

A checklist of the vascular flora of El Morro National Monument, Cibola County, New Mexico¹

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RINK, G. R. (Northern Arizona University, Flagstaff, AZ 86001), A. C. CULLY (National Park Service Southern Colorado Plateau Network, Northern Arizona University Flagstaff, AZ 86011), AND D. A. MCCALLUM (Applied Bioacoustics, Eugene, OR 97405). *J. Torrey Bot. Soc.* 136: 000–000. 2009—Three hundred and ninety-one vascular plant taxonomic entities within 61 families and 219 genera were documented for El Morro National Monument, an area of 419 hectares. These include 140 new non-horticultural records for El Morro and 60 records that had not been recorded in either Cibola County or nearby Valencia County. The checklist includes 55 entities that are exotic to El Morro. One species tracked by the New Mexico Natural Heritage Program, *Besseyia arizonica* (Arizona coraldrops), occurs at El Morro. El Morro is dominated by juniper (*Juniperus monosperma*) woodland, with ponderosa pine (*Pinus ponderosa*) in mesic sites, and shrublands in drier sites.

Key words: biological inventory, Cibola County, El Morro, flora, New Mexico, rare plants, Valencia County.

This project is one part of a biological inventory effort taking place throughout the National Park Service (NPS). The Natural Resource Challenge (NRC), a legislative and administrative mandate (NPS 2006), recognizes that our national parks are some of the best preserved landscapes in our country. The NPS is responsible for protecting and maintaining the biological diversity and ecosystems found within the parks, and its managers require basic information on those resources in order

to make sound decisions for their long-term protection. The National Park Service Inventory and Monitoring Program (I&M) resulted from the NRC.

The goals of the I&M are: 1) inventory the natural resources under NPS stewardship to determine their nature and status; 2) monitor park ecosystems to better understand their nature and status, and to provide reference points for other, more altered systems; 3) integrate natural resource inventory and

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monitoring information into planning, management, and decision-making; and 4) share NPS accomplishments with other natural resource organizations and form partnerships for attaining common goals and objectives (www.nature.nps.gov).

The NPS created networks of parks linked by geography and natural resource characteristics. The Southern Colorado Plateau Network (SCPN), comprising 19 parks and monuments in the southwestern United States, developed a plan for biological inventory (Stuart 2000) and recognized the need for vascular plant inventory at El Morro National Monument (ELMO). The SCPN adopted the goals of the I&M program, including documenting 90% of the estimated species of vascular plants in the park through existing specimens and targeted field studies. The outcome of the inventory was designed to be integrated into NPS databases for use in planning and management, and to be made available to the larger scientific community and the public. We have followed the recommendations of Palmer et al. (1995), where appropriate, to make this checklist of plant species as useful as possible to others.

New Mexico is poorly collected in relation to neighboring states (Dodson 1990). The plant collecting history at ELMO dates from the 1850s, and yet few vascular plant checklists have been created for areas within Cibola County. This checklist provides a unique look at vascular plant diversity present in a region that has been less-well collected than other regions of the state, perhaps partly because it is far from herbaria and academic institutions.

National Park Service researchers and managers can use this vouchered checklist to support vegetation mapping efforts (Charlet 2000), to plan for restoration and evaluate its success, to manage existing exotics and note new invasions, to develop and adjust the list of species of conservation concern, to mitigate plant issues related to new development, and to improve their natural history interpretive programs. Exotic plant managers and rare plant specialists can use this checklist to improve their knowledge of the ranges of both exotic and rare plants. Those in the scientific community can use this checklist and the vouchers associated with it to improve regional botanical inventories, to study plant migrations and dispersal, to improve our knowledge of the ranges of plants, to note

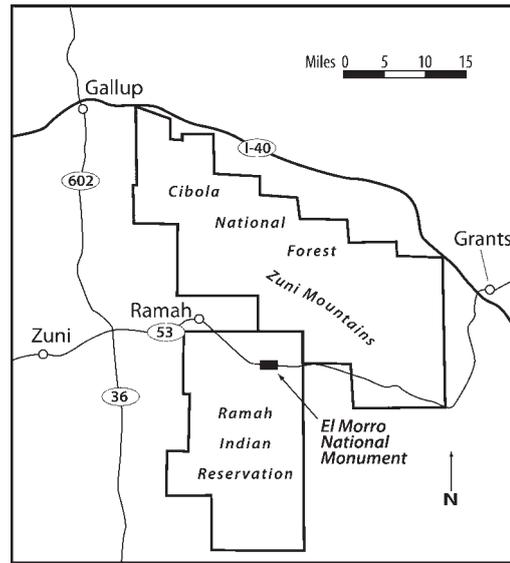


FIG. 1. The regional context of El Morro National Monument, New Mexico. Private land adjacent to monument boundaries not shown because of scale limitations.

both contractions and expansions of the ranges of plants, for phytogeographical analysis, to study the variation within and amongst species, and as a predictor of diversity in similar nearby areas. The vouchers associated with this checklist allow others to check the veracity of the determinations, and they can be used for chromosome and molecular work. Much of what is known about the flora of any region is based on voucher specimens in herbaria. Recent studies at three parks in the Northern Colorado Plateau Network underscore the importance of voucher specimens. Fertig (in press, a) showed that 123 species formerly considered part of the Hovenweep National Monument flora were actually false reports. Fertig (in press, b) and Fertig et al. (in press) found high numbers of false reports at Natural Bridges and Colorado National Monuments as well. Vouchers are the foundation of reliable checklists.

SITE DESCRIPTION. El Morro National Monument is located in Cibola County in northwestern New Mexico across the El Morro Valley from the Zuni Mountains (Fig. 1). El Morro became the second national monument in the nation in 1906, established to protect over 2,000 petroglyphs and inscriptions as well as Ancestral Pueblo structures and artifacts. El

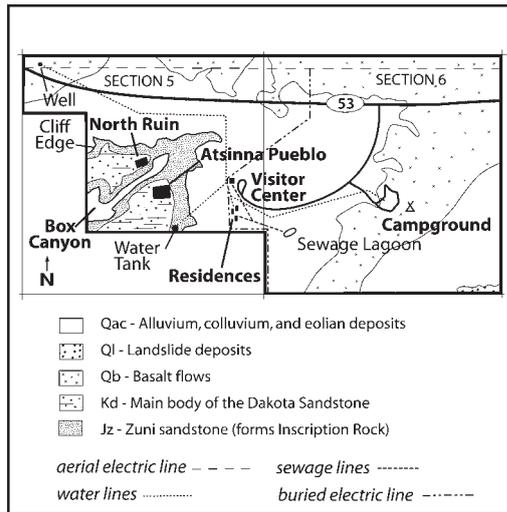


FIG. 2. El Morro National Monument, New Mexico. Geology from Anderson and Maxwell (1991).

Morro highlights Inscription Rock, a tilted mesa of stratified rock (a *cuesta*) rising 60 m above the surrounding plain (Fig. 2). The bald rock naturally collects rainwater and melting snow, which accumulates as a pool of water at its base. This water enticed early day inhabitants and travelers to camp there and while there, some made inscriptions in the rock, inscriptions which the monument is now designed to protect. A short box canyon within the *cuesta* and shaded north slopes provide cool, mesic habitats. The original size of the monument was 64.7 ha, but several additions have brought it up to 419 ha. The monument is authorized to include two full sections, but 97.1 ha are still in private ownership.

The inventory reported here includes only lands within the existing boundaries of ELMO, including Sections 5 and 6 of Township 9 North, Range 14 West, except the south $\frac{1}{4}$, the northwest $\frac{1}{4}$ of the southwest $\frac{1}{4}$ and the southwest $\frac{1}{4}$ of the northwest $\frac{1}{4}$ of Section 6. The study area falls within latitudes 35.0311° and 35.0464° N and longitudes 108.3278° and 108.3639° W. The El Morro 7½ minute topographic quadrangle (United States Geological Survey) covers the study area, which ranges in elevation from 1,707 m to 1,768 m.

The population of Cibola County was 25,595 in 2000 and 27,481 in 2006; there were

2.18 people per square km in 2000 and 2.34 people per square km in 2006 (U. S. Census Bureau 2007a). The nearest city is Grants, New Mexico 68 km to the northeast, with a population of 8,806 in 2000 (U. S. Census Bureau 2007b). Ramah lies 17.7 km to the west with a population of 407 in 2000, and Zuni Pueblo is 48.3 km to the west. Visitation to El Morro is high; 79,544 in 2004; 62,638 in 2005, and 63,243 in 2006 (NPS 2005, 2006, 2007). Cibola County originated as a segregate of Valencia County on June 19, 1981 (U.S. Census Bureau 2007c), which produces some confusion when tracking down El Morro specimens. Land ownership within 3.2 km of the monument is mostly private, with some belonging to the Ramah Chapter of the Navajo Nation and some New Mexico State land (NMGISP 2008).

GEOLOGY. The cliffs of Inscription Rock are composed of 61 m of Jurassic Zuni Sandstone that is covered, in places, with 9 m of Cretaceous Dakota Sandstone (Cross 1996) (Fig. 2). Sandy, gravelly stream deposits and dark shales separate these two rock units. The Zuni Sandstone erodes easily because the uniform sand grains are cemented with clays. The Dakota Sandstone at El Morro is made up of sandstone, siltstone, mudstone, carbonaceous mudstone/shale and conglomeratic layers (Cross 1996). The pueblos atop the *cuesta* were built on gray mudstone and shale of the upper portion of the Dakota Sandstone. Pliocene and Pleistocene volcanic basalts cover some of the eastern and northern portions of the monument (NPS 2002). Various colluvial, alluvial, and eolian deposits cover much of the rest of the monument (Anderson and Maxwell 1991). Soils information for ELMO can be located online (SSURGO 2007). Plant diversity at ELMO is enhanced by this variety of substrates.

CLIMATE. Much of the Four Corners Region has a bimodal, winter/summer precipitation pattern, with winter precipitation being a more reliable source of moisture than summer. In contrast, at ELMO, the monsoonal months of July, August, and September, on average, receive nearly twice the precipitation of the winter months of December, January, and February. Storms with the largest amounts of precipitation occur during summer. The average precipitation at ELMO was 34.90 cm for the period of record 3/1/1938 to 12/31/2005.

Temperatures at ELMO range from near -10°C in the winter to nearly 30°C in the summer. El Morro has an average frost-free period of 111 days (Western Regional Climate Center 2007).

During 2000 and 2001, the first years of this study, annual precipitation was slightly below average, 31.19 cm and 33.05 cm respectively. During 2002, precipitation was 36.14 cm. During 2006, the second to last year of this study, annual precipitation was 41.73 cm. Above average precipitation resulted in many plants blooming that hadn't bloomed in many years at ELMO. During January through October of 2007, the year this study ended, the precipitation was 27.79 cm (NWS 2007), a bit below average, though August was exceptionally wet with 11.25 cm of precipitation.

VEGETATION. McCallum (1981a) mapped six plant associations at ELMO. These included ponderosa pine (*Pinus ponderosa*)-Gambel oak (*Quercus gambelii*) woodland, in the most mesic areas which include the box canyon and the north and east sides of the rock; alligator juniper (*Juniperus deppeana*)-pinyon (*Pinus edulis*) woodland, also in the most mesic areas; pinyon-one-seed juniper (*Juniperus monosperma*) woodland, covering large areas of the monument on top of and proximal to the rock, and at the eastern and western portions; juniper (*Juniperus monosperma*) savannah, also covering a large part of the monument on lower slopes surrounding the lowest areas of the monument; horsebrush (*Tetradymia canescens*)-rabbitbrush (*Chrysothamnus* and *Ericameria*) shrubland, which includes other shrubs such as four-wing saltbush (*Atriplex canescens*), wolfberry (*Lycium pallidum*), winterfat (*Krascheninnikovia lanata*), and sand sage (*Artemisia filifolia*); and finally grassland, which includes blue grama (*Bouteloua gracilis*), sand dropseed (*Sporobolus cryptandrus*), and cheat grass (*Bromus tectorum*). These grasses are common throughout the monument, but occur as mapped plant associations only in a few isolated locations. Both McCallum (1981a) and Schackel (1984) reported major changes in the vegetation during the last 150 years, mainly invasion of pinyon and juniper into former grassland. They speculated that fire suppression and grazing are the main factors causing this change. Salas and Bolen (2007) produced a

vegetation classification system, which included 21 map units (including three unvegetated units) within five main classes, and a digital vegetation map of ELMO. Salas and Bolen's five main vegetation classes were forest, woodland, shrubland, dwarf shrubland, and herbaceous vegetation. They reported that 60% of the Park is covered by pinyon-juniper/blue grama woodland.

DISTURBANCE. Ancestral Puebloans occupied El Morro from AD 1000–1375, building two large residential structures, North Ruin on the west arm of the mesa with nearly 200 rooms, and Atsinna Pueblo on the south arm of the mesa with well over 500 rooms (Kintigh 1985). Portions of the monument were farmed into modern times. The Spanish introduced grazing animals in the 1600s, and grazing probably intensified in the mid 1800s (NPS 2002). Grazing of the original monument was halted in 1906, and then in successive stages as land was added to the monument.

The pool at the base of the rock (the historical enticement to human use of the area) was enlarged by small dams both prehistorically and historically. In 1933 and 1934, twelve teams (of horses) and 20 men filled in the arroyo below the pool with $11,500\text{ m}^3$ of dirt and planted the reclaimed area with grama grass (*Bouteloua gracilis*), yellow sweet clover (*Melilotus officinalis*), oats (*Avena fatua*), pinyon pine (*Pinus edulis*) and juniper (probably *Juniperus monosperma*).

The Park Service attempted to transplant sagebrush and rabbitbrush near the inscriptions, but these plants did not survive (NPS 1939, 1940). A 1966 landscape plan for the visitor center (NPS 1966) called for planting exotics including deerbrush (*Ceanothus integerrimus*), algerita (*Berberis fremontii*), deerbriar (*Ceanothus fendleri?*), mountain mahogany (*Cercocarpus montanus*), canyon grape (*Vitis arizonica*), and Virginia creeper (*Parthenocissus vitacea*), none of which are currently found at ELMO.

“The ELMO fire management plan (Kessler 2005) calls for reducing wildland fire hazard around developed areas and identified cultural sites, and using surrogate fire treatments to restore and maintain primary natural resources and their processes. Recent projects included mechanical thinning and pile-burning in the eastern and northern portion of the monument

during 2007. Plans are underway to continue this effort in other parts of the monument" (Collins, ELMO Superintendent, 2008, pers. comm.) National Park Service personnel pulled/cut native thistle (*Cirsium*) from near the trail in 2007, presumably thinking they were exotic. No exotic thistles (*Cirsium* or *Carduus*) have been reported for ELMO.

New Mexico State Highway 53, and two regional utility lines, traverse 3.2 km through the monument. Many unused roads cross ELMO. Much of the surrounding lands are privately owned and are being developed at a rapid rate. This development will increase the rate of exotic species invasion.

PREVIOUS WORK. Samuel W. Woodhouse, naturalist with the Sitgreaves Expedition, arrived at El Morro on August 29, 1851 after collecting plants in the Zuni Mountains. "I dried a number of plants that I procured today" (Woodhouse 197-?, Tomer and Brodhead 1992). The next day, he scratched his name onto El Morro and left for Zuni soon after. Torrey (1853) reported that Woodhouse collected *Cleome integrifolia* Torr. & Gray, *Sphaeralcea incana* var. *oblongifolia* Gray, and *Lathyrus palustris* L. at Inscription Rock. Woodhouse's *Cleome integrifolia* specimen is curated at the Academy of Natural Sciences (PH) in Philadelphia. *Cleome integrifolia* Torr. & Gray is now known as *Cleome serrulata* Pursh., which we have vouchered for El Morro. We found *Sphaeralcea incana* subsp. *cuneata* Kearney at ELMO, but have found no modern equivalent for the name *Sphaeralcea incana* var. *oblongifolia* Gray. *Lathyrus palustris* L. is not known for New Mexico. Searches at the New York Botanical Garden (NY), PH, and the Smithsonian Institution (US) failed to find these specimens.

John Milton Bigelow visited El Morro during the Whipple Expedition and on November 19, 1853 collected the type for *Opuntia brachyarthra* Engelm. & Bigelow (Tropicos 2007), now located at the Missouri Botanical Garden (MO) as their accession #2015210. This specimen was annotated as *O. fragilis* var. *brachyarthra* by L. Benson of Pomona College in 1959 and then as *O. fragilis* by B. Parfitt of Arizona State University in 1991. We have failed to locate other specimens that Bigelow made at El Morro. Bigelow comments, "Unfortunately, we passed this region between 18th of November and the 25th of December... This

was the most unpropitious season of the whole year for the collection of herbaceous plants" (Bigelow 1856, p. 6).

George M. Wheeler's survey visited El Morro in 1873. A botanist (John T. Rothrock, Oscar Loew, or John Wolf) likely accompanied this portion of the trip and may have collected plants there. If so, the specimens would likely be at the Gray Herbarium (GH), Cambridge, Massachusetts, Academy of Natural Sciences (PH), Philadelphia, or the United States National Arboretum (NA), Washington, DC (Ewan and Ewan 1981). Rothrock's report (1878) does not give El Morro as a specific collecting locality. Lindsey (1951) documented the vegetation on volcanic substrates to the east of ELMO.

Several graduate students from the University of New Mexico have compiled floras of nearby areas, but unfortunately, these works are not generally available. DeBruin (1988) documented 173 vascular plant species at El Malpais National Monument in her comparison of plants and lichens on lava and sandstone substrates. Bleakly (1994) produced a flora of El Malpais National Monument. Osborn (1962) produced a flora of Mount Taylor, 70 km east-northeast of ELMO and went on to compare this flora to the flora at Redondo Peak, another 120 km to the east-northeast (Osborn 1966). Riffle (1973) documented 353 species in 61 families on and around Mount Sedgwick and in the vicinity of the Zuni Mountains approximately 30 km to the east-northeast of ELMO. Plant specimens from Cibola National Forest are curated in their small herbarium in Albuquerque.

At ELMO, D. A. McCallum (1981b) vouchered 257 taxonomic entities while covering the entire monument on foot many times from July 1978 through December 1980, producing a flora and a vegetation map (both unpublished) from his 2-1/2 year effort. G. Stoltz (1986) revised McCallum's (1981b) list.

Methods. The latest inventory plan for ELMO involved: 1) a review of previous work and herbaria specimens, 2) a stratified random sampling plan, and 3) a targeted survey within existing ELMO boundaries.

Database searches were followed by manual searches and a review of each ELMO specimen found at University of New Mexico Herbarium, Albuquerque, New Mexico (UNM); at El Malpais National Monument

Headquarters in Grants, New Mexico (NPS); at New Mexico State University at Las Cruces (NMC); and also at San Juan College Herbarium, Farmington, New Mexico (SJNM).

A stratified sampling plan (Pielou 1974) was developed in 2001 (Stuart 2000). Stratification was based on Gap Analysis land cover maps of New Mexico (Thompson 1996 and Thompson et al. 1996). National Park Service personnel generated random sampling points based on area of each land cover type present in the study area. The sampling-based approach was supplemented by targeted surveys of potentially productive habitats and unusual habitats that were missed by the randomly distributed points. National Park Service researchers A. Cully, R. Taylor, and J. Paige visited ELMO on May 24, 2001, and A. Cully, J. Adams, and H. Nelson revisited the area on May 30 and September 25, 2002 (Cully 2002). Drought conditions during 2001 and 2002 resulted in poor inventory results, so SCPN staff determined that additional inventory work was needed. Staff decided that targeted searches in productive and unusual habitats would best serve these needs, especially considering ELMO's small size and the limited budget for additional inventory. G. Rink spent 125 field hours seeking additional plant records on September 2, 3, 4, 21 and 22, and Oct. 3 in 2006, and on May 3, 4, 12, 26, and 27, and on June 3, 4, 23, and 24, and August 1 and 2 of 2007. Rink concentrated on and around Inscription Rock, in disturbed areas, and at the southeast corner of the monument. Specimens from this work are curated as accession number ELMO-00076 at NPS, UNM, the Deaver Herbarium, Northern Arizona University, Flagstaff, Arizona (ASC), and also at SJNM.

Martin and Hutchins (2001) was the primary source used for determinations. Other manuals consulted include Harrington (1954), Wootton and Standley (1915), Cronquist (1994), Cronquist et al. (1977, 1984, 1994, 1997), and Holmgren et al. (2005), Flora of North America, Vols. 2, 3, 4, 5, 19, 20, 21, 22, 23, 24, and 25 (1993–2007), McDougall (1973), Welsh et al. (1993), and Weber and Wittman (1996). The determination of specific groups of plants was aided by Hitchcock (1935), Gould (1951), Barneby (1964, 1989), and Rollins (1993). The identification of cultivated plants was aided by Bailey (1949) and Rehder (1987). Comparison of ELMO

specimens to the specimens in the ASC and UNM reference collections was crucial. Some specimens were determined by A. Salywon (Desert Botanical Garden), H. D. Hammond (ASC), K. Heil (SJNM), and S. O'Kane (University of Northern Iowa).

We used the abundance scale developed by Palmer et al. (1995) and followed the nomenclature of the Integrated Taxonomic Information System (ITIS <http://www.itis.usda.gov/>), the US Department of Agriculture Plants Database (USDA 2007), and the Flora of North America (1993–2007).

Results. Herbarium searches yielded 376 vascular plant specimens from ELMO at UNM, 369 ELMO specimens curated at El Malpais National Monument Headquarters in Grants, New Mexico (NPS), 16 specimens at NMC, and no specimens at SJNM. The field work in 2001 and 2002 resulted in 113 specimens. Because the drought conditions for those years resulted in poor species representation and depauperate specimens of those species that were present, the specimens were collected primarily for determination and were not intended for use as permanent vouchers. We collected 602 specimens during the 2006 and 2007 field work. Vouchered specimens in the checklist include 61 families, 219 genera, 372 species, ten subspecies, seven varieties, and two hybrids, as summarized in Table 1. These numbers reflect subspecific entities only in cases when another subspecific entity within that species was already in the checklist. For example, *Descurainia pinnata* (Walt.) Brit. consists of two subspecies, subsp. *pinnata* (Walt.) Brit. and subsp. *ochroleuca* (Woot.) Detling at ELMO; one added to the species count and one to the subspecies count as per Heil and O'Kane (2003). In addition to vouchered specimens, 48 taxonomic entities in Appendix B were reported. Fourteen of these were collected in the 2000s and determined by Rink, but were subsequently lost. Sixteen of the 48 reports are likely for El Morro, and would bring the checklist up to 404 taxonomic entities. Sixty of the non-horticultural entities are new records for both Cibola and Valencia Counties (INRAM 2007, USDA 2007). An additional 80 non-horticultural records, though known for Cibola or Valencia Counties, are new for El Morro National Monument (McCallum 1981a). Many of these new finds were a result of the high precipitation

Table 1. Summary of taxonomic information.

Class	Families	Genera	Species	Subsp.	Var.	Hyb.	Exotics	Total taxonomic entities
Filicopsida	1	1	1	-	-	-	0	1
Equisetopsida	1	1	1	-	-	-	0	1
Pinopsida	2	2	5	-	-	-	0	5
Magnoliopsida	48	170	277	6	6	1	37	290
Liliopsida	9	45	88	4	1	1	16	94
Total	61	219	372	10	7	2	53	391

that occurred during 2006. Fifty-five of the vouchered entities are exotic (ITIS 2007); eight are horticultural introductions. Four of the eight horticultural introductions are exotic to North America, one is exotic to New Mexico, and the other three are native to the region, but do not grow naturally at ELMO. Twelve percent of the El Morro flora (non-horticultural) is exotic, which is similar to other National Park Service areas in the region (Rink 2005).

Besseyia arizonica (Arizona coraldrops), tracked by the New Mexico Natural Heritage Program, occurs at ELMO along the north side of Inscription Rock. Five species that occur in Cibola County that are Listed Threatened or Species of Concern with the U.S. Fish & Wildlife Service (USFWS 2007), considered rare by the New Mexico Rare Plant Technical Council (NMRPTC 2007), or tracked by the New Mexico Natural Heritage Program (NMNHP 2007) that may one day be found at ELMO are listed in Appendix A.

Discussion. Based on the area's wide climatic variability and the number of reports of species not yet vouchered, we estimate that this checklist is about 80% complete, somewhat short of our goal of 90%. Fig. 3 is a taxa accumulation curve that does not seem to be approaching an asymptote. Searching for new records during wet years is likely to yield significant diversity.

Botanists working in the 2000s did not locate 47 of the records that McCallum's work (1981b) vouchered. We suspect that of these, only *Carex microptera* is extirpated from El Morro. S. Carlson found *C. microptera* below the water spigot in the campground in 1978. This sedge may have been eradicated due to the NPS practice of routinely mowing herbaceous vegetation next to roadways and other developed portions of the monument, including next to the water spigot in the campground. Of course, *Carex microptera* would

not likely have lived in this (formerly dry) area prior to the development of the campground. The other 44 species may only be visible during years in which weather conditions are right for their germination, growth, and reproduction, or we may have simply missed them. Our coverage was significantly less than 100%.

We compared ELMO vascular plant species diversity (or species richness; the number of species present within the park represented by vouchered specimens) to that found in 18 other parks in the southwest (Table 2). We attempted to reduce the checklists from other parks to only vouchered entities. Subspecific entities were added only in cases when another subspecific entity within that species was already in the checklist. For example, if *Asclepias asperula* (Decne.) Woods. and *Asclepias asperula* subsp. *capricornu* (Woods.) Woods. are both in a checklist, they were counted as only one taxonomic entity. Bowers and McLaughlin (1982) compared 20 vascular plant checklists from Arizona and found that of the variables, elevation range, area, and collecting time, that elevation range and collecting time accounted for 77% of the

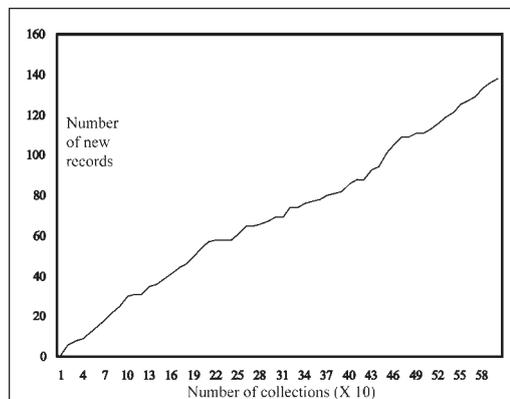


FIG. 3. Taxa accumulation per every ten collections made. Note that the curve does not seem to be approaching an asymptote.

Table 2. Comparison of vouchered vascular plant diversity at 19 parks in the Southwest. Park = NPS acronym (AZRU = Aztec Ruins National Monument, NM; CACH = Canyon de Chelly National Monument, AZ; CHIR = Chiricahua National Monument, AZ; COLM = Colorado National Monument, CO; ELMA = El Malpais National Monument, NM; ELMO = El Morro National Monument, NM; FOBO = Fort Bowie National Monument, AZ; GICL = Gila Cliff Dwellings National Monument, NM; HOVE = Hovenweep National Monument, CO and UT; HUTR = Hubbell Trading Post National Historic Site, AZ; NABR = Natural Bridges National Monument, AZ; NAVA = Navajo National Monument, AZ; PISP = Pipestone National Monument, AZ; SUCR = Sunset Crater National Monument, AZ; TONT = Tonto National Monument, AZ; TUZI = Tuzigoot National Monument, AZ; WACA = Walnut Canyon National Monument, AZ; WUPA = Wupatki National Monument, AZ; YUHO = Yucca House National Monument, CO); Taxa = number of vascular plant taxonomic entities vouchered for that park; Elev. range = elevation range of the park; Area = area of the park in hectares; Effort = person/days of effort put into finding plant diversity during the latest study; Water = presence of water in the park; Canyon = presence of canyon environments in the park; Lat. = latitude; Un. = number of parcels of land that make up the park.

Park	Taxa	Elev. range	Area (Ha)	Effort	Water	Canyon	Lat.	un.	citation
AZRU	350	61	104	47	yes	no	37	1	Rink & Cully 2008
CACH	771	640	40,000	110	yes	yes	36	1	Rink 2005
CHIR	409	823	4850	36	yes	yes	32	1	Powell et al. 2008
COLM	414	758	8,310	na	no	yes	39	1	Fertig et al. in press
ELMA	476	536	46,479	na	no	no	35	1	NPSpecies 2009
ELMO	391	59	419	24	no	yes	35	1	Rink et al. this report
FOBO	500	200	405	18	yes	no	32	1	Powell et al. 2006
GICL	483	155	215	66	yes	yes	33	2	NPSpecies 2009
HOVE	273	475	318	na	yes	yes	37	6	Fertig in press a
HUTR	184	20	65	8	wash	no	36	1	Roth 2004a
NABR	317	280	3009	na	no	yes	38	1	Fertig in press b
NAVA	357	230	146	20	yes	yes	37	3	Roth 2004b
PISP	215	55	16	na	yes	no	37	1	Fertig & Alexander 2008
SUCR	116	369	1230	na	no	no	35	1	NPSpecies 2009
TONT	425	500	453	60	yes	yes	34	1	Albrecht et al. 2007
TUZI	264	20	148	na	no	no	35	1	Powell et al. 2005
WACA	370	200	761	na	yes	yes	35	1	NPSpecies 2009
WUPA	264	432	14350	na	no	no	36	1	NPSpecies 2009
YUHO	261	100	962	45	yes	no	37	2	Rink & Cully 2007

variability in diversity for these checklists. They considered that the remaining variance was associated with vegetation community type, presence of water, and presence of canyon environments. Latitude is a variable which significantly influences vascular plant diversity and should be considered in these types of comparisons (Qian 1999). Of the 19 parks compared in Table 2, Fort Bowie National Historic Site and Tonto National Monument are most similar to ELMO in area, but have greater diversity than ELMO, probably related to their location at lower latitudes. Chiricahua National Monument is exceptional in that it is 11 times larger than ELMO, is at a lower latitude, but has only 18 taxa more than ELMO. When the diversity at ELMO is compared with parks at a similar or higher latitude, ELMO has a high vascular plant species diversity.

Recommendations. We recommend that when de-vegetation and re-vegetation efforts

are planned at ELMO, qualified re-vegetation botanists should be included in planning and monitoring to assure that species targeted for removal are identified correctly and that appropriate reclamation approaches and locally-derived seed sources are used. Mowing of roadsides reduces fire danger, but, if done during flowering, can increase the seed supply and distribution of exotic species. Managers should be cognizant of these tradeoffs, realizing that invasive species often do best in disturbed habitats. Appropriate weed management is best attained through hand pulling of exotics.

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Checklist of Vascular Plants of El Morro National Monument

Checklist is arranged alphabetically by family. Species name and authorities (ITIS 2007); 62 new records (according to USDA (2007) and INRAM (2007)) for both Cibola County and Valencia Counties are in bold font; common name (ITIS 2007); collector (or curatorial facility) (Bi = J. M. Bigelow, Bo = Bone, c = S. Carlson, i = J. Ikai, k = E. Kayes, m = D. McCallum, n = N. & D. Najera, NMC = New Mexico College (with Accession #), R = R. Taylor, r = G. Rink); collector number (sn = without number), collector numbers for new records for El Morro from this inventory work are in bold font; Nativity, N = native, E = exotic, (H) = horticultural introduction (ITIS 2007), exotic means either not native to El Morro or not native to the continental United States (check ITIS for further information); 1–5, abundance scale (Palmer et al. 1995); notes.

Agavaceae

Yucca angustissima Engelm. ex Trel., narrowleaf yucca, r6082, N, 3

Yucca baccata Torr., banana yucca, r6031, N, 3

Amaranthaceae

Amaranthus hybridus L., smooth pigweed, r5116, N, 3

Amaranthus palmeri S. Wats., Palmer amaranth, **r5128**, N, 2

Amaranthus powellii S. Wats., Powell pigweed, **r5361**, N, 3

Amaranthus torreyi (Gray) Benth. ex S. Wats., Torrey's amaranth, **r5186**, N, 3

Amaranthus viridis L., slender amaranth, m842, N, 0

Froelichia arizonica Thornb. ex Standl., Arizona snakecotton, **r5193**, N, 1

Anacardiaceae

Rhus trilobata var. *anisophylla* (Greene) Jepson, skunkbush sumac, r5753, N, 3

Apiaceae

Cymopterus bulbosus A. Nels., bulbous spring parsley, **r5756**, N, 1

Cymopterus multinervatus (Coul. & Rose) Tidestrom, Arizona spring parsley, **r5885**, N, 1

Pseudocymopterus montanus (Gray) Coul. & Rose, false spring parsley, **r5889**, N, 1

Asclepiadaceae

Asclepias asperula (Dcne.) Woods., antelope horns, m496, N, 0

Asclepias involucrata Engelm. ex Torr., dwarf milkweed, m746, N, 0

- Asclepias subverticillata* (Gray) Vail, horsetail milkweed, r6240, N, 1
- Asteraceae**
- Achillea millefolium* var. *occidentalis* DC., western yarrow, r5382, N, 3
- Ageratina herbacea* (Gray) King & H.E. Robins., fragrant snakeroot, r5212, N, 3
- Ambrosia acanthicarpa* Nutt., annual bursage, r5145, N, 3
- Ambrosia artemisiifolia* L., ragweed, **r5429**, N, 1
- Ambrosia psilostachya* DC., western ragweed, **r5368**, N, 2
- Antennaria marginata* Greene, whitemargin pussytoes, r5887, N, 2
- Antennaria parvifolia* Nutt., little-leaf pussytoes, r5769, N, 3
- Antennaria rosea* Greene, rose pussytoes, **r6035**, N, 1
- Artemisia campestris* var. *scouleriana* (Hook.) Cronq., field sagewort, r6275, N, 3
- Artemisia ludoviciana* Wood ex Carruth., Carruth's sagewort, r6241, N, 2
- Artemisia dracunculus* L., false tarragon, r5132, N, 3
- Artemisia filifolia* Torr., sand sagebrush, r5289, N, 2
- Artemisia frigida* Willd., fringed sagebrush, r6237, N, 4
- Artemisia ludoviciana* subsp. *albula* (Woot.) Keck, white sagebrush, r5126, N, 3
- Artemisia ludoviciana* subsp. *sulcata* (Rydb.) Keck, green sagewort, r5356, N, 3
- Artemisia tridentata* Nutt., big sage, r5350, N, 5
- Bahia dissecta* (Gray) Britt., ragleaf bahia, r5127, N, 3
- Brickellia californica* (Torr. & Gray) Gray, california brickellbush, **r5287**, N, 3
- Brickellia grandiflora* (Hook.) Nutt., mountain brickellbush, r5271, N, 3
- Chaetopappa ericoides* (Torr.) Nesom, smallflower aster, r5760, N, 3
- Chrysothamnus depressus* Nutt., dwarf rabbitbrush, r6291, N, 1
- Chrysothamnus Greenei* (Gray) Greene, Green's rabbitbrush, r5435, N, 4
- Chrysothamnus viscidiflorus* subsp. *lanceolatus* (Nutt.) Hall & Clements, lanceleaf rabbitbrush, **r6272**, N, 3
- Cirsium neomexicanum* Gray, New Mexico thistle, r6124, N, 4
- Cirsium undulatum* (Nutt.) Spreng., wavy-leaf thistle, **r6244**, N, 3
- Conyza canadensis* (L.) Cronq., horsetweed, r6242, N, 3
- Coreopsis tinctoria* Nutt., golden tickseed, r6306, N, 2
- Cosmos parviflorus* (Jacq.) Pers., southwestern cosmos, r5284, N, 3
- Crepis runcinata* subsp. *glauca* (Nutt.) Babcock & Stebbins, fiddleleaf hawksbeard, **r5890**, N, 2
- Dyssodia papposa* (Vent.) A.S. Hitchc., fetid marigold, m629, N, 0
- Engelmannia peristenia* (Raf.) Goodman & Lawson, Engelmann's daisy, **r6247**, N, 1
- Ericameria nauseosa* var. *bigelovii* (Gray) Nesom & Baird, rubber rabbitbrush, r5138, N, 4
- Ericameria nauseosa* var. *glabrata* (Gray) Nesom & Baird, rubber rabbitbrush, m915, N, 4
- Ericameria nauseosa* var. *oreophila* (A. Nels.) Nesom & Baird, rubber rabbitbrush, r5137, N, 4
- Erigeron canus* Gray, hoary fleabane, **R390**, N, 1
- Erigeron concinnus* (Hook. & Arn.) Torr. & Gray, Navajo daisy, r6002, N, 3
- Erigeron divergens* Torr. & Gray, spreading fleabane, r5142, N, 4
- Erigeron flagellaris* Gray, trailing fleabane, r5239, N, 3
- Erigeron speciosus* (Lindl.) DC., aspen fleabane, **r6305**, N, 3
- Gaillardia aristata* Pursh, common gaillardia, **r6283**, N (H), 1
- Grindelia nuda* var. *aphanactis* (Rydb.) Nesom, rayless gumweed, r5178, N, 3
- Gutierrezia sarothrae* (Pursh) Britt. & Rusby, snakeweed, r5327, N, 4
- Helianthus annuus* L., annual sunflower, **r6261**, N, 1
- Helianthus anomalus* Blake, western sunflower, **r5326**, N, 1
- Helianthus petiolaris* Nutt., prairie sunflower, r6254, N, 4
- Heliomeris multiflora* var. *oreophila* Nutt., showy goldeneye, r5161, N, 4
- Heterosperma pinnatum* Cav., wingpetal, **r5206**, N, 4
- Heterotheca canescens* (DC.) Shinnars, hoary false goldenaster, r5114, N, 3
- Heterotheca villosa* (Pursh) Shinnars, hairy goldenaster, **r5422**, N, 4
- Hieracium fendleri* Schultz-Bip., yellow hawksbeard, r6127, N, 2
- Hymenopappus filifolius* var. *cinereus* (Rydb.) I.M. Johnston, fineleaf hymenopappus, r5305, N, 3
- Hymenopappus flavescens* var. *canotomentosus* Gray, collegeflower, r6067, N, 3
- Hymenoxys richardsonii* (Hook.) Cockerell, Colorado rubberweed, r5421, N, 2
- Lactuca serriola* L., prickly lettuce, r5261, E, 2
- Laennecia schiedeana* (Less.) Nesom, pineland marshtail, **r5426**, N, 2
- Machaeranthera canescens* (Pursh) Gray, hoary aster, r5324, N, 4
- Machaeranthera gracilis* (Nutt.) Shinnars, slender goldenweed, r6094, N, 3
- Machaeranthera tanacetifolia* (Kunth) Nees, tansyleaf aster, r5269, N, 3
- Malacothrix fendleri* Gray, Fendler's desert dandelion, i9, N, 0
- Packera multilobata* (Torr. & Gray ex Gray) W.A. Weber & A. Löve, lobeleaf grounsel, k35, N, 3
- Pseudognaphalium pringlei* (Gray) A. Anderb., Pringle's cudweed, r5275, N, 3
- Psilostrophe tagetina* (Nutt.) Greene, woolly paperflower, m356, N, 0
- Ratibida columnifera* (Nutt.) Woot. & Standl., prairie coneflower, r6122, N, 2
- Ratibida tagetes* (James) Barnh., shortray prairie coneflower, r6277, m900, N, 1
- Sanvitalia abertii* Gray, Abert creeping zinnia, **r5187**, N, 3

- Schkuhria multiflora* Hook. & Arn., manyflower false threadleaf, r5172, N, 3
Scorzonera laciniata L., cutleaf vipergrass, **r6062**, E, 2
Senecio spartioides var. *multicapitatus* (Greenm. ex Rydb.) Welsh, ragwort groundsel, r5111, N, 4
Stephanomeria exigua Nutt., small wire lettuce, m797, N, 0
Tagetes micrantha Cav., licorice marigold, **r5207**, N, 2
Taraxacum laevigatum (Willd.) DC., rock dandelion, **r6020**, E, 3
Taraxacum officinale G.H. Weber ex Wiggers, dandelion, m911, E, 0
Tetradymia canescens DC., gray horsebrush, r6251, N, 5
Tetranneuris argentea (Gray) Greene, perkysue, r5777, N, 3
Thelesperma megapotanicum (Spreng.) Kuntze, Hopitea greenthread, r6095, N, 2
Tragopogon dubius Scop., common salsify, r6066, E, 3
Verbesina encelioides subsp. *encelioides* (Cav.) Benth. & Hook. f. ex Gray, golden crownbeard, r5441, N, 5
Xanthium strumarium L., cocklebur, **r5318**, N, 3
- Berberidaceae**
Mahonia repens (Lindl.) G. Don, creeping barberry, r5748, N, 3
- Boraginaceae**
Cryptantha cinerea var. *jamesii* Cronq., bownut cryptantha, r5301, N, 3
Cryptantha fendleri (Gray) Greene, Fendler's cryptantha, r5112, N, 3
Lappula occidentalis var. *cupulata* (Gray) Higgins, flatspine stickseed, **r6012**, N, 4
Lappula occidentalis var. *occidentalis* (S. Wats.) Greene, desert stickseed, r6064, N, 4
Lithospermum incisum Lehm., fringed puccoon, **r5752**, N, 2
- Brassicaceae**
Alyssum minus (L.) Rothm., European alyssum, **r6065**, E, 3
Boechera fendleri (S. Wats.) W.A. Weber, Fendler's rockcress, r6023, N, 3
Boechera perennans (S. Wats.) W.A. Weber, perennial rockcress, r5886, N, 3
Camelina microcarpa DC., littleseed falseflax, **r6099**, E, 2
Capsella bursa-pastoris (L.) Medik., shepherd's purse, m515, E, 0
Chorispora tenella (Pallas) DC., blue mustard, **r5742**, E, 2
Descurainia californica (Gray) O.E. Schulz, Sierra tansymustard, r5147, N, 4
Descurainia incana subsp. *viscosa* (Rydb.) Kartesz & Gandhi, mountain tansy mustard, **r6018**, N, 3
Descurainia obtusa (Greene) O.E. Schulz, blunt tansy mustard, r6075, N, 3
Descurainia pinnata subsp. *pinnata* (Walt.) Britt., western tansy mustard, m905, N, 0
Descurainia pinnata subsp. *ochroleuca* (Woot.) Detling, western tansy mustard, **r5899**, N, 3
Descurainia sophia (L.) Webb ex Prantl, flaxweed tansymustard, **r5727**, E, 2
Dimorphocarpa wislizenii (Engelm.) Rollinspectaclepod, r6006, N, 3
Draba aurea Vahl ex Hornem., golden draba, r5226, N, 3
Erysimum capitatum (Dougl. ex Hook.) Greene, western wallflower, r6101, N, 3
Erysimum repandum L., repand wallflower, r5772a, E, 1
Lepidium densiflorum Schrad., common pepperweed, r6013, N, 3
Lesquerella rectipes Woot. & Standl., straight bladderpod, r5888, N, 3
Pennellia micrantha (Gray) Nieuwl., mountain mock thelypody, r6294, N, 2
Schoenocrambe linearifolia (Gray) Rollins, slimleaf plains mustard, r5183, N, 2
Sisymbrium altissimum L., tumblemustard, r5732, E, 3
Thlaspi montanum var. *montanum* L., alpine pennycress, r5750, N, 2
- Cactaceae**
Echinocereus coccineus Engelm., scarlet hedgehog cactus, r6008, N, 2
Echinocereus fendleri (Engelm.) F. Seitz, Fendler hedgehog cactus, **r6073**, N, 2
Escobaria vivipara (Nutt.) Buxbaum, spinystar, c7, r6104, r6288, N, 2
Mammillaria wrightii Engelm., Wright pincushion cactus, **r6256**, N, 2
Opuntia fragilis (Engelm. & Bigelow) Coult., brittle pricklypear, Bi-sn, N, 0
Opuntia imbricata (Haw.) DC., tree cholla, r5292, N (H), 1
Opuntia macrorhiza var. *macrorhiza* Engelm., big-flower pricklypear, m780, N, 3
Opuntia phaeacantha Engelm., brownspine pricklypear, r5202, N, 3
Opuntia whipplei Engelm. & Bigelow, Whipple cholla, **r6070**, N, 3
- Capparaceae**
Cleome serrulata Pursh, Rocky Mountain beeplant, r5168, N, 3
- Caprifoliaceae**
Symphoricarpos oreophilus var. *utahensis* (Rydb.) A. Nels., Utah snowberry, r6083, N, 4
- Caryophyllaceae**
Arenaria fendleri var. *fendleri* Gray, Fendler's sandwort, r6115, N, 3
Arenaria fendleri var. *brevifolia* (Maguire) Maguire, Fendler's sandwort, **r5166**, N, 3
Arenaria lanuginosa subsp. *saxosa* (Gray) Maguire, spreading sandwort, r6129, N, 1
Drymaria glandulosa K. Presl, Fendler's drymary, **r5362**, N, 3
Drymaria leptophylla (Cham. & Schlecht.) Fenzl ex Rohrb., canyon drymary, **r5198**, N, 3
Silene laciniata Cav., cardinal catchfly, r5214, N, 2
Silene scouleri subsp. *pringlei* (S. Wats.) C.L. Hitchc. & Maguire, Pringle catchfly, **r6304**, N, 1
Spergularia salina J. & K. Presl., salt sandspurry, **r5306**, N, 1

Chenopodiaceae

- Atriplex canescens* (Pursh) Nutt., fourwing saltbush, r6119, N, 5
Chenopodium album var. *missouriense* (Aellen) I.J. Bassett & C.W. Crompton, common lambsquarters, m889, N, 0
Chenopodium ambrosioides L., Mexican tea, m644, E, 0
Chenopodium fremontii S. Wats., Fremont goosefoot, r5355, N, 2
Chenopodium graveolens Willd., fetid goosefoot, r5134, N, 4
Chenopodium leptophyllum (Moq.) Nutt. ex S. Wats., narrowleaf goosefoot, r5328, N, 3
***Chenopodium neomexicanum* Standl.**, New Mexico goosefoot, r5367, N, 3
Kochia scoparia (L.) Schrad., common kochia, r6252, E, 3
Krascheninnikovia lanata (Pursh) A.D.J. Meeuse & Smit, winterfat, r5385, N, 4
***Salsola collina* Pallas**, slender Russian thistle, r5119, 6273, E, 3
Salsola tragus L., Russian thistle, r5163, E, 3

Commelinaceae

- Commelina dianthifolia* var. *longispatha* (Torr.) Brashier, birdbill dayflower, r5156, N, 4
Tradescantia occidentalis var. *occidentalis* (Britt.) Smyth., prairie spiderwort, r6260, N, 4
Tradescantia pinetorum Greene, pinewoods spiderwort, r5201, N, 3

Convolvulaceae

- Convolvulus arvensis* L., European bindweed, r6087, E, 3
Ipomoea hederifolia L., scarlet creeper, r5188, N, 2

Crassulaceae

- Crassula aquatica* (L.) Schoenl.**, water pygmyweed, r5411, N, 1

Cupressaceae

- Juniperus deppeana* Steud., alligator juniper, r5196, N, 3
Juniperus monosperma (Engelm.) Sarg., one-seed juniper, r5771, N, 5
Juniperus scopulorum Sarg., Rocky Mountain juniper, r5409, N, 4

Cuscutaceae

- Cuscuta leptantha* Engelm.**, slender dodder, r5370, N, 2
Cuscuta salina Engelm., goldenthread, m847, N, 0

Cyperaceae

- Carex duriuscula* C. A. Mey, needleleaf sedge, r6123, N, 1
Carex geophila Mackenzie, White Mountain sedge, r5767, N, 2
Carex microptera Mackenzie, ovalhead sedge, c21, 22, N, 0
Carex obtusata Lilj., blunt sedge, r6136, N, 1
Carex occidentalis Bailey, western sedge, r5766, N, 3
***Carex rossii* Boott**, Ross sedge, r6130, N, 2
Cyperus esculentus L., chufa, r5148, N, 3
Cyperus fendlerianus Boeckl., Fendler's flatsedge, r5189, N, 3
***Cyperus squarrosus* L.**, awned flatsedge, r5122, N, 3

Dryopteridaceae

- Woodsia neomexicana* Windham, New Mexico cliff fern, r6301, N, 2

Ephedraceae

- Ephedra cutleri* Peebles**, Cutler Mormon tea, r6281, N, 3

Ericaceae

- Pterospora andromedea* Nutt., woodland pinedrops, m366, N, 0

Euphorbiaceae

- Chamaesyce micromera* (Boiss. ex Engelm.) Woot. & Standl.**, desert spurge, r5257, N, 3
Chamaesyce serpyllifolia subsp. *serpyllifolia* (Pers.) Small, thymeleaf spurge, r5256, N, 3
Euphorbia brachycera Engelm., horned spurge, r5734, N, 3

Fabaceae

- Astragalus mollissimus* var. *matthewsii* (S. Wats.) Barneby Matthew's woolly milkvetch, r6010, N, 2
Dalea candida var. *oligophylla* (Torr.) Shinnery, white prairie clover, r6290, N, 2
***Dalea polygonoides* Gray**, six-weeks prairie-clover, r5279, N, 2
Hoffmanseggia drepanocarpa Gray, sicklepod holdback, R448, N, 1
Lotus wrightii (Gray) Greene, Wright's deervetch, r5407, N, 3
Lupinus kingii S. Wats., King's lupine, r6088, N, 2
Medicago lupulina L., black medik, r5153, E, 2
***Medicago polymorpha* L.**, bur clover, r5891, E, 2
Medicago sativa L., alfalfa, Bo-sn, E (H), 2, native to Eurasia and Africa (GRIN 2008)
Melilotus officinalis (L.) Lam., yellow sweet clover, r6089, E, 2
Psoraleidium lanceolatum (Pursh) Rydb., dune scurfpea, r5150, N, 3
Trifolium gymnocarpon subsp. *gymnocarpon* Nutt., hollyleafclover, m728, N, 1
Trifolium repens L., white clover, m895, E, 2
Vicia americana subsp. *minor* (Hook.) C.R. Gunn, purple vetch, r5274, N, 2

Fagaceae

- Quercus gambelii* Nutt., Gambel oak, r5751, N, 5
Quercus x pauciloba Rydb. (pro sp.), wavyleaf oak, r5303, N, 2

Fumariaceae*Corydalis aurea* subsp. *aurea* Willd., scrambledeggs, r6021, N, 2*Corydalis curvisiliqua* subsp. *occidentalis* (Engelm. ex Gray) W.A. Weber, curvepod fumewort, **r6016**, N, 3**Geraniaceae***Erodium cicutarium* (L.) L'Hér. ex Ait., filaree, r5369, E, 3*Geranium caespitosum* James, pineywoods geranium, m621, N, 3*Geranium caespitosum* var. *parryi* (Engelm.) W.A. Weber, Parry geranium, **r5234**, N, 3**Grossulariaceae***Ribes cereum* var. *pedicellare* Brewer & S. Wats., squaw currant, r6120, N, 4**Hydrophyllaceae***Nama dichotomum* (Ruiz & Pavon) Choisy, wish-bone fiddleleaf, **r5157**, N, 2*Phacelia alba* Rydb., white phacelia, r5106, N, 3**Juncaceae***Juncus interior* Wieg., inland rush, r6296, N, 2*Juncus interior* var. *arizonicus* (Wieg.) F.J. Herm., Arizona rush, m552, N, 2*Juncus saximontanus* A. Nels., Rocky Mountain rush, **r6295**, N, 2**Lamiaceae***Agastache pallidiflora* subsp. *neomexicana* (Briq.) Lint & Epling, New Mexican giant hyssop, **r6266**, N, 2*Dracocephalum parviflorum* Nutt., American dragonhead, r6025, N, 2*Hedeoma oblongifolia* (Gray) Heller, false pennyroyal, r5209, N, 2*Marrubium vulgare* L., horehound, r6030, E, 2*Monarda pectinata* Nutt., horsemint, r6302, N, 2*Monarda punctata* var. *lasiodonta* Gray, spotted beebalm, r5144, N, 2*Salvia reflexa* Hornem., blue sage, r5151, N, 3*Salvia subincisa* Benth., sawtooth sage, r5160, N, 3**Liliaceae***Allium cernuum* Roth, nodding onion, m850, N, 2*Echeandia flavescens* (J.A. & J.H. Schultes) Cruden, Torrey's cragliliy, r5197, N, 2**Linaceae***Linum australe* Heller, southern flax, **r6071**, **6093**, N, 2*Linum neomexicanum* Greene, New Mexico yellow flax, **r6289**, N, 2*Linum pratense* (J.B.S. Norton) Small, meadow flax, m408, N, 0**Loasaceae***Mentzelia albicaulis* (Dougl. ex Hook.) Dougl. ex Torr. & Gray, white blazingstar, r6009, N, 2**Malvaceae***Malva neglecta* Wallr., cheeseweed, r5295, E, 2*Sphaeralcea coccinea* (Nutt.) Rydb., orange globemallow, r6269, N, 3*Sphaeralcea coccinea* subsp. *elata* (E.G. Baker) Kearney, scarlet globemallow, NMC18328, N, 3*Sphaeralcea digitata* subsp. *digitata* (Greene) Rydb., juniper globemallow, r6287, N, 2*Sphaeralcea digitata* subsp. *tenuipes* (Woot. & Standl.) Kearney, juniper globemallow, r5339, N, 3*Sphaeralcea fendleri* subsp. *fendleri* Gray, fendler globemallow, **r5276**, N, 3*Sphaeralcea grossulariifolia* subsp. *pedata* (Torr. ex Gray) Kearney, berryleaf globemallow, **r5184**, N, 3*Sphaeralcea incana* subsp. *cuneata* Kearney, soft globemallow, r6286, N, 3**Nyctaginaceae***Abronia fragrans* Nutt. ex Hook., sweet sandverbena, r6102, N, 3*Mirabilis decipiens* (Standl.) Standl., broadleaf four-o'clock, **r5230**, N, 3*Mirabilis glabra* (S. Wats.) Standl., smooth four-o'clock, r5108, N, 3*Mirabilis linearis* (Pursh) Heimerl, narrowleaf four-o'clock, r5129, N, 3*Mirabilis multiflora* (Torr.) Gray, Colorado four-o'clock, r6106, N, 3*Mirabilis oxybaphoides* (Gray) Gray, spreading four-o'clock, r5312, m961, N, 2*Tripterocalyx carnea* var. *wootonii* (Standl.) L.A. Gal., Wooton sandpuffs, r5304, N, 2**Oleaceae***Fraxinus cuspidata* Torr., flowering ash, m476, N, 0*Menodora scabra* var. *scabra* Engelm. ex Gray, rough menodora, **r5199**, N, 2*Syringa vulgaris* L., common lilac, **r5313**, E (H), 2, native to eastern Europe (GRIN 2008)**Onagraceae***Gaura coccinea* Nutt. ex Pursh, scarlet guara, r5219, N, 3*Gaura hexandra* subsp. *gracilis* (Woot. & Standl.) Raven & Gregory, harlequinbush, r5255, N, 3*Gaura mollis* James, velvet weed, r6284, N, 2*Gayophytum ramosissimum* Torr. & Gray, pinyon groundsmoke, m439, N, 0*Oenothera albicaulis* Pursh, white-stem evening-primrose, r5770, N, 3*Oenothera caespitosa* subsp. *caespitosa* Nutt., tufted evening primrose, **r5154**, N, 2*Oenothera coronopifolia* Torr. & Gray, crownleaf evening primrose, r6017, N, 2*Oenothera elata* subsp. *hirsutissima* (Gray ex S. Wats.) W. Dietr., Hooker's evening primrose, **r6267**, N, 2*Oenothera elata* subsp. *hookeri* (Torr. & Gray) W. Dietr. & W.L. Wagner, Hooker's evening primrose, m358, N, 2*Oenothera flava* (A. Nels.) Garrett, yellow evening primrose, r5743, N, 2

- Oenothera pallida* subsp. *runcinata* (Engelm.) Munz, pale evening primrose, m353, m794, N, 0
***Oenothera pallida* subsp. *trichocalyx* (Nutt.) Munz & W. Klein**, pale evening primrose, **r5113**, N, 3
- Orchidaceae**
Corallorrhiza maculata (Raf.) Raf., spotted coralroot, m481, N, 0
- Orobanchaceae**
Orobanche fasciculata Nutt., purple broomrape, r5998, N, 2
- Oxalidaceae**
Oxalis violacea L., violet woodsorrel, **r6258**, N, 2
- Pinaceae**
Pinus edulis Engelm., pinyon pine, r5773, N, 5
Pinus ponderosa P.& C. Lawson, ponderosa pine, r5774, N, 5
- Plantaginaceae**
Plantago argyrea Morris, saltmeadow plantain, r6103, N, 3
Plantago patagonica Jacq., woolly plantain, **r5999**, N, 3
- Poaceae**
Achnatherum hymenoides (Roemer & J.A. Schultes) Barkworth, Indian rice grass, r5418, N, 3
Achnatherum nelsonii subsp. *dorei* (Barkworth & Maze) Barkworth, Columbia needlegrass, m953, N, 0
Achnatherum scribneri (Vasey) Barkworth, Scribner needlegrass, **r5164**, N, 2
Agropyron cristatum (L.) Gaertn., crested wheatgrass, **r6096**, E, 3
Agrostis scabra Willd., rough bentgrass, r6297, N, 3
Andropogon gerardii Vitman, big bluestem, r6262, N, 2
Aristida arizonica Vasey, Arizona threeawn, r5391, N, 3
Aristida divaricata Humb. & Bonpl. ex Willd., poverty threeawn, **r5280**, N, 3
Aristida purpurea var. *fendleriana* (Steud.) Vasey, Fendler threeawn, m935, N, 3
Aristida purpurea var. *longiseta* (Steud.) Vasey, red threeawn, r6092, N, 3
Aristida schiedeana var. *orcuttiana* (Vasey) Allred & Valdés-Reyna, Orcutt's threeawn, r5423, N, 2
Blepharoneuron tricholepis (Torr.) Nash, pine dropseed, m852, N, 0
***Bothriochloa ischaemum* (L.) Keng**, Turkestan beardgrass, **r5309**, E, 2
Bouteloua curtipendula (Michx.) Torr., sideoats grama, r5425, N, 4
Bouteloua gracilis (Willd. ex Kunth) Lag. ex Griffiths, blue grama, r5347, N, 5
Bromus ciliatus L., fringed brome, **r5242**, N, 2
***Bromus commutatus* Schrad.**, hairy chess, **r5260**, E, 2
Bromus inermis Leyss., smooth brome, **r5433**, E, 2
Bromus japonicus Thunb. ex Murr., Japanese bromer, r6091, E, 2
Bromus lanatipes (Shear) Rydb., woolly brome, r6298, N, 4
Bromus polyanthus Scribn., Great Basin brome, m966, N, 0
Bromus tectorum L., cheat grass, r5322, E, 5
Cenchrus echinatus L., burgrass, **r5175**, N, 2
Chloris verticillata Nutt., windmillgrass, r5296, N, 2
Echinochloa muricata var. *microstachya* Wieg., rough barnyard grass, **r5173**, N, 1
Elymus elymoides subsp. *brevifolius* (J.G. Sm.) Barkworth, squirreltail, r5342, N, 4
Elymus elymoides subsp. *elymoides* (Raf.) Swezey, squirreltail, k66, N, 0
Elymus trachycaulus subsp. *trachycaulus* (Link) Gould ex Shinners, slender wheatgrass, r6126, N, 3
Elymus x pseudorepens (Scribn. & J.G. Sm.) Barkworth & D.R. Dewey, creeping wildrye, m954, N, 0
Eragrostis barrelieri DaveauMediterranean lovegrass, m902, E, 0
Eragrostis cilianensis (All.) Vign. ex Janchen, lovegrass, **r5152**, E, 3
***Eragrostis lehmanniana* Nees**, Lehmann lovegrass, **r5308**, E, 0
Eragrostis mexicana subsp. *mexicana* (Hornem.) Link, Mexican lovegrass, **r5403a**, N, 3
***Eragrostis mexicana* subsp. *virescens* (J. Presl) S.D. Koch & Sánchez**, Mexican lovegrass, **r5273**, N, 3
Eragrostis pectinacea (Michx.) Nees ex Steud., purple lovegrass, r5252, N, 3
Festuca arizonica Vasey, Arizona fescue, **r6117**, N, 3
***Festuca idahoensis* Elmer**, Idaho fescue, **r6032**, N, 3
Hesperostipa comata (Trin. & Rupr.) Barkworth, needle and thread, r6004, N, 3
Hesperostipa comata subsp. *intermedia* (Scribn. & Tweedy) Barkworth, intermediate needle and thread, **r5302**, N, 3
Holcus lanatus L., common velvetgrass, **r6134**, E, 2
Hordeum jubatum L., foxtail barley, **r5445**, N, 3
Hordeum murinum subsp. *glaucum* (Steud.) Tzvelev, smooth barley, r5325, m741a, E, 3
Koeleria macrantha (Ledeb.) J.A. Schultes, june grass, r6263, N, 2
Lolium perenne subsp. *multiflorum* (Lam.) Husnot, annual ryegrass, r5294, E, 2
***Lolium pratense* (Huds.) S.J. Darbyshire**, meadow ryegrass, **r6133**, E, 2
Lycurus phleoides Kunth., wolftail, m551, N, 0
Lycurus setosus (Nutt.) C.G. Reeder, bristly wolftail, **r5203**, N, 2
Monroa squarrosa (Nutt.) Torr., false buffalo-grass, m499, N, 3
Muhlenbergia brevis C.O. Goodding, short muhly, **r5424**, N, 2
Muhlenbergia dubia Fourn. ex Hemsl., pine muhly, r5281, N, 2
Muhlenbergia minutissima (Steud.) Swallen, annual muhly, **r5121**, N, 3

- Muhlenbergia montana* (Nutt.) Hitchc., mountain muhly, r5167, N, 4
Muhlenbergia pauciflora Buckl., New Mexico muhly, r5378, N, 4
Muhlenbergia repens (J. Presl) A.S. Hitchc., creeping muhly, r6038, N, 2
Muhlenbergia richardsonis (Trin.) Rydb., mat muhly, r5141, N, 2
Muhlenbergia sinuosa Swallen, marshland muhly, r5406, N, 3
Muhlenbergia torreyi (Kunth) A.S. Hitchc. ex Bush, ring muhly, r5185, N, 2
Muhlenbergia wrightii Vasey ex Coult., spike muhly, r5140, N, 3
Panicum bulbosum Kunth., bulb panicgrass, r5222, N, 2
Panicum capillare L., annual witchgrass, r6246, N, 2
Panicum miliaceum subsp. *miliaceum* L., broomcorn millet, r5159, E, 1
Panicum virgatum L., switchgrass, r5194, N, 2
Pascopyrum smithii (Rydb.) A. Löve, western wheatgrass, r5333, N, 2
Paspalum setaceum Michx., fringleaf paspalum, m650, N, 0
Piptatherum micranthum (Trin. & Rupr.) Barkworth, littleseed ricegrass, r5420, N, 4
Poa annua L., annual blue grass, R442a, E, 1
Poa bigelovii Vasey & Scribn., Bigelow bluegrass, r6061, N, 1
Poa fendleriana subsp. *fendleriana* (Steud.) Vasey, muttongrass, r6080, N, 4
Poa fendleriana subsp. *longiligula* (Scribn. & Williams) Soreng, muttongrass, r6026, N, 4
Poa pratensis L., Kentucky bluegrass, r6039, E, 2
Schizachyrium scoparium (Michx.) Nash, little bluestem, r5436, N, 3
Secale cereale L., common rye, m483, E, 0
Setaria viridis (L.) Beauv., bottlegrass, r5130, E, 2
Setaria vulpiseta (Lam.) Roemer & J.A. Schultes, plains bristlegrass, r5124, N, 0
Sorghastrum nutans (L.) Nash, indiagrass, r6033, N, 2
Sporobolus airoides (Torr.) Torr., alkali sacaton, R447, N, 1
Sporobolus contractus A.S. Hitchc., spike dropseed, r5387, N, 3
Sporobolus cryptandrus (Torr.) Gray, sand dropseed, r5110, N, 4
Vulpia myuros (L.) K.C. Gmel., rat-tail fescue, R469, E, 1
Vulpia octoflora (Walt.) Rydb., sixweeks fescue, r5737, N, 2
Polemoniaceae
Gilia ophthalmoides Brand, eyed gilia, r6079, N, 2
Ipomopsis longiflora (Torr.) V. Grant, white-flowered gilia, r6100, N, 4
Ipomopsis multiflora (Nutt.) V. Grant, manyflowered gilia, r5220, N, 2
Leptodactylon pungens (Torr.) Torr. ex Nutt., common prickly gilia, r6000, N, 3
Phlox gracilis (Hook.) Greene, slender phlox, r5730, N, 4
Polygonaceae
Eriogonum alatum Torr., winged buckwheat, r6265, N, 3
Eriogonum annuum Nutt., annual buckwheat, r5107, N, 3
Eriogonum cernuum Nutt., nodding buckwheat, r5105, N, 3
Eriogonum jamesii var. *jamesii* Benth., James' buckwheat, r5135, N, 3
Eriogonum microthecum var. *laxiflorum* Hook., slender buckwheat, r5120, N, 2
Eriogonum microthecum var. *simpsonii* (Benth.) Reveal, Simpson buckwheat, r5417, N, 3
Eriogonum polycladon Benth., sorrel buckwheat, r5314, N, 3
Eriogonum racemosum Nutt., redroot buckwheat, r6113, m802, N, 3
Polygonum aviculare L., prostrate knotweed, r5181, E, 2
Polygonum convolvulus L., black bindweed, r5228, E, 1
Polygonum douglasii subsp. *johnstonii* (Munz) Hickman, Johnston knotweed, r6118, N, 1
Polygonum erectum L., erect knotweed, r5251, N, 2
Polygonum ramosissimum Michx., tall knotweed, r6285, N, 2
Rumex altissimus Wood, smooth dock, m777, N, 0
Rumex crispus L., curly dock, r6131, E, 2
Portulacaceae
Portulaca halimoides L., silk-cotton purslane, r5432, N, 2
Portulaca oleracea L., common purslane, r6279, E, 2
Talinum parviflorum Nutt., prairie flameflower, r5250, N, 2
Potamogetonaceae
Stuckenia filiformis subsp. *filiformis* (Pers) Boerner, fineleaf pondweed, r5293, N, 1
Primulaceae
Androsace occidentalis Pursh, western rock jasmine, r5754, N, 2
Androsace septentrionalis subsp. *glandulosa* (Woot. & Standl.) G.T. Robbins, pygmyflower rock jasmine, r6014, N, 2
Androsace septentrionalis subsp. *puberulenta* (Rydb.) G.T. Robbins, pygmyflower rock jasmine, r5235, N, 2
Ranunculaceae
Clematis ligusticifolia Nutt., virginsbower, m883, N, 0
Delphinium scaposum Greene, barestem larkspur, m485, N, 2
Myosurus nitidus Eastw., western mousetail, m423, N, 0
Thalictrum fendleri var. *wrightii* (Gray) Trel., Wright meadow rue, r5210, N, 3

Rosaceae

- Amelanchier utahensis* Koehne, Utah serviceberry, r5747, N, 3
Chamaebatiaria millefolium (Torr.) Maxim., fernbush, **r5311**, E (H), 1, native to eastern Arizona, approximately 250 km to the west
Fallugia paradoxa (D. Don) Endl. ex Torr. Apache plume, r5291, N (H), 1
Fragaria virginiana subsp. *virginiana* Duchesne, Virginia strawberry, **r6022**, N, 2
Potentilla pensylvanica L., prairie cinquefoil, r6090, N, 3
Rosa spinosissima L., Scotch rose, **r6081**, E (H), 1, native to Eurasia (GRIN 2008)
Rosa woodsii Lindl., Woods rose, **r6300**, N, 2

Rubiaceae

- Houstonia wrightii* Gray, pygmy bluet, m792, N, 0

Saxifragaceae

- Heuchera parvifolia* Nutt. ex Torr. & Gray, littleleaf alumroot, r6086, N, 2

Scrophulariaceae

- Besseyia arizonica* Pennell, Arizona coraldrops, r6028, N, 2
Castilleja integra Gray, squawfeather, r5259, N, 3
Castilleja linariifolia Benth., Wyoming Indian paintbrush, m865, N, 0
Cordylanthus wrightii Gray, Wright bird's-beak, r6236, N, 2
Mimulus suksdorfii Gray, miniature monkey-flower, m421, N, 0
Penstemon barbatus subsp. *torreyi* (Benth.) Keck, Torrey's penstemon, **r5290**, H, 1
Penstemon barbatus subsp. *trichander* (Gray) Keck, beardlip penstemon, r6111, N, 2
Penstemon crandallii subsp. *glabrescens* (Pennell) Keck, Crandall beardtongue, **r6034**, N, 1
Penstemon jamesii Benth., James beardtongue, **r6121**, H, 1
Penstemon linarioides Gray, creeping penstemon, m851, N, 0
Penstemon ophianthus Pennell, Arizona penstemon, **r6076**, N, 1
Penstemon virgatus Gray, upright blue beardtongue, r6245, N, 3
Verbascum thapsus L., common mullein, r6268, E, 3

Solanaceae

- Lycium pallidum* Miers, pale wolfberry, r5165, N, 2
Physalis hederifolia var. *fendleri* (Gray) Cronquist, fendler groundcherry, r5223, N, 3
Physalis subulata var. *neomexicana* (Rydb.) Waterfall ex Kartesz & Gandhi, New Mexican ground cherry, r5155, N, 2
Solanum jamesii Torr., wild potato, r5268, N, 2
Solanum physalifolium Rusby, hairy nightshade, **r5300**, N, 2
Solanum triflorum Nutt., cutleaf nightshade, r6274, N, 2

Typhaceae

- Typha latifolia* L., broadleaf cattail, Nsn, r440, N, 1

Ulmaceae

- Ulmus pumila* L., Siberian elm, **r5169**, E (H), 1, native to central and eastern Asia (GRIN 2008)

Verbenaceae

- Glandularia wrightii* (Gray) Umber, Wright verbena, **r6255**, N, 1
Verbena bracteata Lag. & Rodr., prostrate verbena, r6110, N, 2
Verbena macdougalii Heller, MacDougal verbena, **r5266**, N, 2

Viscaceae

- Phoradendron juniperinum* Engelm. ex Gray, juniper mistletoe, r6257, N, 2

Zygophyllaceae

- Tribulus terrestris* L., goathead, r6270, E, 2

Appendix A

Five Listed Threatened or Species of Concern with the U.S. Fish and Wildlife Service known to occur in Cibola County (USFWS 2007); considered rare by the New Mexico Rare Plant Technical Council (<http://nmrareplants.unm.edu>) (in bold); or tracked by the New Mexico Natural Heritage Program (<http://nhnm.unm.edu>) (marked with *) that have been, or may one day be, found at El Morro National Monument.

Astragalus accumbens Sheldon*, Zuni milkvetch

Besseyia arizonica Pennell*, Arizona coraldrops, occurs at ELMO

Erigeron acomanus Spellenberg & P. Knight* Acoma fleabane, Species of Concern,

Erigeron rhizomatus Cronq., Zuni fleabane, Listed Threatened

Talinum brachypodium S. Wats., Laguna fame flower

Appendix B

Forty eight entities reported, but not vouchered, or vouchers not seen by the authors. Range information is from INRAM (2007) or the USDA (2007). Those in bold have been reported for Cibola County.

Androsace septentrionalis subsp. *subumbellata* (A. Nels.) G.T. Robbins, collected by J. Adams in 2002. Specimen lost.

Arabis fendleri var. *spatifolia* (Rydb.) Rollins, reported by McCallum (1981) in the Box Canyon.

Artemisia ludoviciana subsp. *mexicana* (Willd. ex Spreng.) Keck, reported by McCallum (1981) growing in sandy soil in the Box Canyon. No specimen found.

Avena fatua L. (Southwestern Monuments monthly report, as cited in Schackel, 1984).

- Bromus anomalus* Rupr. ex Fourn.**, reported by McCallum (1981) in "sand-filled cracks in cliffs and pine forest."
- Bromus arvensis* L., reported by McCallum (1981) as rare near campground, annotated to *B. japonicus*. *Bromus marginatus* Nees ex Steud., collected by R. Taylor in 2001. Specimen lost.
- Calliandra humilis* Benth., reported by McCallum (1981), "a single plant...growing at the base of the cliff of the side canyon W of the mouth of the Box Canyon."
- Carex molesta* MacKenzie ex Bright**, unknown source.
- Castilleja miniata* subsp. *miniata* Dougl. ex Hook. reported by Stoltz (1986) as *C. confusa*, no specimen found.
- Ceratocephala testiculata* (Crantz) Bess., bur buttercup, collected as r5778 in the Campground, specimen lost.
- Chrysothamnus pulchellus* (Gray) Greene, (Stoltz 1986). Rink annotated McCallum specimen to *C. depressus*.
- Chrysothamnus viscidiflorus* subsp. *viscidiflorus* (Hook.) Nutt.**, reported by McCallum (1981) as "widespread, but uncommon." No specimen found.
- Comandra umbellata* subsp. *pallida* (A. DC.) Piehl, collected by R. Taylor in 2001. Specimen lost.
- Cymopterus purpurascens* (Gray) M. E. Jones, reported by McCallum (1981), annotated to *C. multinervatus*.
- Descurainia incana* subsp. *incisa* (Engelm.) Kartesz & Gandhi**, McCallum (1981) reported this taxon "N of the mesa and W of trail," as *Descurainia richardsonii* ssp. *incisa*. No specimen found.
- Descurainia incana* subsp. *incisa* (Engelm.) Kartesz & Gandhi as McCallum (1981) reported this as *Descurainia richardsonii*. Rink annotated this specimen to *D. pinnata* subsp. *pinnata*.
- Descurainia pinnata* subsp. *glabra* (Woot. & Standl.) Detling, McCallum (1981) reports that some of the *D. pinnata* material from El Morro was determined as subspecies *glabra*. The authors found no material annotated to this taxon.
- Echinocereus triglochidiatus* Engelm.**, reported by McCallum (1981), probably *E. t.* var. *coccineus*, which has been upgraded to species status as *E. coccineus*, as determined by M. Baker.
- Ericameria nauseosa* var. *speciosa* (Nutt.) Nesom & Baird**, reported by McCallum (1981). No specimen found.
- Erigeron pumilus* Nutt., (Stoltz 1986). Rink annotated McCallum specimen to *E. concinnus*.
- Escobaria vivipara* var. *arizonica* (Engelm.) D.R. Hunt, Arizona spiny star, reported by McCallum (1981). All specimens found were *E. v.* var. *vivipara* (Nutt.) Buxbaum.
- Festuca ovina* L., reported by McCallum (1981). NPS specimen lacks florets.
- Geranium caespitosum* var. *caespitosum* James**, McCallum (1981) reported this and the following as equally common in the Box Canyon. McCallum's specimens are not determined to varietal level.
- Geranium caespitosum* var. *eremophilum* (Woot. & Standl.) W.C. Martin & C.R. Hutchins**, McCallum (1981) reported that *G. c.* var. *eremophilum* was equally common as *G. c.* var. *caespitosum*, though his specimens are not determined to varietal level.
- Gilia clokeyi* Mason, collected by R. Taylor in 2001. Specimens lost. Probably *Gilia ophthalmoides* Brand.
- Gilia sinuata* Dougl. ex Benth., reported by McCallum (1981). Probably *Gilia ophthalmoides* Brand.
- Hesperostipa neomexicana* (Thurb. ex Coult.) Barkworth**, collected by J. Adams in 2001. Specimen lost.
- Hieracium fendleri* var. *mogollense* Gray, collected by R. Taylor in 2001. Specimen lost.
- Hordeum glaucum* subsp. *leporinum* (Link) Arcang., reported by McCallum (1981) as *Hordeum leporinum* Link. without definite locality. Rink annotated McCallum's specimen to *Hordeum murinum* subsp. *glaucum* (Steud.) Tzvelev.
- Lathyrus graminifolius* (S. Wats) White**, McCallum (1981) reports that this entity was collected by Woodhouse in 1851.
- Lathyrus palustris* L., Torrey (1953) reported this entity as a S. Woodhouse collection from 1851. Specimen not found.
- Lepidium densiflorum* var. *ramosum* (A. Nels.) Thellung**, collected by R. Taylor in 2001. Specimen lost.
- Lesquerella fendleri* (Gray) S. Wats.**, (Stoltz 1986), no specimen found.
- Lesquerella intermedia* (S. Wats.) Heller**, collected by R. Taylor in 2001. Specimen lost.
- Linum kingii* S. Wats., reported by McCallum (1981). McCallum had two specimens determined as this entity. Rink annotated one of these to *Menodora scabra* var. *scabra* Engelm. ex Gray, and the other to *Linum pratense* (J.B.S. Norton) Small.
- Medicago minima* (L.) L., collected by R. Taylor in 2001. Specimen lost.
- Myosurus minimus* L., collected by R. Taylor in 2001. Specimen lost.
- Opuntia humifusa* var. *humifusa* (Raf.) Raf., reported by Stoltz (1986) as *O. rafinesque* (Stoltz 1986). No specimen found.
- Pennellia longifolia* (Benth.) Rollins, reported by Stoltz (1986) as *Thelypodium longifolium*, annotated to *P. micrantha*.
- Phacelia neomexicana* Thurb. ex Torr., reported by McCallum (1981). Probably var. *alba*, which has been upgraded to species level and is common at ELMO.
- Pleuaphis jamesii* Torr.**, collected by R. Taylor in 2001. Specimen lost.
- Pseudotsuga menziesii* (Mirbel) Franko**, reported by Schackel (1984).
- Quercus turbinella* Greene, (Stoltz 1986). No specimen found, nor plants found. We looked carefully for this shrub, since it is one of the parents of the hybrid *Quercus x pauciflora*, which does occur here.

Salsola kali L., reported by McCallum (1981). Probably *S. tragus*.

Thelesperma subnudum Gray, reported by McCallum (1981) in the housing area. No specimens found.

Thlaspi montanum var. *fendleri* (Gray) P. Holmgren, collected by R. Taylor in 2001. Specimen lost.

***Townsendia* Hook.**, one plant reported by McCallum (1981) between the campground and the sewage lagoon on a lava outcrop.

***Townsendia exscapa* (Richards.) Porter**, (Stoltz 1986), no specimen found.