- 7a. Glumes acute to rounded; lemma awn lacking, or if present, 1-2cm long and widely
 divergent.....**Pseudoroegneria**
 7b. Glumes truncate; lemma awn 0.....*Elytrigia pontica* subsp. *pontica*
- 8a. Glumes blunt to truncate; lemmas blunt; leaf with >8 weakly ribbed
 veins.....*Elytrigia intermedia* subsp. *intermedia*
 8b. Glumes acute to acuminate; lemmas mostly acute; leaf with <8 veins, some veins
 conspicuous.....9a
- 9a. Leaf blades flat, 5-10mm wide, often drooping; glumes acute to
 acuminate.....*Elytrigia repens*
 9b. Leaf blades inrolled and mostly <5mm wide, stiff; glumes acute to blunt.....10a
- 10a. Glume 5-7 veined, shorter than first lemma, mostly unawned, sparsely hairy to
 glabrous; lemmas often with conspicuous hairs, acute to awn
 tipped.....*Elymus lanceolatus*
 10b. Glumes 3-5 veined, as long as first lemma, often awned, mostly glabrous; lemma
 glabrous or sparsely hairy, awn <5mm.....*Pascopyrum*
- 11a. Plants greater than 7dm; blades mostly wider than 6mm.....**Leymus**
 11b. Plants less than 7dm; blades narrower than 6mm.....12a

- 12a. Spikelets 3 per node.....13a
 12b. Spikelets 2 per node.....14a
- 13a. Central spikelet sessile and fertile; lateral spikelets pedicelled and reduced,
 infertile.....**Hordeum**
 13b. Central spikelet fertile; lateral spikelets sterile, and glume
 like.....*Elymus elymoides* subsp. *hordeoides*
- 14a. Plant an annual.....**Taeniatherum**
 14b. Plant a perennial.....**Elymus**
- 15a. Floret 1 per spikelet.....16a
 15b. Floret 2 or more per spikelet.....18a
- 16a. Plants annual; fertile florets 1-2mm.....**Muhlenbergia**
 16b. Plants perennial; fertile florets >2mm.....17a
- 17a. Panicle open to loose, especially the lower; glumes 18-40mm; lemma awn 7-
 20cm.....**Hesperostipa**
 17b. Panicle narrow; glumes 10-15mm; lemma awn <6cm.....**Achnatherum**
- 18a. Glumes, especially upper, as long or longer than lower floret; lemma awned from
 back or awnless.....19a
 18b. Glumes shorter than lower floret; lemma awned from tip or awnless.....20a
- 19a. Panicle open; glumes >18mm; lemma awned from back, awn stout and
 twisted.....**Avena**
 19b. Panicle greatly condensed; upper glume +/- 5mm; lemma awn lacking or awn
 minute.....**Koeleria**
- 20a. Leaf sheaths closed above middle; spikelets large, mostly >12mm; lemma awned
 from minutely cleft apex.....**Bromus**
 20b. Leaf sheaths mostly open above middle, if closed above middle, then reddish and/or
 spikelets <12mm; lemma awned or not, but without minutely cleft apex.....21a
- 21a. Lemmas awnless.....**Poa**
 21b. Lemmas awned.....22a
- 22a. Plants perennial.....**Festuca**
 22b. Plants annual.....**Vulpia**

Achnatherum needlegrass

- 1a. Basal segment of awn scabrous, deciduous, and not twisted; inflorescence open, branches and pedicles widely spreading.....*A. hymenoides*
- 1b. Basal segment of awn hairy, awn twisted and persistent; inflorescence not open.....2a
- 2a. Lowest awn hairs longer than hairs of upper lemma, some awn hairs >1mm; ligules >2mm; glumes often purple.....*A. thurberianum*
- 2b. Lowest awn hairs shorter than hairs of upper lemma, awn hairs <1mm; ligules <2mm; glumes greenish.....*A. occidentale*

Achnatherum hymenoides (Roemer & Schultes) Barkworth – Indian ricegrass

A densely tufted and showy perennial bunchgrass. Inflorescence wiry and spreading, the capillary branches in pairs. Lemma with conspicuous long silky-hairs. Occasional to uncommon, collected from the Petroglyphs and near the Northeast entrance. [*Oryzopsis hymenoides*]

Achnatherum occidentale (Thurber) Barkworth – needlegrass

A tufted perennial bunchgrass with a closed inflorescence. Palea less than half as long as lemma. Two subspecies occur in the monument.

A. occidentale (Thurber) Barkworth subsp. *californicum* (Merr. & Burt Davy ex H.M. Hall) Barkworth

Lower awn segment hairy and upper segment not hairy, glabrous or rough. Common in the southern portion of the monument. [*Stipa californica*]

A. occidentale (Thurber) Barkworth subsp. *occidentale*

Lower and upper awn segments hairy. Uncommon in the southern portion of the monument; a subspecies more commonly found at higher elevations. [*Stipa occidentalis*]

Achnatherum thurberianum (Piper) Barkworth – Thurber's needlegrass

A tufted perennial bunchgrass with a closed inflorescence. Spikelets often purplish-tinged. Common among sagebrush scrub in the monument. [*Stipa thurberiana*]

Agropyron

- 1a. Inflorescence internodes <1mm.....*A. cristatum*
- 1b. Inflorescence internodes >1mm.....*A. desertorum*

Agropyron cristatum (L.) Gaertn. – crested wheatgrass

A perennial bunchgrass with dense spikes and short internodes. Found in the northern portion of the monument where it has migrated into the monument from adjacent croplands, where it was planted for erosion control.

Agropyron desertorum (Fischer) Schultes – desert wheatgrass

A perennial bunchgrass with dense spikes and short internodes; this species is similar to *A. cristatum* but with the inflorescence internodes >1mm. Found in the northern portion of the monument where it has migrated into the monument from adjacent croplands, where it was planted for erosion control.

Avena*Avena fatua* L. – wild oat

An annual up to 12dm tall. Inflorescence an open panicle; spikelets large, glumes 18-25mm long, awns 25-40mm long, bent and twisted below bend. Collected from a disturbed site near Canby's Cross.

Bromus brome

- 1a. Plants perennial or biennial.....2a
 1b. Plants annual.....3a
- 2a. Rhizomes absent; spikelets strongly compressed.....***B. carinatus*** var. ***carinatus***
 2b. Rhizomes present; spikelets not strongly compressed.....***B. inermis*** subsp. ***inermis***
- 3a. Lower glume 1 veined, upper glume 3 veined; awn >11mm.....***B. tectorum***
 3a. Lower glume 3-5 veined, upper glume 5-7 veined; awn <10mm.....4a
- 4a. Lemma body membranous, margins not inrolled not enclosing fruit; awn >5mm.....***B. japonicus***
 4b. Lemma body hard, margins inrolled and enclosing fruit; awn <5mm.....***B. secalinus***

Bromus carinatus Hook. & Arn. var. ***carinatus*** – California brome

A perennial, over 3dm tall, lacking rhizomes. Inflorescence loose to compact with some of the pedicles greater than the strongly compressed spikelets. Uncommon in the monument, found in dry to moist shrublands, woodlands, or coniferous forests. Collected from Thomas-Wright Battlefield and Caldwell Butte.

Bromus inermis Leyss. subsp. ***inermis*** – smooth brome

A glabrous, rhizomatous perennial. Inflorescence a congested panicle, branches erect to ascending. Rare in the monument, collected once from near East Wildlife Overlook.

Bromus japonicus Thunb. ex Murr – Japanese brome

An annual grass with long hairs. Inflorescence open; spikelet stalks thread-like and flexible, often nodding. A native to Eurasia, this roadside and wasteland plant has been collected from the old sheep enclosure on Gillem Bluff and along the road between Canby's Cross and Captain Jack's Stronghold.

Bromus secalinus L. – rye brome

A short-hairy annual. Inflorescence spreading to ascending, nodding in fruit. Rare in the monument, occurring on top of Gillem Bluff in the old sheep enclosure.

Bromus tectorum L. – cheatgrass

An annual grass, with an open and nodding inflorescence; a dominant non-native throughout the western US. Cheat grass can be recognized, often at a distance, by the purplish-brown or, after drying, straw-brown patches it forms. Found throughout the monument, this grass has become especially invasive in the northern portion.

Elymus squirreltail

- 1a. Glumes not greatly elongate; axis of spike not breaking apart at maturity; spikelets mostly 1 per node *E. lanceolatus* subsp. *lanceolatus*
 1b. Glumes greatly elongate; axis of spike breaking apart at maturity; spikelets 2 or 3 per node.....2a
 2a. Spikelets 3 per node; central spikelet fertile, lateral spikelets sterile, undeveloped, appearing glume-like; plants mostly <2dm....*Elymus elymoides* subsp. *hordeoides*
 2b. Spikelets mostly 2 per node; some lateral spikelets fertile; mostly >2dm.....3a
 3a. Glumes entire or 2-cleft into 2 outward curving awns; auricle <1mm, obscure.....*E. elymoides*
 3b. Glumes 3-cleft into three outward curving awns; auricles mostly 1mm, obvious.....*E. multisetus*

Elymus elymoides (Raf.) Swezey – squirreltail

A loose to densely tufted perennial bunchgrass with long awns from both glumes and lemmas. Spikelets becoming separated at maturity, easily scattered by the wind. [*Sitanion hystrix*]

E. elymoides (Raf.) Swezey subsp. *brevifolius* (J.G. Smith) Barkworth
 Spikelets mostly 2 (occasionally 3) per node, the lower spikelets with 2 entire glumes. Occasional, rocky areas among sagebrush scrub in the monument.

E. elymoides (Raf.) Swezey subsp. *elymoides*
 Spikelets mostly 2 (occasionally 3) per node, the lower spikelets with 2 glumes and 1 glume-like reduced floret; some glumes divided. Common, sagebrush scrub in the monument.

E. elymoides (Raf.) Swezey subsp. *hordeoides* (Suksd.) Barkworth
 Spikelets 3 per node, central fertile, lateral sterile, reduced, and glume-like. Uncommon, rocky areas among sagebrush scrub in the monument.

Elymus lanceolatus* (Scribner & J.G. Smith) Gould subsp. *lanceolatus

– thickspike wheatgrass

A strongly rhizomatous and often glaucous perennial. Lemmas often hairy. Uncommon in the monument, collected from the sheep enclosure on Gillem Bluff and near the Devils Homestead flow. [*Agropyron dasystachyum*]

***Elymus multisetus* (J.G. Smith) Burt Davy – big squirreltail**

A densely cespitose perennial bunchgrass often found on disturbed soils. In contrast to *E. elymoides*, this species often has well developed auricles, .5- 1.5mm long. Uncommon, open areas in the northern portion of the monument. [*Sitanion jubatum*]

Elytrigia wheatgrass

- 1a. Plants lacking rhizomes; stems tufted, mostly
>10dm.....*Elytrigia pontica* subsp. *pontica*
- 1b. Plants from rhizomes; stems not tufted, mostly <10dm.....2a
- 2a. Glumes and lemmas obtuse to blunt.....*Elytrigia intermedia* subsp. *intermedia*
- 2b. Glumes and lemmas acute.....*Elytrigia repens*

***Elytrigia intermedia* (Host) Nevski subsp. *intermedia* – intermediate wheatgrass**

A rhizomatous perennial. Leaves flat to loosely rolled, 2-8mm wide. Glumes without awns. Found in the disturbed area along Powerline Road near the entrance fee booth.

***Elytrigia pontica* (Podp.) Houlb ssp. *pontica* – tall wheatgrass**

A tall, mostly >10dm, tufted and glaucous perennial. Glumes weakly keeled with truncate tips. Leaf sheaths ciliate below the middle; leaves often rolled 2-6.5mm wide. The largest population in the monument occurs just north of Captain Jack's Stronghold, scattered individuals occur along the road shoulders in the northern portion of the monument.

***Elytrigia repens* (L.) Desv. Ex B.D. Jacks. – quackgrass**

A strongly rhizomatous perennial. Leaves flat, 3-14mm wide. Glumes often with an awn <4mm. Found along the southern portion of the main park road across from the Gillem Bluff parking area.

Eragrostis lovegrass***Eragrostis cilianensis* (All.) Vignolo ex Janchen – stinkgrass**

An annual grass with spreading to decumbent, sometimes abruptly bent stems. Inflorescence open with many florets, 10-45 per spikelet. Glands present below stem nodes, on branches of the inflorescence, and on keels of the glumes and lemmas. Only collected once in the monument near park staff housing.

Festuca fescue

- 1a. Leaf sheath closed, reddish, shredding with age; rhizomes often present.....***F. rubra***
 1b. Leaf sheath open above, greenish, not shredding with age; rhizomes
 absent.....***F. idahoensis***

Festuca idahoensis Elmer – Idaho fescue

A densely tufted perennial bunchgrass. Leaves mostly basal, inrolled and <1mm wide. The ovary tip glabrous. This native species is associated with healthy native habitats and the more mesic *Artemisia tridentata* habitats within the monument.

Festuca rubra L. -- red fescue

A loosely clumped, often rhizomatous, perennial. Stems decumbent at base. Only collected once from Indian Well Campground.

Hesperostipa needle and thread***Hesperostipa comata*** (Trin. & Rupr.) Barkworth subsp. ***comata***

– needle and thread

A perennial bunchgrass with long, bent, and twisted, on the lower half, awns. Uncommon to occasional among sagebrush in the northern portion of the monument. [*Stipa comata*]

Hordeum Barley

- 1a. Plant perennial or annual; auricles 0 or mostly <1mm.....***H. jubatum***
 1b. Plant annual; auricles well developed, some >1mm.....2a
 2a. Inflorescence breaking apart at maturity; leaf blades mostly <5mm wide; lemma not
 three lobed near tip, awn <50mm.....***H. murinum***
 2a. Inflorescence not breaking apart at maturity; leaf blades 5-16mm wide; lemma three
 lobed near tip, awn 60-160mm.....***H. vulgare***

Hordeum jubatum L. – foxtail barely

A tufted perennial with slender awns, >10mm, and awn-like glumes, >30mm. Inflorescences look feathery and often drooping. Found on disturbed sites in sagebrush habitats, common along the road shoulder in the northern ¼ of the monument. A native to western North America this species is considered invasive.

Hordeum murinum L. – mouse barely

Annual up to 5dm tall with all three florets well developed and mostly equal in size. Sheaths and stems glabrous, blades often sparsely long-hairy. Subspecies *murinum* occurs in the monument; defined by the sessile to subsessile (stalk <.5mm long) central spikelet. Found at Indian Well Campground and near the Research Center.

Hordeum vulgare L. – common barely

A tall annual up to 12dm. *H. vulgare* is the source of barely, the main ingredient in beer; this plant is widely cultivated and can persist for up to two years, but likely never becomes established. Collected from Hovey Point, an agricultural escapee.

Koeleria Junegrass

Koeleria macrantha (Ledeb.) J.A. Shultes – prairie Junegrass

A caespitose perennial bunchgrass often with pubescent sheaths and leaves. Inflorescence a dense spike-like panicle; spikelets each with 2-3 tan to purplish awnless florets. Common to occasional in the monument, easy to observe at the Whitney Butte trailhead. [*Koeleria cristata*, *Koeleria pyramidata*]

Leymus Ryegrass

Leymus cinereus (Scribner & Merr.) A. Love – basin wildrye

A tall, often over 1m, and robust tufted bunchgrass; often forming clumps up to 1m across. Inflorescence unbranched; spikelets sessile, 2 or more per node. Leaves large, often over 1cm wide. Commonly found in the northern 1/4 of the monument and in cave collapses. [*Elymus cinereus*]

Muhlenbergia muhly

Muhlenbergia minutissima (Steudel) Swallen – annual muhly

A weakly rooted annual, <3dm tall. Inflorescence an open diffuse panicle often as large as 2-4cm wide by 10-12 cm long in well developed plants, and accounts for 1/3-2/3 the total height of the plant; spikelets one flowered and small, ~2mm. A rare roadside occurrence in the monument, likely found elsewhere in dry rocky habitats.

Pascopyrum wheatgrass

Pascopyrum smithii (Rydb.) A. Love – western wheatgrass

A rhizomatous glaucous perennial. Inflorescence spike-like; spikelets overlapping, 1 or, less commonly, 2 per node and 2-ranked. The plant's most distinctive features are the stiff curved glumes that taper to the awn tip. Collected once from the roadshoulder in the northern portion of the monument, could be expected elsewhere in dry sandy alkaline soils.

Phleum timothy

Phleum pratense L. – timothy

A loosely tufted perennial, generally with a bulbous base. Glumes keeled, the keel ciliate. Rare in the monument, collected once from Hovey Point.

Poa bluegrass

- 1a. Stems bulbous at base; most florets dark purple bulblets.....*P. bulbosa*
1b Stems not bulbous at base; florets without dark purple bulblets.....2a

- 2a. Rhizomes present.....3a
 2b. Rhizomes lacking.....4a
- 3a. Stems and nodes compressed, 2-edged; lemma base with few cobwebby hairs.....*P. compressa*
 3b. Stems and nodes not compressed; lemma base with dense cobwebby hairs.....*P. pratensis*
- 4a. Spikelet compressed, ovate in outline; lemma keeled to base.....*P. cusickii* subsp. *cusickii*
 4b. Spikelet little compressed, lanceolate to ovate in outline; lemma keel obscure..... *P. secunda*

Poa bulbosa L. – bulbous bluegrass

A tufted perennial lacking rhizomes. Stems from bulbous bases, purplish below. Bulbous florets with foliaceous linear protrusions (which look like ‘tails’) up to 2mm long. Uncommon to occasional in disturbed areas of the monument.

Poa compressa L. – Canada bluegrass

A rhizomatous perennial with a flattened stem. Collected once on road to Caldwell Ice Cave.

Poa cusickii subsp. *cusickii* Vasey – Cusick’s bluegrass

A caespitose perennial, basal leaves in a dense tuft. Inflorescence ovate to lanceolate in outline, dense; lemma keeled. Collected once in the monument, no location noted.

Poa pratensis L. – Kentucky bluegrass

A strongly rhizomatous sod forming perennial. Inflorescence generally spreading, ovate to triangular in outline. A common lawn grass in temperate regions. Occuring along the road shoulder in the northern portion of the monument and in lawns around seasonal housing.

Poa secunda J.S. Presl. – Sandberg bluegrass

A densely tufted perennial. Inflorescence tending to be one sided or secund. A highly variable species with many ecological forms and with the subspecies tending to intergrade. Current taxonomy places 7 former individual species into two subspecies, both of which occur at Lava Beds.

P. secunda J.S. Presl. subsp. *juncifolia* (Scribner) R. Soreng

Lemma base glabrous; inflorescence branches appressed; ligule <2mm. Often taller than subsp. *secunda* and more glaucous green. Occasional, generally among woodlands, in the monument. [*Poa juncifolia*]

P. secunda J.S. Presl. subsp. *secunda*

Lemma base with even short hairs on keel; inflorescence branches spreading; ligule >2mm. Common among sagebrush scrub in the monument. [*Poa ampla*, *Poa canbyi*]

Pseudoroegneria bluebunch wheatgrass***Pseudoroegneria spicata*** (Pursh) A. Love subsp. *spicata* – bluebunch wheatgrass

A tufted perennial bunchgrass, occasionally forming short rhizomes. Spikelets one per node with >4 florets, some < internodes of the rachis. Lemma awns vary in length from 0-20mm and often divergent. A very important native bunchgrass ranging from Alaska south to Arizona and east to the Keweenaw Peninsula, Michigan. Common throughout the monument. [*Agropyron spicatum*]

Secale rye*Secale cereale* L. – cereal rye

A robust annual, or sometimes biennial, with glabrous sheaths. Spikelets 2-flowered. A widely cultivated species which has invaded the extreme northern portion of the monument.

Taeniatherum*Taeniatherum caput-medusae* (L.) Nevski – medusahead

A highly invasive annual with small spikes, 1-5cm, not including awns. 2 spikelets per node, with one fertile and one infertile, much reduced, floret per spikelet. Collected from the sheep enclosure on Gillem Bluff and Hovey Point. Other infestations should be reported to monument staff, so eradication measures may be deployed.

Vulpia

1a. Florets 5-12, closely overlapping, obscuring spikelet axis.....*V. octoflora*

1b. Florets 1-5, not closely overlapping, spikelet axis visible.....2a

2a. Lower glume <half the length of upper glume.....*V. myuros*

2b. Lower glume >half the length of upper glume.....3a

3a. Inflorescence narrow, lowest branches appressed to erect.....*V. bromoides*

3b. Inflorescence broader, lowest branches spreading or reflexed.....*V. microstachys*

Vulpia bromoides (L.) S.F. Gray – brome fescue

A loosely tufted annual < 5dm tall with 1-3 branches per node. Lemmas never pubescent, occasionally scabrous. An introduced species from Europe. Occasionally found among rock outcrops or disturbed sagebrush scrub in the monument.

Vulpia microstachys (Nutt.) Munro. – Pacific fescue

An annual with 1 branch per node, the branches spreading, often perpendicular to stem axis. Lemmas pubescent to glabrous. Leaf sheaths pubescent. Variety ***pauciflora*** (Beal) Lonard & Gould collected from the campground road shoulder; defined by glabrous to scabrous spikelets. Expected to occur in disturbed areas of the monument.

Vulpia myuros (L.) Gmelin – rat-tail fescue

A loosely tufted to singularly stemmed annual <5dm tall. Easily distinguished from other *Vulpias* occurring in the monument by the short lower glume. Variety ***myuros*** occurs in the monument; defined by a glabrous upper lemma margin. Collected at entrance to Valentine Cave, may occur in dry disturbed areas elsewhere in the monument.

Vulpia octoflora (Walter) Rydb. – sixweeks fescue

A tufted annual. Leaf sheaths often pubescent. Spikelets laterally compressed and densely 5-12, occasionally 15, flowered. Uncommon in the monument, found in disturbed sagebrush scrub.

Appendix D. Glossary to Key

Acaulescent -- stemless

Achene -- a small, dry, one-seeded, indehiscent fruit, deriving from a one-chambered ovary

Acuminate -- narrowing gradually to a point, with more or less concave sides along the tip

Acute -- tapering to a sharp-pointed apex with more or less straight sides along the tip

Alternate -- placed singly along stem or axis

Annual -- a plant that completes its life cycle from the its germination as a seed to the production of new seeds in a single year and then dies

Anthers -- the pollen-bearing portion of a stamen

Appressed -- lying flat

Aromatic -- an obvious smell

Ascending -- sloping or curving upwards

Auricle -- a small earlike lobe or appendage

Awl -- tapering from the base to the apex

Awn -- a bristle-like appendage

Axillary -- in the axil

Axil -- the upper angle formed between two structures or organs, such as a leaf and the stem from which it grows

Axis -- the main stem, a central line of symmetry

Barbed -- with hooked hairs, a backward-facing tip

Barbellate -- see barbed

Basal -- at the base of

Beaked -- with a firm, pointed terminal appendage

Berry -- fleshy, indehiscent fruit in which the seed or seed immersed in pulp

Biennial -- a plant that takes two years to complete its life cycle, usually growing vegetation in the first year and producing flowers and seeds in the second, then dying

Bilateral -- divisible through the center in only one longitudinal plane for the two halves to be mirror images

Bisexual -- having both stamens and pistils in the same flower

Blade -- the expanded terminal portion of a leaf, petal or other structure, the portion of the leaf that does not include the stalk

Bloom -- a white, powder-like coating

Blunt -- not pointed

Bract -- a modified leaf which may be reduced in size or different in other characteristics from the foliage leaves and which usually subtends a flower or an inflorescence

Bractlet -- a small bract

Bristle -- a stiff hair, usually erect or curving away from its attachment point

Bud -- a young shoot, protected by scale leaves, a leaf, stem or flower

Bulb -- an underground plant part derived from a shoot that is enclosed in numerous overlapping thickened leafy scales whose purpose is to store food

Bulblet -- a small bulb

Bulbous -- having or resembling a bulb

Calyx -- the outer whorl of the perianth, composed of the sepals

Canescent -- densely covered with short, greyish white hairs

Capillary -- hair-like

Capsule -- a dry, dehiscent fruit divided into two or more seed compartments

Catkin -- a spike-like, often pendulous, inflorescence of petalless unisexual flowers, either staminate or pistillate

Caudex -- the persistent, often woody base of an otherwise annual herbaceous stem

Caulесcent -- with an obvious stem

Cauline -- attached to or referring to the stem, as opposed to 'basal', often used to describe leaf position

Cespitose -- having a densely clumped, tufted or cushion-like growth form

Chaff -- thin scales or bracts subtending individual flowers in many species of the Asteraceae

Ciliate -- with a row of fine hairs situated along the margin

Circumscissile -- dehiscing by a line round the fruit or anther, the top coming off like a lid

Clasping -- having the lower edges of a leaf blade partly surrounding the stem

Claw -- the narrow, basal stalklike portion of some sepals and petals

Clone -- a group of plants arising by vegetative reproduction from a single parent and which are genetically identical

Columnar -- growing in the shape of a vertical cylinder

Compound -- made up of two or more similar parts, as in a leaf which has leaflets

Cone -- a seed-bearing organ on conifers

Conic -- cone-shaped

Cordate -- heart-shaped

Corolla -- the inner whorl of the perianth, between the calyx and the stamens, a collective term for the petals of a flower

Corolla limb -- one of the free parts joined to the corolla tube

Cotyledon -- one of the first leaves of the embryo of a seed plant

Crenate -- with rounded teeth

Crenulate -- with small, rounded teeth

Crisped -- with the margin curled or crumpled

Crown -- the upper, branched part of a tree

Cylindric -- shaped like a straight tube, but solid

Cyme -- a broad, flat-topped inflorescence in which the central flower is the first to open

Deciduous -- falling off seasonally

Decumbent -- lying along the ground, but with the tip curved up

Decurrent -- running down, when a leaf base extends downward along the stem

Dehiscent -- opening naturally

Deltoid -- broadly triangular in shape

Dentate -- with sharp, outward-pointing teeth on the margin

Dichotomously branched -- branching regularly and repeatedly in pairs

Dioecious -- having staminate and pistillate flowers on separate plants

Disciform -- having a flowering head that contains both filiform and disk flowers, referring to members of the Asteraceae

Discoïd -- having only disk flowers, referring to flower heads in the Asteraceae

Disk flowers -- one of the central, regular flowers in members of the Asteraceae

Dissected -- finely cut or divided into many, narrow segments

Distal -- the end opposite the point of attachment, away from the axis

Divergent -- diverging or spreading

Dorsal -- the back or outer surface

Drooping -- erect or spreading at the base, then bending downwards

Drupe -- a fleshy indehiscent fruit enclosing a nut or hard stone containing generally a single seed such as a peach or cherry

Elliptic -- broadest near the middle and tapering gradually to both ends

Entire -- describing a leaf that has a continuous, unbroken margin with no teeth or lobes

Erect -- upright

Evergreen -- retaining most leaves throughout the year

Exserted -- projected from or extending beyond surrounding parts

Fertile -- having the capacity to produce fruit, having a pistil

Fibrous -- thread-like

Filaments -- the basal, sterile portion of a stamen below the anthers

Fleshy -- thick, spongy

Floret -- a small individual flower in a flower head

Flower -- the structure in angiosperms concerned with sexual reproduction

Follicle -- a dry, many-seeded fruit derived composed of a single carpel and only opening along one side

Fron**d** -- a fern leaf

Fruit -- a mature ovary with its enclosed seeds and sometimes with attached external structures

Funnel shaped -- resembling a funnel

Fused -- united

Galea -- a hood or helmet-shaped structure formed by the perianth segments of certain flowers

Glabrous -- smooth, without hairs

Gland -- an organ producing a secretion

Glandular -- having glands, producing tiny globules of sticky or oily substance

Glaucous -- covered with a thin, light-colored waxy or powdery bloom

Globular -- spherical or globe-shaped

Glume -- in grasses, the bracts (generally two) that form the lowermost parts of the spikelet

Granular -- having a slightly rough texture

Hastate -- spear- or arrowhead-shaped with the basal lobes facing outward

Head -- a short, dense spike of flowers

Herbage -- referring to leaves

Hip -- a fleshy, berry-like fruit

Hypanthium -- a cup-shaped enlargement of the receptacle, created by the fusion of sepals, petals and stamens

Indehiscent -- not opening by itself, said of a seed pod

Indurate -- hardened and/or stiffened

Indusium -- a scale-like outgrowth on a fern leaf which forms a covering for the sporangia

Inferior -- below, as when the ovary appears embedded in the pedicel below the floral parts

Inflorescence -- the flowering portion of a plant

Internode -- the portion of a stem between two successive nodes

Involucel -- a secondary involucre, as in the Apiaceae

Involucral bracts -- see involucre

Involucre -- a set of bracts subtending a flower or an inflorescence

Irregular -- describes a flower that is not radially symmetric, the similar parts of which are unequal in size or form

Keel -- the two lower petals of most pea flowers, united or partially joined to form a structure similar to the keel of a boat

Lacinate -- cut into slender lobes

Lanceolate -- significantly longer than wide and widest below the middle, gradually tapering toward the apex

Leaf -- a lateral outgrowth from the stem, usually with a petiole and blade

Leaf sheath -- the lower part of a leaf stalk which more or less encloses the stem

Leaflet -- one segment of a compound leaf

Legume -- a dry, dehiscent fruit derived from a single carpel and usually opening along two lines of dehiscence like a pea pod

Lemma -- in grasses, the lower and usually larger of the two bracts of the floret

Ligulate -- describing a floral head in the Asteraceae that contains only ray flowers, or ligules

Ligule -- 1) a strap-shaped structure, the limb of ray flowers in the Asteraceae, or 2) a scarious projection from the top of the leaf sheath in grasses

Linear -- long and narrow with sides that are parallel or nearly so

Lobe -- usually a rounded segment of an organ

Midrib -- the main or central rib or vein of a leaf

Monoecious -- having both male and female flowers on the same plant

Mottled -- spotted or blotched with different shades or colors

Multicellular hairs -- many celled hairs, with the cells appearing stacked on top of one another

Nectary -- a plant part that secretes nectar, a sweet liquid that attracts bees, insects, and birds

Nodding -- hanging down

Node -- a point on a stem where leaves or branches originate

Nut -- a dry, usually one-seeded, indehiscent fruit with a hard-walled exterior

Nutlet -- a small nut or one of the sections of the mature ovary

Oblanceolate -- inversely lanceolate, broadest towards the apex and tapered towards stalk

Oblong -- two to four times longer than broad with nearly parallel sides, but broader than 'linear'

Obovate -- inversely ovate, broadest towards the apex and tapered towards stalk

Obtuse -- blunt

Opposite -- leaves that are situated in pairs at each node along an axis

Oval -- broadly elliptic, the width over half the length

Ovary -- the basal portion of a pistil where female germ cells develop into seeds after germination

Ovate -- with an egg-shaped outline, wider below the middle

Ovoid -- egg-shaped

Ovule -- the structure that develops into the seed inside the ovary after fertilization

Palea -- in grasses, the upper and generally smaller of the two bracts of the floret

Palmate -- divided to the base into separate leaflets, all leaflets arising from the end of the leaf stalk

Panicle -- a compound inflorescence in which the branches are racemose and the flowers are pedicled on the branches

Pappus -- collectively, the bristles, hairs or scales at the apex of an achene in the Asteraceae

Parasite -- a plant which derives most or all of its food from another organism to which it attaches itself

Pedicle -- the stalk of a single flower

Peduncle -- the stalk of an inflorescence

Pendent -- hanging downward or drooping

Pendulous -- see pendent

Perennial -- a plant living for more than two years

Perfect -- containing both stamens and pistils

Perfoliate -- the stem apparently piercing the leaf or surrounded by basally joined opposite leaves

Perianth -- a collective term for the calyx and corolla

Petal -- a single segment of a divided corolla

Petaloid -- having the appearance of a petal

Petiole -- a leaf stalk

Phyllary -- one of the bracts below the flower head in the Asteraceae

Pinnate -- with separate leaflets along each side of a common stalk

Pinnately compound -- see pinnate

Pinnately lobed -- with lobes along each side of a common stalk

Pinnule -- a secondary division of a pinnate leaf

Pistil -- the central reproductive organ of a flower, consisting of ovary, style and stigma

Pistillate -- a female flower that has two or more pistils but no functional stamens

Pith -- the central column of spongy tissue in stems

Plumose -- appearing plume-like or feathery from fine hairs that line two sides of a central axis

Polygamous -- having both unisexual and bisexual flowers on the same plant

Pome -- a fleshy indehiscent fruit derived from an inferior, compound ovary and consisting of a modified floral tube surrounding a core with several seeds, such as an apple

Pouch -- a bag-shaped structure

Prickle -- a superficial, sharp-pointed outgrowth of the bark or epidermis of a plant

Prostrate -- lying flat

Puberulent -- minutely pubescent

Pubescent -- covered with short, soft hairs

Raceme -- an elongate, unbranched inflorescence with pedicled flowers on the main stem

Rachis -- the main stalk of a flower cluster or of a compound leaf, also that part of a fern frond stem that bears the leaflets

Radial -- divisible through the center of the flower in several or many longitudinal planes, the halves of the flower being mirror images in every case

Radiate -- a flower head in the Asteraceae that contains both ray and disk flowers

Ray flowers -- one of the outer irregular flowers in the flower heads of some Asteraceae

Receptacle -- the expanded apex of a flower stalk which bears the floral organs, either such structures as individual petals, sepals etc., or entire flowers in head-like inflorescences such as is typical of the Asteraceae

Recurved -- curved backwards or outwards

Reflexed -- abruptly bent or curved downward

Regular -- see radial

Reniform -- kidney-shaped or rounded with a notch at the base

Retorse -- bent backward or downward, reflexed

Retuse -- slightly notched at the tip

Rhizome -- an underground stem capable of producing new stems or plants at its nodes

Rhombic -- with the shape of a diamond

Rosette -- a cluster of leaves in a circular arrangement at the base of a plant, often called the basal rosette

Round -- like a circle

Sagittate -- arrowhead-shaped

Sap -- the juice of a plant

Saprophytic -- deriving food from dead or decaying organic material in the soil, plants usually lacking in chlorophyll

Scabrous -- rough to the touch

Scale -- greatly reduced leaf or other outgrowth on a plant surface

Scapose -- having a leafless stalk

Scarious -- thin, dry, membranous and more or less translucent

Schizocarp -- a fruit which breaks up at maturity into many one-seeded portions

Secund -- directed towards one side

Seed -- a unit of sexual reproduction developed from a fertilized ovary

Segmented hair -- hairs with segments appearing to be stacked on top of each other

Sepal -- a single segment of a divided calyx

Septum -- any kind of a partition, specifically the wall between chambers in a compound ovary

Serrate -- having sharp, forward-pointing teeth on the margin

Sessile -- attached directly and without a petiole, pedicel or other type of stalk

Sheath -- a tubular covering

Sheathing -- with at least the base of the leaf or stipule forming a tube that more or less encloses the stem or stalk

Silicle -- a capsular fruit on the Brassicaceae less than three times as long as broad

Silique -- a capsular fruit on the Brassicaceae at least three times as long as broad

Simple -- a leaf that has one part, not subdivided into leaflets

Sori -- clusters of spore sacs on a fern frond (singular: sorus)

Spatulate -- spoon-shaped, gradually widening to a rounded apex

Spikelet -- in grasses, the smallest aggregation of florets plus any subtending glumes

Spike -- an elongated, unbranched inflorescence with sessile or nearly-sessile flowers

Spinose -- having a stiff and tough acuminate tip

Sporangium -- a spore-case or sac in which spores are produced

Spore -- the reproductive unit in ferns, produced in the sporangium and developing into a prothallus

Spur -- a hollow tubular extension of a petal or sepal, often nectariferous

Stamen -- the male or pollen-bearing organ of a flower, composed of filament and anthers

Staminate -- describing a male flower that contains one or more stamens but no functional pistils

Staminode -- a sterile stamen or other nonfunctional structure occupying the position and having the overall appearance of a stamen

Stellate -- star-like, with radiating branches and often referring to the pattern of hairs on the surface of a leaf

Stem -- the main upward-growing axis of a plant

Sterile -- unable to reproduce sexually

Stigma -- the terminal portion of a style, which receives the pollen

Stipe -- that portion of a fern frond below the rachis, i.e. below where the leaflets are attached

Stipule -- an appendage at the base of a petiole, usually in pairs

Stolon -- an elongated horizontal shoot above or below the ground, rooting at the nodes or apex

Stomata -- a small pore or opening on the surface of a leaf through which gaseous exchange takes place

Strigose -- covered with rough, stiff, sharp hairs that are more or less parallel to a particular surface

Style -- the narrowed portion of a pistil between and connecting the ovary and the stigma

Subretuse -- almost or somewhat notched at the tip

Subsessile -- almost or somewhat sessile

Superior -- above, as when the ovary is situated above other floral parts on the receptacle

Taproot -- the primary root continuing the axis of the plant downward often quite deeply into the ground

Tepal -- a collective term for sepals and petals, used when they cannot be easily differentiated

Terminal -- at the end of the branch or stem

Ternate -- in threes

Tomentose -- woolly, with long, soft, matted hairs

Toothed -- having small lobes or points along the margin

Tripinnate -- three times pinnate

Truncate -- with a base or apex appearing as if cut straight across

Tubercle -- a knoblike projection

Tuber -- a short, thickened underground stem which bears numerous buds

Tubular -- cylindrical and hollow

Tufted -- a dense clump

Umbel -- an inflorescence in which the flower stalks arise from a common point

Undulate -- wavy

Unisexual -- bearing either stamens or pistils but not both

Urn -- an object having a concave shape

Valve -- one of the parts or segments into which a dehiscent fruit splits

Vein -- the vascular portion of a leaf

Whorl -- a circle of three or more structures radiating outward from the same node

Wing -- a thin, paper-like flat margin bordering or extending from a seed capsule, stem or flower