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VEGETATION AND WILDLIFE INVENTORY

OF EL MALPAIS NATIONAL MONUMENT

Final Report

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SUMMARY

A vegetation and wildlife inventory was conducted at El Malpais National Monument (ELMA), New Mexico. The purpose of this inventory was to document the occurrences of plant and animal species of ELMA, and to identify plant and animal habitats and communities of ELMA. An emphasis was made to identify habitats and species that are rare or distinctive to ELMA.

The flora and fauna of ELMA were found to be typical for the region, with Great Basin (Colorado Plateau), Rocky Mountain, and Chihuahuan Desert affinities. A total of 424 species of vascular plants, and 167 species of cryptogams were found at ELMA. A total of 36 species of mammals, 109 species of birds, 15 species of reptiles, 2 species of amphibians, and 354 species of arthropods were found at ELMA. During this inventory, 15 new or undescribed species of arthropods were discovered at ELMA. At this time, those new species are known only from ELMA, and should be treated as local endemics unless they are found to occur elsewhere.

One plant species and 5 animal species that are listed as candidates (category 2) for federal threatened or endangered species status were found at ELMA. No listed federal threatened or endangered species were found. One New Mexico state listed endangered plant species was found at ELMA. Most of these listed species were not associated with volcanic habitats.

The volcanic features of ELMA provide a variety of unusual habitats for plants and animals. The most distinctive environments and associated plants and animals, were found in the entrances of lava tube ice caves. Lava tube ice caves are not found elsewhere in the region, and at ELMA they support unique assemblages of plants and animals, including isolated populations of species that are probably Pleistocene relics, and some newly discovered species of arthropods. The lava tube caves also provide critical habitats for a number of species of bats, and historically provided habitat for bighorn sheep.

Other outstanding biological features found at ELMA included unusual stunted growth forms of trees and other plants on the lava fields. Ancient Douglas fir trees are also known from the lava fields. Melanism was found in two species of lizards from the lava flows, but melanism was not as common in animals living on lava at ELMA as it is among animal populations on other lava fields in south-central New Mexico. Plant and animal species that typically occur in moist environments were found along lava flow edges and pahoehoe lava tube areas. Non-volcanic areas that supported rare species included sandy habitats on the east side of ELMA, and temporary water pools represented by playas and tinajas.

We recommend that more intensive follow-up research be conducted on the fauna living inside of the lava tube caves. Lava tube caves at ELMA are likely to harbor more rare or new species that may be sensitive to human impacts resulting from the activities of visitors to the monument. Follow-up research should also be conducted to assess the geographic distributions of the

new species found at ELMA to determine whether or not they are local endemics.

We recommend that the NPS consider the unique and fragile environments of lava tube caves and cave entrances when developing ELMA for visitors. A number of the lava tube caves and ice caves support plant and animal communities that will not be able to withstand the impacts of large numbers of human visitors. We suggest that a number of specific lava tube caves (named in the report) be closed to visitors, or subject only to limited access via NPS guided tours. We observed significant visitor damage at several of the lava tube caves during our survey.

We also recommend that careful consideration be given to the develpment of other environments at ELMA that were found to support rare or unsual plant and animal species. These other environments include cinder cones, playa ponds, and sandy areas. Areas of the lava flows that support ancient Douglas fir trees should be managed in such a way as to protect the trees and the associated habitats from visitor impacts.

I. Introduction.

1. Research Plan.

This report summarizes the findings of a three-year biological inventory of El Malpais National Monument, Cibola County, New Mexico. The purposes of this inventory were to determine what plant and animal species occur at El Malpais National Monument (ELMA) and to identify and define habitats and biotic communities at ELMA. An additional effort was made to search for federal and New Mexico state listed threatened or endangered plant and animal species.

A research plan was drafted in 1992 outlining the goals and rationale for this inventory. A copy of that research plan is presented in Appendix 1. In summary, the two principal goals of this project as outlined in the research plan were to 1) provide information on vegetation and wildlife species and habitats for the National Park Service (NPS) to enhance resource management, and 2) to provide information on the flora, fauna, and biotic communities for future ecological monitoring projects.

2. Geographic Location and Physiographic Setting.

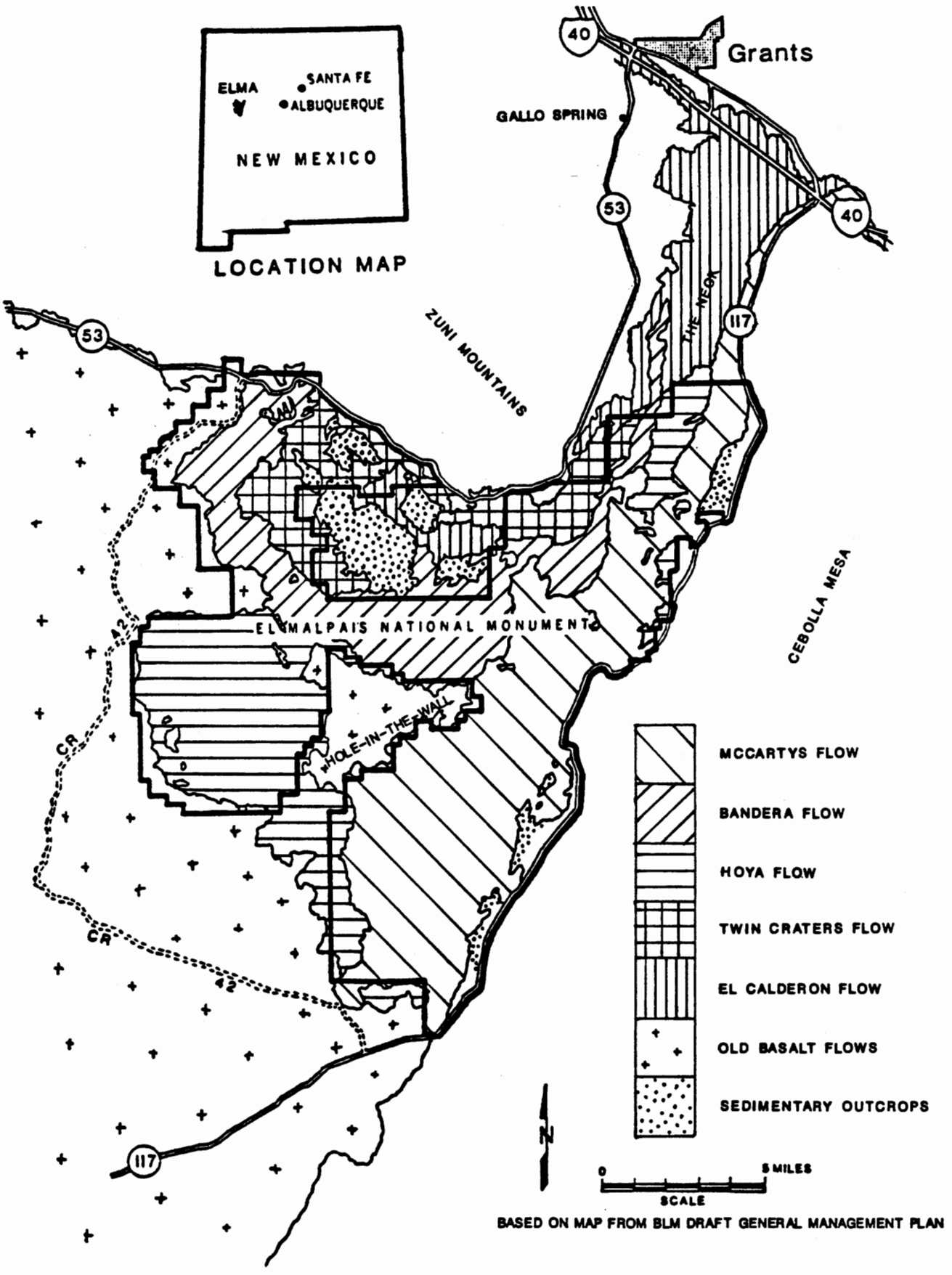
El Malpais National Monument is located in Cibola County, southwest of Grants, New Mexico, about 120-145 km (75-90 mi) west of Albuquerque, in the west-central part of the state (Figure 1). "El Malpais" is Spanish for "badlands" and in the Southwest typically refers to recent, rough lava flows; many of which blanket most of the monument. ELMA is located near the southeastern edge of the Colorado Plateau physiographic province in the Datil Section (Fenneman and Johnson 1946).

ELMA is covered almost entirely by lava flows of recent geological age although the entire extent of these flows is not contained within the monument boundaries (Maxwell 1986). Small portions extend from the northeast edge of ELMA and extensive, closely-related "old basalts" lie almost entirely off the monument to the south and west. In addition, areas of non-lava substrate (e.g., sedimentary outcrops, alluvial deposits) and kipukas ("islands" of lava or non-lava material surrounded by newer lava flows) are scattered throughout the monument.

State highway 117 (NM-117) skirts the eastern edge of the flows. The northern and part of the western limits of the basalt are roughly paralleled by State highway 53 (NM-53). Part of the western and southern boundary is followed by Cibola County Road 42 (CO-42). A majority of the lava flow edges are near a road. Travel into the lava fields is limited to few rough roads and foot trails in certain areas; vehicular travel is otherwise impossible and walking is slow and tiring.

Immediately to the north of the monument area are the Zuni Mountains, a small, ancient uplift with a core of Precambrian rocks and a mantle of Mesozoic and Paleozoic sediments. The highest point, Mount Sedgwick, is 2821 m (9255 ft) in elevation.

Figure 1. EL MALPAIS NATIONAL MONUMENT AREA



BASED ON MAP FROM BLM DRAFT GENERAL MANAGEMENT PLAN

To the east of ELMA is Cebolla Mesa which is composed of later Mesozoic sediments capped by lava flows that are not directly related to the ELMA flows. South and west of the monument are extensive, grassy lava plains with well-developed soils.

The Continental Divide roughly parallels the western boundary of ELMA, placing it in the Rio Grande drainage. Near the northwest corner of the monument, NM-53 crosses this feature at about 2403 m (7850 ft). Within the monument, elevation ranges from 2532 m (8309 ft) at the top of Bandera Crater to approximately 1996 m (6550 ft) in the northeast part (the narrow "Neck" section of the flows) for a total range of 536 m (1759 ft). The downward elevation gradient moves south or southeast from the northwest part of the park and then continues toward the northeast. The whole area south of the Zuni Mountains and west of Cebolla Mesa roughly slants from the southwest toward the northeast. The direction of flow of the different lavas found in ELMA coincide with this elevation gradient. However, there is no discernible surface drainage on the lava and only small, self-contained drainage basins are found along the lava flow edges within the monument.

ELMA is one of the newest monuments in the National Park system, being created on 31 December 1987. Until its creation, the land ownership was a checkerboard of Bureau of Land Management (BLM), private, state, and US Forest Service property. Much of the non-monument BLM land was reorganized to create a series of National Conservation Areas (NCA) and Wilderness areas which now mostly surround the monument. The monument boundaries are still being defined via the ongoing processes of land exchanges, transfers, and outright acquisitions. Some locations investigated for this survey and referred to in this report are not currently located within the monument boundaries, but will be in the future. The area of the monument after all the boundaries are set will be about 46,479 ha (114,848 acres or 179 mi^2).

A. Geology.

An understanding of the geology of ELMA is basic to an understanding of its flora and fauna. The surface geology is dominated by lava and cinders, but sedimentary outcrops and alluvium are also important. The geology influences the topography and the following description of the area is based on the surrounding topographical features.

To the northwest of the monument are the Zuni Mountains, an elongated, heavily eroded uplift oriented along a southeast-northwest axis. The core is of Precambrian granites and metamorphics which are overlain with several hundred feet of Permian to Triassic sandstones and limy sandstones occurring in several formations. Another several hundred feet of Jurassic to Cretaceous sediments have been eroded from the Zuni Mountains that originally were situated on top of the current surface. These upper layers however are still visible in the cliffs of Cebolla Mesa east of the monument boundary. The sediments now

visible on the surface of the Zuni Mountains are buried hundreds of feet below the cliffs on the east side of the monument. These cliffs have been somewhat protected from erosion by a cap of basalt that originated in the Mount Taylor Volcanic Field, 25 km (16 mi) northeast of the monument, long before the ELMA lavas were emplaced. The lavas from Mount Taylor are the oldest dated basalts in the area (though not on the monument proper) and range in age from about 2.9 to 3.7 Ma (million years; Perry et al. 1990).

The lava flows found on ELMA are part of the Zuni-Bandera Lava Field (ZBLF) the bulk of which is not located within the monument boundaries, but extends many miles to the south and west. The field is composed of a number of flows that have been deposited so that newer flows overlie sections of the older ones. This situation may result in difficulty in determining the source of the older flows and ascertaining the true edges of flows of any age.

The oldest lava flow unit in ELMA is the grassy plains area south and west of the monument. It is actually composed of several flows, the oldest of which may be a few million years old (Laughlin, DLB pers. comm.). The source(s) of the oldest members of this unit have probably eroded away or have been covered by subsequent eruptions. The "Old Basalt", Qb, of Maxwell (1986) is apparently the newest member of this group at about 0.2-0.15 Ma, and probably erupted from the vents in the Chain of Craters west of the monument. This flow underlies at least some of the later ones as indicated by Hole-in-the-Wall which is really a kipuka of Old Basalt surrounded by more recent lavas.

A list of the newer lava flows that cover most of ELMA is presented in Table 1. The oldest of the most recent lava flows at ELMA is the El Calderon (or Laguna) flow (Maxwell's Qbc) which is probably about 0.1 Ma in age. The source of the El Calderon flow is a cone in the northwest part of the monument but its lava is best seen in the Neck region because the rest of the flow has been covered by subsequent flows. Next youngest in age, at about 16 Ka (thousand years or 0.016 Ma), is the Twin Craters lava flow. This flow is exposed in a rather small area in the northern part of the monument; some of it is probably buried by later flows. The Hoya (or Hoya de Cibola) flow is apparently next youngest, but no dates are available for it. This unit originated near the western edge of the monument and it covers substantial areas in the west and south. A large kipuka of this flow is located in the Neck. Next youngest in age is the Bandera flow at about 10,000 years. It is quite extensive about 40 mi^2 (100 km^2) and has probably covered large parts of the older flows. Through the center of it is an extensive tube system, one of the longest known in the world at about 17.9 miles (28.6 km) long (Causey 1970). The newest flow, the McCartys, was until recently thought to have formed approximately 1000 years ago, but charcoal from presumed roots excavated from under the edge of the flow were dated by ^{14}C at about 3000 years (Laughlin et al. 1993). This unit is one of the largest recent lava flows in the world at

about 7 km^3 (1.7 mi^3) (Crumpler 1982). The recent McCartys flow is completely exposed and essentially unweathered. It erupted from near the south end of ELMA and flowed more than 40 km (25 mi) to the north and a few kilometers to the south. The movement of the lava was constricted between the El Calderon flow and the sandstone cliff to form a channel about 50 feet (15 m) wide just where west-bound Interstate freeway 40 enters the El Malpais valley a few miles east of Grants. After the lava was free of this narrow spot it entered the Rio San Jose valley and continued to flow a few miles downstream.

Table 1. Approximate ages of El Malpais lava flows.

Lava flow name	Approximate age
Old Basalt	150,000 to 3.8 x 10^6 ? years
El Calderon	100,000 years
Twin Craters	16,000
Hoya (de Cibola)	no estimates
Bandera	10,000
McCartys	3,000

The various lava flows have left a rather complex pattern of distribution and exposed surfaces. Generally, older flows have been covered by more recent ones. Lava flows do not usually completely inundate the surface over which they move but often leave uncovered spaces or "islands" within the body of the flow. These "islands" in the lava are called kipukas (a Hawaiian term) and are of two types. One obvious case occurs when higher ground is not inundated by the basalt ("tall kipukas"). The other involves the nature of moving fluids in which the front does not flow evenly but rather moves in lobes or fingers which leave uncovered internal gaps. In this latter case, the gaps or kipukas are composed of basalts of earlier flows. Examples at ELMA are Hole-in-the-Wall and Navajo Kipuka. Tall kipukas at ELMA are all outcrops of sedimentary rocks, composed of the same formations found in the Zuni Mountains or below Cebolla Mesa. Examples include Mesita Blanca, Hidden Kipuka, and Zuni-Acoma Kipuka.

Within the monument boundary but at the edges of the flows on the east and north sides are other sedimentary outcrops, such as Sandstone Bluffs, that are composed of the formations found in the Zuni Mountains or cliffs of Cebolla Mesa.

During the last 3000 years and before, alluvial deposits have collected along the edges of the lava flows. Eolian material has also been deposited throughout the area and appears to be the

major component of the soil, especially evident in the Old Basalt.

Basalts are the dominant lava type with cinders comprising another important volcanic substrate. Morphologically, basalts have been categorized as aa, a very rough-surfaced, loose, clinkery type, and pahoehoe, a solid-surfaced, smooth, flowing type. Both are common in ELMA and may be adjacent to each other on the same flow. Paheohoe is typically seen in the centers or lobes of flows where the lava was hottest and flowed fastest. Slower moving, cooler aa usually flanks the pahoehoe on either side. Cinders cover about 486 ha (1200 ac) in the monument and are often the result of a final burst of activity from a particular vent or cone, such as Cerro Bandera (Causey 1970).

A very important geomorphic feature at ELMA and most other basalt flows are lava tubes and related structures. Lava tubes form in the centers of flows when the surface cools, hardens, and insulates the still-flowing lava underneath. Eventually the lava flows away often leaving a linear, hollow tube. After the eruption ceases, the surface of the tube cools and cracks but can stay intact (sometimes for hundreds of meters) but, more often, sections of the roof fail forming collapse structures. Collapse structure is a general term for a variety of features caused by roof failure in lava tubes. The collapsed section of a tube can occur 1) in the center of an otherwise intact tube forming a "skylight" (e.g., Big Skylight Cave); 2) along only part of a tube and leaving a cave at the mouth of the adjacent intact portion of the tube (e.g., Braided Cave); and 3) in long sections resulting in a linear depression. These types and many variations in size and configuration are found at ELMA.

B. Soils.

Since the vast majority of ELMA is covered with recent basalt, little soil has developed or accumulated. However, the older the flow the greater the soil cover with the Old Basalt having the best development. In this area, the underlying lava is mostly covered by soil with only scattered lava outcrops visible. At the edges of the newer flows alluvial soils have been deposited, some apparently associated with lakes. Near sedimentary rock outcrops, sandy soils and occasional small dunes have developed.

Eolian deposition is the major mechanism for soil accumulation on the lava flows at ELMA (Wells et al. 1985). In situ origination of soil by action of lichens appears to be inconsequential. Wells et al. (1985) indicate that eolian deposition is a discontinuous process and that perhaps the earliest Holocene (10,500 to 9,500 years before present) was a time of much greater (4x to 20x) depositional activity than at present (40-200 $gm/m^2/yr$). This presumably corresponds to large amounts of glacially-created dust released after the warming of the climate and melting of the Pleistocene glaciers.

Some soils that are found at ELMA include 1) Aridic and Lithic Haplustalfs; 2) Ustollic Haplargids; 3) Cumlic Haploborolls; 4) Lithic Eutroboralfs; 5) Typic Argiborolls; 6) Lithic Argiborolls; 7) Aridic and Lithic Argiustolls; 8) Typic and Vertic Ustifluvents; 9) Aquic Calciustolls; 10) Ustic Torriorthents; and 11) Typic Ustipsamments (Wall 1989). Such soils vary from deep to shallow and are usually well-drained.

C. Water and ice.

Due to the nature of the basalt landscape there is no apparent surface drainage system on the lava. Higher lands surrounding the monument supply runoff from snowmelt or precipitation to the edges of the flows where water occasionally ponds. A few drainages approach and sometimes follow the edge of a flow, such as the Agua Fria system not far from Bandera Crater, and appear to be active most often in years of high snowmelt runoff. All of these features seem to end in small basins along the edges of the flows. No known, overt drainage exists to connect El Malpais to the Rio San Jose. Precipitation that does not evaporate or is utilized by plants enters the aquifer.

Ojo de Gallo or Gallo Spring is located at the east end of the Zuni Mountains southwest of present Grants about 3.2 km (2 mi) and about 13 km (8.5 mi) north of the monument boundary. Agricultural usage of the surface flow was important during the late 1800s and into the 1940s. However, withdrawal of groundwater for uranium mining reduced a virgin discharge of about 7 cubic feet per second to zero in 1953 (White 1989). A rich wetlands was almost destroyed during the 25 year period of intensive withdrawal. At the end of the uranium industry's use of ground water in the late 1970s, the spring reemerged in the winter of 1980-1981 (White 1989). Wetlands are redeveloping and overflowing water is following its former path across northwest corner of the lava to supply the Rancho del Padre Spring (near I-25) and to join the Rio San Jose.

Temporary ponds are fairly common in the ELMA area. Most are natural, silt-bottomed depressions in the Old Basalt on the west and south sides of the monument. Man-made cattle tanks are fairly common on alluvium or elsewhere on the Old Basalt. These features are wet only in the spring or during the summer rainy season. Tinajas (potholes) are common in sandstone outcrops throughout ELMA. These small, natural basins fill with rainwater during the summer.

Permanent surface water is found rarely at ELMA. Shallow pools associated with lava tube ice caves are found in the upper Bandera flow. A spring with a pool has been reliably reported to exist along the southwest edge of Big Hole, barely off the monument. Gallo Spring and associated water features are found a few miles north of the monument near the village of San Rafael.

Permanent ice in several caves is a distinctive feature of El Malpais. Zuni or Candelaria Ice Cave on the Bandera flow, the well-known modern tourist attraction, was apparently mined for

ice by the military during the mid 1800s when Fort Wingate was located at Gallo Spring (Thompson et al. 1991). Marchantia Cave (also seen as Marchanita), located about 2.4 km (1.5 mi) east of Zuni Cave on the Twin Craters flow, also contains large ice deposits. A few other tube structures have ice including Ice Pond Cave on Rendija and Navajo Cave east of Little-Hole-in-the-Wall. Many collapse structures contain ice in sheltered areas in the spring. The laminated structure of the ice in Zuni and Marchantia Caves is being investigated for possible climatological significance (Thompson et al. 1991).

D. Climate.

El Malpais has a continental type climate but, being located on the elevated Colorado Plateau, the regime is somewhat modified (Ruddiman & Kutzbach 1991). Continental climates are characterized by a large yearly temperature range and relatively low precipitation. El Malpais' elevation causes a slightly reduced temperature range, a lower annual average temperature, and slightly more precipitation than would be expected otherwise. The western US and New Mexico are affected by the rain shadow caused by the series of mountain ranges which intercept moisture carried in by the predominately westerly jet stream (storm path). Moisture from the Gulf of Mexico and east-central Pacific Ocean increases precipitation during the summer.

The weather patterns at ELMA are typical of most of New Mexico. At least half the year's precipitation falls during the summer months. In the summer, two high pressure cells, one located off California and the other in the Atlantic (the Bermuda High) are located so as to force the jet streams far to the north, away from the Southwest. The weather then is strongly influenced by warm, moist tropical air masses. Concurrently, a continental low develops over the southwestern United States and northwestern Mexico which allows convective storms or "monsoons" to develop. During the fall, both high pressure cells weaken and move southward causing the jet stream to flow near the north border of the state. The summertime Southwestern low disappears and is often replaced by high pressure. This leads to lower precipitation than in the summer, except where higher elevations counterbalance it somewhat. The storms that most often affect New Mexico during the winter originate in the Gulf of Alaska; occasionally, storms come via the subtropical jet from the east-central Pacific.

Rainfall and temperature data in the ELMA area were first organized by Hooper (1941) and by Lindsey (1951). Collection of meteorological data on El Malpais has just recently begun and at only two locations. In 1991, the BLM installed a meteorological station at the east Ranger Station near Sandstone Bluffs Overlook that records temperature, precipitation, and certain atmospheric pollutants. A remote recording station in the Little Hole has been maintained by the NPS since the late 1980s. This data covers

such a short time span that it was not used in the following analyses.

Since essentially no long-term data is available for the monument itself, nearby sites must be used to infer the meteorological parameters. The two locations nearest ELMA that approximate the elevation and geographical range of the monument and with relatively long records, El Morro National Monument and Grants Airport, were used in this study (Table 2). Data were obtained from *Climatological Data* monthly and yearly summaries (1938-1992). The lowest elevation in ELMA is about 1996 m (6550 ft) and is located in the far northeastern corner approximately 19 km (12 mi) from the Grants airport which is about 9 m (30 ft) lower. The highest elevation in ELMA is the summit of Bandera Crater at 2543 m (8309 ft), but an estimated average elevation for the highest, northwestern part of the monument, in the upper Bandera flow and around the Candelaria Trading Post, might be about 2347 m (7700 ft), which is about 152m (500 ft) higher than El Morro
N.M.

Table 2. Weather data collection sites near ELMA.

SITE NAME	ELEVATION	COORDINATES	YEARS OF RECORD
EL MORRO N.M.	2189-2202 m (7182-7225′)	35°03′X 108°21′	46 (1938-1991)
GRANTS AIRPORT	1987 m (6520′)	35°10′X 107°54′	34 (1954-1991)

Note:

1) range of elevations at El Morro indicates a change in location of weather station;
2) years of record are those that have all 12 months of data for precipitation (since this is more commonly recorded than temperature); therefore, not all years indicated in the range of years within parenthesis have complete records and are thus not counted in the total

a. Precipitation.

Average precipitation for ELMA probably ranges from about 254 to 355 mm (10" to 14") per year, apparently depending mostly on elevation and partially on location relative to the Zuni Mountains. Grants' monthly precipitation is remarkably constant at about 13 mm (0.5") per month from November through June (8 months or two-thirds of the year), varying from the low in February of 11 mm (0.44") to 17 mm (0.66") in December. The average contribution of these months to the yearly total is approximately 108 mm (4.26"; about 40%). The "monsoon" or wet

season, from July through October, brings about 156 mm (6.16"), or about 60% of the years' total. It is possible that the lower lava flows get more precipitation than indicated by the data from Grants. Grants is lower in elevation than the lowest part of ELMA and may be in the rainshadow of the Zuni Mountains which are well-situated to intercept moisture from fronts following the predominately southwesterly to westerly stormtrack. A rainshadow effect would also cause the windward side of the Zuni Mountains to be moister than otherwise.

The higher elevations in the northwest part of ELMA receive more precipitation than the lower elevations, and the monthly distributional patterns are somewhat different (Table 3). The November through June period receives about 170 mm (6.7") of precipitation which is about 64 mm (2.5") more than Grants and about 50% of the yearly total. There are slight peaks in December-January and in March. July through October receive about 177 mm (6.95"), which is about the same amount as the other eight months, and only slightly more than that received at Grants during the same time period. Thus, about half the precipitation in the ELMA area falls during the four month wet season in the summer and half during the rest of the year. A very similar pattern of peaks is seen at Reserve, NM, located about 145 km (90 mi) southwest of El Morro along the San Francisco River at about 1759 m (5770') in elevation (Tuan et al. 1973).

Table 3. Mean monthly precipitation for El Morro National Monument (1938-1992) and Grants airport (1954-1992) and yearly mean. Number of records included in the mean for each month: El Morro 49-52; Grants 36-38. Number of years included in yearly mean: El Morro 46; Grants 34.

	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE
ELMO	25.9 mm (1.02")	22.1 mm (0.87")	29.5 mm (1.16")	18.3 mm (0.72")	15.5 mm (0.61")	14 mm 0.55"
GRANT	12.4 mm (0.49")	11.2 mm (0.44")	13.7 mm (0.54")	11.9 mm (0.47")	14.5 mm (0.57")	14 mm 0.56"
JULY	**AUGUST**	**SEPTEMBER**	**OCTOBER**	**NOVEMBER**	**DECEMBER**	**MEAN**
50 mm 1.97"	65.3 mm (2.57")	35.3 mm (1.39")	25.9 mm (1.02")	19.1 mm (0.75")	25.9 mm (1.02")	348mm 13.7"
44 mm 1.73"	52.6 mm (2.07")	34.5 mm (1.36")	25.4 mm (1.00")	13.5 mm (0.53")	16.8 mm (0.66")	271mm 10.7"

As in most other semiarid environments, El Malpais shows large yearly variations in total precipitation and large interannual variation by month (Appendix 2). Grants has recorded yearly totals ranging from 112 mm (4.41") in 1956 to 458 mm (18.04") in 1984 (mean about 271 mm (10.67"); see Appendix 2). El

Morro's total has fluctuated from 198 mm 7 (.78") in 1950 to 498 mm (19.62") in 1979 (mean about 348 mm [13.7"]; Appendix 2).

Monthly interannual precipitation varies markedly at Grants and El Morro. Generally, the lowest low amounts fall from September through June and the highest large amounts in August (Appendix 2). The lowest monthly total at both sites is usually zero (or at most 1.5 mm [0.06"]) for all but July and August. The lowest in these two months ranges from 10.1 to 13 mm (0.40" to 0.51"). The greatest amount for any month is August (115 mm [4.54"] in Grants and 227 mm [8.93"] at El Morro), but the minimum highest amount is at least 41 mm (1.6") in Grants (January) and 56 mm (2.2") at El Morro (April). Otherwise, the lowest high amounts at Grants are lowest in January, increase steadily until they peak in August, then decrease to November (which shows a second low, slightly higher than January), and finally show a small peak in December. El Morro shows a more complex pattern of this parameter than does Grants with several lows points and small peaks.

b. Temperature.

In New Mexico, elevation has the greatest effect on temperature; lower elevations have higher average temperatures than higher elevations (Tuan et al. 1973). Among other factors, the next most important variable affecting mean annual temperature in New Mexico is latitude (decreasing with increasing latitude). At ELMA, elevation is the dominant variable.

Monthly and yearly temperature means for El Morro and Grants airport are found in Table 4. The range of average monthly temperatures at El Morro is 22.4°C (40.4°F), the coldest month being January (-2.3°C or 27.9°F) and the warmest July (20.2°C or 68.3° F). The range at Grants airport is 23.3°C (42°F) with same months the coldest and warmest (-1.7°C or 29.0°F; 21.7°C or 71.0°F). Grants airport is, on monthly average, about 1.2°C (2.16°F) warmer than El Morro. The smallest difference is in December (0.3°C or 0.6°F) and the largest in June (2.1°C or 3.7°F).

In summary, based on proxy weather data, ELMA exhibits an expected pattern of precipitation and temperature regimes for the region. The higher elevations (nearer El Morro) are cooler and moister and the lower elevations (nearer Grants) warmer and drier. Mountain ranges are known to affect the local climate by causing orographic uplift of air masses, thus initiating precipitation on the windward side and by creating rain-shadows on the leeward side. Although there is no direct evidence to support it, the Zuni Mountains probably induce similar effects in the ELMA area.

Table 4. Mean monthly temperature for El Morro National Monument (1938-1992) and Grants airport (1954-1992) and yearly mean. Number of records included in the mean for each month: El Morro 48-50; Grants 35-38. Number of years included in the yearly mean: El Morro 41; Grants 31.

	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE
ELMO	-2.3 C 27.9 F	-0.2 C 31.7 F	2.9 C 37.3 F	7.5 C 45.5 F	11.9 C 53.5 F	17.1C 62.7F
GRANT	-1.7 C 29.0 F	1.2 C 34.1 F	4.4 C 40.0 F	9.1 C 48.3 F	13.7 C 56.7 F	19.1C 66.4F
JULY	**AUGUST**	**SEPTEMBER**	**OCTOBER**	**NOVEMBER**	**DECEMBER**	**MEAN**
20.2C 68.3F	18.9 C 66.0 F	15.4 C 59.8 F	9.7 C 49.4 F	2.9 C 37.3 F	-1.3 C 29.7 F	8.6C 47.5F
21.7C 71.0F	20.2 C 68.3 F	16.4 C 61.5 F	10.3 C 50.5 F	3.8 C 38.9 F	-0.9 C 30.3 F	9.8C 49.7F

3. History of Land Use.

The human land use practices in the vicinity of ELMA have influenced the ecology of the area. Native American usage probably had some effects on the biota of the lava flows and surrounding areas especially after they had acquired livestock, mostly sheep and horses, from the Spanish. Navajo hostility kept Europeans out of the ELMA area until the mid 1850s when the Americans arrived. Early American military expeditions reported luxuriant pastures and abundant wildfowl at Gallo Spring (Mangum 1990). After the Native Americans were subdued in the 1860s, settlers arrived in the Gallo Spring area and began farming and running huge herds of sheep all around the lava flows (Mangum 1990). In 1881, the railroad arrived at Grants, an event which fostered sheep and wool production in the area; in 1885, the San Rafael area supported 10,000 sheep and 820 cattle (Mangum 1990) while the state's sheep population was estimated at 4 million (Denevan 1967). As the result of overgrazing, drought, and changes in the national economy, the sheep boom was over by 1920. Cattle grazing has been continuous in the area since the 1860s.

Compared to livestock grazing, logging was slow to develop in the ELMA region, but in 1908, 35,000,000 board feet of lumber was being milled from trees cut in the Zuni Mountains (Glover *and* Hereford 1986). By the mid 1920s, large, easily-accessible timber was scarce, and by 1942, commercial logging ceased in the Zuni Mountains. Remains of presumed lumber mills have been seen in the Little Hole-in-the-Wall area, old stumps are common in many areas, and partially decomposed piles of precut logs have been noted elsewhere in the fringes of the monument (personal observations). Lumbering occurred mostly in the high, northwest

part of ELMA along the edges of the lava flows and on the less-impenetrable ones. Limited fuelwood cutting presumably takes place currently.

Grazing has probably been the greatest human-caused influence on the ecology in the ELMA area. Although the grasslands surrounding the lava flows were the most heavily used, it is possible that interior lava flows were visited by sheep. The introduction of domestic sheep and the decline of the grasslands appear to correlate with the decrease in numbers of pronghorn and extirpation of bighorn sheep. Logging probably had a minor effect except for the opening of roads. Fire suppression, in effect since about 1880, aided by removal of fine fuels by grazing, has caused a shift in wildfire frequency from once every few years to rare events (Henri Grissino-Mayer, DLB pers. comm.).

4. Biological Literature Review.

A. Flora.

It was not until the late 1930s that any scientific investigations were conducted in the ELMA area. Lindsey (1951) made the first detailed study of the vegetation, unique communities, and climate of the lava flows.

Prior to Lindsey, plant collectors seemed to have avoided the lava flows. Spellenberg (1979) conducted a survey for threatened, endangered, or rare plant species on the lava flows. No such species were encountered although a few somewhat unusual occurrences were noted including *Asplenium septentrionale* (L.) Hoffm. and *A. trichomanes* L. DeBruin (1988) compared the vascular and lichen floras on basalt and sandstone substrates on the east side of the monument. The only other known reported studies of plants in nearby areas are by Riffle (1973) of the Mount Sedgwick area in the Zuni Mountains and McCallum (1981) of El Morro National Monument. McCallum also collected in the Zuni Mountains during the 1980s but no report or list was published.

B. Fauna.

The most extensive animal surveys done in the ELMA region prior to this survey were studies of mammals by Hooper (1941), and reptiles and amphibians by Gehlbach (1965). Hooper (1941) conducted a survey of mammals occurring on or near the ELMA lava fields. Hooper (1941) also looked for melanistic populations, but found no clear evidence of melanism in mammals at ELMA. Gehlbach conducted a survey of amphibians and reptiles from the Zuni Mountains, and surrounding areas. As with Hooper's findings with mammals, the amphibian and reptile species found by Gehlbach were typical inhabitants of the region. Stolz (1986a, 1986b) compiled unpublished lists of amphibians, reptiles, and mammals found at nearby El Morro National Monument.

The birds of ELMA were previously poorly known and undocumented. The most extensive records of bird species

occurring in the ELMA region that we are aware of are records from the New Mexico Department of Game and Fish (Klingel 1992) for Cibola County. Klingel (1992) also includes records of other vertebrate animals from Cibola County. Painter (New Mexico Department of Game and Fish; pers. comm. 1993) provided additional records of reptiles and amphibians from Cibola County. These county records include a large geographic area around ELMA, including habitats and species that are not found at ELMA. However, the county records do provide an indication of what species may occur at ELMA.

Peck (1982) conducted a survey of lava tube caves for invertebrates at ELMA from 1975-1979 in an attempt to find cave-specialized species. No cave specialists were found and he commented that the ELMA lava tube cave fauna was depauperate compared to lava tubes elsewhere in North America. We are not aware of any other studies of invertebrates at ELMA.

C. Federal and New Mexico State Listed Threatened or Endangered Species.

Several species of plants and animals that are listed as federal threatened or endangered species, candidate federal threatened or endangered species, or New Mexico state listed endangered species (U.S. Fish & Wildlife Service 1987, 1989a, 1989b, 1990, 1991a, 1991b, 1993; New Mexico Dept. Game and Fish 1988a, 1988b; Sivinsky and Lightfoot 1992) may occur in the ELMA region.

The most extensive survey for endangered plants at ELMA was conducted by Spellenberg (1979). Spellenberg (1979) listed several endangered species as potentially occurring in the area, but none were found during his survey. The most extensive survey for endangered animals at ELMA was that done by Egbert (1980). Egbert reported the bald eagle from ELMA and noted several other federally listed or candidate endangered animal species as potentially occurring in the area.

D. Ecology of Volcanic Regions.

Volcanic areas are found throughout the world and often support plant and animal assemblages that differ from surrounding non-volcanic areas. An extensive world literature exists on studies of plants and animals associated with volcanic environments (see references below for examples). Some of the most extensively studied areas in the world for volcanic biota include Hawaii (Howarth 1972, 1982, Drake & Mueller-Dombois 1993), Japan (Saito 1977, Kawakatsu & Mack 1975), the Canary Islands (Martin & Oromi 1986, Ashmole et al. 1992), Italy (Marchese et al. 1989), Iceland (Bjarnason 1991, Fridriksson 1987), the Galapagos Islands (Peck and Shear 1987), and some volcanic areas in North America: Craters of the Moon area in southern Idaho (Eggler 1941, Horning & Barr 1970), the Carrizozo Malpais and other lava flows in central New Mexico (Weckerly &

Best 1985, Best & James 1984), Lava Beds National Monument (Stohlgren 1993; Johnson and Smathers 1976), and volcanic areas of Mount St. Helens and elsewhere in the Cascade Range of south-central Washington and central Oregon (Peck 1973, Senger & Crawford 1984).

Most ecological studies of volcanic landscapes have focused on primary succession or the colonization of barren lava fields by plants and animals. Studies of plant succession on lava flows have been carried out in Hawaii (Drake 1992, Drake & Mueller-Dombois 1993, Jackson 1971), Iceland (Bjarnason 1991, Fridriksson 1987), Italy (Marchese et al 1989), and Craters of the Moon National Monument in Idaho (Eggler 1941). All of these studies report similar patterns of colonization: first by sequences of lichen and moss species and later by a sequence of vascular plants. Most of those studies report distinctive species compositions and total vegetation cover values from lava flows of different ages in the same area.

Some animal studies have examined the succession of animals species associated with different aged lava flows (Ashmole et al. 1992), but most have focused on the specialization of certain species to certain habitats (Best & James 1984, Howarth 1983) and the occurrences of new species associated mostly with lava tube caves (Peck 1973, Howarth 1972).

One feature of some animals that live on lava habitats is a darkening of body color, presumably so that the animals will be camouflaged from predators on the dark-colored lava. This darkening of individuals in populations that live on lava is called melanism and is genetically based. Melanism has been found in a number of species of rodents (Dice 1929, Benson 1932, Blossom 1933) and reptiles (Lewis 1949, 1951, Prieto & Jacobson 1968, Best & James 1984) living on lava in southern and central New Mexico. Some melanistic rodent populations are considered to be distinct subspecies (Weckerly & Best 1985).

Lava tube caves are unique features of lava fields throughout the world. Lava tube caves form extensive subsurface habitats for animals that are typically cooler, moister, and darker than the surrounding areas (Howarth 1983). The stable isolated environments of caves provide situations where populations may become adapted to the local environment and evolve into new and distinctive species (Barr 1968, Culver 1982, Howarth 1983).

Animals that live in caves are called cavernicoles (Howarth 1983), and become specialized to the cave environments to various degrees. Names have been applied to groups of animals that exhibit various degrees of specialization to the cave environments (Howarth 1983). Species that are obligate cavernicoles and have become adapted to live their entire lives only within caves are called troglobites. Troglobites have modified morphological features that appear to be adaptations to cave environments. Typical morphological features of troglobites include loss or reduction in pigmentation, loss or reduction of

eyes, and an increase in size, or elongation of appendages (Culver 1982, Howarth 1983).

Species that facultatively occur in caves or are able to spend their entire lives in caves, but also occur in similar non-cave environments are called troglophiles. Troglophiles may or may not possesses the specialized adaptations observed in troglobites. Species that live in caves most of the time, but must leave the cave to complete their life-cycle are called trogloxenes. Obligate trogloxenes are species that require cave habitats to complete part of their life-cycle. Other animals that are often found in caves, but do not normally live in caves are called accidentals.

Throughout the world many new species of animals, mostly troglobitic arthropods, have been found endemic to particular lava tube caves, or cave systems. The majority of lava tube species have been found in Hawaii (Howarth 1972, Bellinger and Christiansen 1974, Brindle 1980, Gurney & Rentz 1978, Gertsch 1973, Fennah 1973), Japan (Habu 1971, Saito 1977, Kawakatsu & Mack 1975), the Canary Islands (Remane & Hoch 1988, Ashmole et al. 1992), the Galapagos Islands (Peck 1987) and in Australia (Muchmore 1982). A number of new endemic troglobites have been found in lava tube caves in the Pacific Northwest (Peck 1973, Briggs 1974, Benedict 1979).

Given the unique environments associated with lava flows and lava tube caves, and the potential for new species, efforts were made in this inventory to identify and survey lava flow habitats and lava tube caves at ELMA. As noted above, Peck (1982) did not find troglobitic invertebrates in a previous survey of lava tubes at ELMA.

II. Methods.

1. General Procedures.

The methodology used to inventory the vegetation and wildlife of ELMA was to establish a number survey sites across the monument. These sites were located in such a way as to include as wide a range of environments as possible. Our objectives were to adequately sample both typical environments or habitats at ELMA, and to locate and sample as many unusual or unique environments at ELMA as possible. In this way, the inventory should not only serve to characterize the flora and fauna of ELMA, but also to encounter rare or unusual species of plants and animals.

2. Study Sites.

We used several information sources to locate potential inventory sites at ELMA. These information sources included USGS 7.5 minute topographic maps, a geological map of ELMA (Maxwell 1986), information provided in the BLM El Malpais National Conservation Area General Management Plan (BLM 1990, 1991), and information provided by NPS personnel.

A Site Characteristics data form was filled-out for each inventory site. Information including site name, location, geologic feature, landscape and vegetation description, were recorded on the Site Characteristics data forms. An example of a blank Site Characteristics data form is presented in Appendix 3. Most sites were approximately one to five hectares in size, although size varied depending on the size of some landscape features that the sites represented. Each site was denoted by a four or five letter acronym code.

Each study site was visited at least once, and most were visited several times over the three-year period. We attempted to visit all of the sites at different times of the year to increase encounters of seasonal species. Some sites served as camp locations, and species lists from those sites tended to be more extensive than from other sites because more time was spent at those sites. Thus, even though we attempted to provide equal sampling effort for as many sites as possible, sampling effort was not uniform across all sites.

3. Vegetation Inventory.

A. Field Inventory and Collecting.

When each site was visited, all plant species were recorded on a Vegetation Records data form. Information including the name, growth form, percent canopy cover over the site, and taxa and collection codes, were recorded. An example of a Vegetation Records data form is presented in Appendix 3. When a given site was revisited, any new plant species found were also recorded.

Thus, over the three-year period, a cumulative plant species list was assembled for each site. Occasionally plants were collected off of the regular inventory sites. Information for specimens collected off of regular sites was recorded on an Off-Site Records form (Appendix 3). The cumulative listing of all plant species from each site and off-site locations provided us with an over-all list of plant species found at ELMA.

Most plant species were tentatively identified in the field. If this could not be done, the plant was collected for later identification and given a code name. After identification in the herbarium, the code names were changed to the actual species name.

Voucher specimens of all plant species encountered were collected during the inventory. Often specimens of what appeared to be the same species were collected from different sites to ensure that similar looking species were not overlooked. Plants were placed in standard plant presses in the field to provide us with herbarium quality specimens. Whole plant samples of herbs were pressed. Portions of trees, shrubs, and succulents necessary for identification were pressed. Most species of cacti were additionally photographed.

Lichens and mosses (cryptogams) were also sampled from ELMA, but in a different way from vascular plants. Because cryptogams are difficult to identify in the field, all types that appeared to be morphologically different were collected at a select set of inventory sites. Identifications were later made from the specimens collected. The sites were selected to represent the major lava flows and non-lava environments present at ELMA.

Lichens were collected by removing specimens and portions of the substrates on which they were growing. A rock hammer and chisel were used to chip pieces of rock substrate and lichens from lava and sandstone surfaces. A knife was used to remove wood and lichen specimens from trees and logs.

B. Species Identifications.

Most of the vascular plants and a few cryptogams could be identified in the field. Regional floras and various taxonomic monographs were consulted for identifications in the herbarium (e.g., Kearny & Peebles and collaborators 1960, Martin & Hutchins 1981, Welsh et al. 1987). All identifications were verified at the University of New Mexico Herbarium from voucher specimens. All plant and cryptogam species that could not be identified in the field, or at the UNM Herbarium, were sent to experts for identification. A list of taxonomic experts who provided identifications is presented in Appendix 4.

C. Plant and Cryptogam Museum Collections.

Representative specimens of all plant and cryptogam species found in the inventory were prepared as museum specimens following standard curatorial protocol. Each voucher plant

specimen was attached to a standard herbarium sheet, and provided with a label including collection location, date, and species name information. Each voucher cryptogam was placed in a standard herbarium envelope, and provided with a label including collection location, date, and species name information.

One specimen of each species will be housed at the plant collection at ELMA headquarters in Grants, New Mexico. Additional specimens will be housed at the UNM Herbarium. Each specimen provided to the National Park Service will be documented in accordance with the NPS Museum Handbook. This documentation data will be stored and maintained at the ELMA Headquarters.

4. Animal Inventory.

A. Field Collecting and Inventory.

a. Vertebrates.

All vertebrate animals observed at each site on each visit were recorded on an Animal Records data form, including each species name and number of individuals observed. An example of an Animal Records data form is presented in Appendix 3. Vertebrate animals included on Animal Records data forms were generally diurnal species that could be observed and identified in the field, in particular birds, diurnal mammals, reptiles, and amphibians.

Small nocturnal mammals, including rodents and bats, were sampled by different methods. Nocturnal rodents were sampled at select sites by the use of Sherman (TM) live-traps. Twenty to forty of these traps were placed around a given site in the evening and baited with rolled oats. The traps were then checked the next morning, and animals caught in the traps were identified, weighed, and measured. At least one voucher specimen of each species was collected. Voucher specimens were killed in a jar containing chloroform vapor. All voucher specimens were taken to the Museum of Southwestern Biology, Mammal Division, at UNM for positive identification and preparation as museum specimens.

Bats were sampled by the use of mist nests placed over water sources (stock ponds or playas) and at the entrance of Bat Cave at night. Bats that were caught in the nets were identified, and some voucher specimens were taken to the Museum of Southwestern Biology for positive identification and preparation of museum specimens.

Animals were also observed and recorded while driving at ELMA, in particular along state highways 117 and 53, and county road 42. Dead animals on the roadways were also recorded, and if in good condition, collected for voucher specimens. Records of animals observed away from inventory sites were recorded on Off-Site Record forms (Appendix 3).

Bones of animals were encountered in a number of lava tube caves. Samples of bones were collected to confirm

identifications. These bones were taken to the Museum of Southwestern Biology for identification.

Pitfall traps used for arthropods (see below) occasionally caught small animals such as lizards, toads, shrews, and rodents which were preserved and kept as voucher specimens.

b. Invertebrates.

Several techniques were used to collect invertebrates. For this inventory, an emphasis was placed on ground-dwelling arthropods which were collected mostly in pitfall traps. Arthropod pitfall traps consisted of small steel cans, measuring 7.6 x 11.4. cm (3 x 4.5"), placed in the ground with the open end of the can at ground level. A small plastic cup, measuring 7.6 by 11 cm (3 x 4") was placed inside of each can so that the top of the cup was even with the top of the can at ground level. Each cup was filled about half full with propylene glycol. The propylene glycol served as a trapping, killing, and preserving agent. A plywood square, measuring 15 by 15 cm (6 x 6"), supported on 9 cm (3.5") nails, was placed about 5 cm (2") above each pitfall trap to protect the trap from precipitation and direct sunlight. Pitfall traps were left open year-round and were sampled once every two months. Sampling of pitfall traps involved pouring the contents through a screen strainer and transferring the strained arthropods to vials filled with ethanol. The strained propylene glycol was then returned to the cup and placed back in the can. New propylene glycol was added as needed. The vials containing specimens were then taken to UNM where the arthropods were sorted and identified.

Pitfall traps on lava substrates were placed in depressions or cracks in the lava, and platforms of small lava rocks were constructed around the cans to make the tops level with the lava substrate. Small lava pebbles were used so as to provide a continuous lava surface around each trap.

Pitfall traps were located at a number of sites at ELMA. The sites were selected to encompass the major lava flows and non-lava landscapes. A special effort was also made to locate pitfall traps in some of the lava tube ice cave entrances. No pitfall traps were placed deep within the dark zones of lava tube caves.

Other techniques were used to sample night-flying insects, arthropods on vegetation, and invertebrates in pools of water. Portable fluorescent lights were set out at night to attract night-flying insects. These insects were captured at the lights, and placed in cyanide kill jars. Arthropods on vegetation were collected with insect sweep nets. Sweep net samples were taken from foliage of several of the common tree and shrub species at ELMA. Non-species-specific sweep samples of herbaceous vegetation were also taken. Approximately 20-50 sweeps were taken from a given plant species at a given site. The contents of the sweep nets, including arthropods and plant material, were transferred to self-sealing plastic bags, and taken to UNM where arthropods were sorted and identified. Invertebrates in small pools of water

such as stock ponds, playas, and tinajas were collected with a small aquarium net and placed in vials of ethanol.

Active diurnal arthropods such as flies, bees, wasps, grasshoppers, and butterflies were collected with aerial insect nets. Specimens were killed in cyanide jars. Other general collecting techniques included searching under rocks and logs, and searching flowering plants for flower-visiting insects. Insects that produce sound such as cicadas and crickets, were located by following their calls and captured. Lava tube caves were visually searched for arthropods with the aid of portable lights.

B. Species Identifications.

a. Vertebrates.

Most vertebrates were identified visually in the field. Some bird species (e.g., empidonax flycatchers) were identified by calls in the field. Voucher specimens of some rodents (e.g., *Peromyscus* species) that were difficult to identify in the field, were collected for positive identifications at the Museum of Southwestern Biology.

b. Invertebrates.

Most invertebrates were sent to expert taxonomists for identification. Field collected specimens were prepared as museum specimens following standard curatorial techniques. For example, all arthropods with strong cuticles (e.g., beetles) were pinned on insect pins with a label providing collection location and date information, following standard procedures found in Borrer et al. (1981). Arthropods with soft cuticles (e.g., spiders) were placed in vials of 70% ethyl alcohol with a label.

Invertebrates belonging to certain taxonomic groups, such as some families of beetles, were then sent to expert taxonomists who are specialists on those groups. A list of names of taxonomists who provided identifications, and their taxonomic specialties is provided in Appendix 4.

C. Animal Museum Collections.

a. Vertebrates.

Vertebrate voucher specimens were prepared as museum specimens by personnel at the Museum of Southwestern Biology. Small mammals were prepared as museum study skins, and reptile and amphibian specimens were preserved with formalin and stored in jars containing ethanol. All specimens were labelled with location, date, and species identification information. One specimen of each species was prepared for the NPS collection at ELMA headquarters, and additional specimens were placed in the

Museum of Southwestern Biology at UNM. Specimens prepared for the NPS are being documented on Museum Handbook data forms.

b. Invertebrates.

Invertebrate voucher specimens were prepared as museum specimens, and sent to experts for identification, as stated above. Once identified specimens were returned from taxonomists a specimen of each species was prepared for the NPS collection at ELMA headquarters, and additional specimens were placed in the Museum of Southwestern Biology at UNM. Specimens prepared for the NPS are being documented on Museum Handbook data forms.

III. Results

1. Study Site Locations.

A total of 101 study sites were established over the course of this inventory. These sites were distributed over the major geological or morphological surfaces that we could identify from Maxwell's (1986) geologic map of the ELMA region. A list of the study sites and the geologic areas or specific environments that they represent is given in Appendix 5 and a map of the study site locations is presented in Figure 2. Detailed information for each study site, obtained from site characteristic data forms, is presented in Appendix 6. A greater proportion of study sites were located on the Bandera lava flow than any other geologic surface because of the large number of lava tube caves and collapse structures present.

Abbreviations of the names of collection sites visited during this study are often used in the text. See Appendix 5 for a list and "translation" of these abbreviations (e.g., HIDD = Hidden Kipuka).

Most study sites were visited several times at different seasons over the three-year period. Sites at or near camping areas, pitfall trap locations, and lava-tube caves tended to receive more visits than other sites. Remote sites were the least often visited.

2. Vegetation.

A. Species Lists.

424 vascular plant species and 167 species of cryptogams (151 lichens, and 16 mosses) were identified during this study from the El Malpais National Monument area (Appendices 7, 8 and 9). 28 of the vascular plant taxa identified were aliens (about 6.6%; Appendix 10). Essentially all of these were weedy, in some sense of the term, and many of them were found exclusively or predominantly along roadsides. 109 vascular plant taxa and 93 species of cryptogams (77 lichens and 16 mosses) were newly identified for the ELMA area (see Appendices 9 and 11). These species were not found in the previously cited studies. 258 vascular plant taxa and 25 species of cryptogams were identified by the previously cited investigators, but were not found during this study (Appendices 9 and 12). In most cases, this is to be expected since the majority of those reported from previous studies were found in the Zuni Mountains.

A list of all plant species known from ELMA, including scientific and common names, is presented in Appendix 7. Scientific names are used throughout the report, so the reader may refer to Appendix 7 for common names of plants. An annotated plant species list, with information on all plant species, is presented in Appendix 8.

Figure 2a. INVENTORY SITE LOCATIONS

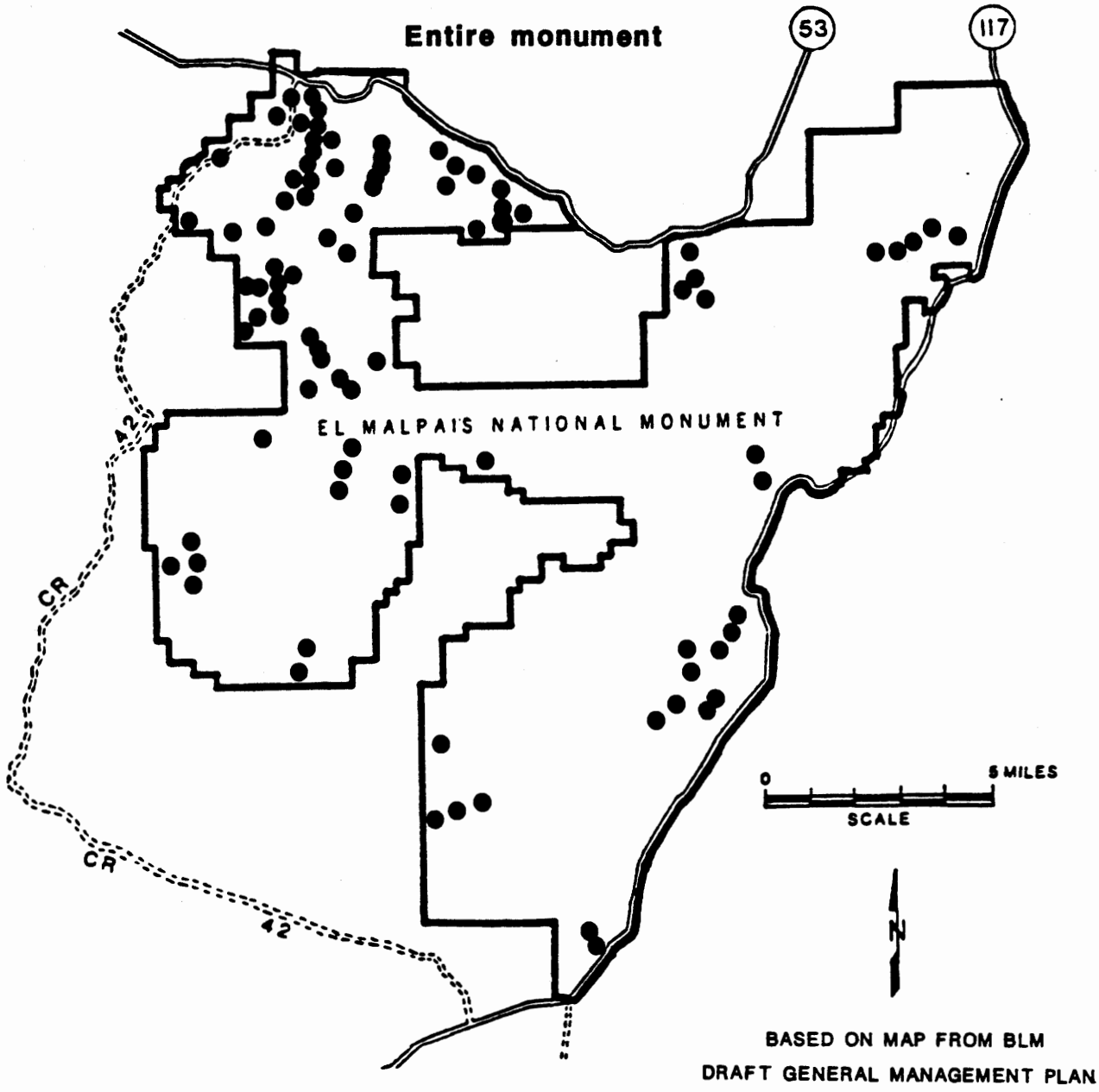


Figure 2b. INVENTORY SITE LOCATIONS

Northwest portion of monument

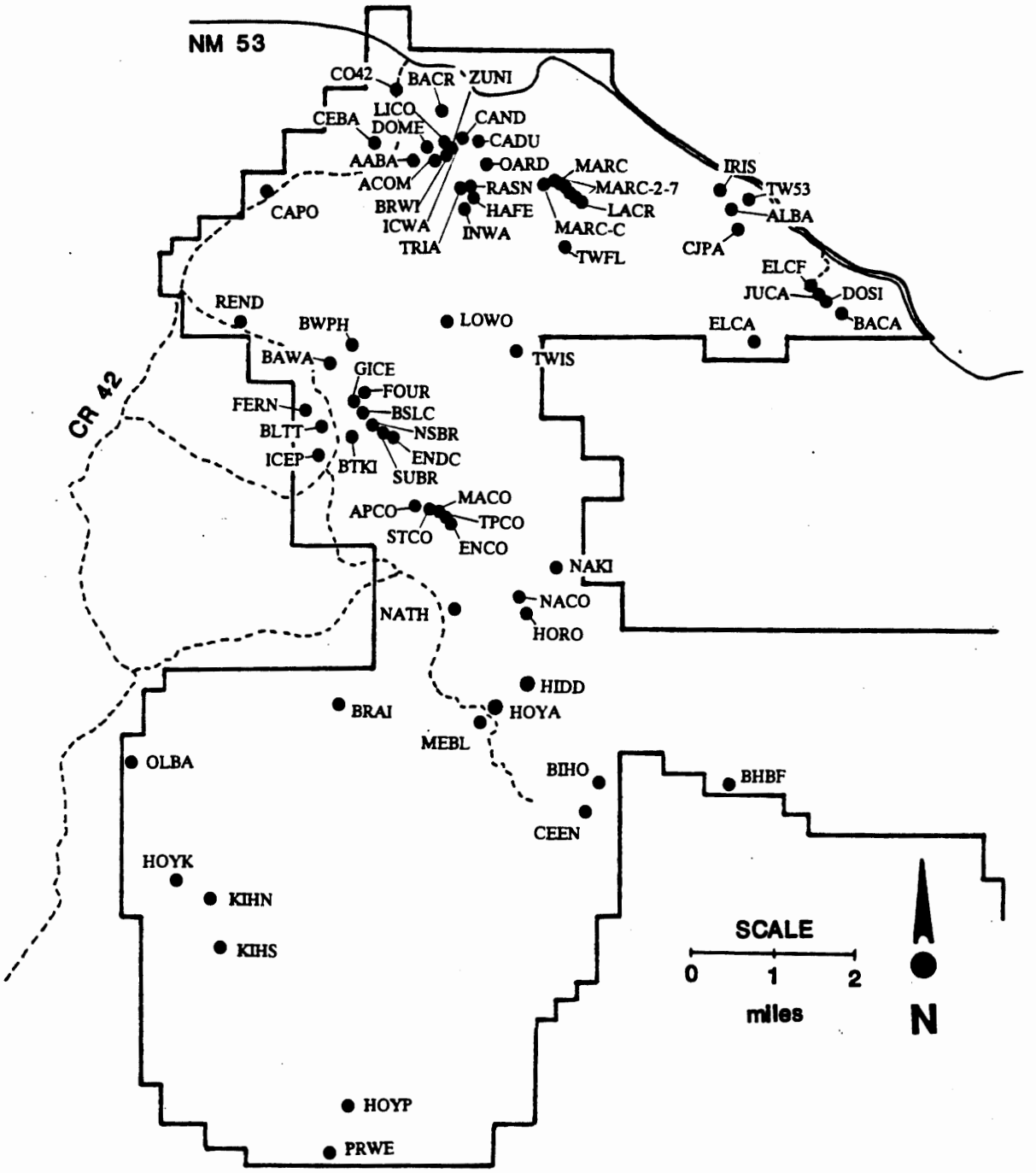


Figure 2c. INVENTORY SITE LOCATIONS

Northeast portion of monument

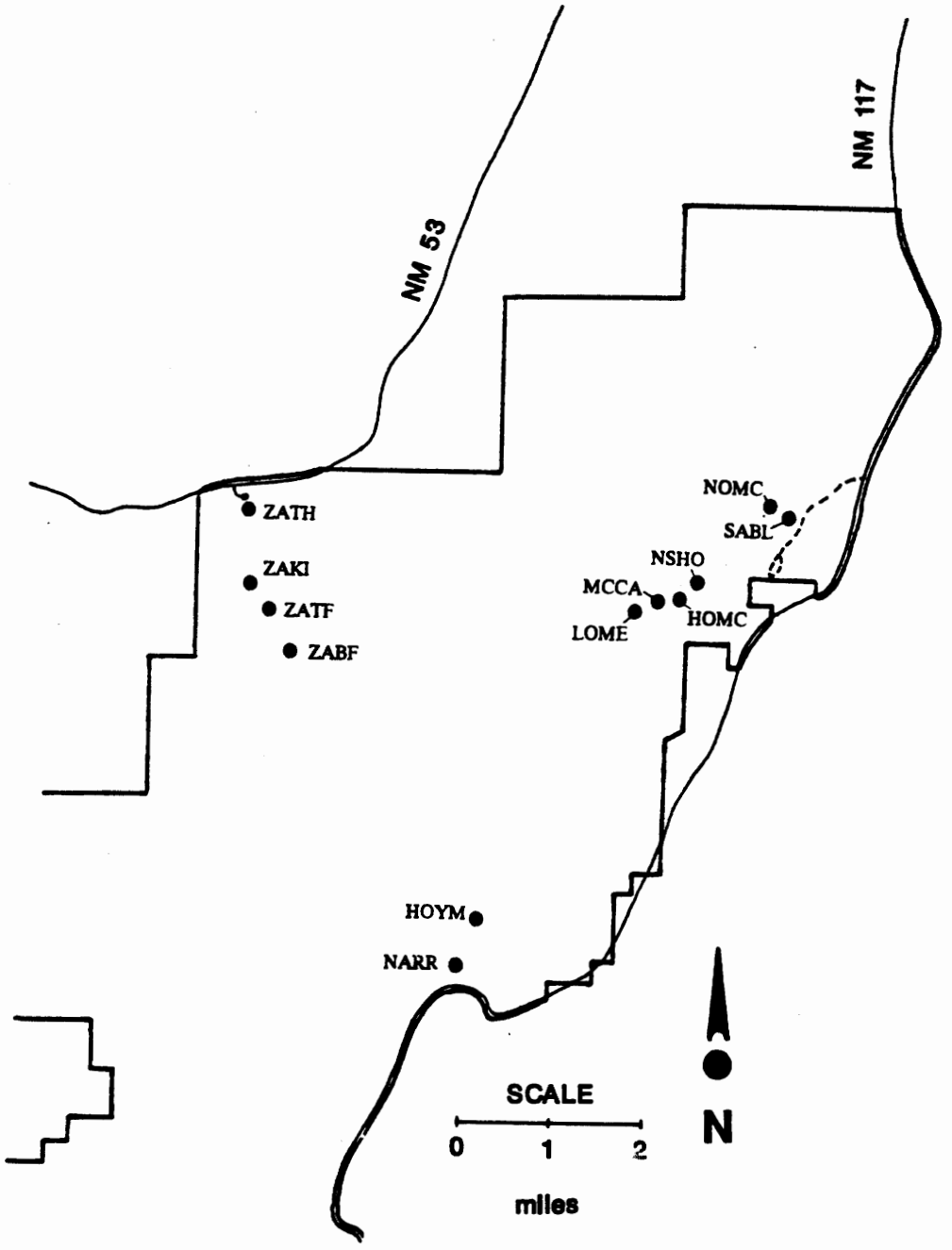
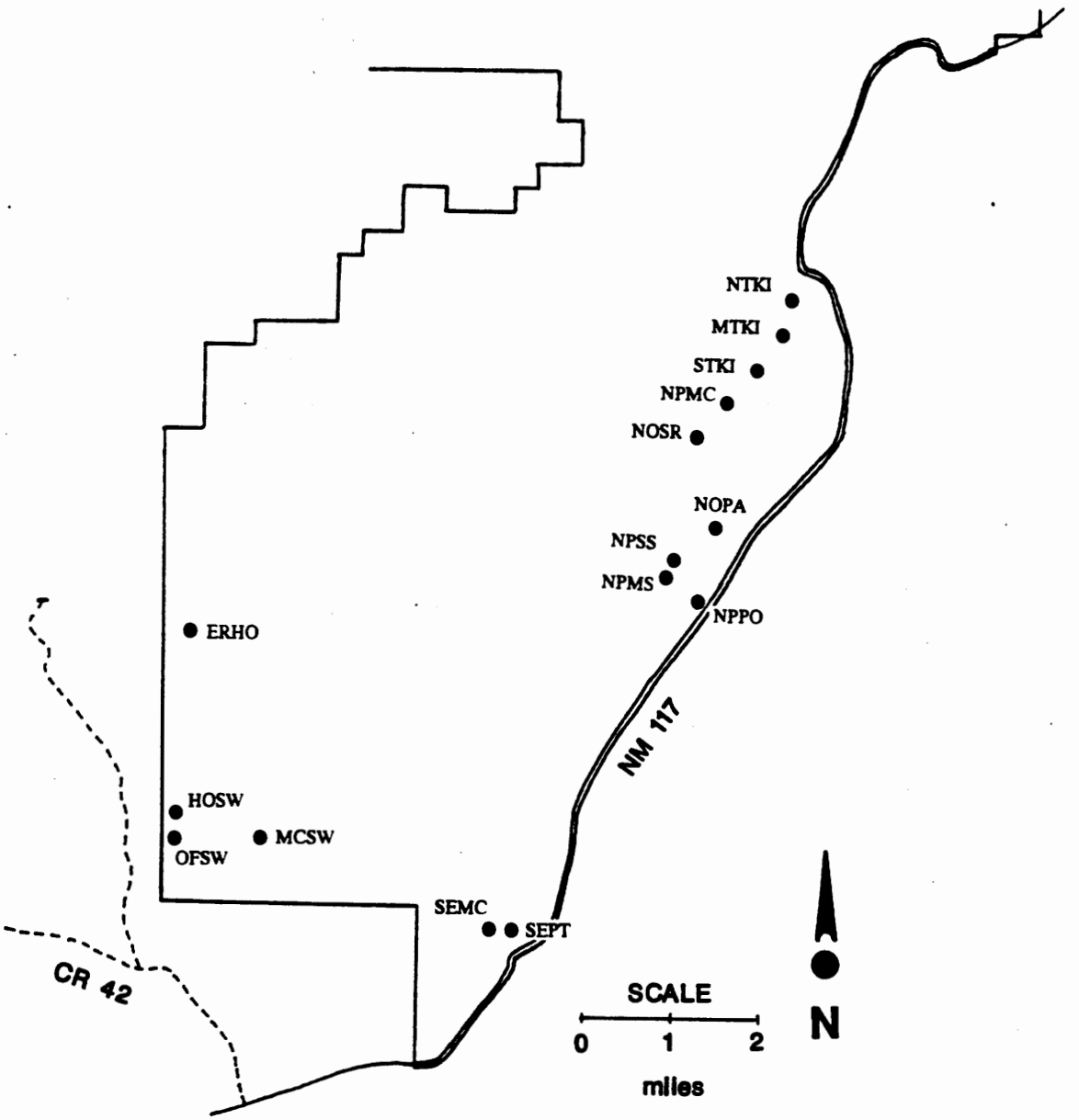


Figure 2d. INVENTORY SITE LOCATIONS

Southeast portion of monument



B. Plant Species of ELMA.

a. Vascular Plants.

A database listing of all plant species found at all sites, along with information on growth form and percent canopy cover at each site is presented in Appendix 13, and all off-site plant records are presented in Appendix 14. Information from the plant records database (Appendix 13) can be cross-referenced with data in the Site Records database (Appendix 6) and the Plant Off-Site Records (Appendix 14) to obtain detailed site location information for each plant species record.

The data in Appendix 13 may be used to evaluate the plant species composition and canopy cover values among the inventory sites across ELMA. The data may also be used to determine the relative abundances of different species at ELMA. A list of the commonest plants (based on the number of sites at which a plant was found) identified during this study is presented in Appendix 15. Gymnosperms (pines and junipers) were the most common trees in the monument area and were found at many sites. Common gymnosperm trees of ELMA included ponderosa pine (*Pinus ponderosa*), Colorado pinon pine (*Pinus edulis*), Douglas fir (*Pseudostuga menziessi*), one-seed juniper (*Juniperus monosperma*), and Rocky Mountian juniper (*Juniperus scopulorum*). See also Appendix 8, the annotated species list, for more information. Dicotyledonous trees (aspens, elms) were not common or rare.

Shrubs, particularly wax current (*Ribes cereum*), New Mexico olive (*Forestiera neomexicana*), and Apache plume (*Fallugia paradoxa*) were very common and widespread. Rabbitbrush (*Chrysothamnus* species) were also prevalent. A few other shrubs or subshrubs were fairly common including snakeweed (*Gutierrezia sarothrae*), ocean-spray (*Holodiscus dumosus*), and various sages (*Artemisia* species).

A variety of annual and perennial herbs were common. *Glandularia wrightii* was abundant in 1991, but decreased during the course of this study. Paintbrush (*Castilleja* species), several composites (*Bahia dissecta, Chaetopappa ericoides, Heterotheca villosa*), *Geranium lentum*, and *Arabis* species are examples of some of the common herbs.

Some cacti were common, especially plains prickly pear (*Opuntia polyacantha*) and claret cup (*Echinocereus triglochidiatus melanacanthus*); the latter was found only on lava flows or cones, sometimes in abundance. A few other cacti were found including *Mammillaria wrightii wrightii*, a New Mexico state listed endangered species.

A large variety of grasses were identified, many not found by previous investigators (Appendix 11). The two most prevalent grasses found during this study were blue grama (*Bouteloua gracilis*) and mountain muhly (*Muhlenbergia montana*).

Ferns composed an interesting part of the flora. One species, *Woodsia plummerae*, was common. Some had very restricted distributions in the monument. For example, bracken (*Pteridium*

aquilinum) was found only on Bandera Crater and male fern (*Dryopterus filix-mas*) was commonly associated with collapse structures. A particularly unusual fern occurrence was water-clover (*Marsilea mollis*) at some playas (PRWE); this area is near the northern edge of its distribution and was found only in 1991 and not subsequently (see below, Rare Plants, for more information).

b. Cryptogams.

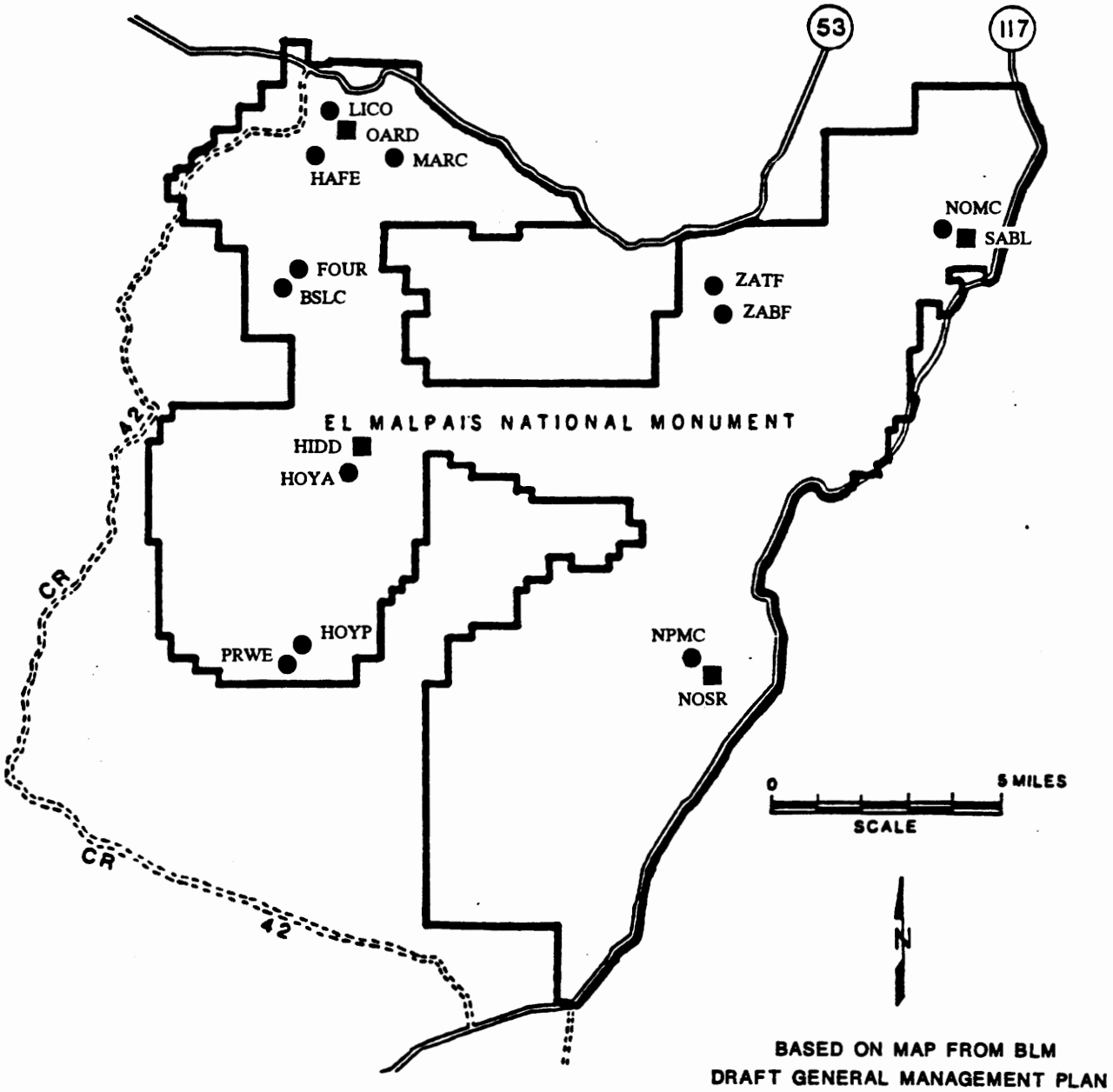
Lichens were sampled from 16 sites that were representative of different geologic features, and different geographic areas at ELMA. Those 16 sites were: BSLC, FOUR, HAFE, HIDD, HOYA, HOYP, LICO, MARC, NOMC, NOSR, NPMC, OARD, PRWE, SABL, ZABF, and ZATF. The locations of those lichen survey sites are plotted in Figure 3. A listing of all lichen species known from ELMA is found in Appendix 9, including a break-down of species found in this inventory, and those found by DeBruin (1988). Taxonomic classification of cryptogams follows that of Weber & Wittmann (1992).

Lichens were a major part of the flora at ELMA, particularly on the lava flows. Much of the lava surfaces were covered with lichens varying from almost total cover in cool moist areas, to practically no lichen cover in the drier, warmer situations. In general, lichen cover was highest on the upper elevation lava flows, on older lava surfaces, and on pahoehoe. The upper Bandera, Twin Craters, Lava Crater, and Hoya lava flows tended to have relatively high lichen cover, generally covering over 50% of the lava surface. In contrast, the more recent, lower-elevation McCartys lava flow typically had lower lichen cover, generally covering less than 20% of the lava surface.

Most species of lichens grow on specific types of substrates. The two broadest classes of substrates at ELMA were rock and wood surfaces. Lichens that tend to grow on rocks are called saxicolous, and those that grow on wood are called corticolous. Among the saxicolous lichens are those that prefer acidic rocks such as basalt, and those that prefer basic rocks such as limestone. Other lichens are terricolous, living on the soil surface, and forming lichen crusts. A listing of lichen species that were found at ELMA and the substrates that they were found on is presented in Appendix 16.

The most ubiquitous lichens of ELMA were the greenish-grey, foliose *Xanthoparmelia* lichens. These lichens covered the lava in many areas, giving the lava a greenish-grey color. The most common species were *Xanthoparmelia lineola*, and *X. plittii* which were found on lava, sandstone, and limestone substrates throughout ELMA. Other ubiquitous lichens included several species of grey crustose lichens in the genera *Lecidea*, *Lecanora*, and *Aspicilia*. These lichens often covered the lava, but were difficult to see because of their low aspect, and similar color to lava surfaces. As mentioned above, total cover of these

Figure 3. LICHEN SURVEY SITES



lichens was greatest on older lava surfaces, and at higher elevations.

A number of species of lichens were found almost entirely on wood throughout ELMA, both on and off of lava areas and across the different lava flows.

Most species of lichens were saxicolous and were abundant on both lava and sandstone surfaces (Appendix 16). However, some species of saxicolous lichens were found almost entirely on lava, while some were found almost entirely on sandstone or limestone (Appendix 16). A few species terricolous lichens were found on soil surfaces.

The lava flows at ELMA provided a variety of micro-environments for lichens, including open exposed surfaces, protected vertical surfaces, and cracks and caves. As mentioned above, the micro-climate of open, exposed surfaces appeared to change from the cooler and moister upper Bandera lava flow to the warmer and drier McCartys lava flow, and lichen assemblages differed between the two areas. However, crack environments appeared to support similar lichen assemblages on both the upper Bandera lava flow and the McCartys lava flow, indicating that the crack environments were similar across flows.

The most striking lichen assemblages observed at ELMA were those associated with lava tube ice caves. Several species of lichens grew abundantly in specific areas or zones within the entrances of ice caves, particularly on the upper Bandera lava flow. A whitish-grey to greenish-grey powdery-appearing crustose lichen, *Lepraria membranacea*, was common on the rock walls in the twilight zones of most ice caves. The most striking species was a bright yellow-orange powdery-appearing crustose species, *Caloplaca citrina*, which only grew in the coldest, dampest areas inside of the cave entrances, often adjacent to ice formations. Light was a limiting factor for this species, because it often grew only on the sides of rocks facing the light within the twilight zone. In dim light locations, *Caloplaca citrina* became greenish-yellow in color.

Just beyond the zone of *Caloplaca citrina*, another bright orange subfoliose lichen, *Xanthoria elegans*, or rarely *X. fallax*, usually formed a band around the cave entrance where temperatures were slightly warmer. Beyond the *Xanthoria*, was a zone of mosses, generally with different dominant species at different caves. This zone was usually located underneath the overhanging roof of cave entrances and subject to dripping water. Beyond the moss zone, was a one of greenish-grey foliose lichen, *Xanthoparmelia wyomingica* which grew on rocks adjacent to the moss. Beyond the *Xanthoparmelia wyomingica* zone, typical lava surface lichens such as the foliose *Xanthoparmelia lineola*, and crustose *Lecidia*, *Lecanora*, and *Aspicilia* species were abundant. This zonation of cryptogams in the entrances of ice caves is one of the most distinctive ecological features that we observed at ELMA.

C. Rare or Unusual Plant Species.

A number of regionally rare plants species, or unusual range extensions, that were found at ELMA are summarized below.

Asplenium septentrionale was fairly common in cracks on the lava flows. This species was mentioned in Spellenberg's report (1979) as being widespread, but scattered and not truly rare throughout its ranges.

Asplenium trichomanes was rare in the monument, and mentioned by Spellenberg (1979) and Lindsey (1951) as a somewhat unusual occurrence on the lava.

Marsilea mollis was found only in 1991 at PRWE. ELMA is at the northern edge of this specie's distribution.

Lithospermum cobrense was rare in the monument, and is also apparently near the northern edge of its distribution.

Mammillaria heyderi var. *meiacantha* was rare in the monument, found only on sandstone ridges at NOSR and NPSS. This cactus has no official status but is susceptible to collecting.

Mammillaria wrightii var. *wrightii* is a New Mexico state listed endangered species. Wright's pincushion cactus is found only in New Mexico, and is susceptible to poaching.

Astragalus egglestonii is endemic to west-central New Mexico and adjacent Arizona. This locoweed is uncommon in higher parts of monument (e.g., OARD).

Astragalus mollissimus var. *mathewsii* is endemic to west-central and northwestern New Mexico. This species was uncommon in the monument.

Dalea exigua was rare in the monument, and is apparently near the northern edge of it's distribution.

Phacelia serrata was recently listed as a candidate for Federal threatened or endangered species status. This species was previously known only from the San Francisco volcanic field area of Arizona. It was found only on cinders in the Bandera Crater area at ELMA.

Monnina wrightii is an inconspicuous plant that seems to be rare in the monument, and is apparently near the northern edge of it's distribution.

Another type of rareness refers to the abundance of a species at ELMA. To ascertain this, the number of occurrences of a taxon (the number of sites at which it was found) was used. For example, in this study, a plant species was considered rare if found at only one or two sites (Appendix 8). Clearly, there are problems with using this method for determining rareness or commonness, most notably the thoroughness of the survey at each site.

A large percentage (113 or 26.6%) of the plant species identified at ELMA were found at only one site (Appendix 17). The 36 commonest plants were found at > 25 sites or about 25% of the sites (Appendix 15). As is encountered elsewhere, there are relatively many "rare" plants and relatively few "very common" plants at ELMA.

The one-location plant data was sorted by site to help indicate certain areas, or habitats, that may be more species-rich and thus more worthy of special attention (Appendix 17). The roadside and pond locations, in this context, are discussed below. The on-monument site with largest number of "rare" taxa was SABL (15), followed by BACR (7), NOPA and OARD (5 each), MEBL, ZATH, and HOYA (4 each), and several others with less than 4 each. There are 15 sedimentary/cinder cone sites and 13 lava sites, but the former sites accounted for about 74% of the "rare" taxa. The sedimentary/cinder cone sites and habitat clearly harbored the most "rare" species, and by this measure, had greater species diversity than lava sites.

Some "rare" plants were found only along roadsides. Roadsides are very disturbed and are often the sites of the human-mediated introductions of exotic plants. The situation is complicated by site-specific factors such as elevation and substrate. Consequently, many of the roadsides supported native and introduced weedy species.

Ponds comprise a another unique habitat in the ELMA area and several "rare" plants were found only at these sites (Appendix 17). Ponds or playas at PRWE are natural features, CAPO and NPPO are cattle tanks, and all are ephemeral. Other rare or unusual plants may potentially be found at these sites, such as mudwort (*Limosella* sp.).

D. Federal and New Mexico State Listed Threatened or Endangered Plant Species.

Cinders phacelia (*Phacelia serrata*), a federally listed candidate species, Category 2 (US Fish & Wildlife Service 1993), was found on cinders in the Bandera Crater area. The New Mexico state endangered plant, Wright's fishhook cactus (*Mammillaria wrightii* var. *wrightii*; Sivinski and Lightfoot 1992) was found also. The cactus was found on sandy or alluvial soils at NOSR, NPSS, ZATH, and along upper NM-53.

3. Animals.

A. Species Lists.

A total of 162 vertebrate animal species were found in this inventory, including 36 mammals, 109 birds, 15 reptiles, and 2 amphibians. A total of 354 invertebrate animals have been identified from ELMA thus far. Identifications of many of the invertebrates are not yet complete, so more invertebrate species will be added to these counts in addenda to this report. A list of mammals species know to occur at ELMA is presented in Appendix 18, a list of birds is presented in Appendix 19, a list of amphibians and reptiles is presented in Appendix 20, and a list of arthropods is presented in Appendix 21. Note that records of vertebrates from other studies in the ELMA area and Cibola County records are also included in the above Appendices.

B. Vertebrate Animals of ELMA.

A database of vertebrate animal records from this inventory is presented in Appendix 22, including each animal species by location and date, with a count of individuals that were observed. Records of animals found off of regular inventory sites are presented in Appendix 23. Information from the animal records database (Appendix 22) can be cross-referenced with data in the Site Records database (Appendix 6) and the Animal Off-Site Records (Appendix 23) to obtain detailed site location information for each animal species record.

Examination of animal data from Appendix 22 shows that some animal species were common, while others were uncommon or rare. Animal species are presented in Appendix 24 in descending order based upon the frequency of locations that observations were made, and in Appendix 25 in descending order based on total numbers of individuals counted. Note that the data for all species were not obtained the same way. Most of the records were obtained as routine observations. However, most of the data for rodents was obtained from live-traps set at night, and data for bats from mist nets set at night. Routine observations were made at all sites, but mammal trapping and bat netting were only done at a subset of sites or other locations. Therefore sampling effort was not uniform for all of the animal species listed in Appendix 22 or in appendices 19 and 20 which were derived from Appendix 22. However, the data should still reflect actual abundances.

a. Amphibians.

The canyon treefrog was the most frequently encountered amphibian at ELMA. Canyon tree frogs were observed throughout ELMA from lava tube collapses on the upper Bandera lava flow to stock tanks and tinajas on the east side of ELMA. New Mexico spadefoot toads were found only on the east side of ELMA, in non-lava areas. Adults were observed or heard calling from NOPA to SABL, and tadpoles were found in temporary ponds at the base of sandstone cliffs at SABL. One Tiger salamander was found in an arthropod pitfall trap at BLTT at the base of Cerro Rendija. No other species of frogs or toads were observed or heard during the inventory.

b. Birds.

Western Bluebirds were the most frequently observed species of bird at ELMA and were common throughout the monument from Bandera Crater to the sandstone formations on the east side year-round. Other frequently observed birds included common ravens, violet-green swallows, pinon jays, red-tailed hawks, rock wrens, Western wood-peewees, ash-throated flycatchers, American robins, common nighthawks, dark-eyed juncos, and black-capped chickadees. All of these bird species were found commonly throughout ELMA.

The cordilleran flycatcher ranks high in frequency in Appendix 24, but that is because a large proportion of inventory sites were lava tube collapse structures, the principal habitat of these birds at ELMA.

The most numerous bird species in terms of total numbers of individuals counted was the pinon jay (Appendix 25). Other species of birds for which large numbers of individuals were observed included violet-green swallows, dark-eyed juncos, common nighthawks, Western bluebirds, vesper sparrows, common ravens, rock wrens, chipping sparrows, mountain bluebirds, and black-capped chickadees.

Many of the bird species were found throughout ELMA and were not associated with geologic features or geographic areas. The main exceptions were rock wrens, canyon wrens, and white-throated swifts, all of which were found almost exclusively in rocky habitats. The wrens were common on both lava and sandstone surfaces, and the swifts were common near large rock cliffs, both volcanic and sandstone.

The only bird species that showed a definite preference for lava was the cordilleran flycatcher (formerly called western flycatcher). These small flycatchers were found exclusively in lava tube collapse structures. Most of the larger lava tube collapse structures on Bandera, Lava Crater, Hoya, and Rendija lava flows supported nesting pairs of cordilleran flycatchers. These birds nested under the rock overhangs in the entrances of lava tube caves. The only place that a cordilleran flycatcher was observed outside of a lava tube collapse was one individual observed on the steep basalt cliffs in Bandera Crater.

Some bird species were restricted to certain plant communities or elevation areas. For example, red crossbills, Stellar's jays, Western wood-peewees, hepatic tanagers, and a number of other bird species were found primarily in higher elevation conifer forests. Other bird species such as the greater road-runner, vesper sparrows, meadow larks, horned larks, and American kestrels were found primarily in open grassland habitats. Species such as killdeer, great blue herons, and green teal, were associated only with playa ponds.

c. Mammals.

The most frequently observed species of mammal was the Colorado chipmunk (Appendix 24). Other frequently encountered mammals included rock squirrels, mule deer, whitetail prairie dogs, coyotes, cliff chipmunks, and cottontail rabbits. Woodrats and pocket gophers rank high in occurrence (Appendix 24), but most of those observations were based on nests or soil mounds. The most frequently trapped small mammal species was the pinon mouse, followed by deer mice and rock mice.

The mammal species for which the most individuals were counted was the whitetail prairie dog (Appendix 25), followed by the colorado chipmunk, mule deer, rock squirrel, cliff chipmunk, and coyote. The largest numbers of individuals of a small mammal

species caught in live-traps were deer mice, followed by pinon mice, and rock mice.

Most species of common mammals were found throughout ELMA, from high elevations around Bandera Crater, to the lowest elevations on the east side. Some species did show preference for certain types of geological features. For example, cliff chipmunks, rock mice, rock squirrels, and Mexican woodrats were found almost exclusively in rocky habitats, both on lava and sandstone. Other species such as whitetail prairie dogs, cottontail rabbits, kangaroo rats, silky pocket mice, and pocket gophers were found in areas with deep loam or sandy soils.

Eight species of bats were found during the inventory. Most bats were caught in mist nets placed over water sources such as stock tanks at various locations at ELMA. We did observe bats in lava tube caves, but for the most part were not able to identify the species in those situations. The most ubiquitous bats were Mexican free-tail bats, which have a large summer colony in Bat Cave, and another much smaller colony in Braided Cave.

Although we did not observe elk or black bear, local people (e.g., D. Candelaria, ranch workers at Los Cerros Ranch) reported observing elk and bears in the Bandera Crater region during winter months. We found the lower jaw bone of a black bear at ZAKI near the Zuni-Acoma Trailhead.

d. Reptiles.

The most frequently encountered reptile at ELMA was the Eastern fence lizard, followed by tree lizards, plateau striped whiptail lizards, gopher snakes, lesser earless lizards, and Western rattlesnakes (Appendix 24). The most numerous reptile species was the Eastern fence lizard, followed by tree lizards, lesser earless lizards and plateau striped whiptail lizards (Appendix 25).

Common reptiles including Eastern fence lizards, plateau striped whiptail lizards, gopher snakes and western rattlesnakes were found throughout ELMA. Tree lizards were only observed on lava, and only in the western portion of ELMA, mostly on the Bandera lava flow. Lesser earless lizards were only observed on sandy soils in the extreme southeastern portion of the monument. Short-horned lizards were found throughout ELMA, usually in areas of sandy soil. Most of the snake records were individuals that were observed dead or alive on road surfaces.

C. Invertebrate Animals of ELMA.

Unlike vertebrate animal records that are based largely from field observations, records for arthropod species are based largely from specimens obtained in field collection samples. Such samples included pitfall traps and vegetation sweep-net collections. These collections were made at a subset of sites as reported above. Pitfall traps were located at 17 sites: OARD,

MARC, HAFE, RASN, CEBA, BLTT, BSLC, HOYK, OLBA, OFSW, HOSW, NPSS, NPMS, NOMC, and SABL. Those 17 sites are plotted on a map in Figure 4. Many arthropods were also individually collected from other locations throughout ELMA. Actual abundance data (i.e., numbers/site or /trap or /sweep) was not recorded for arthropods, so the following results are based largely on a combination of species occurrences in collection samples, and qualitative field observations.

The most common and widespread ground dwelling arthropods were ants, spiders, harvestmen, crickets, grasshoppers, darkling beetles, ground beetles, jumping bristletails, springtails, and millipedes. Each of these groups were represented by several common, widespread species, and several geographically localized uncommon species. A listing of all arthropod species determined to date is found in Appendix 21.

a. Ants (Hymenoptera: Formicidae).

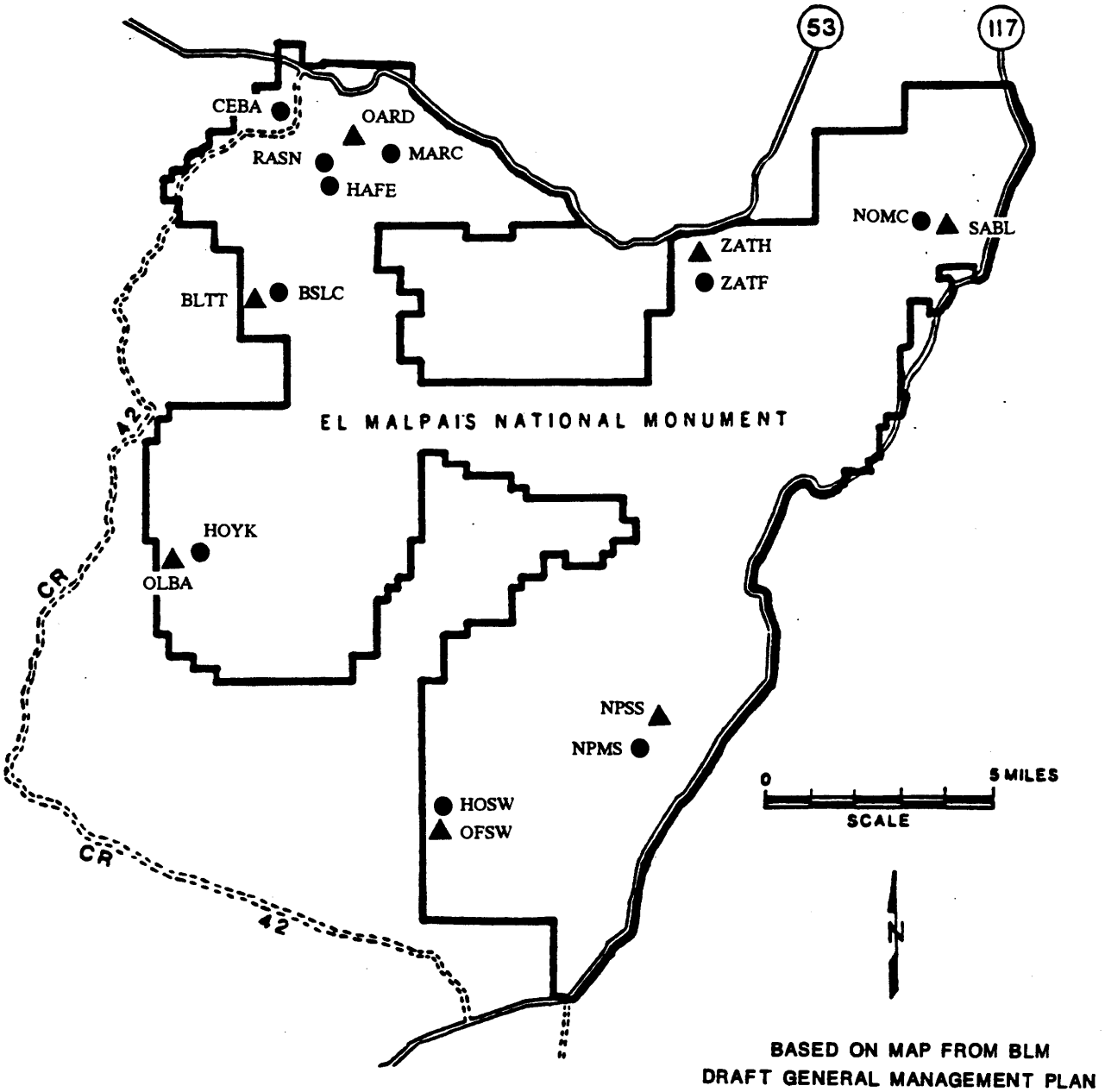
Many species of ants were found throughout ELMA on and off of lava areas. One of the most ubiquitous species was the Western harvester ant (*Pogonomyrmex occidentalis*) who's large conical mounds were common throughout ELMA on well developed soils. Most ant species, and the greatest numbers of individuals were found in areas where soils were well developed. Other common and widespread ant species included several species of *Formica, Camponotus, Crematogaster*, and *Pheidole*. Honey-pot ants (*Myrmecocystus mexicanus*) were common in areas off of the lava flows throughout ELMA. Ant species that were most common, but not exclusively found on lava flows included *Formica podzolica, Camponotus vicinus, Forelius pruinosus*, and *Tapinoma sessile*.

b. Spiders (Araneae).

The most common and widespread ground-dwelling spiders were wolf spiders and gnaphosid spiders. The wolf spiders *Pardosa yavapa* and *Varacosa gosiuta* were the most common and widespread wolf spiders. These species were found on and off of lava, throughout ELMA. Other wolf spider species, including *Schizocosa mimula* and unidentified species of *Lycosa* were less common and widespread. An unidentified species of *Geolycosa* was found only in sandy areas on the east side. The most abundant gnaphosid spiders were *Herpyllus bulbucus, H. propinquus*, and *Zelotes lasalanus*. These species were widespread throughout ELMA. The ground-dwelling crab spiders *Xysticus apachecus* and *X. lassanus* were also common and widespread throughout ELMA.

Several spider taxa were found associated with lava tube ice caves and are probably pleistocene relics at those locations. In particular, spiders in the family Linyphiidae (sheet web weavers) were found mostly associated with the entrances of ice caves. One such species is *Lepthyphanes turbatrix*. This species was originally described from Greenland and previously only known to occur in New Mexico in the Jemez Mountains (D. Richman, pers.

Figure 4. ARTHROPOD PITFALL TRAP SITES



comm.). *Lepthyphanes turbatrix* was only found in rock moss communities in the entrances of Hanging Fern Ice Cave and Big Skylight Ice Cave. Other linyphiid spiders were also found primarily associated with lava tube ice cave entrances or lava tube collapse structures.

A new species of dictynid spider in the genus *Cicurina* was found at a number of localities throughout ELMA including RASN, MARC, NOMC, OARD, and CEBA. This new species appears to be endemic to ELMA (D. Richman, pers. comm.)

One species of tarantula, *Aphonopelma behlei*, was found throughout ELMA, from the Bandera Crater area, to the east side. Black widow spiders (*Latrodectus hesperus*) were rare at ELMA. Only a few black widow spiders were found in the sandstone bluffs area on the east side, and south of Big Hole in The Wall.

c. Harvestmen (Opiliones).

Three species of harvestmen were found at ELMA. One species, *Leiobunum townsendi* was common and widespread throughout ELMA. This species of harvestman was found both on and off of the lava flows. *Leiobunum townsendi* has very long legs, and was found commonly in lava tube caves. Another species, *Trachyrhinus marmoratus*, was common at lower elevations on the east side, but also found near Bandera Crater at Marchantia Ice Cave. This species was common on McCartys lava flow and in sandstone areas. The third species is an undescribed species of *Globipes*, which was previously not known to occur in the ELMA region (J. Cockendolpher, pers. comm.). *Globipes* new species was found only at SABL, associated with sandstone cliffs.

d. Crickets (Orthoptera: Gryllidae, Gryllacrididae).

The most common and widespread crickets included the camel crickets *Ceuthophilus utahensis*, and *Styracosceles neomexicana*. *Ceuthophilus utahensis* was the most common and widespread camel cricket encountered. *C. utahansis* was found from the highest to the lowest elevations, and on both lava and non-lava substrates. *C. utahensis* was the common "cave cricket" found in lava tube caves, but not at all restricted to the caves. *Styracosceles neomexicana* was found mostly on non-lava substrates. They were especially common at higher elevations such as in the Bandera Crater area, but also at the sandstone bluffs on the east side.

The camel cricket species *Pristoceuthophils leptodrilus* was found only at high elevations in the Bandera Crater region. The species *Ceuthophilus testaceus*, *C. pallidus*, and *C. polingi* were found only at low elevations on the east side. *C. testaceus* was found mostly on the McCartys lava flow, and *C. pallidus* and *C. polingi* from sandstone areas.

Two new species of camel crickets were found at ELMA, and both are endemic to ELMA (T. Cohen, per. comm.). A probable new species of *Ceuthophilus* related to the species *arizonensis*, was

found only in the collapse of Marchantia Ice Cave. A new species of sand-treading camel cricket in the genus *Ammobaenetes*, related to the species *phyixocnemoides*, was found on sand at NPSS and SABL on the east side.

Field crickets (genus *Gryllus*) were also common ground-dwelling arthropods throughout ELMA. All but one species that were found at ELMA are undescribed and, with the exception of one (#3), probably occur elsewhere (D. Weissman, pers. comm.). The most common *Gryllus* is a species (#1) related to *veletis* that occurs throughout the western portion of ELMA. *Gryllus* #1 was most common on non-lava substrates, but was occasionally found on lava. Two additional species (#2 and #3) were found on McCartys flow lava on the east side of ELMA. *Gryllus* #2 is very similar to *Gryllus* #1, and was also found off of the lava flow in sandstone areas. *Gryllus* #3 was found commonly, but exclusively on McCartys flow lava. *Gryllus* #3 is likely to be endemic to ELMA (D.Weissman, pers. comm.). One described species, *Gryllus integer*, was found on the east side and is common throughout the western U.S.

An unidentified species of ground cricket (Nemobiinae) was found on the McCartys lava flow in the North Pasture area. These crickets were uncommon and were found only on the lava flow, not on adjacent non-lava soils. They could be heard singing on the open lava flow at night and were observed on open bare lava, on lichens, and in wind deposited soil and plant litter on the lava. These crickets were only found on the lava in the late summer following rains.

Other ground-dwelling crickets found at ELMA including the Jerusalem crickets (*Stenopelmatus fuscus*, and an undescribed species) and scaly bush crickets (*Cycloptilum comprehendens* and *Hoplosphyrum boreal*) were represented by widespread species that occur throughout the southwest.

e. Grasshoppers (Orthoptera: Acrididae).

Many species of grasshoppers were found at ELMA, and most were associated with certain soils or other substrates, either directly living on the substrates or on plants associated with those substrates. The most widespread and conspicuous species was *Trimerotropis cyaneipennis*. This species lives on rock substrates and was found throughout the monument on lava and sandstone. *T. cyaneipennis* was replaced on the east side of ELMA by the closely related *T. fraturcula*, which occurred on the sandstone formations east of McCartys lava flow. Other wide-spread and common grasshopper species included *Trimerotropis pallidipennis*, *Xanthippus corallipes*, *Arphia conspersa*, and *Melanoplus aridus*. In general, the highest species diversity was found off of the lava flows where soil and vegetation were well developed. The highest grasshopper diversity was on grama grassland/loam soil areas such as OFSW, NOPA, and ZATH.

Several species that are typical of a Rocky Mountain fauna were found at higher elevations in the Bandera Crater area. These

species included *Circotettix rabula*, *Trimerotropis cincta*, *Melanoplus bruneri*, and *Dissoteira carolina*. Species more typical of a Great Plains or Chihuahuan Desert grasslands were found on the grama grassland areas in the southern and eastern portions of ELMA. Such species included *Cordillacris crenulata*, *Melanoplus gladstoni*, *Melanoplus packardii*, *Trachyrachis coronata*, *Trimerotropis latifasciata*, and *Phlibostroma quadrimaculata*.

One undescribed species of grasshopper was found at ELMA. This was a species of *Trimerotropis* that is related to *T. whitei*, which is known from south-central Utah (D. Weissman, pers. comm.). This new species was restricted to sand dune areas on the east side including SABL, NOPA, NPSS, MTKI, and LOME.

A rare grasshopper species, *Shotwellia isletea*, was also found at ELMA. This species was previously known only from two locations in the southern Rio Grande valley of New Mexico and a few sites in Mexico. *Shotwellia* is restricted to playa habitats and was found at NOPA and OFSW.

f. Darkling Beetles (Coleoptera: Tenebrionidae).

Darkling beetles were frequent and abundant ground-dwelling arthropods throughout ELMA. In general, tenebrionid beetles were more abundant off of lava flows, in areas where soil was well developed. The species *Eleodes extricatus* and *E. obscurus* were the most common and widespread, occurring throughout ELMA mostly off of lava, but occasionally on lava flows. Other species, such as *Eleodes nigrinus*, *E. hispilabris*, *E. dissimilis*, and *Neobaphion planipennis*, were largely restricted to higher elevation non-lava areas on the west side of ELMA. Other species, such as *Empahion contusum* and *Eleodes longicollis*, were mostly limited to the lower elevation non-lava areas on the east side of ELMA.

g. Ground Beetles (Coleoptera: Carabidae).

Ground beetles were the other common ground-dwelling beetle group at ELMA. One species, *Harpalus desertus*, was the most common ground beetle found throughout ELMA on both lava and non-lava areas. *Pasimachus atronitens* was also common throughout ELMA, but mostly on non-lava substrates. Several uncommon ground beetles were found in association with lava and lava tube caves at higher elevations on the west side of ELMA. These species included *Rhadine longipes*, *Rhadine umbra*, and *Scaphinotus snowi*.

h. Jumping Bristletails (Microcoryphia).

Jumping bristletails, or Microcoryphia, were common ground-dwelling arthropods throughout ELMA. Two species, *Mesomachils hearticus* (Machilidae) and *Machilinus aurantidcus* (Meinertillidae) were common on and off of lava substrates throughout ELMA.

i. Springtails (Collembola).

Springtails or tended to occur in specific habitats at ELMA. Several species including *Tomocerus vulgaris*, *Entomobryoides guthriei*, and *E. triangularis* were found in the entrances of ice caves and in lava tube collapse structures on the upper Bandera lava tube. Others, such as *Entomobrya decemfasciata*, were found in sandy areas on the east side. Others such, as *Dreparnura californica*, were found throughout ELMA in different habitats.

Seven new species of springtails were discovered at ELMA (R. Snider, pers. comm.). Those new species are reported below.

j. Millipedes (Diplopoda).

Millipedes were commonly found throughout ELMA. The two groups represented were Julida and Spirostreptida millipedes. The julid millipede *Apacheius guadalupensis* was the common small brown cylindrical millipede found in all habitats throughout ELMA. The large desert millipede, *Orthoporus ornatus*, was found only at the lower elevations on the east side and near the Zuni-Acoma trailhead. Desert millipedes were frequently observed on the paved highways 53 and 117 in the late summer after rains.

k. Centipedes (Chilopoda).

Centipedes were frequently encountered throughout ELMA. Stone centipedes (Lithobimorpha) and scolopendra centipedes (Scolopendromorpha) were the two groups found. Several species of stone centipedes were found, but no taxonomists are available to identify these species. Stone centipedes were found on and off of lava throughout ELMA. One species that has unusually long legs and is light in color and was found in lava tube caves at BSLC and ZATF, may be a troglobite. The common species of scolopendra centipede was *Scolopendra viridis*. This species was not common, and was found mostly in non-lava habitats.

l. Sunspiders (Solpugida).

One species of sunspider or windscorpion was found throughout ELMA. This species was *Eremobates zinni* and was found on lava and non lava substrates from the Bandera Crater area to the east side.

m. Scorpions (Scorpiones).

Two species of scorpions were found. One species, *Vaejovis* species near *paysonensis*, was common and widespread throughout ELMA on and off of lava substrates. This species may be undescribed and endemic to ELMA, but is very similar to the known species *paysonensis* (D. Sissom, pers. comm.). *Vaejovis* sp. nr. *paysonenis* was also found inside of lava tube caves. The other scorpion species found at ELMA was *Paruroctonus utahensis*. This

species is restricted to sand habitats and was only found on the east side at SABL and NPSS on sandy soil.

n. Other Invertebrates.

Many other species of insects were found at ELMA including less common ground-dwelling arthropods and common non-ground-dwelling arthropods. Although the primary goal of the inventory was to focus on ground-dwelling arthropods, common flying insects such as butterflies, wasps, bees, and flies were also collected. Insects that live on some of the dominant plant species were also collected, especially those from the various conifer trees and some of the common shrubs. Thus far, three new species of chloropid flies (Family Chloropidae) have been identified from our inventory (Appendix 21, and discussed below). As identification results become available, additional new species from ELMA may be reported.

D. Unusual or Rare Animal Species.

As noted above several rare animal species or unusual distribution records were found in this inventory. These species are summarized here.

a. Vertebrates.

1. Amphibians.

No rare or unusual species found.

2. Birds.

A Northern Goshawk was observed in Bonita Canyon in the Zuni Mountains near ELMA. These hawks probably occur at ELMA in the denser conifer forests on the northwest portion adjacent to the Zuni Mountains. Mountain plovers were observed on a playa at PRWE, and are discussed below. A green-backed heron was observed at a stock pond at North Pasture. Green-backed herons are typically not found in west-central New Mexico. Two great blue herons were seen, one at CAPO and one at Laguna Americana. Also seen at Laguna Americana were a small flock of white-faced ibis.

3. Mammals.

No rare or unusual species found.

4. Reptiles.

One large western diamondback rattlesnake was found in the northeast portion of the monument on NM 117, north of SABL.

b. Invertebrates.

15 new or probably new species of arthropods were found at ELMA during this inventory. At the time this report was written, those species are known to occur only at the locations where they were found at ELMA. Those new arthropod species are summarized in Table 5, along with a listing of specific sites where each species was found (refer to Appendix 6 for site information).

1. Ants.

No rare or unusual species found.

2. Spiders.

A new species of dictynid spider belonging to the genus *Cicurina* was found at numerous locations throughout ELMA. This new species of *Cicurina* is probably endemic to ELMA (D. Richman, pers. comm.). Several species of linyphiid spiders (e.g., *Lepthyphantes turbatrix*), that are probably Pleistocene relics, were found in lava tube ice caves.

3. Harvestmen.

An undescribed species of *Globipes,* representing a new distribution record into northwestern New Mexico, was found only at SABL.

4. Crickets.

A new species of camel cricket related to *Ceuthophilus arizonensis* was found at Marchantia Ice Cave. The status of this species is still uncertain, but it probably is new (T. Cohn, pers. comm.). This species is only known from this locality. Another new species of sand-treader camel cricket related to *Ammobaenetes phrixocnemoides* was found on sand at SABL and NPSS and is only known from those locations. The rare camel cricket, *Ceuthophilus polingi*, was found at SABL associated with sandstone cliffs. An undescribed species of field cricket in the genus *Gryllus* (Gryllus #3) was found only on McCartys lava flow on the east side of ELMA. The status of this species is still uncertain, but it probably is new (D. Weissman, pers. comm.). This species may be endemic to ELMA. An unidentified species of nemobiine cricket was also found only on McCartys lava flow in the North Pasture area.

Table 5. New species of arthropods discovered during this inventory and currently known only from ELMA.

GROUP/SPECIES	TAXONOMIC EXPERT	LOCATIONS WHERE FOUND
SPRINGTAILS		
Bourletilla sp. 1	R. Snider	NOMC
Bourletilla sp. 2	R. Snider	SABL
Isotoma sp.	R. Snider	OARD
Ptenothrix lightfooti	R. Snider	BSLC, HAFE, RASN
Seira malpaisensis	R. Snider	HAVE, OARD, RASN, MARC, CEBA, NOMC
Seira sp.	R. Snider	NOMC, OARD, RASN
Sminthurus sp.	R. Snider	RASN, NOMC, SABL, OARD
SPIDERS		
Cicurina sp.	D. Richman	MARC, NOMC, RASN, OARD, CEBA, HAFE
CRICKETS		
Ammobaenets sp.	T. Cohn	SABL, NPSS
Ceuthophilus sp.	T. Cohn	MARC
Gryllus sp. #3	D. Weissman	NOMC, NPMC, NPMS
GRASSHOPPERS		
Trimerotropis sp.	D. Weissman	SABL, LOME, NTKI, MTKI, STKI NOPA, NPSS
FLIES		
Holamluroides sp.	C. Sabrosky	MARC
Neodiplotoxa sp.	C. Sabrosky	MARC
Neoscinella sp.	C. Sabrosky	MARC

5. Grasshoppers.

A new species of *Trimerotropis* related to *T. whitei* was found on sand at NPSS, NOPA, SABL, MTKI, NTKI, STKI, and LOME. This species is known only from those localities. Records for the rare grasshopper *Shotwellia isletea* at NOPA and OFSW are new distribution records for this rare grasshopper, extending the known range into northwestern New Mexico.

6. Darkling Beetles.

One species, *Parisida lirata*, collected at OARD, is a new state record for New Mexico.

7. Ground Beetles.

Two uncommon species, *Rhadine longipes* and *Scaphinotus snowi snowi*, were found associated with lava tube caves on the upper Bandera and Hoya lava flows. *Rhadine longipes* is probably a troglophile.

8. Jumping Bristletails.

No rare or unusual species found.

9. Springtails.

Seven new species of springtails were found at ELMA, and all appear to be endemic to ELMA (R. Snider, pers. comm.). *Seira* (n.sp.) was found at higher elevations on and off of the upper Bandera lava flow. *Seira malpaisensis* (n.sp.) was found throughout ELMA on and off of lava. *Ptenothrix lightfooti* (n.sp.) was found only associated with ice caves at HAFE, RASN, and BSLC. *Bourletiella* (n.sp. 1) was found only on McCartys lava at NOMC and *Bourletiella* (n.sp. 2) was found in a sandstone area at SABL. *Isotoma* (n.sp.) was found off lava at OARD, and a new species of *Sminthurus* was found on and off of lava throughout ELMA.

10. Millipedes.

No rare or unusual species found.

11. Centipedes.

No rare or usual species known. One unidentified species of stone centipede that was found in lava tube caves may be a troglobite.

12. Sunspiders.

No rare or unusual species found.

13. Other Invertebrates.

One new species of bee, *Hylaeus* new species, which is known from elsewhere in the ELMA region, was found. Three new species of chloropid flies (*Homaluroides* sp., *Neodiplotoxa* sp., and *Neoscinella* sp.) have been identified from our samples (C. Sabrosky, pers. comm.). All three chloropid flies were found at Marchantia Ice Cave.

E. Federal and New Mexico State Listed Threatened or Endangered Animal Species.

Four federally listed candidate threatened or endangered (Category 2) animal species were observed in ELMA during the survey and one was observed near the monument. A loggerhead shrike was observed near El Calderon. Mountain plovers were found on a playa at PRWE. A small flock of white-faced ibis was seen at Laguna Americana. Southwestern cave myotis bats were found in Four Windows Cave, and five miles south of Los Cerros Ranch. We also observed a Northern goshawk in Bonita Canyon in the Zuni Mountains north of the El Calderon area.

Sightings of black-footed ferrets at the whitetail prairie dog town at the mouth of Cebollita Creek canyon, just south of the Little Narrows, along NM-117, have been reported to the NPS (Kent Carlton, pers. comm.). None of the sightings have been confirmed. Long-tailed weasels in the Southwest have black face markings similar to black-footed ferrets, and may be mistaken for ferrets. We did not observe any long-tail weasels, but they are known to occur in the ELMA region.

IV. Discussion and Conclusions.

1. Accomplishments of Inventory and Research Plan Goals.

The results of the vegetation and wildlife inventory provide information that accomplishes the original goals of the inventory as specified in the Research Plan (Appendix 1). We have provided information on the occurrences of plant and animal species at ELMA, and we have identified both typical and unusual habitats, and biotic communities. The information presented in this report should enhance the ability of NPS to evaluate issues related to management of plant and animal resources. Special consideration should be given to the status of newly recognized, rare, unique, or sensitive species and communities identified in this report.

Information presented in this report will also enable researchers to make decisions necessary to establish long-term monitoring studies at ELMA. We have identified communities and habitats and their constituent plant and animal species that occur across both narrow and broad environmental gradients that would be ideal for long-term monitoring studies.

2. Interpretations of Inventory Results.

A. ELMA and the Regional Biota.

Results from this inventory demonstrate that ELMA has a flora and fauna that is typical for the region. In general the taxonomic composition of species found at ELMA is similar to that of surrounding areas. However, ELMA does have environments that are distinctive for the region, and these environments support unusual assemblages of regional species and some species that are typically not found in the region.

Brown (1982) provides a general interpretation of biotic regions of the southwestern United States based on plant and animal distributions. ELMA is situated within the Great Basin biogeographic region as presented by Brown. Other biogeographic provinces that are closely situated to ELMA include the Petran (Rocky Mountain), Chihuahuan, and Arizonan (Mogollon). The flora and fauna of ELMA demonstrates affinities to all of these biotic provinces.

a. Flora.

The flora of the ELMA is derived from the regional Great Basin (Colorado Plateau), Petran (Rocky Mountain), Arizonan (Mogollon), and Chihuahuan biogeographic provinces (Brown 1982). The fora of ELMA is most characteristic of the eastern Great Basin or Colorado Plateau. Characteristic plant communities include pinon/juniper and ponderosa pine woodlands throughout ELMA. Rocky Mountain elements include the ponderosa pine, Douglas fir, and aspen associations with an understory of mountain muhly found at higher elevations at ELMA. Chihuahuan grassland elements

are evident in the grasslands on eolian soils at lower elevations. Characteristic species include blue and hairy grama grass, and wolf-tail grass. Arizonan elements include scattered associations of ponderosa pine and/or juniper and Gambel or shrub live oak.

b. Vegetation Communities.

Dick-Peddie (1993) developed a detailed classification of New Mexico vegetation, and we follow that classification to describe the major vegetation communities or types at ELMA. Three principal vegetation types occur at ELMA: 1) lower montane coniferous forest: ponderosa pine-pinon pine-Gambel oak series, 2) pinon-juniper woodland, and 3) juniper savanna (Dick-Peddie 1993). The lower montane coniferous forest and pinon-juniper woodland vegetation types occur throughout New Mexico at mid-elevations in mountainous areas. Juniper savanna also occurs throughout New Mexico at slightly lower elevations than the pinon-juniper woodlands. Dick-Peddie (1993) provides detailed discussions of the plant species associated with each of these vegetation types.

At ELMA, the lower montane coniferous forest: ponderosa pine-pinon pine-Gambel oak series occurs at higher elevations, generally above 2200 meters, on and off of lava flows. The composition and structure varies from relatively dense ponderosa pine forest to more open ponderosa pine and pinon pine woodlands. Ponderosa pine (*Pinus ponderosa*) was the dominant tree, but Colorado pinon (*Pinus edulis*), one-seed juniper (*Juniperus monosperma*) Rocky Mountain juniper (*Juniperus scopulorum*), and Gambel oak (*Quercus gambelii*) were often common. Understory vegetation consisted mostly of grasses, especially mountain muhly (*Muhlenbergia montana*), pine dropseed (*Blepharoneuron tricholepis*), Western wheatgreass (*Elymus smithii*), and blue grama (*Bouteloua gracilis*). Inventory sites that were located within this vegetation type included OARD, CAND, MARC-C, BLTT, and HOYA. More recent lava flows and aa lava fields tend to be barren and not representative of this vegetation type.

The pinon-juniper woodland vegetation type was found at elevations just below the coniferous forest, and on the tall sedimentary kipukas, outcrops, and cinder cones. At ELMA this vegetation type was dominated by Colorado pinon and one-seed juniper. The substrates included sandstones, limy sandstones and associated sandy soils derived from these rocks, and cinders. Other plants commonly present included ponderosa pine, oaks (*Quercus* spp.), and a variety of herbs, shrubs, and grasses. Inventory sites that were located in this vegetation type included HIDD, MEBL, CJPA, SABL, CEBA, and ZAKI.

The juniper savanna was found at ELMA primarily on the landscapes surrounding the newer lava flows. One-seed juniper was the dominant tree, along with occasional pinon pines. Blue grama (*Bouteloua gracilis*), bluestems (*Andropogon* spp., *Schizachyrium* spp.), muhlys (*Muhlenbergia* spp.), and a variety of other grasses

were the typical dominant grasses. The subshrubs rabbitbrush (*Chrysothamnus* spp.) and snakeweed (*Gutierrezia sarothrae*) were usually common. Substrates consisted mostly of the Old Basalts or alluvium near the edges of the flows. The best developed soils in the monument were found in these areas, and were either eolian or alluvial in origin. Collection sites occurring within this vegetation type included OLBA, PRWE, NOPA, ZATH, and OFSW.

The BLM (BLM 1990, Carroll 1992) created a landscape classification and map of Biophysical Land Units (BLUs) for ELMA and the surrounding BLM National Conservation Area. BLUs are homogeneous, ecological response units derived from satellite imagery, soil, topographic, surface water drainage, and vegetation cover data. The data is used in a geographical information system (GIS) to provide a tool for landscape classification for management purposes. BLUs are not intended to correspond directly to biological communities, yet they do reflect environmental factors that determine plant and animal distributions, and BLUs are partially based on vegetation cover.

We are referring to the BLU concept in this report because we believe that the existing BLU GIS may provide a useful tool for managing the biological resources at ELMA. Existing BLUs may be interpreted as representing vegetation types and animal habitats as discussed below. The existing GIS may then provide a means of determining the biological resources on any given land surface within ELMA.

BLUs correspond fairly well with Dick-Peddie's (1993) vegetation classification. At ELMA, BLUs D, G, H, and J correspond with lower montane coniferous forest. BLU C corresponds with pinon-juniper woodland, and BLU A corresponds with juniper savanna. The remaining BLUs represent barren lava, smaller scale topographic or edaphic features, or are not found within ELMA.

Attempts to define plant communities or associations in more detail than Dick-Peddie's (1993) vegetation types and series, become problematic due to local variation in environmental conditions and plant species composition. Plant communities or associations at ELMA appear to result largely from individual species responses to environmental factors. Elevation and variation in edaphic features appear to be the major environmental factors influencing the distribution and abundance of plants at ELMA. For example, ponderosa pine is common throughout ELMA, yet its relative abundance or dominance, and growth form vary considerably among different geomorphic surfaces and at different elevations.

The lava fields of ELMA provide unique environmental conditions that are not present in adjacent non-lava areas. The above vegetation classification is derived from such non-lava landscapes. Thus the vegetation of the lava fields does not conform well with these vegetation types. Dick-Peddie (1993) considered the vegetation of lava fields to represent special types of vegetation associations that vary locally and regionally with environmental conditions.

Lindsey (1951) described three lava field plant communities; 1) Douglas fir, 2) ponderosa pine, and 3) Apache plume, and two lava collapse structure plant communities; 1) ice caves and 2) lava sink-hole ponds, on the lava flows at ELMA. These five plant communities reflect different environmental conditions found on the lava flows of ELMA, and appear to provide a fairly good descriptive classifications of plant communities for these lava flows. The BLM (1990) considered the lava flows of ELMA to be represented by only two BLUs; F (barren lava), and G (vegetated lava). Lindsey's five lava flow plant communities provide a more detailed representation of the plant assemblages associated with the lava flows, and account for differences in species composition due to elevation and age of flow.

The relatively small elevation range (about 536 m or 1760 feet) and the predominance of one substrate (lava) within the monument proper, appears to limit the number of plant communities that are found there. The relatively low physiographic diversity at ELMA may attribute to the relatively small number of plant species that were found there (424). Other areas of similar size that contain a greater variety of substrates, greater elevation range (e.g., mountains), more topographic diversity (e.g., canyons), or where presence of water plays a more important part (e.g., riparian areas) usually have many communities and plant taxa compared to ELMA (Columbus 1988, Wagner 1977, Bowers & McLaughlin 1987). For example, Bowers & McLaughlin (1987) discerned nine community types and identified about 1000 plant taxa in the Rincon Mountains of Arizona, which cover about 200 square miles (518 km^2; somewhat larger than ELMA's 179 mi^2) and have an elevation range of about 5600 feet.

The lava flows do provide a number of habitats for plant species that would otherwise probably be absent from ELMA, and the elevation range provides habitats for more species than found at the Carrizozo malpais in central New Mexico. Shields and Crispin (1956) found only 175 species of plants on the lava flows and adjacent soils at the Carrizozo malpais. The low plant species richness at the Carrizozo malpais probably results from both lower physiographic diversity and lower elevations than found at ELMA.

c. Fauna.

The fauna of the ELMA region consists largely of species that are typical of Great Basin (Colorado Plateau), Petran (Rocky Mountain), Arizonan (Mogollon), and Chihuahuan biogeographic provinces (Brown 1982). Within ELMA, animal species tend to occupy similar habitats to those characteristic of the larger biogeographic regions where they occur. For example, species with affinities to the Chihuahuan Desert, like the lesser earless lizard, Chihuahuan whiptail lizard, greater roadrunner, Western diamondback rattlesnake, and desert millipede, were found in lower elevation, Chihuahuan-like habitats on the east side of

ELMA. Typical Rocky Mountain species such as Tassel-eared squirrels, Colorado chipmunks, elk, red crossbills, and Clarks nutcrackers, tended to occur mostly in Rocky Mountain-like habitats at higher elevations on the northwest side of ELMA. Great Basin or Colorado Plateau fauna such as pinon mice and pinon jays, were found throughout ELMA.

Many of the common animal species at ELMA have geographic distributions that include all or several of the above biogeographic provinces, such as mule deer, coyotes, deer mice, Western rattlesnakes, black bear, and many bird species. The concept of biogeographic affinities may have utility in relating the fauna of ELMA to the regional fauna, and in relating some species to certain habitats. However, many of the species occurring at ELMA are common throughout larger geographic regions of western North America, and utilize a broad range of habitat types.

Animal species that were found at ELMA, but are more typical or common to other regions, should be given special consideration. These species may represent populations on the edges of their geographic distributions, and may be more sensitive to local extinction than geographically wide-spread species. For example, within ELMA, habitats on the east side, such as sandy areas, that support lesser earless lizards, Western diamondback rattlesnakes, and greater roadrunners, should be considered more sensitive than habitats such as ponderosa pine woodland that does not support any species that appear to be on the edge of their geographic distributions.

d. Animal Habitats and Communities.

Animal communities or assemblages at ELMA appear to result from individual animal species preferences for habitats determined by edaphic features, vegetation, and elevation. Major differences in animal habitats and thus animal assemblages or communities result from the variety of geologic formations and edaphic features, and the vegetation types or communities present at ELMA. Animal distribution among the various habitat types listed below tends to vary in two ways: 1) among ground-dwelling or edphically specialized animals, and 2) among animals specializing on certain plant species or vegetation structure.

The distributions and habitat use of ground-dwelling animals varies as a function of substrate. Species that prefer loose soils, or sand, are found in areas of loose soil and sand, even though vegetation in those habitats may vary. For example, the scorpion *Paruroctonus utahensis* was found in sandy areas on the east side of ELMA, but the habitats included ponderosa pine or blue grama vegetation overstory. Rock wrens and canyon wrens preferred open rocky habitats, such as the rocky slopes of Cerro Bandera with scattered Douglas fir and aspen, or the rocky surfaces of the McCartys lava flow with scattered apache plume and cactus, or the rocky sandstone bluffs. In contrast, animal species that are more dependent on vegetation characteristics,

are found in habitats where those vegetation characteristics occur, regardless of edaphic features. For example, red crossbills were found associated with pine trees whether on the cinder soils of Oak Ridge, or the open lava of the upper Bandera lava flow. Other species such as coyotes, mule deer, and common ravens, are generalists, and were found commonly throughout a variety of habitat types.

Major geological features and vegetation types probably best describe the major animal habitats. Animal communities may be defined as the assemblages that tend to be associated with those habitats. Species that are specialized to those habitats are the best indicators of those communities. The major animal habitats of ELMA appear to correspond reasonably well with the BLM BLU's (BLM 1990) discussed above. The major exception is associated with elevation change within a BLU. For example BLU's F and G representing lava habitats, do not discriminate between higher elevation Bandera lava flow habitats, and lower elevation McCartys lava flow habitats, which have different micro-environments, and support different animal species.

Large-scale Habitats.

Seven major large-scale (i.e., encompassing large geographic areas) animal habitats, may be defined as follows base on our observations and records.

1. Ponderosa pine/Douglas fir forest (mostly above 2,300 m elevation, but lower on north slopes and moist/cool areas).

This habitat is mixed conifer forest composed of large trees with dense canopy foliage, and poorly developed understory vegetation. This habitat does not correspond well with any BLU's, and are within the lower montane conifer forest vegetation type. These forests occur mostly in the Twin Craters-Lost Woman area, and in the adjacent Zuni Mountains.

Animal species that utilize this habitat include species associated with dense coniferous forests such as tassel-eared squirrels, deer mice, black bear, elk, red crossbills, and Northern goshawk.

2. Mid-low elevation ponderosa pine woodland (mostly below 2,300 m elevation, but higher on south slopes).

This habitat is open ponderosa pine parkland, and has a well developed grass understory. These areas correspond to BLU's G, H, and J, and is also within the lower montane conifer forest vegetation type. This habitat occurs on and off of lava flows, and on cinder cones.

Animal species that utilize this habitat include species typical of open pine parklands such as Colorado chipmunks, Western wood peewees, common flickers, and sharp-shinned hawks.

3. Pinon/Juniper woodlands.

This habitat is dense to open pinon/juniper woodland, and is found at all elevations at ELMA. The understory vegetation is well developed and consists largely of blue grama grassland, snakeweed, and rabbitbrush. This habitat corresponds well with BLU C, and the pinon-juniper vegetation type. This habitat is found primarily off of the lava flows, but also occurs on lava flows, as well as sandstone slopes, and cinder cones.

Animal species that utilized this habitat include species typical of pinon/juniper woodlands such as pinon jays, Townsend's solitaires, mountain bluebirds, pinon mice, desert cottontails, and eastern fence lizards.

4. Juniper savanna.

This habitat is represented by open blue grama grassland, with widely scattered pinon or juniper trees, and snakeweed and rabbitbrush are common. Dominant grasses include blue grama, wolf-tail, and three-awns. This habitat corresponds to BLU A, and the juniper savanna vegetation type. This habitat is found almost entirely off lava flows on fine loam or silty soils.

Animal species that utilize this habitat include typical grassland species such as vesper sparrows, pronghorn antelope, whitetail prairie dogs, silky pocket mice, American kestrels, and Northern harriers.

5. Sand dunes and sandy areas.

This habitat consists of old stabilized sand dunes, and other eolian sand deposits on the east side of ELMA. This habitat is represented by BLU B, and such areas are located within the pinon-juniper woodland and juniper savanna vegetation types. Sand habitats are best developed between the McCartys lava flow and the bases of sandstone bluffs from SABL to NOPA. Fairly extensive sand and dune habitats are found at the north end of SABL, and the west side of NOPA.

A number of sand and loose-soil specialized animals live these sand habitats including lesser earless lizards, Ord's kangaroo rats, and a number of sand specialized arthropods including burrowing wolf spiders, the new species of sand treader camel cricket and grasshopper, and the scorpion *Pauruoctonus utahensis*.

6. Lava flows.

This habitat consists of open lava flows where there the surfaces is composed mostly of bare lava with very little soil development. This habitat is represented by BLU F. Bandera, Hoya, Twin Craters, and McCartys lava flows are the principal geological features defining this habitat. The lava flow habitat

varies across an elevation gradient. At higher elevations in the Bandera Crater region, lichen cover is much higher on the lava than at lower elevations on the McCartys flow. Temperature and moisture conditions appear to vary across this gradient from cooler and higher moisture conditions on the upper elevation flows, to warmer and drier conditions on the lower elevation flows.

Animals that occur in this habitat include species that prefer open rocky habitats such as tree lizards, Eastern fence lizards, rock wrens, canyon wrens, and rock mice.

7. Cinder cones and sandstone and limestone ridges.

This habitat consists of rocky slopes, and often rock cliffs and bluffs, with or without vegetation. No BLUs correspond specifically to this habitat type. Steep sided cinder cones are common in the western portion of ELMA, and sandstone and limestone escarpments are found on the north central (Cerro de Jaspe, Oak Ridge) area, and all along the east side (sandstone bluffs).

A number of animal species, especially birds, prefer these steep rocky areas and peak tops, including red-tailed hawks, white-throated swifts, and common ravens.

Small-scale Habitats.

Four geographically small-scale or restricted habitats were found within the above major large-scale habitats. No BLUs vegetation types correspond specifically to these small-scale habitats. These habitats include:

i. Lava tube caves: ice caves, dry caves, cave openings, and lava tube collapse structures.

Lava tube caves and associated collapse structures and cave mouth environments, provide unique and important habitats for many animal species. The dark, cool, moist environments associated with the lava tubes are very different from the surrounding open lava flow habitats.

Animals that were found associated with lava tube cave and collapse habitats included several species of bats, bighorn sheep (remains), cordilleran flycatchers, and a number of arthropods found only in the caves and collapse structures, included a new species of camel cricket and several new species of collembola. Great horned owl nests were common on collapse structure rock overhangs.

ii. Lava flow edges.

The ecotone along the edges of lava flows appear to provide an environment where water availability is greater. The presence of Douglas fir and aspen and high densities and sizes of other

trees and shrubs along upper elevation lava flow edges, indicates an unusual environment.

Animals that utilize this habitat include those that benefit from increased plant production and ecotone conditions for foraging. We found that some rodents such as deer mice and white-footed mice were common on lava flows in the ecotone areas, but not in the open lava flow habitats. The lava edge habitats may in turn provide good hunting areas for predators such as owls.

iii. Ephemeral ponds.

Several small ephemeral lakes or playas are present in the southern portion of ELMA. These playas provide important habitat to many species when water is present, and to others when dry. These playas are situated primarily within grassland habitats.

Animal species that utilize the playa habitats include spadefoot toads, heron, killdeer, ducks, freshwater shrimp, and aquatic insects. These playa ponds are undoubtedly important sources of drinking water for many animals.

iv. Ephemeral tinajas.

Small temporary pools of water in sandstone depressions provide important habitats for some aquatic invertebrates and breeding pools for amphibians. Tinajas are common in the sandstone bluffs on the east side, at Hidden Kipuka, and at Cerro de Jaspe and Oak Ridge.

Animal species that utilize temporary tinaja pools include canyon treefrogs, shrimp, various aquatic insects. As with playa ponds, tinajas are probably important sources of drinking water for many animals.

v. Human disturbances: roadsides, trails, structures.

Environments that are disturbed by humans are generally occupied by colonizer or pioneer species. At ELMA such disturbed areas include roadsides, trails or footpaths, areas around buildings or structures, and areas around stock tanks. The vegetation of these areas is often very different from the surrounding undisturbed habitats, and thus the habitat structure and food resources are different for animals.

Animals use such disturbed habitats primarily for foraging. Such animals include scavengers and predators that feed on road-kills or garbage, and granivores and herbivores that feed on the abundance of foliage and seeds produced by weedy plant species. Scavengers and predators include common ravens, turkey vultures, coyotes, grey fox. Herbivores and granivores include rock squirrels, jackrabbits, cottontail rabbits, rodents, grasshoppers, crickets, vesper sparrows, lesser goldfinches, and mule deer.

B. Unusual Environments and Biotic Communities.

The most outstanding biological features at ELMA were the presence of new, rare and unusual species, and the presence of distinctive environments associated with the lava fields that supported unusual plant and animal assemblages or communities. Additionally, environmental conditions on lava fields produce unusual growth patterns and longevity of certain plants. Unusual volcanic environments of ELMA and their associated plant and animal species are discussed below, followed by a discussion of new, rare, and unusual species.

a. Lava Fields.

i. Plants.

The lava flows at ELMA supported vegetation that was different from non-lava areas. The species composition, and growth forms of plants were different on lava substrates. The major features of vegetation on the ELMA lava flows in comparison to adjacent non-lava surfaces were 1) lower canopy cover and species richness, 2) stunted or dwarfed plants, 3) species occurring at lower elevations, and 4) different vegetation composition and structure on different aged flows.

These findings are consistent with other studies of vegetation on lava fields (Drake & Muller-Dombois 1993, Hoare 1983, Marchese et al. 1989, Eggler 1941). Lindsey (1951) conducted a detailed study of the vegetation of ELMA and reported similar vegetation patterns to the four above. Lindsey concluded that the low species richness and cover, and stunted individual plants were the result of a harsh environment on the lava fields. A lack of soil, and relatively harsh moisture and temperature conditions produce an environment that is difficult for plants to become established in. Once plants do become established on the lava, stunted growth patterns result from the extreme environmental conditions. Sheilds and Crispin (1956) found similar vegetation patterns on the Carrizozo malpais in central New Mexico, and attributed the sparse vegetation to severe environmental conditions, as have researchers working in lava fields throughout the world (Drake & Muller-Dombois 1993, Bjarnason 1991, Eggler 1941).

The occurrence of plant species on the lava fields at lower elevations than they normally occur appears to be contradictory to the above findings, since those species occur at higher elevations were temperatures are lower, and moisture is higher. We found many plant species such a Douglas fir, aspen, ponderosa pine, Rocky Mountain juniper, and gooseberry to occur at lower elevations on the ELMA lava fields than they normally occur. Lindsey (1951) also noted this at ELMA, as did Sheilds and Crispin (1956) at Carrizozo, and Eggler (1941) at Craters of the Moon in Idaho. Dick-Peddie (1993) noted that most of the plant species that Lindsey (1951) and Sheilds and Crispin (1956) found

only on the lava flows, were typically riparian species. All of the above authors attributed these unusual vegetation patterns to the water retaining characteristics of the lava.

The lava flows are extensively fractured by cracks that range from narrow to wide. These cracks in the basalt allow rain water to infiltrate into the lava flow, and the shaded surfaces within the cracks then retain the moisture, forming cool, moist, micro-environments (Lindsey 1951, Sheilds & Crispin 1956). Thus, the bare lava surfaces may be hot and dry, but the cracks below tend to be cool and moist. As plant seeds are deposited onto the lava flows, some fall into the cracks, and become established in the cool and moist micro-environments. The water retaining action of the cracks in the lava appears to account for the occurrences of riparian plants, and species occurrences at lower elevations on the lava than on non-lava substrates. The extensive dry surfaces of the basalt apparently account for the over-all lower vegetation cover on the lava flows than on adjacent non-lava substrates.

The vegetation cover on the lava flows at ELMA differed considerably between aa and pahoehoe lava types, even in the same area on the same lava flow. For example, on the Bandera flow, pahoehoe lava supported much more vegetation than adjacent aa fields. We attribute this difference in vegetation to physical differences in the lava surfaces. Pahoehoe lava tends to have an extensive surface crust, with many cracks. Those cracks apparently provide micro-environments favorable to plants. In contrast, aa lava consists of jumbles of rocks, with no or few moisture retaining cracks. Water probably percolates through the aa lava to depths where the moisture is not available to plants, resulting in a relatively dry, unvegetated surface.

As lava flows age, soil forms on the lava surfaces, primarily from wind deposition of eolian soil and plant litter (Sheilds & Crispin 1956, Drake & Muller-Dombois 1993). Over very long time periods, weathering of the basalt may also contribute to soil development. As a result of the above processes, soil development and vegetation development on lava flows is generally a function of the age of the flow. Older lava flows tend to have better developed soil and vegetation than more recent lava flows. We attribute the differences in vegetation among the different lava flows at ELMA to the ages of the flows and soil development. Sequences of vegetation on lava flows of different ages have been well documented from volcanic areas around the world (Drake & Muller-Dombois 1993).

Some parts of the Old Basalt flows in the ELMA area may be over one million years old. These lava flows support well developed soils and vegetation. The Bandera and the Twin Craters flows are 10,000 to 20,000 years old and support little soil, and sparse vegetation. The McCartys flow is only 3,000 years old, and is the most barren of all the lava flows at ELMA.

The edges or boundaries of lava flows are often remarkable in having denser cover of some plants, especially aspen and Douglas fir. The occurrence of aspen and other plants in higher

densities at the edges of the lava flows may be caused by runoff from the surrounding non-lava soil surfaces and/or the lava itself. The situation may be analogous to greater plant growth at the edge of paved roads. The presence of aspen and increased densities of other plants at edges of the lava flows was an unusual and distinctive ecological feature at ELMA.

Some individuals or groups of trees (usually Ponderosa pine, Douglas fir, and Colorado pinon, occasionally others) exhibited remarkable phenotypic variation in certain areas of the lava flows. Lindsey (1951) first reported such characteristics as transverse grain in pines and Douglas fir and tiny trees that are nevertheless reproductive. Miniature and/or very deformed individuals may be found in micro-habitats such as narrow cracks while more-or-less normal-sized trees grow nearby. Trees with sprawling, twisted trunks were relatively common in certain areas. Transverse grain was sometimes seen in dead trees on the upper Bandera flow. Dwarfed trees, that is, ones with normal patterns of development and overall shape but whose woody parts are relatively smaller or shorter, were common throughout ELMA. Some of these dwarfed trees have been dated and some are quite old (Grissino-Mayer, pers. comm. 1993). Such individuals were found on many of the pahoehoe sections of most flows, although more deformed trees appeared to be located on parts of the Bandera and McCartys flows. In some areas of the McCartys lava flow, "forests" of miniature trees were present; these are sometimes called "pygmy forests" or "bonsai forests." These phenomena are probably related to difficult growing conditions and lack of nutrients.

One of the most outstanding features of vegetation on the lava flows of ELMA are the very old conifer trees, especially Douglas fir, found on the upper Bandera lava flow. The oldest known inland Douglas Fir is located on the Bandera flow northwest of Rendija and has a pith date of 1062 A.D. (Swetnam and Brown 1992). Since then, a living tree that germinated in about 950 A.D. has been found in the same area (Henri Grissino-Mayer, pers. comm. 1993). Fire scar records from trees throughout ELMA indicate a pre-1880s fire frequency of every few years (Henri Grissino-Mayer, DLB pers. comm. 1993). Apparently low productivity on the lava and frequent cool fires (and recently, inaccessibility to loggers) have allowed the old trees to survive. Because of fire suppression and presumed buildup of fuels, a very destructive fire is possible in the area of the old trees.

Lichens were one of the most prevalent life forms on ELMA lava flows. A number of species were common on lava, including *Xanthoparmelia lineola*, other species of *Xanthoparmelia*, and species of *Lecidea*, *Lecanora*, and *Aspicilia*. The cover of lichen on the rock surfaces was often greater than 50%. The association of lichens to lava is a distinctive feature of ELMA. Patterns of lichen distribution and abundance on the lava at ELMA appears to reflect the age and elevation of the various lava flows. Older or higher elevation lava flows such as Bandera, Twin Craters, and

Lava Crater support greater lichen floras than more recent, lower elevation lava fields such as McCartys flow. These different lichen communities probably result from different environmental conditions, and different stages of ecological succession.

The abundance of saxicolous lichens growing on lava at ELMA is typical for lava habitats studied elsewhere. Lichens have been documented as being the most abundant plants on lava flows in Hawaii (Jackson 1971, Hoare 1983), Iceland (Bjarnason 1991, Fridriksson 1987), Italy (Marchese et al. 1989), and at Craters of the Moon in Idaho (Eggler 1941). Generally lichens are considered to be the early or pioneer plant species that occupy lava substrates during primary succession (Jackson 1971, Drake & Mueller-Dombois 1993). Most of the above cited studies reported chronosequences of different lichen species colonizing lava flows of different ages. Most of the differences in lichen species compositions and cover that were related to lava flow were among lava flows less than 1000 years old.

All of the lava flows at ELMA are at least 3000 years old, and much of the variation in lichen cover and species distribution appears to be related to microclimate differences. The same common lichens species appeared to occur at about the same relative abundances on all lava flows at ELMA. The low cover of lichens on portions of the McCartys lava flow may result from the lower elevation, warmer and drier climate on the east side of ELMA, and/or because the McCartys flow is considerably younger than the other lava flows.

Among the saxicolous lichens, many species such as *Xanthoparmelia linolea, Lecanora novomexicana, Lecidea tesselata, Acarospora fuscata, Dimelaena oreina*, and *Caloplaca modesta* were found both on the presumably more acidic lava and on more basic sandstones and limestones. Some species tended to be more abundant on one rock type than the other. Other species such as *Aspicilia quartizitica, A. caesiocinerea, Pannaria tavaresii, Phaeophyscia hispidula, Rhizocarpon geographicum, Lecanora agrophilus*, and *Leptogium gelatinosum* were found exclusively on lava, and others such as *Verricaria calciseda, Acarospora smaragdula, Caloplaca lamprochelia*, and *Rinodina castanomela* were found exclusively on sandstone and limestone.

DeBruin (1988) found similar results in a study of lichens and other vegetation on lava and sandstone substrates on the east side of ELMA. DeBruin found 74 species of lichens, and about 50% of the saxicolous species were on both lava and sandstone, with many more species only on sandstone. Over the entire monument, we found 150 species of lichens, and most of the saxicolous species that occurred on sandstone were also on lava, but some were rare on lava. Overall, we found more species on lava than on sandstone. For the most part, the species composition of lichens on the lava flows was not greatly different from the species composition of lichens growing on sandstone. More pronounced were differences in the species composition of lichens growing in different micro-habitats on the lava and on the sandstone. Most

lichen species tended to occupy similar micro-environments on both types of rocks.

Assemblages of micro-invertebrates such as mites, springtails, and nematodes, are undoubtedly associated with the lichens growing on lava. Examination of such micro-invertebrate communities was beyond the scope of this inventory, but there is potential for new, rare, or unique species associated with the lichens on lava surfaces, given the nature of the environment.

ii. Animals.

Animals that we found associated with open lava field habitats were geographically widespread species that prefer rock habitats. Rock wrens, tree lizards, Eastern fence lizards, rock mice, and rock squirrels were the most common vertebrate animals of open lava habitats. Other studies have shown that animals of open lava fields tend to occur in rocky habitats elsewhere, but may express different adaptations for living on lava (Wecker & Best 1985, Best & James 1984), although some vertebrates are specialized to live specifically on lava (Schluter 1984).

Invertebrates, especially arthropods, that live in open lava fields feed largely upon wind blow detritus that is deposited on the lava surface (New & Thornton 1988, Howarth 1979, Ashmole & Ashmole 1987). As lava flows age and plant succession occurs, animal species composition also changes, apparently as the habitat and food resources change (Ashmole et al. 1992). Ashmole et al. (1992) found a distinctive chronological sequence or succession of arthropod species on lava fields of different ages in the Canary Islands.

The arthropod species that we found living on the open lava fields at ELMA were represented by the same species at different sites, even on different lava flows. Many of the same species were also found on non-lava areas. Two species of crickets (*Gryllus* #3, and an unidentified nemobiine) were found only on open lava, and both species were found on the younger McCartys lava flow on the east side of ELMA. Although there may be a distinctive and specialized micro-arthropod assemblage associated with open lava habitats, there appears to be little specialization in macro-arthropods and vertebrates that utilize open lava habitats of ELMA. In a study of the insects of Craters of the Moon National Monument, Horning and Barr (1970) did not report any insects that were specialized to lava field habitats.

One of the most distinctive features of animals living on lava is a change in body color to blend in with the dark lava surface. This change to a darker color has been called melanism, and is known to occur in mammals (Dice 1929, Benson 1932, Blossom 1933, Hooper 1941, and Weckerly & Best 1985) and reptiles (Lewis 1949, 1950, 1951, Best & James 1984) in south-central New Mexico. However, not all species of animals encountered in the above cited studies exhibited melanism. Melanism is a genetically determined condition, or an adaptation to the dark lava surfaces.

Hooper (1941) conducted a survey of the mammals of the ELMA lava fields for examples of melanism, and did not find any clear examples of melanism at ELMA. He reported that some individuals of rock mice, white-throated woodrats, and Mexican woodrats were darker than usual. However he found dark animals on and off of the lava flows, and no melanistic populations of animals restricted to the lava flows.

Our observations support Hooper's findings. We did not observe any obvious examples of melanism in mammals at ELMA. Some rock mice (*Peromyscus difficilis*) caught on lava did tend to be slightly darker than rock mice caught on sandstone or limestone, but the distinctions were not clear, and our sample sizes were small. Several melanistic subspecies of the rock pocket mouse (*Chaetodipus intermedius*) are known from different lava fields in southern New Mexico and Arizona (Weckerly & Best 1985). Other mammals that we observed on lava at ELMA, such as cliff chipmunks, rock squirrels, woodrats, and other species of *Peromyscus*, did not appear to be darker than individuals from non-lava areas.

Tree lizards (*Urosaurus ornatus*) were found only on lava (despite the common name, tree lizards typically occur on rocks), and were dark in color. We did not find tree lizards off of lava, so we did not have non-lava individuals for comparison. However, the tree lizards at ELMA were darker than tree lizards that occur in non-volcanic areas elsewhere in New Mexico (personal observation, DCL). Tree lizards are able to change body color to thermoregulate or as a behavioral response, which may account for the dark color of tree lizards at ELMA. Since the tree lizards were consistently dark, we assume that the tree lizards of ELMA are melanistic. Lewis (1951) found melanistic tree lizards on lava flows in southern New Mexico.

We found one short-horned lizard (*Phrynosoma douglassi*) on lava that was much darker than horned lizards that we observed off of the lava flows at ELMA. Horned lizards typically match the colors of backgrounds that they live on, and this individual may have been an example of melanism. Eastern fence lizards were the most common lizard species on and off of lava substrates. We did not observe any obvious melanism in Eastern fence lizards on the lava flows. These lizards were lighter in color than tree lizards at the same locations on the Bandera lava flow.

Other species of lizards that are known to be melanistic in New Mexico include side-blotched lizards, desert spiny lizards, and collared lizards (Lewis 1951). Lizards that have been found on lava that are not melanistic include leopard lizards and desert whiptail lizards. Western diamondback rattlesnakes and black-tailed rattlesnakes are commonly melanistic on lava, but western rattlesnakes are not (Best & James 1984). We found several western rattlesnakes near lava and on lava at ELMA, and all were characteristically light colored, showing no evidence of melanism. We found only one western diamondback off of lava that was not melanistic.

Two species of ground-dwelling grasshoppers at ELMA were melanistic on lava. *Trimerotropis cyaneipennis* and *Phrynotettix tshivavensis* both typically occur on rocky substrates. At ELMA both species were found on lava and on sandstone substrates. Individuals from lava flows were much darker than those living on sandstone. Background color matching is common in ground-dwelling grasshoppers and maybe either genetically or environmentally induced (Uvarov 1977).

Hooper (1941) concluded that the lack of melanism in mammals at ELMA was probably because the lava habitats are less isolated from other rocky habitats (e.g., sandstone) than the lava fields in south-central New Mexico. He suggested that the lack of habitat isolation may allow enough gene-flow between lava and non-lava populations to prevent the evolution of lava-colored populations. The lava fields in south-central New Mexico are isolated from adjacent rocky habitats, and do harbor isolated populations of melanistic rock-inhabiting mammals.

Another possible reason for low frequency of melanism among animals at ELMA relative to animals from other lava fields in New Mexico, may be that the lava surfaces at ELMA have enough light-colored lichen cover to mask much of the darker color of the lava. The situation between lichens on lava at ELMA and melanism in animals, may be analogous to the reverse of industrial melanism as demonstrated in the peppered moth (Kettlewell 1961). Kettlewell (1961) found that when lichens were killed by pollution, the frequency of a dark or melanistic form of the moth became dominant over the previously light colored form that was cryptic on lichens. The lack of light-colored lichens on the trees favored dark morphs of the moths, which were better camouflaged from bird predators.

The Carrizozo or Tularosa and other lava fields in south-central New Mexico that do have melanistic forms of rodents and reptiles are relatively young at about 1000 years old (Shields & Crispin 1956), and perhaps because they occur at lower elevations than the El Malpais flows, support very little lichen (personal observation, DCL). These lava flows tend to be black in color. Large portions of the McCartys lava flow at ELMA are also black and barren, however we did not find any obvious examples of melanism in animals living there, perhaps for the reason suggested by Hooper (1941).

b. Lava Tubes and Caves.

Lava tube caves and ice caves of ELMA provided the most unique and usual environments for plants and animals that we encountered. Lava tube caves are known for unusual and endemic biota world-wide, including many species of troglobites (Howarth 1983). Lindsey (1951) provided a detailed discussion of the unusual flora associated with ELMA lava tubes and ice caves. As Lindsey noted, the environmental conditions of ELMA lava tube ice caves produce micro-environments found nowhere else in the region.

With the exception of the McCartys flow, lava tubes are known in all the ELMA lava flows. The Bandera tube system is the longest and includes most of the ice caves known at ELMA. Other major lava tube systems include Lava Crater (Marchantia), El Calderon (Bat Cave, etc.), Hoya (Braided Cave), Twin Craters, and Rendija. The environmental conditions vary among these different lava tubes and associated caves, and this variation seems to account for the different assemblages of plant and animal species associated with various caves or collapse structures.

We encountered four main types of lava tube cave environments that varied in temperature and moisture conditions across a gradients from cold to warm, and from wet to dry. These included: 1) wet, cold caves, 2) wet, warm caves, 3) dry, cold caves, and 4) dry, warm caves. The types of plants an animals that occurred in a given cave or cave entrance seemed to depend largely on the temperature and moisture conditions. The usual plant and animal assemblages that we found associated with ELMA lava tubes are discussed below in relation to the cave environments.

i. Plants.

The lava tube collapse structures and cave entrances provided cooler and moister environments for plants than the surrounding lava fields. Deep collapses and caves are invariably cooler by many degrees than the surroundings, regardless of the presence or absence of ice in the collapse. Even the shady bottoms of shallower dry or iceless structures are usually cooler than ambient temperatures of the open lava fields. In caves with large masses of ice, such as Zuni and Marchantia ice caves, the temperature approaches freezing near the ice. These situations create a strong temperature gradient of sometimes as much as 60 degrees F between the surface of a flow and an ice-bottomed collapse during the hottest weather (personal observation, DBL). Strong moisture/humidity and light gradients are usually present also.

The cold, moist environments near entrances to ice caves, such as Marchantia, created conditions favorable for many plant species. This was evident in the greater abundance of trees, shrubs, and herbs, and the larger sizes of some plants at such locations. Some plant taxa were found rarely or nowhere else at ELMA away from ice cave collapse structures. The only location where we found *Ribes inerme* was just outside of the entrance of Marchantia Ice Cave. Other species, such as *Marchantia polymorpha* and *Asplenium trichomanes*, were found almost exclusively near the entrances to ice caves or in collapse structures.

The distinct zonation of cryptogams in ice cave entrances, including *Caloplaca citrina, Xanthoria elegans, Xanthparmelia wyomingica*, and several species of mosses, demonstrated species responses to the steep temperature, moisture, and light gradients in the ice cave entrances. These cryptogam assemblages, first reported by Lindsey (1951), were the most interesting and unusual

plant features associated with lava tubes at ELMA, and such assemblages do not occur anywhere else in the region. Although the constituent species of these communities are geographically widespread and even occurred sparingly in other cool moist environments at ELMA, nowhere else were the communities of these species as well developed as in ice cave entrances. These ice cave/cryptogam communities are one of the most unusual and important biological features of ELMA.

Lindsey (1945, 1951) noted that the alga *Chlorella vulgaris*, which grows in cold ponds in ice cave entrances and collapse structures, is another unique feature of ELMA. The impressive blooms of this algae on the water surfaces at certain times of the year is a biologically important feature at ELMA.

ii. animals.

Bats were the most obvious animals associated with caves at ELMA. The large colony of Mexican freetail bats at Bat Cave is the best example. Eight other bat species were also found at ELMA, including the Southwestern cave myotis bat (*Myotis velifer*) which is a candidate for listing as a federal threatened or endangered species (US Fish & Wildlife Service 1989b, 1991b). The lava tube caves of ELMA do provide important habitat for many species of bats. We observed bats in a number of lava tube caves, and found that most bats were in the drier and warmer caves. We found no bats in any ice caves. The many skeletons of cave myotis bats (*Myotis velifer*), other *Myotis* species, and big brown bats (*Eptesicus fuscus*) found in Four Windows Cave, indicates that many bats utilized that cave at some time in the past. Four Windows Cave was wet and cold in the mid-section where the bat skeletons were found, and perhaps the environment of the cave has changed over time. Cave myotis bats may still inhabit Four Windows cave, since that species will live in wet, cold caves. The lava tube caves at ELMA provide significant, critical habitats for many species of bats in the region.

Colonies of bats in caves also create habitats for many invertebrate species. Guano accumulations are rich in nutrients, and are usually occupied by many species of micro-arthropods, including mites, pseudoscorpions, diplurans, and collembola. Examination of micro-arthropods was beyond the scope of this inventory project, but is currently being carried out by another research team. Findings from that project are likely to result in the discovery of additional rare or new species.

The historic use of lava tube caves by bighorn sheep is another ecologically unusual feature of ELMA. Remains of bighorn sheep have been found inside of many of the lava tube caves at ELMA, particularly in the Big Tubes area of the Bandera lava tube. Bighorn sheep typically prefer steep, open, rocky slopes in mountainous terrain. The habitats around the lava tube collapses and caves where bighorn remains have been found, are generally flat, and moderately forested with ponderosa pine, pinon, and juniper woodland. Why the bighorn sheep used these habitats is a

mystery. The steep rock cliffs around collapse structures, and the open lava may provide favorable foraging habitats, and the caves shelter. Permanent ponds in the entrances of ice caves could provide reliable water sources. The collapse structures and caves were used by bighorn sheep as recently as fifty years ago (Carlton 1993), demonstrating that the larger lava tube caves and collapses are currently potentially important habitat for bighorn sheep.

The use of lava tube collapse structures and caves by cordilleran flycatchers was one of the most distinctive associations between birds and lava tubes. Cordilleran flycatchers used rock overhangs in cave entrances for nesting sites. Most of the lava tube cave entrances on the upper Bandera lava tube, and along the Lava Crater lava tube, were utilized by nesting pairs of cordilleran flycatchers. Cordilleran flycatchers were the one of the most frequently observed bird at ELMA, and we attribute this to the high frequency of nesting pairs encountered at the entrances of lava tube caves. This association between cordilleran flycatchers and lava tubes is one of the biologically unique features of ELMA. Cordilleran flycatchers are generally uncommon in any given area, and utilize steep rocky cliffs, such as those of canyons, for breeding habitat.

No confirmed troglobitic invertebrates were found in this inventory, although one species of centipede, and a ground beetle found in lava tube caves and collapses may be troglobites. Until more individuals have been found, and more is known about the life histories of these arthropods we will not consider them to be true troglobites. The species of camel crickets, (*Ceuthophilus*), harvestmen (Opiliones), and spiders (pholcids and some linyphiids) that we found in lava tube caves, were all troglohiles, that were also found outside of caves, even in non-lava areas. More intensive studies of lava tube cave invertebrates may reveal troglobitic invertebrates.

Peck (1982) conducted a survey of the ELMA lava tubes for cave specialized invertebrates, and found no troglobites, nor any other distinctive species. He concluded that the most likely reason for a lack of troglobites was a lack of a suitable ancestral soil-litter fauna in the region. Peck stated that the Zuni Mountains and surrounding areas supported a impoverished fauna of ground-dwelling and subterranean arthropods from which lava tube troglibites at ELMA might evolve. Our findings of many species of ground-dwelling arthropods, including camel crickets, harvestmen, and spiders, does not support Peck's hypothesis.

The cool moist communities in the entrances of ice caves supported unique species of arthropods. Linyphiid spiders such as *Lepthyphantes turbatrix* were found only associated with the ice cave moss communities. These spiders typically occur in more northern latitudes where similar habitats are more common. These spiders are probably Pleistocene relics of geographically more extensive populations during the last ice age (D. Richman, pers. comm.). The new species of springtails, chloropid flies, and a camel cricket found in ice cave entrances may also be newly

evolved species derived from Pleistocene relics. These arthropods demonstrate that not only do the ice cave entrances support unique plant communities, but also provide habitats for populations of unique arthropods, further demonstrating the biological importance of ice cave moss communities at ELMA.

c. Kipukas.

At ELMA kipukas were visually distinguishable from the surrounding lava by vegetation, topographic, and substrate differences. The vegetation on lava and sedimentary kipukas was similar to that found on the same substrate elsewhere. However, as habitat islands, kipukas have the potential to support different assemblages and relative abundances of plants and animals than the surrounding terrain or similar substrates elsewhere. In a study of kipukas at Craters of the Moon National Monument in Idaho, Carter-Lovejoy (1982) did not find differences in plant or animal assemblages of kipukas as a result of kipuka isolation. He examined the effect of kipuka size and distance from source areas for patterns in species richness and found that species diversity was related only to size. Carter-Lovejoy concluded that animals moved freely across the lava and colonization rates on kipukas was probably high. Habitat diversity related to kipuka size probably accounted for the positive relationship between kipuka size and species richness.

Our findings appear to be consistent with Carter-Lovejoy's. Overall, the vegetation of kipukas was similar to vegetation of the same substrates outside of the lava fields. We predicted that the exclusion of cattle from kipukas might have resulted in higher grass cover on kipukas relative to similar non-lava soils outside of the lava flows. Grass cover was similar, and in some cases less, on kipukas than on the closest non-lava areas. The only noticeable vegetation differences were unusually high densities of banana yucca (*Yucca baccata*) and large amounts of dead, down pinon pine trees on the small eolian kipukas in the McCartys lava flow.

Increased yucca density may have resulted from reduced seed predation or herbivory on the kipukas, or perhaps a reduced frequency in wild fire on the small isolated kipukas. We observed that sometimes nearly all of the young yucca inflorescences were eaten by cattle in areas off of the lava flows. The yucca plants on the kipukas did successfully flower in the absence of cattle. The preponderance of yucca on some of the kipukas may therefore result from the absence of cattle browsing on flower stalks. Kerley et al. (1993) found that cattle browsing on yucca flowers (*Yucca elata*) in southern New Mexico significantly reduced reproductive success of the plants.

The dead pinon pines on the kipukas probably died during the droughts of the 1940s and 1950s. The large amount of remaining down wood may be due to a lack of wildfire or because the kipukas are isolated from human wood cutters. We observed fire scars and a lack of lower canopy branches on pines in larger kipukas, such

as Mesita Blanca, where yucca is not dense and dead/down wood was not common. We did not observe fire scars or a lack of lower branches on trees in the small kipukas where yucca and dead/down wood were unusually abundant. Smaller kipukas in the McCartys flow may be less susceptible to fire because they are small and have a low probability of receiving a lighting strike, allowing dead wood to accumulate and fire-sensitive yuccas to survive. Also, the low vegetation cover and fire fuel load of the surrounding McCartys flow is less than that of the other lava flows, further reducing the probability of fire to the kipukas.

We found evidence that native animals moved across the lava to kipukas. Mule deer tracks were common on all kipukas. A dispersing whitetail prairie dog was seen running around the North Three Kipukas. The new species of grasshopper, *Trimerotropis* sp., restricted to sand on the east side of the monument, was present in most of the small sandy kipukas including Los Medanitos, North, Middle, and South Three Kipukas.

The kipukas of ELMA are ecologically interesting features, but not as unusual as we had anticipated. The occurrence large numbers of yucca is an interesting situation.

d. Cinder Cones.

Cinder cones were different from other environments, with loose cinder surfaces and steep slopes, and exhibiting greater elevation range than most other habitats. Thus cinder cones provided a variety of micro-habitats resulting from differences in slope, aspect, and elevation. Many plants were found only on cones or cinders. Alligator juniper, while not rare, was found only on cinders in the higher parts of ELMA. Bandera Crater (BACR) supported seven plant species that were found nowhere else during the survey. Cerro Bandera, Cerro Encierro, and Rendija each had one plant species that was found nowhere else. The montane limber pine (*Pinus flexilis*) was found only on Bandera Crater, which is the highest point in the monument and located near the Zuni Mountains. There were major differences in vegetation resulting from aspect on cones, with many more pine species, among other taxa, found only on the north slopes. The south slopes sometimes supported impressively large clumps of claret cup cactus (*Echinocereus triglochidiatus melanacanthus*), especially on Lost Woman. Bracken fern (*Pteridium aquilinum*) covered large areas of the BACR. Cinders phacelia (*Phacelia serrata*) was found only in the Bandera Crater area strictly on cinders (see Rare Plants, below).

e. Ephemeral Ponds.

Ephemeral water bodies, found in playa-like depressions, cattle tanks, and tinajas, were distinctive and important habitats for a variety of plant and animal species at ELMA. Small playas are known to provide habitat for a number of plant and animal species (Mackay et al. 1980). Since there are no streams

or permanent bodies of water at ELMA, these temporary ponds provide drinking water for wildlife and habitats for aquatic animals and plants.

Ephemeral ponds, distinct from tinajas, were uncommon and were usually found off the monument proper. Two types were found almost exclusively on the Old Basalt. One type was natural playa-like areas with silty bottoms. Laguna Americana (located off the west side of ELMA) and depressions near Prairie Dog Well (PRWE) are examples. The other type was man-made cattle tanks (CAPO and NPPO) scraped into areas with deep soil. In many ways the playa-like areas and cattle tanks were similar since they both were morphologically and structurally alike, they contained water in the spring and/or after the summer rains, and they supported unique plant species.

Many plant species were found nowhere else than on the playa-like areas and others at the cattle ponds, (e.g., *Rorippa microtites*, *Polygonum erectum*, *Phyla cuneifolia*, and *Marsillea mollis*), weedy plants (e.g., *Polygonum aviculare*, *Verbena bracteata*, *Amaranthus* sp., *Phyla cuneifolia*, *Veronica peregrina*, *Suckleya suckleyana*), and plants requiring more moisture (such as *Eleocharis* sp., *Myosurus minimus*, *Echinochloa muricata*, *Rumex triangulivalvis*). The aquatic fern, *Marsillea mollis*, was an unexpected find at PRWE in 1991; it was not found in subsequent years. It was presumably introduced by migrating waterfowl but was unable to establish itself in this marginal habitat. As water levels changed in the playas, species composition changed. Some plants, such as *Coreopsis tinctoria*, grew on the silty soil when the playas were dry, and other species such as *Eleocharis* sp. grew in the water when the playas were full. Other plant species, such as *Limosella* species, that require ephemeral pond habitats are likely to be found in the future.

Many animal species utilized the playa-like areas for drinking water, and a number of species utilized the playas as breeding habitat. Spadefoot toads, freshwater shrimp, and many types of aquatic insects were found living in the waters of playas. Green-winged teal, great blue herons, and killdeer were observed utilizing the playas when water was present. Two species of birds that are candidates (category 2) for federal threatened or endangered species status, mountain plovers and white-faced ibis, were observed utilizing wet playas at PRWE and Laguna Americana. The presence of playas is essential to the existence of these organisms at ELMA. The rare grasshopper *Shotwellia isletea*, lives only on the bare soil of dry playas. This species was found at two playas at ELMA, well outside of the previous known geographic distribution for the species.

Tinajas, natural sandstone depressions that intermittently fill with rain water, were common on the sandstone formations on the east side of ELMA. They provided water and important habitat for animals. Many animals, especially birds, utilize tinajas as drinking water sources. Other animals such as canyon treefrogs, fresh water shrimp, and aquatic insects, were found living and

breeding in tinaja waters. If tinajas were not present at ELMA, these species would probably be much rarer, or absent at ELMA.

f. Human Disturbance.

Human-mediated disturbance has provided habitats for several species in the monument area. Such habitats included roadsides (CO42), cattle ponds (CAPO, NPPO), and a trash dump (CADU). Many species were found only in such areas (see Rare Plants, below) and many of those are weedy species, whether native or introduced. It has been shown that where ever humans build roads and when visitation increases, exotic, often weedy species soon follow (Burgess 1991; Lesica et al. 1993). Thus, as ELMA is developed for visitors, more alien plants are likely to become established. At the time of the survey, most of the introduced plants found in the area were rare or absent from undisturbed environments at ELMA. However, some invasive species, such as cheat grass (*Bromus tectorum*), may eventually spread throughout ELMA. Cheat grass is common on lava fields in the Great Basin, such as Craters of the Moon (personal observation, DCL).

Unlike plants, animal species that were associated with human disturbance, were native species that were also found commonly throughout ELMA, usually in a variety of undisturbed habitats (e.g., common ravens and black-tailed jackrabbits). The weedy plants (or road-killed animals) in disturbed areas apparently provide an additional source of food for these animals. This was particularly true for some birds such as lesser goldfinches, that congregated on the annual sunflower plants growing along roadsides.

C. Rare, New, and Unusual Species.

A number of rare, new, and unusual animal and plant species were found in this inventory, including some species that are candidates for federal threatened or endangered species status, and New Mexico state listed endangered species. We have not yet received results for a number of arthropod taxa that were sent to experts for identification. Additional new species are possible as the results of those determinations become available.

a. Plants.

Although cryptic in habit, the fern *Asplenium septentrionale* was fairly common at ELMA growing in large cracks on lava flows. This species is fairly widespread (Spellenberg 1979). Another fern, *Asplenium trichomanes,* was rare at ELMA and was also reported to be rare by Spellenberg (1979) and Lindsey (1951). This species was only found at MTKI. The aquatic fern *Marsilea mollis* was found only once in 1991 at PRWE and has not been observed since.

Several plant species such as *Lithospermum cobrense*, *Monnina wrightii*, and *Dalea exigua* are found in southern New Mexico and

were rare at ELMA. The records of these species at ELMA probably represent populations near the northern limits of their geographic distributions. *Astragalus mollissimus* var. *mathewsii* is endemic to west-central and northwestern New Mexico and was uncommon at ELMA. *Astragalus egglestonii*, uncommon at ELMA, is found only in west-central New Mexico and adjacent Arizona.

Mammillaria heyderi var. *meiacantha* and Wright's pincushion cactus, *Mammillaria wrightii* var. *wrightii*, were both rare at ELMA. Wright's pincushion cactus is listed as a New Mexico state endangered species (Sivinsky & Lightfoot, 1992), but Heyder's pincushion cactus has no legal protection. Both species are sought by cactus collectors.

Cinders phacelia, *Phacelia serrata*, a candidate federal threatened or endangered species (US Fish & Wildlife Service 1993), was rare at ELMA. This species is discussed below.

b. Animals.

Several new and likely endemic species of arthropods were found in this inventory, and more may be reported as arthropod identifications are completed. These findings are not unusual or to be unexpected since arthropods from the region were not well known. Since the lava environments are unique to the region, those species that were found in lava habitats should be given special consideration as probable local endemics to ELMA.

Several of the new arthropod species that were found on lava were found in lava tube ice cave mouths, or collapse structures. Several new species of springtails were found in moss habitats associated with ice caves and collapse structures in the upper Bandera lava flow, particularly at Hanging Fern Cave, Rattlesnake Collapse Structure, and Big Skylight Cave. The new species of camel cricket (*Ceuthophilus* species) was found only in the Marchantia Ice Cave collapse structure. All three new species of chloropid flies were found only at Marchantia Ice Cave. Currently all of these new species are only known from these locations, and until they are found elsewhere, should be considered to be local endemics. These species live in fragile habitats that may be degraded as visitor activity increases at ELMA. Although these new species have no federal or state protection status, they should be considered sensitive to human activities, and susceptible to extinction.

One new species of field cricket (Gryllus #3) was found only on McCartys lava flow. This species was abundant and widespread across the lava flow. This species also lived in cracks and crevices in the lava, which is a widespread habitat, and a habitat that is resistant to human disturbance. Unlike the above species associated with ice caves, this species is probably not in danger from human activities.

The new species of grasshopper (*Trimerotropis* sp., nr. *whitei*) and sand treader camel cricket (*Ammobaenetes* sp., nr. *phrixocnemoides*) were both restricted to sand habitats on the east side of ELMA, from Sandstone Bluffs Overlook to North

Pasture. These species were locally common, however their habitats are restricted in area, and they could become threatened by human activity in their limited habitats. Since these species are associated with sandy habitats that are found elsewhere in the region, they may occur outside of ELMA. Until they are found elsewhere, they should be considered local endemic species at ELMA.

Species at ELMA that are representatives of disjunct geographic distributions, such as Pleistocene relics in ice caves, should be given special consideration as potentially genetically unique populations. These species populations may have been isolated in these limited habitats for several thousand years.

D. Federal and State Listed Threatened or Endangered Species.

Several species that are candidates for federal threatened or endangered species status (US Fish & Wildlife Service 1987, 1989a, 1989b, 1990, 1991a, 1991b, 1993) or New Mexico state listed endangered species (New Mexico Department of Game and Fish 1988a, 1988b, Sivinsky & Lightfoot 1992) were found at ELMA. These were all species that occur elsewhere in New Mexico or the western United States, but are rare and potentially threatened.

a. Plants.

Cinders phacelia (*Phacelia serrata*) was the only federal candidate (category 2) threatened or endangered (US Fish and Wildlife Service 1993) plant species found at ELMA. This plant grows only on cinders and was previously known only from the San Francisco volcanic field in northern Arizona. At ELMA, cinders phacelia was only found on cinder slopes in the Bandera Crater area. Development of cinder areas around Bandera Crater may threaten this species at ELMA.

Wrights pincushion cactus (*Mammillaria wrightii wrightii*) is a New Mexico state listed endangered species (Sivinsky & Lightfoot 1992), but has no federal status (US Fish & Wildlife Service 1989a, 1990, 1991b, 1993). This cactus was found on sandy soils near the Zuni-Acoma Trailhead (ZATH) and on sandstone ridges near North Pasture (NOSR and NPSS). It has also been found along NM 53 between the Zuni-Acoma Trailhead and El Calderon (D. Ferguson, pers. comm., 1993). Wright's pincushion cacti were scarce at ELMA and usually only a few individuals were found at any site. We conducted an intensive search for these cacti at NOSR where several plants were initially found. We eventually found a total of 21 individuals all growing in an area of less than one hectare. No plants were found outside of this area, even though the pinon/juniper woodland habitat was continuous over a much larger area.

Since Wrights pincushion cacti were rare and localized at ELMA, the species may be threatened at ELMA if the few locations where plants do occur are impacted by development and visitor

activity. Sivinsky and Lightfoot (1992) listed cactus collectors as the main threat to this species.

b. Animals.

The Southwestern cave myotis bat (*Myotis velifer brevis*) is a federal candidate (category 2) threatened or endangered species (US Fish & Wildlife Service 1989b, 1991b). The Southwestern cave myotis bat occurs throughout the western United States, but for unknown reasons, populations have been declining. Cave mytois bats were caught in mist nets at a stock tank five miles south of Los Cerros Ranch, and many skeletons were found in Four Windows Cave. We did not observe any live cave myotis in Four Windows Cave. An intensive inventory of lava tube caves for bat utilization should be conducted at ELMA to determine which caves are used by Southwestern cave myotis bats. These bats could be threatened at ELMA if the caves they utilize are developed for visitors.

The logger-head shrike (*Lanius ludovicianus*) is a federal candidate (category 2) threatened or endangered species. They are widespread throughout North America, but populations have been declining for unknown reasons. Logger-head shrikes are fairly common in New Mexico, and may not be in danger locally. One shrike was observed at ELMA near El Calderon. The open grassland and pinon/juniper habitats at ELMA provide potential breeding areas for this species. This species is probably not threatened at ELMA.

Mountain plovers (*Charadrius montanus*) occur in intermountain western United States. Mountain plovers are listed as federal candidate (category 2) threatened or endangered species (US Fish & Wildlife Service 1989b, 1991b). We observed a small flock of mountain plovers on a playa at Prairie dog well on the southwest portion of ELMA. Mountain plovers breed on dry short-grass prairie in northeastern New Mexico, and elsewhere in the western Great Plains. Mountain plovers are typically not associated with lakes or ponds, as are most other shore birds. The birds observed at ELMA were probably migrating between winter range in the Southwest and breeding range in the western plains.

White-faced ibis (*Plegadis chihi*), another federal candidate (category 2) threatened or endangered species (US Fish & Wildlife Service 1989b, 1991b), was observed on mudflats at Laguna Americana, just outside of the ELMA boundary. The playas of the North Plains or Old Basalt flow, may represent important habitat for white-faced ibis in the region. These habitats have historically been impacted heavily by livestock. Mountain plovers may be threatened at ELMA if playa habitats are not protected.

We observed a Northern goshawk (*Accipiter gentilis*) in Bonito Canyon, in the Zuni Mountains, just north of ELMA. Northern Goshawks have been reported elsewhere in Cibola County (Klingel 1992). The Northern goshawk is a federal candidate (category 2) threatened or endangered species (US Fish & Wildlife

Service 1989b, 1991b). The Northern goshawk is widespread in coniferous forests of North America, but populations have been declining. Although we did not observe any Northern goshawks at ELMA, the species probably does occur in some of the denser conifer forests in the Bandera Crater-Lost Woman area. The intense logging of conifer forests over much of the northwestern portion of ELMA probably eliminated much of the preferred habitat for Northern goshawks at ELMA. Preservation of conifer forest habitats may enhance Northern goshawks at ELMA.

Several other federal or state listed or candidate species may also occur at ELMA, but were not observed in this inventory. In an earlier report, Egbert (1980) noted that bald eagles (federal listed endangered species, US Fish & Wildlife Service, 1987, 1989a, 1991a) are known to occur at ELMA. Bald eagles migrate through central New Mexico between summer breeding areas to the north, and wintering areas in the south. No breeding habitats (lakes, marshes, rivers, or sea coast) are present at ELMA, and bald eagle sightings probably represent migrating individuals passing through the area. Stohlgren (1993) documented the importance of large trees at Lava Beds National Monument in California as winter roosting habitat for bald eagles. However, Lava Beds National Monument is located near extensive wetland habitats of the Modoc National Wildlife Refuge, which supports many bald eagles.

Egbert (1980) also listed peregrine falcons and black-footed ferrets as federal endangered species that may occur at ELMA. To our knowledge, no peregrine falcons have been observed at ELMA, although there are records for Cibola County (Klingel 1992). The sandstone bluffs of Cebollita Mesa and the Narrows provide good potential nesting habitat for peregrine falcons. We surveyed the cliffs for indications of peregrine falcons or remnant nests, but found none. We did observe numerous white-wash areas on cliffs, but determined them to be created by common ravens or red-tailed hawks. Peregrine falcons may be absent from this area because of constant human activity along NM 117 which runs along the base of the bluffs.

Several unconfirmed reports of black-footed ferrets have been made from the mouth of Cebollita Canyon, just north of the Narrows. A small whitetail prairie dog town is located there, and the sightings have involved ferret-like animals running across NM 117 in the vicinity of the prairie dog town. None of these sightings has been confirmed. Black footed-ferrets are generally associated with blacktail prairie dog towns, which are more extensive and provide more food to ferrets than whitetail prairie dog towns. The blacktail prairie dogs probably did occur in the ELMA area, but are now thought to be extinct in the region. In the southwestern United States, the long-tailed weasel has a dark face mask similar to that of the black-footed ferret. Long-tailed weasels do occur in the ELMA area, and may be responsible for the unconfirmed ferret sightings. Although it is unlikely that black-footed ferrets do occur at ELMA, the possibility does exist.

Egbert (1980) listed several other federal candidate threatened or endangered animal species as potentially occurring at ELMA. These included the Swainson's hawk, ferruginous hawk, spotted bat, long-billed curlew, western yellow-billed cuckoo and southern spotted owl. To our knowledge, the Swainson's hawk and "western" yellow-billed cuckoo are not listed (US Fish & Wildlife Service 1989b, 1991b). There are no records of Swainson's hawks or yellow-billed cuckoos in Cibola County (Klingel 1992), although we did observe a Swainson's hawk at North Pasture.

The Southern or the Mexican spotted owl is now proposed threatened (US Fish and Wildlife Service 1991b). Mexican spotted owls prefer dense conifer forest or canyon habitats. Some of the conifer forests in the Lost Woman area of ELMA may support Mexican spotted owls, but those habitats are limited. As with the Northern goshawk, historic logging probably destroyed potential spotted owl habitat at ELMA.

Ferruginous hawks breed on the northern Great Plains, but winter in the Southwest, and some birds winter in New Mexico. Ferruginous hawks have not been recorded from Cibola County (Klingel 1992), but individuals may occasionally pass through the ELMA area as do bald eagles. Spotted bats are rare, and may occur at ELMA. Although we did not encounter any spotted bats in our mist-netting surveys, there are records of spotted bats in Cibola County (Klingel 1992). Long-billed curlews prefer marshland habitats, none of which occur at ELMA, and this species has not been recorded from Cibola County (Klingel 1992).

E. Recommendations

1. Significance of Sensitive Habitats and Species at ELMA.

The volcanic landscapes of ELMA possesses a variety of unique and biologically important environments or habitats for plants and animals. Although other volcanic areas are present in New Mexico, including Capulin volcanic area, the Tularosa or Carrizozo Malpais, the Pedro Armendariz lava field, and the lava fields associated with Kilbourne Crater and the Portrillo Mountains, we are not aware of any other lava tube ice caves and conifer woodlands on lava flows like those found at ELMA.

On a regional and national scale, the ice cave lava tube environments of ELMA and their associated plants and animals are a unique natural resource. Lava tube ice caves are present in other national monuments, such as Craters of the Moon National Monument, Lava Beds National Monument, and Mount St. Helens National Volcanic Monument. Additional lava tube ice caves are found on U.S. Forest Service land in the Cascade Range of the Pacific Northwest. ELMA lava tube ice caves are distinctive from all of the above mentioned locations by being located in the Southwest by supporting plants and animals derived from different regional floras and faunas. In this resect, ELMA supports volcanic environments and an associated flora and fauna that is unique on a national scale.

2. Suggestions for Additional Research on Biotic Resources of ELMA.

A. Intensive Lava Tube Cave Biological Inventories.

This inventory project provided a broad-scale overall biotic survey for ELMA. We have identified specific biological features of ELMA that are unique or otherwise represent valuable natural resources. We suggest that additional and more intensive inventory be conducted within the lava tube caves of ELMA. In particular an intensive inventory of cave animals, including bats and invertebrates. As the monument becomes developed for visitors, and visitor use of lava tube caves increases, there will be considerable potential for the destruction and loss of unique cave habitats and associated plant and animal species. There is still much potential for the existence of local endemic, undescribed invertebrates within the lava tube caves. A complete assessment of cave utilization by bats should be conducted to determine which caves, other than Bat Cave and Braided Cave, provide critical breeding and hibernation habitats for bats.

B. Long-term Ecological Monitoring Studies at ELMA.

The environmental gradients and variety of landscape features at ELMA provide an ideal setting for long-term monitoring studies of plant and animal assemblages and populations in relation to climate change. ELMA possesses both large scale gradients across different aged lava flows that appear to have different micro-environments, and over the same and different lava flows across a broad elevation gradient. Steep, small scale environmental gradients exist in the openings of lava tube ice caves.

The results of our inventory revealed a number of plant and animal species that are ideally suited for such monitoring studies across gradients. There are plant and animal species that tend to be specific for certain types of micro-environments or habitats, and others that tend to be generalists across a variety of micro-environments or habitats. This combination of environmentally restricted and environmentally broad scale species provides a variety of species that should exhibit predictable responses to climate changes. The historic record of climate change at ELMA is well documented in tree rings of Douglas fir and ponderosa pine trees.

Monitoring studies in the mouths of ice caves would also provide information on the effects of human activities on the plants and animals associated those unique environments. A comparison of species trends over time from caves that receive many visitors to caves where visitors are excluded, should provide valuable information on the environmental impacts of humans to these fragile biotic communities.

3. Suggestions For Management of Biological Resources at ELMA.

We have commented throughout this report that the lava tube caves and ice cave entrances support the most outstanding biological resources at ELMA. The lava tube caves provide critical habitats for animals such as bats, bighorn sheep (recent historic), and rare arthropods. The entrances to ice caves provide critical habitats for distinctive cryptogam and associated arthropod communities, including new and probably endemic species of arthropods. Six new species of arthropods were found at Marchantia Ice Cave, and five new species at Hanging Fern Cave and Rattlesnake Collapse during this inventory project. These habitats and the biotic communities are unique to the region, and of national significance.

The lava tube and ice caves are probably also one of the most attractive features of ELMA for visitors. Lava tube environments are fragile, and susceptible to irreparable damage by human victors (Senger & Crawford 1984). We recommend that the NPS manage the monument in such a was as to minimize human impacts to these unique environments. It may be necessary to completely close some of the caves to visitors, or to provide limited access only by NPS ranger guided tours. Guided tours, such as those conducted at Carlsbad Caverns and other national parks and monuments, allow visitors to enjoy natural resources, and provide NPS personnel with a means of protecting those resources. A few caves representative of outstanding visual features might be developed for visitors, while most others should be restricted from visitors. Intensive biological surveys should be conducted in any caves that are considered for heavy visitor use, prior to such development.

Lava tube caves and ice caves that we recommend be closed from unsupervised visitor activity are Marchantia Ice Cave (and all adjacent collapse structures and caves on the Lava Crater lava tube, including Dripping Lava Cave), Hanging Fern Cave, Lichen Collapse, Big Skylight Cave and Four Windows Cave, the entire Apache Ice Cave-Classic Collapse tube area, Navajo Ice Cave, Braided Cave, and Bat Cave. Zuni Ice cave is already degraded by visitors, and therefore may be a good candidate to remain a major visitor attraction, with some effort to reduce the current level of damage.

We observed numerous examples of visitor impacts to some of the lava tube caves at ELMA during our survey. The commercial Zuni or Candelaria Ice Cave had been greatly affected by visitors. The soil inside the cave was trampled and compacted, cryptogams on the rocks had been partially destroyed, and trash and large rocks had been tossed into the collapse structure. Moss communities in other ice cave entrances such as Marchantia, Big Skylight, Four Windows, and Navajo ice caves had been trampled and portions of the mosses destroyed. Soil compaction and cryptogam damage was pronounced at Junction Caves. Even at Bat Cave where a sign was placed in front of the entrance requesting visitors to stay out of the cave, the soil on the floor of the

cave was heavily trampled by human feet, well into the depths of the cave were Mexican freetail bats live. Considerable amounts of trash had been tossed into the impressive lava fissure at the Zuni-Acoma Trailhead. As visitor use increases at ELMA, we expect the detrimental impacts of visitors to cave environments to increase as well.

Other volcanic features of ELMA that support unusual biological communities are probably less vulnerable to human impacts. The environments of open lava fields are probably fairly resistant and resilient to the impacts of visitors. We did note that the lichens growing on rocks of open lava fields were destroyed by persistent foot traffic along trail routes. Trees such as the ancient Douglas firs and stunted ponderosa pines may be vandalized and destroyed by visitors.

Cinder cone environments are very susceptible to impacts by visitors. The cinder soils are easily displaced by foot traffic, and disturbance on the cinder slopes may increase erosion potential. Visitor activities should be minimized in cinder areas where the cinders phacelia grows. Bandera Crater is and will be a major tourist attraction. Management strategies should emphasize an effort to restrict visitors to designated trails.

Playas of ELMA support a different fauna and flora than any other habitats. Two species of candidate federal threatened or endangered species, mountain plovers, and white-faced ibis, were observed on playas at or adjacent to ELMA. These playas have historically been, and are currently degraded by domestic cattle. As cattle grazing declines, and visitor use increases, management strategies should provide protection for the playa habitats of ELMA. Such playas are located along the upper portion of county road 42, at Prairie Dog Well, and at North Pasture.

Two new species of arthropods were found on sand dune or sandy habitats on the east side of ELMA at Sandstone Bluffs Overlook area, and in the North Pasture area. These sand habitats are limited to small areas between the McCartys lava flow and the sandstone escarpments. The state listed endangered Wright's pincushion cactus was also found in some of these areas. Since the new cricket and grasshopper are only known from these locations and are likely to be endemic to ELMA, consideration should be made to protect these limited sandy habitats from development and visitor impacts.

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VEGETATION AND WILDLIFE INVENTORY

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Appendix 1

EL MALPAIS NATIONAL MONUMENT/SEVILLETA LTER: VEGETATION AND WILDLIFE INVENTORY RESEARCH PLAN FOR EL MALPAIS NATIONAL MONUMENT

APPENDIX 1.

EL MALPAIS NATIONAL MONUMENT/SEVILLETA LTER: VEGETATION AND WILDLIFE INVENTORY RESEARCH PLAN FOR EL MALPAIS NATIONAL MONUMENT

I. Introduction.

The University of New Mexico is conducting a vegetation and wildlife inventory of El Malpais National Monument through a cooperative agreement contract with the National Park Service. The primary objective of this inventory is to document the occurrences of plant and animal species, and to describe biotic communities and ecosystems present at the monument.

The information obtained from this inventory will be used for several purposes. The National Park Service will utilize this information to better understand natural resources at the monument. Information on the resident flora and fauna will aide in the management of monument lands for natural resources and recreation. Documentation of rare or unusual species and habitats will be of particular importance for resource management and recreation planning.

Information from the inventory will also be utilized by the scientific community and federal and state agencies to better perceive the biota of north-central New Mexico. The Sevilleta Long-term Ecological Research (LTER) program, Department of Biology, University of New Mexico, will utilize information from this inventory to initiate the establishment of a regional database for plants, animals, and biotic communities and ecosystems in the region.

The ultimate goals of a regional biotic database are to establish monitoring sites throughout north-central New Mexico to assess long-term responses of species populations, communities, and ecosystem processes to changes in climate. The primary objective of the Sevilleta LTER program is to monitor populations, communities, and ecosystem processes across environmental gradients and among sites in different environments at the Sevilleta National Wildlife Refuge. In addition to monitoring sites locally at the Sevilleta, the LTER program aims to expand the geographic distribution of sites to other areas in the region. A geographic spread of sites will provide more meaningful information on regional climate influences on biotic communities and ecosystems. Such an approach is similar in concept to the Very Large Array (VLA) radiotelescope near Socorro, New Mexico. The VLA relies on a spread of numerous small information collecting points to provide a more detailed set of data, comparable in resolution to one very large data collecting area.

The Sevilleta LTER project plans to locate additional sites at El Malpais National Monument for monitoring plants and animals. Information derived from the vegetation and wildlife inventory will aide in locating and designing future monitoring sites. The Sevilleta LTER is in the process of submitting research proposals to the National Park Service Global Change Program that would establish monitoring sites at El Malpais.

The purpose of this research plan is to establish research goals for the vegetation and wildlife inventory of El Malpais National Monument. Those goals focus on characterizing the flora and fauna of the monument, and providing information for a regional database in conjunction with the Sevilleta LTER program. The research plan includes a discussion of inventory goals and methods, and a discussion of regional database objectives.

II. El Malpais National Monument Vegetation and Wildlife Inventory.

1. Inventory Goals.

As stated above, the goals of the inventory are to document the presence of plant and animal species at the monument, and to characterize biotic communities. Particular emphasis is directed toward documenting the occurrences of unique or rare species, and unusual ecological communities or environments.

2. Inventory Methods.

The general procedure for the inventory is to visit sites throughout the monument to document the plants and animals present at those sites. The sites are also characterized by geographic location, landscape features, and biotic communities.

Personnel and material resources for the inventory are not sufficient to include the entire monument, so a subset of inventory sites must be selected for sampling. Sites are selected on the basis of known environmental uniqueness, or as being representative of geographically widespread environments. Sites are distributed geographically throughout the monument as evenly as possible, with the exception of concentrations of sites at unusual locations such as lava tube caves. Attemps will be made to visit all sites several times at different seasons.

a. Site Characteristics.

A site characteristics data form is filled out for each site. The data form includes such information as site name, code, geographic location, physiography, and general vegetation type.

b. Vegetation.

A list of plant species at each site with percent canopy cover is listed on a site vegetation data form. Lichens and mosses are included. Voucher specimens of all unidentified species are collected.

c. Animals.

All vertebrate animal species and numbers of individuals observed at each site are listed on an animal data form. Arthropods are collected as they are encountered.

d. Additional Information.

At some sites additional methods are used to obtain more information. Nocturnal small mammals are live trapped at some sites, and pitfall traps for arthropods are placed at some sites. Because these methods are labor intensive, they cannot be performed at all sites, so a subset of unique or regionally characteristic sites are chosen. Voucher specimens of all captured species are retained.

e. Plant and Arthropod Collections.

A voucher collection of all plant and arthropod species observed during the course of the inventory will be assembled. At least one specimen of each species will go to the National Park Service, and duplicate material to the Museum of Southwestern Biology at the University of New Mexico. Any vertebrate animals collected will also be included in a voucher collection.

f. Documentation of biotic communities.

Information from the inventory site data will provide a basis for identifying and evaluating biotic communities at the monument. Both geographically extant large-scale plant associations, and small-scale localized communities particular to limited microenvironments will be identified.

g. Human impact assessments.

Human impacts will be noted, particularly when associated with rare or unique habitats. Recommendations will be made as to the potential impacts of human recreation on the various biotic communities, at large and small spatial scales.

III. Regional Biological Database.

North-central New Mexico is topographically and biologically one of the most diverse areas in North America. Environments range from low elevation hot, dry creosotebush deserts to cool, mesic high elevation subalpine conifer forests. Several major biomes converge in this region including Great Basin shrublands, Chihuahuan Desert shrublands, Great Plains grasslands, Rocky Mountain conifer woodlands, and Sierra Madraen conifer woodlands. The geographic proximity of the region to these biomes, and the great range of elevation gradients creates an ideal setting to monitor the effects of climate change on natural communities and individual species populations. Most of these communities and species occur where they do as a result of environmental conditions controlled largely by temperature and moisture.

The Sevilleta LTER program is oriented toward assessing long-term effects of climate change on the geographic pattern of biotic communities and species at the Sevilleta National Wildlife Refuge (NWR). The Sevilleta NWR encompasses a large area of land ranging from Rio Grande valley riparian bottomlands to moderate elevation mountain ridges. Numerous temperature and moisture gradients exist in conjunction with those elevation gradients.

The Sevilleta LTER efforts have thus far been limited to the Sevilleta NWR and sites in the Magdellena Mountains and at Bosque del Apache NWR. To better address the effects of climate change on biotic communities, the Sevilleta LTER program intends to expand monitoring sites to a broader regional scale.

The Sevilleta LTER program plans to expand biotic monitoring to several locations throughout north-central New Mexico. In this way population, community, and ecosystem level responses may be evaluated in relative to climatic change on a regional scale. An integrated regional scale approach will provide more useful information on biotic responses to climate change than data from single locality sources.

A regional organized array of monitoring sites would be an ecological analog of the Very Large Array radiotelescope (VLA) near Socorro. The VLA consists of numerous small dish antennae spread over a large area. The combined input from numerous small data collection points provides much higher resolution information than could be obtained from any one single antenna. The more individual antennae and the greater the spread of antennae, the greater the resolution of data collected.

The Sevilleta LTER program is currently monitoring a series of sites in various habitats ranging from Rio Grande riparian forest through grassland, shrub-steppe, desert shrubland, pinon-juniper woodland, mixed-conifer subalpine forest, and subalpine meadow. El Malpais could provide additional shrub-steppe, pinon-

juniper woodland, and ponderosa pine woodland in the same region. With the inclusion of El Malpais, we could address problems that require simultaneously-measured, multi-biome data. Research could focus on the role of drought or wet cycles on primary production, decomposition, and nutrient cycling on both local and regional scales across precipitation and temperature gradients. Species populations, and the structure of biotic communities with multi-biome distributions could be simultaneously monitored across moisture and temperature gradients.

The regional monitoring projects will all be designed and implemented in conjunction with the Sevilleta LTER program. All sampling procedures, data processing and analyses will be done in exactly the same way on all sites. Such standardization of procedures and data will allow for direct comparisons of results from all of the various research sites throughout north-central New Mexico.

The Sevilleta LTER program is in the process of submitting proposals to the National Park Service Global Change Program to implement the regional database. Research resulting from these proposals would extend the monitoring of weather, plants, and animals to El Malpais and Bandeleir National Monuments. The design, sampling procedures, and protocol for data analysis will be the same as currently being used at Sevilleta.

The objective of the proposed regional research is to develop a long-term ecological research program at El Malpais and Bandelier National Monuments, which in collaboration with the Sevilleta LTER program, would address the following questions: 1) How do the natural ecosystems of these sites respond to annual fluctuations and long-term changes in moisture regimes? 2) What are the natural temporal variations in plant and animal demographics and populations abundances, and how might these change in relation to future patterns of global change? 3) Given a regional climate fluctuation (e.g., a drought or exceptionally wet period), are the responses exhibited by each ecological community similar or different? 4) How are nutrient budgets influenced by climate fluctuations, and what long-term changes might occur as a result of directional changes in precipitation and temperatures? 5) Which organisms might best serve as indicator species for various types of global change, and do these organisms serve equally well in all ecosystems in which they are found?

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Appendix 2

MONTHLY AND ANNUAL PRECIPITATION AND TEMPERATURE DATA FOR EL MORRO NATIONAL MONUMENT AND GRANTS AIRPORT

APPENDIX 2.

MONTHLY AND ANNUAL TEMPERATURE AND PRECIPITATION DATA
EL MORRO NATIONAL MONUMENT.

January 1938 - August 1992
2200-2202 m (7218-7225 ft) elevation
35° 03′ latitude, 108° 21′ longitude

	°F	ppt"						
JAN38		0.30	FEB38		2.00	MAR38	38.80	1.72
JAN39	25.40	1.82	FEB39	19.60	1.11	MAR39	37.40	1.43
JAN40		1.40	FEB40		1.35	MAR40		1.00
JAN41		1.72	FEB41		1.66	MAR41		2.11
JAN42	29.00	0.44	FEB42	29.50	0.70	MAR42	34.60	0.45
JAN43	32.00	0.68	FEB43	37.90	0.64	MAR43	39.20	1.22
JAN44	27.00		FEB44	33.00		MAR44	35.80	
JAN45	28.70	0.65	FEB45	35.60	0.62	MAR45	35.80	1.70
JAN46			FEB46			MAR46		
JAN47		0.54	FEB47		0.12	MAR47		0.20
JAN48	29.30	0.24	FEB48	31.60	1.29	MAR48	30.70	2.33
JAN49	22.30	1.36	FEB49	25.80	0.70	MAR49		
JAN50	29.40	0.87	FEB50	34.90	0.77	MAR50	39.30	0.82
JAN51	28.70	0.71	FEB51	32.10	0.22	MAR51	37.30	0.44
JAN52	32.70	1.11	FEB52	30.50	0.51	MAR52	32.80	1.32
JAN53	32.60	0.63	FEB53	30.80	0.30	MAR53	39.10	1.40
JAN54	30.60	0.43	FEB54	37.60	0.27	MAR54	36.00	1.61
JAN55	23.80	1.19	FEB55	23.20	0.73	MAR55	38.20	0.11
JAN56	34.80	2.77	FEB56	22.90	0.51	MAR56	38.90	0.07
JAN57	33.20	1.29	FEB57	39.90	1.26	MAR57	38.20	1.15
JAN58	29.40	0.10	FEB58	35.60	0.79	MAR58	34.40	1.69
JAN59	29.20	0.47	FEB59	31.90	0.22	MAR59	36.20	0.17
JAN60	21.30	1.12	FEB60	25.70	0.81	MAR60		
JAN61	28.30	0.95	FEB61	32.40	0.30	MAR61	38.20	2.11
JAN62	24.10	1.03	FEB62	33.30	0.57	MAR62	32.90	0.69
JAN63	20.30	0.20	FEB63	32.60	1.13	MAR63	37.30	0.99
JAN64	23.50	0.66	FEB64	21.40	0.98	MAR64	31.00	0.87
JAN65	31.40	1.49	FEB65	28.10	1.46	MAR65	34.80	0.51
JAN66	24.20	0.66	FEB66	23.30	0.82	MAR66	37.80	0.43
JAN67	26.10	0.22	FEB67	33.90	0.19	MAR67	42.00	0.43
JAN68	24.80	0.08	FEB68	35.50	0.71	MAR68	38.40	1.06
JAN69	32.40	1.38	FEB69	32.20	0.60	MAR69	32.40	1.18
JAN70	29.00	0.18	FEB70	36.10	0.63	MAR70	36.20	1.26
JAN71	28.20	0.22	FEB71	31.30	1.08	MAR71	39.50	0.23
JAN72			FEB72			MAR72		
JAN73	24.40	0.93	FEB73	30.50	1.01	MAR73	34.80	2.29
JAN74	28.30	1.70	FEB74	30.60	0.45	MAR74	42.60	0.05
JAN75	26.60	0.58	FEB75	29.90	1.29	MAR75	36.80	1.88
JAN76	25.00	0.18	FEB76	37.40	0.64	MAR76	37.50	0.83
JAN77	22.70	2.65	FEB77	31.70	0.04	MAR77	35.50	0.65
JAN78	30.20	1.14	FEB78	32.10	1.61	MAR78	41.60	2.53
JAN79	24.10	4.37	FEB79	27.90	1.95	MAR79	36.00	0.93

JAN80	32.20	1.82	FEB80	35.60	2.23	MAR80	37.50	1.17
JAN81	34.60	0.34	FEB81	34.60	0.90	MAR81	37.00	3.14
JAN82	26.60	2.60	FEB82	31.50	1.30	MAR82	38.90	1.63
JAN83	28.70	1.78	FEB83	32.30	1.17	MAR83	38.00	2.37
JAN84	29.50	0.06	FEB84	33.00	0.12	MAR84	38.30	
JAN85	28.80	2.04	FEB85	26.80	0.68	MAR85	39.00	1.64
JAN86	36.80	0.00	FEB86	36.80	1.10	MAR86	41.80	1.27
JAN87	27.20	1.62	FEB87	31.50	1.84	MAR87	34.20	1.00
JAN88	25.50	0.64	FEB88	34.90	0.82	MAR88	38.00	0.07
JAN89	26.80	1.29	FEB89	35.80	1.54	MAR89	42.50	0.29
JAN90	26.50	0.58	FEB90	31.70	0.56	MAR90	40.10	0.93
JAN91	25.40	1.04	FEB91	35.60	0.17	MAR91	36.30	1.86
JAN92	25.30	0.96	FEB92	34.90	0.86	MAR92	40.10	1.39
MEAN	27.90	1.02		31.70	0.87		37.29	1.16
MAX	36.80	4.37		39.90	2.23		42.60	3.14
MIN	20.30	0.00		19.60	0.04		30.70	0.05
COUNT	49.00	52.00		49.00	52.00		48.00	49.00

APR38	46.20	0.81	MAY38	51.60	0.46	JUN38	63.90	1.03
APR39	48.20	0.75	MAY39	54.50	0.05	JUN39	63.10	0.01
APR40		1.05	MAY40		0.38	JUN40		0.54
APR41		1.84	MAY41		1.49	JUN41		0.64
APR42			MAY42	53.80	0.03	JUN42	61.40	0.00
APR43	48.90	0.48	MAY43	53.90	0.37	JUN43	62.60	0.74
APR44	43.20		MAY44	52.60		JUN44	61.30	
APR45	43.80	0.42	MAY45	53.00	0.04	JUN45	58.80	0.09
APR46			MAY46			JUN46		
APR47		0.00	MAY47		1.25	JUN47		0.61
APR48			MAY48	55.20	0.58	JUN48	62.70	1.29
APR49	45.30	0.60	MAY49	52.70	0.09	JUN49	62.30	0.85
APR50	48.20	0.01	MAY50	52.80	0.07	JUN50	62.80	0.07
APR51	45.10	1.21	MAY51	54.60	0.40	JUN51	60.80	0.00
APR52	46.30	1.27	MAY52	54.80	0.24	JUN52		1.11
APR53	44.90	1.01	MAY53	49.80	0.30	JUN53	65.40	0.15
APR54	49.90	0.00	MAY54	55.90	1.32	JUN54	63.50	0.60
APR55	44.50	0.26	MAY55	53.10	0.40	JUN55	62.20	0.90
APR56	44.00	0.49	MAY56	56.20	0.59	JUN56	66.00	0.38
APR57	43.30	0.55	MAY57	51.30	1.17	JUN57	63.60	0.65
APR58	44.10	1.04	MAY58	57.00	0.01	JUN58	65.80	0.50
APR59	47.20	0.84	MAY59	53.60	0.02	JUN59	66.40	0.64
APR60	46.60	0.44	MAY60	52.90	0.61	JUN60	64.10	0.52
APR61	45.00	0.65	MAY61	54.20	0.34	JUN61	66.10	0.27
APR62	48.90	0.30	MAY62	52.10	0.03	JUN62	61.20	0.25
APR63	45.30	0.13	MAY63	56.10	0.00	JUN63	61.40	0.06
APR64	41.50	1.24	MAY64	53.10	0.15	JUN64	61.20	0.23
APR65	44.50	1.80	MAY65	50.90	0.77	JUN65	58.20	1.37
APR66	45.70	1.16	MAY66	56.10	0.21	JUN66	62.20	0.66
APR67	45.60	0.08	MAY67	52.20	0.21	JUN67	61.20	1.52
APR68	42.80	0.77	MAY68	51.70	0.51	JUN68	62.20	0.12

APR69	47.00	0.58	MAY69	55.10	1.15	JUN69	61.10	0.02
APR70	40.50	0.40	MAY70	53.90	0.35	JUN70	62.60	0.77
APR71	44.60	0.69	MAY71	50.90	0.08	JUN71	63.00	0.00
APR72			MAY72			JUN72		
APR73	40.60	0.51	MAY73	52.70	1.04	JUN73	61.30	0.35
APR74	45.10	0.36	MAY74	56.10	0.00	JUN74	67.30	0.01
APR75	40.60	1.20	MAY75	50.50	0.21	JUN75	59.90	0.11
APR76	45.70	0.16	MAY76	54.60	1.09	JUN76	62.50	0.28
APR77	46.50	2.13	MAY77	52.10	0.57	JUN77	64.10	0.36
APR78	47.10	0.19	MAY78	51.90	1.46	JUN78	63.10	0.29
APR79	46.60	0.44	MAY79	52.00	2.56	JUN79	62.20	0.63
APR80	44.70	0.64	MAY80	51.40	0.46	JUN80	64.50	0.00
APR81	49.00	1.64	MAY81	53.50	0.42	JUN81	66.30	1.31
APR82	45.60	0.14	MAY82	52.20	0.91	JUN82	60.50	0.00
APR83	41.20	0.42	MAY83	52.50	0.82	JUN83	59.60	0.40
APR84	42.90	1.00	MAY84	57.80	0.00	JUN84	63.30	0.67
APR85	48.50	1.43	MAY85	54.80	0.60	JUN85	64.90	0.12
APR86	47.10	0.88	MAY86	53.60	0.84	JUN86	62.90	1.60
APR87	47.10	0.42	MAY87	52.30	1.35	JUN87	62.30	1.18
APR88	45.20	2.20	MAY88	54.30	0.51	JUN88	64.00	2.65
APR89	50.20	0.00	MAY89	56.50	0.14	JUN89	62.40	0.01
APR90	48.20	1.38	MAY90	52.90	1.42	JUN90	66.10	0.91
APR91	44.00	0.00	MAY91	53.40	0.00	JUN91	59.60	0.85
APR92	48.80	0.00	MAY92	54.00	3.83	JUN92	60.00	0.44
MEAN	45.54	0.72		53.49	0.61		62.73	0.55
MAX	50.20	2.20		57.80	3.83		67.30	2.65
MIN	40.50	0.00		49.80	0.00		58.20	0.00
COUNT	48.00	50.00		50.00	52.00		49.00	52.00

JUL38	67.30	1.01	AUG38	66.50	1.91	SEP38	58.90	1.90
JUL39	69.10	1.20	AUG39	67.60	0.98	SEP39	61.50	1.31
JUL40		2.92	AUG40		3.20	SEP40		2.17
JUL41		1.35	AUG41		2.18	SEP41		3.12
JUL42	69.20	0.96	AUG42	66.00	2.53	SEP42	60.30	0.70
JUL43	68.80	2.70	AUG43	67.30	3.08	SEP43	60.00	0.81
JUL44	67.40		AUG44	67.60		SEP44	59.30	
JUL45	68.90	1.70	AUG45	68.90	3.12	SEP45	59.90	0.53
JUL46			AUG46			SEP46		
JUL47		2.04	AUG47		8.93	SEP47		0.93
JUL48			AUG48	67.00	2.20	SEP48	61.20	2.10
JUL49	67.70	1.83	AUG49	65.40	1.03	SEP49	62.10	1.68
JUL50	66.80	2.78	AUG50	64.60	0.76	SEP50	56.60	1.31
JUL51	71.00	0.92	AUG51	67.10	3.19	SEP51	60.60	0.42
JUL52	67.20	1.73	AUG52	67.70	3.12	SEP52	61.80	0.92
JUL53	70.00	2.51	AUG53	65.80	1.52	SEP53	62.40	0.00
JUL54	69.90	2.28	AUG54	65.40	2.82	SEP54	61.30	3.05
JUL55	67.50	4.18	AUG55	66.20	3.29	SEP55	61.00	0.03
JUL56	67.30	1.49	AUG56	63.90	1.23	SEP56	62.50	0.07
JUL57	68.10	3.05	AUG57	64.90	2.72	SEP57	59.30	0.02

JUL58	67.90	1.26	AUG58	67.90	1.86	SEP58	60.70	1.56
JUL59	69.90	0.88	AUG59	65.40	4.80	SEP59	58.60	0.14
JUL60	68.50	0.87	AUG60	68.40	0.59	SEP60	61.90	0.32
JUL61	69.00	1.75	AUG61	66.50	3.43	SEP61	57.10	0.34
JUL62	67.30	1.06	AUG62	66.70	0.51	SEP62	60.00	3.49
JUL63	70.20	1.52	AUG63	64.50	3.71	SEP63	61.70	3.13
JUL64	69.10	1.98	AUG64	64.70	4.04	SEP64	58.40	1.90
JUL65	67.20	3.59	AUG65		2.12	SEP65	56.40	0.74
JUL66	69.90	1.87	AUG66	66.20	2.06	SEP66	59.30	2.01
JUL67	69.50	4.03	AUG67	64.30	2.47	SEP67	59.30	0.72
JUL68	66.80	2.19	AUG68	62.70	1.79	SEP68	57.00	0.10
JUL69	69.80	2.40	AUG69	69.00	3.55	SEP69	61.00	1.11
JUL70	69.90	1.09	AUG70	67.20	2.49	SEP70	58.80	0.80
JUL71	70.20	1.67	AUG71	64.70	4.49	SEP71	58.00	2.05
JUL72			AUG72			SEP72		
JUL73	67.10	1.47	AUG73	66.30	1.90	SEP73	57.70	0.93
JUL74	67.60	1.17	AUG74	64.50	3.61	SEP74	59.00	0.88
JUL75	67.90	1.31	AUG75	65.60	1.75	SEP75	57.70	3.40
JUL76	68.80	1.89	AUG76	65.90	1.87	SEP76	60.50	1.01
JUL77	68.10	3.72	AUG77	68.20	2.72	SEP77	61.20	2.64
JUL78	68.70	0.98	AUG78	64.60	0.89	SEP78	59.70	0.22
JUL79	68.40	1.14	AUG79	64.30	2.98	SEP79	62.80	0.10
JUL80	70.40	0.42	AUG80	66.90	1.48	SEP80	61.20	2.87
JUL81	68.30	2.50	AUG81	67.20	1.42	SEP81	60.40	1.91
JUL82	67.00	2.23	AUG82	66.50	3.57	SEP82	61.10	1.65
JUL83	67.20	2.03	AUG83	66.80	2.56	SEP83	62.40	3.85
JUL84	69.00	2.13	AUG84	65.60	4.17	SEP84	60.00	3.54
JUL85	69.70	3.06	AUG85	66.90	1.61	SEP85	56.70	1.40
JUL86	66.00	3.78	AUG86	67.50	1.93	SEP86	57.10	1.13
JUL87	65.00	2.20	AUG87	65.30	3.74	SEP87	57.40	0.30
JUL88	67.70	1.39	AUG88	65.40	3.27	SEP88	57.40	0.27
JUL89	68.60	3.13	AUG89	64.40	1.64	SEP89	59.90	1.36
JUL90	67.00	2.22	AUG90	63.30	1.74	SEP90	62.10	2.29
JUL91	67.00	1.24	AUG91	66.10	2.27	SEP91	59.80	1.45
JUL92	64.80	1.78	AUG92	64.50	3.01			
MEAN	68.28	1.97		66.04	2.57		59.82	1.39
MAX	71.00	4.18		69.00	8.93		62.80	3.85
MIN	64.80	0.42		62.70	0.51		56.40	0.00
COUNT	49.00	51.00		49.00	52.00		49.00	51.00

OCT38	51.00	0.04	NOV38	32.10	0.07	DEC38	32.40	0.63
OCT39	47.50	0.87	NOV39	40.30	1.39	DEC39	32.60	0.66
OCT40		0.95	NOV40		1.46	DEC40		2.49
OCT41		1.23	NOV41		0.79	DEC41		0.86
OCT42	48.90	1.10	NOV42	41.00	0.03	DEC42	33.60	2.09
OCT43	48.70	1.46	NOV43	38.00	0.31	DEC43	31.20	0.56
OCT44	52.20		NOV44	35.10		DEC44	30.10	
OCT45	50.80	0.86	NOV45	36.40	0.01	DEC45	24.60	1.69
OCT46			NOV46			DEC46		

OCT47		1.79	NOV47		0.98	DEC47		0.40
OCT48	50.30		NOV48	31.50	0.08	DEC48	29.80	
OCT49	47.10	0.89	NOV49	41.60	0.21	DEC49	26.20	0.96
OCT50	55.80	0.12	NOV50	40.70	0.16	DEC50	34.40	0.04
OCT51	49.30	0.44	NOV51	36.40	0.62	DEC51	27.70	1.57
OCT52	51.60	0.00	NOV52	32.90	1.42	DEC52	27.80	0.64
OCT53	50.00	0.53	NOV53	39.00	0.56	DEC53	23.80	0.95
OCT54	51.50	0.65	NOV54	40.40	0.11	DEC54		0.45
OCT55	51.90	0.15	NOV55	37.40	0.38	DEC55	33.40	0.80
OCT56	50.90	0.61	NOV56	32.50	0.12	DEC56	27.70	0.17
OCT57	48.20	2.18	NOV57	33.30	0.76	DEC57	32.70	0.65
OCT58	49.70	0.74	NOV58	36.40	0.80	DEC58	33.60	0.22
OCT59	47.50	2.32	NOV59	37.50	0.03	DEC59	32.50	1.19
OCT60	46.80	1.78	NOV60	38.20	0.13	DEC60	26.80	0.45
OCT61	47.40	2.15	NOV61	35.50	0.52	DEC61	25.00	1.46
OCT62	49.00	1.72	NOV62	40.00	1.09	DEC62	30.60	0.48
OCT63	52.40	1.35	NOV63	38.90	1.36	DEC63	28.70	0.18
OCT64	50.40	0.25	NOV64	36.20	0.65	DEC64	26.80	1.18
OCT65	49.40	0.29	NOV65	40.40	1.25	DEC65	29.60	2.39
OCT66	49.10	0.20	NOV66	41.10	0.40	DEC66	28.40	1.05
OCT67	49.70	0.46	NOV67	40.00	0.34	DEC67	23.70	2.06
OCT68	49.60	0.37	NOV68	36.00	0.67	DEC68	25.30	1.26
OCT69	47.40	1.75	NOV69	36.80	0.76	DEC69	33.80	0.35
OCT70	44.00	0.94	NOV70	38.90	0.11	DEC70	30.80	0.61
OCT71	46.90	1.72	NOV71	37.80	0.51	DEC71	28.80	1.12
OCT72			NOV72	34.20	1.07	DEC72	28.10	1.04
OCT73	50.00	0.02	NOV73	38.60	1.59	DEC73	31.30	0.75
OCT74	50.40	4.40	NOV74	37.90	0.09	DEC74	26.20	0.54
OCT75	49.30	0.02	NOV75	36.30	1.58	DEC75	27.10	1.53
OCT76	47.30	1.04	NOV76	35.80	0.36	DEC76	29.50	0.24
OCT77	51.10	0.75	NOV77	39.00	0.74	DEC77	34.50	0.70
OCT78	51.90	0.86	NOV78	39.20	1.92	DEC78	26.90	1.44
OCT79	51.80	0.93	NOV79	34.20	1.66	DEC79	31.40	1.93
OCT80	48.30	0.52	NOV80	37.40	0.16	DEC80	37.20	0.56
OCT81	49.00	0.79	NOV81	40.30	0.31	DEC81	33.00	0.05
OCT82	46.80	0.20	NOV82	37.90	0.94	DEC82	29.20	1.72
OCT83	50.40	1.37	NOV83	36.60	1.06	DEC83	33.30	1.47
OCT84	43.40	2.33	NOV84	37.30	1.45	DEC84	33.10	1.33
OCT85	49.60	1.49	NOV85	37.80	1.51	DEC85	31.30	0.46
OCT86	47.60	1.91	NOV86	38.10	2.43	DEC86	31.30	2.68
OCT87	51.00	0.71	NOV87	36.80	0.98	DEC87	28.30	1.13
OCT88	51.70	0.14	NOV88	36.50	0.68	DEC88	29.20	0.47
OCT89	48.40	1.35	NOV89	36.30	0.02	DEC89	27.90	0.09
OCT90	48.20	0.93	NOV90	38.00	0.86	DEC90	24.00	2.73
OCT91	49.60	1.12	NOV91	36.70	1.39	DEC91	30.60	1.73
MEAN	49.40	1.02		37.34	0.75		29.71	1.02
MAX	55.80	4.40		41.60	2.43		37.20	2.73
MIN	43.40	0.00		31.50	0.01		23.70	0.04
COUNT	49.00	50.00		50.00	52.00		49.00	51.00

YEARLY TOTALS

1938		11.88
1939	47.20	11.58
1940		18.91
1941		18.99
1942		
1943	49.00	13.05
1944	47.00	
1945	47.10	11.43
1946		
1947		17.79
1948		
1949		
1950	48.90	7.78
1951	47.50	10.14
1952		13.39
1953	47.80	9.86
1954		13.59
1955	46.90	12.42
1556	47.30	8.50
1957	48.00	15.45
1958	48.60	10.78
1959	48.00	11.72
1960		
1961	47.00	14.27
1962	47.20	11.22
1963	47.50	13.76
1964	44.80	14.13
1965		17.78
1966	46.90	11.53
1967	47.30	12.73
1968	46.10	9.63
1969	48.20	14.83
1970	47.30	9.63
1971	47.00	13.86
1972		
1973	46.30	12.79
1974	48.00	13.26
1975	45.70	14.86
1976	47.50	9.59
1977	47.90	17.67
1978	48.10	13.53
1979	46.80	19.62
1980	48.90	12.33
1981	49.40	14.73
1982	47.00	16.35
1983	47.40	19.30
1984	47.80	
1985	47.90	16.04
1986	48.90	19.55
1987	46.50	16.47
1988	47.50	13.11
1989	48.30	10.86
1990	47.40	16.55
1991	47.00	13.12
MEAN	47.89	13.70
MAX	49.40	19.62
MIN	44.80	7.78
COUNT	41.00	46.00

MONTHLY AND ANNUAL PRECIPITATION AND TEMPERATURE DATA
GRANTS AIRPORT, NM
May 1953 - August 1992
1987 m (6520 feet) elevation
35° 10′ latitude; 107° 54′ longitude

	°F	ppt"						
JAN54	31.10	0.15	FEB54	37.10	0.04	MAR54	37.40	1.00
JAN55	25.10	0.38	FEB55	25.50	0.26	MAR55	38.20	0.29
JAN56	34.80	0.98	FEB56	27.10	0.37	MAR56	39.70	0.00
JAN57	34.50	0.91	FEB57	40.70	0.26	MAR57	39.70	0.88
JAN58	28.10	0.26	FEB58	36.70	0.14	MAR58	35.40	1.12
JAN59	30.00	0.30	FEB59	32.50	0.29	MAR59	37.00	0.00
JAN60	24.80	0.51	FEB60	29.60	0.28	MAR60		
JAN61	28.90	0.20	FEB61	34.80	0.23	MAR61	40.10	1.27
JAN62	26.40	0.36	FEB62	37.10	0.09	MAR62	34.60	0.16
JAN63	20.20	0.69	FEB63	35.40	0.86	MAR63	40.20	0.01
JAN64	25.00	0.24	FEB64	20.50	1.07	MAR64	35.20	0.33
JAN65	32.90	0.66	FEB65	31.60	0.91	MAR65	36.70	0.06
JAN66	24.00	0.18	FEB66	27.60	0.44	MAR66	39.90	0.07
JAN67	28.20	0.09	FEB67	35.20	0.35	MAR67	44.30	0.10
JAN68	25.40	0.02	FEB68	37.90	0.65	MAR68	39.30	0.90
JAN69	36.30	0.35	FEB69	33.40	0.37	MAR69	34.90	0.83
JAN70	28.30	0.01	FEB70	36.60	0.03	MAR70	38.40	0.66
JAN71	28.80	0.27	FEB71	33.20	0.29	MAR71	41.20	0.16
JAN72			FEB72			MAR72		
JAN73			FEB73			MAR73		
JAN74			FEB74			MAR74	44.40	0.00
JAN75	27.00	0.34	FEB75	33.60	0.18	MAR75	38.40	0.09
JAN76	28.20	0.00	FEB76	37.60	0.08	MAR76	38.30	0.33
JAN77	24.00	0.86	FEB77	33.80	0.54	MAR77	36.10	0.37
JAN78	33.10	0.68	FEB78		0.57	MAR78	43.50	0.24
JAN79	26.30	1.06	FEB79	32.90	0.55	MAR79	40.40	0.08
JAN80	35.80	0.92	FEB80	37.80	0.94	MAR80	39.00	0.58
JAN81	34.40	0.36	FEB81	36.40	0.29	MAR81	39.90	1.68
JAN82	31.40	0.47	FEB82	33.90	1.66	MAR82	41.80	1.71
JAN83	30.00	0.73	FEB83	34.80	0.90	MAR83	41.70	0.84
JAN84	28.80	0.96	FEB84	34.40	0.00	MAR84	41.10	0.39
JAN85	29.90	0.51	FEB85	33.10	0.54	MAR85	43.50	0.55
JAN86	36.40	0.00	FEB86	39.40	0.55	MAR86	44.60	0.32
JAN87	26.50	1.60	FEB87	32.70	1.24	MAR87	38.00	0.54
JAN88	29.20	0.19	FEB88	37.70	0.09	MAR88	40.30	0.07
JAN89	27.20	0.77	FEB89	36.40	0.45	MAR89	47.20	0.16
JAN90	26.90	0.35	FEB90	34.20	0.17	MAR90	43.60	0.88
JAN91	27.30	0.66	FEB91	36.30	0.05	MAR91	39.90	1.04
JAN92	27.00	0.72	FEB92	37.30	0.27	MAR92	45.00	1.59
MEAN	28.95	0.49		34.14	0.44		39.97	0.54
MAX	36.40	1.60		40.70	1.66		47.20	1.71
MIN	20.20	0.00		20.50	0.00		34.60	0.00
COUNT	36.00	36.00		35.00	36.00		36.00	36.00

			MAY53	52.20	0.13	JUN53	67.50	0.44
APR54	52.60	0.06	MAY54	57.60	0.62	JUN54	65.30	0.97
APR55	44.60	0.02	MAY55	54.20	0.78	JUN55	64.00	0.49
APR56	45.80	0.02	MAY56	57.80	0.27	JUN56	68.40	0.04
APR57	45.80	0.52	MAY57	52.70	0.37	JUN57	65.70	0.30
APR58	45.80	1.02	MAY58	59.10	0.39	JUN58	68.30	0.39
APR59	50.00	1.01	MAY59	57.10	0.18	JUN59	68.50	1.21
APR60	48.10	0.12	MAY60	55.20	0.65	JUN60	67.90	0.66
APR61	47.60	0.57	MAY61	56.90	0.11	JUN61	68.40	0.38
APR62	51.10	0.16	MAY62	55.90	0.00	JUN62	66.30	0.00
APR63	49.50	0.03	MAY63	61.00	0.50	JUN63	66.20	0.50
APR64	44.90	0.38	MAY64	57.40	0.24	JUN64	65.20	0.70
APR65	46.50	1.16	MAY65	54.20	0.49	JUN65	61.90	3.07
APR66	48.40	0.53	MAY66	59.20	0.11	JUN66	65.50	0.29
APR67	48.70	0.01	MAY67	55.20	0.39	JUN67	64.50	2.00
APR68	44.80	0.41	MAY68	55.00	0.34	JUN68	66.20	0.12
APR69	49.90	0.25	MAY69	57.70	1.96	JUN69	64.50	0.72
APR70	43.50	0.02	MAY70	56.30	0.92	JUN70	63.80	0.73
APR71	45.70	0.21	MAY71	54.00	0.23	JUN71	66.20	0.19
APR72			MAY72			JUN72		
APR73			MAY73			JUN73		
APR74	45.50	0.16	MAY74	59.50	0.00	JUN74	69.30	0.00
APR75	43.00	0.52	MAY75	52.60	0.00	JUN75	63.70	0.00
APR76	48.00	0.00	MAY76	57.20	0.41	JUN76	64.70	0.19
APR77	48.60	0.23	MAY77	56.10	0.34	JUN77	67.00	0.19
APR78	50.10	0.00	MAY78	54.90	1.22	JUN78	67.60	0.31
APR79	48.70	0.32	MAY79	56.30	1.95	JUN79	65.30	1.18
APR80	46.30	1.33	MAY80	54.10	0.38	JUN80	68.60	0.00
APR81	51.50	0.31	MAY81	57.60	0.77	JUN81	70.00	0.14
APR82	48.70	0.10	MAY82	55.60	0.30	JUN82	65.10	0.06
APR83	44.30	0.41	MAY83	55.10	0.51	JUN83	63.80	0.19
APR84	46.50	0.71	MAY84	62.70	0.16	JUN84	67.00	0.33
APR85	51.80	1.41	MAY85	58.50	0.35	JUN85	67.60	0.43
APR86	52.10	0.47	MAY86	58.00	1.29	JUN86	67.30	1.94
APR87	48.40	0.28	MAY87	56.40	0.89	JUN87	65.00	0.26
APR88	49.20	1.74	MAY88	57.00	0.20	JUN88	66.60	1.06
APR89	55.00	0.00	MAY89	60.20	0.08	JUN89	67.30	0.10
APR90	51.60	1.54	MAY90	58.00	1.02	JUN90	71.30	0.37
APR91	49.50	0.65	MAY91	57.60	0.26	JUN91	64.80	0.99
APR92	55.00	0.67	MAY92	58.10	2.68	JUN92	65.40	0.46
MEAN	48.30	0.47		56.69	0.57		66.36	0.56
MAX	55.00	1.74		62.70	2.68		71.30	3.07
MIN	43.00	0.00		52.20	0.00		61.90	0.00
COUNT	37.00	37.00		38.00	38.00		38.00	38.00

JUL53	71.40	2.76	AUG53	67.30	0.79	SEP53	61.20	0.02
JUL54	71.20	2.65	AUG54	66.40	2.33	SEP54	62.50	2.62
JUL55	68.30	1.34	AUG55	68.60	4.54	SEP55	61.30	0.06
JUL56	69.20	1.97	AUG56	66.20	0.47	SEP56	61.90	0.00
JUL57	69.50	2.83	AUG57	66.70	2.38	SEP57	59.60	0.00
JUL58	71.00	1.00	AUG58	70.40	1.21	SEP58	61.40	1.36
JUL59	72.00	1.35	AUG59	68.10	2.56	SEP59	61.30	0.06
JUL60	70.60	0.92	AUG60	69.50	0.73	SEP60	63.00	0.96
JUL61	71.80	1.16	AUG61	68.50	2.69	SEP61	59.30	1.37
JUL62	70.20	2.27	AUG62	70.10	0.75	SEP62	63.20	1.62
JUL63	73.40	0.40	AUG63	68.30	3.38	SEP63	63.70	2.23
JUL64	71.50	1.44	AUG64	67.80	2.21	SEP64	61.60	1.11
JUL65	69.10	3.91	AUG65	66.80	1.94	SEP65	58.80	1.36
JUL66	72.40	2.76	AUG66	67.80	3.88	SEP66	60.40	1.87
JUL67	72.00	1.79	AUG67	66.90	2.08	SEP67	60.80	2.36
JUL68	69.70	1.05	AUG68	64.90	2.82	SEP68	59.40	0.07
JUL69	72.30	0.72	AUG69	70.70	1.38	SEP69	62.00	2.85
JUL70	71.20	1.03	AUG70	68.90	2.18	SEP70	60.20	0.41
JUL71	71.40	2.96	AUG71	67.40	3.17	SEP71	60.00	1.96
JUL72			AUG72			SEP72		
JUL73			AUG73			SEP73		
JUL74		1.51	AUG74	66.70	2.26	SEP74	58.80	1.63
JUL75	68.90	2.45	AUG75	65.40	0.96	SEP75	56.80	4.23
JUL76	69.70	0.50	AUG76	66.70	3.79	SEP76	59.60	0.43
JUL77	70.10	2.63	AUG77	69.90	1.35	SEP77	63.10	1.49
JUL78		0.50	AUG78	68.00	1.03	SEP78	62.40	0.70
JUL79	71.10	1.46	AUG79	68.60	2.02	SEP79	64.60	0.46
JUL80	73.50	1.23	AUG80	70.10	2.15	SEP80	63.30	2.56
JUL81	71.40	3.70	AUG81	69.70	1.47	SEP81	62.20	0.56
JUL82	72.10	1.12	AUG82	69.10	2.19	SEP82	63.10	1.78
JUL83	70.60	2.25	AUG83	70.00	1.25	SEP83	64.80	2.12
JUL84	72.10	0.52	AUG84	69.20	2.46	SEP84	63.40	2.06
JUL85	71.30	2.22	AUG85	68.40	0.78	SEP85	59.10	1.21
JUL86	69.50	1.75	AUG86	70.70	1.53	SEP86	59.60	1.10
JUL87	68.90	2.61	AUG87		3.05	SEP87	61.60	0.72
JUL88	72.50	1.22	AUG88	69.30	2.30	SEP88	60.70	1.46
JUL89	73.10	0.98	AUG89	69.30	0.90	SEP89	62.80	1.64
JUL90	71.30	1.96	AUG90	67.70	3.99	SEP90	65.00	2.13
JUL91	71.20	1.05	AUG91	70.00	1.66	SEP91	63.40	1.83
JUL92	69.70	1.68	AUG92	68.70	1.86			
MEAN	70.98	1.73		68.35	2.07		61.51	1.36
MAX	73.50	3.91		70.70	4.54		65.00	4.23
MIN	68.30	0.40		64.90	0.47		56.80	0.00
COUNT	36.00	38.00		37.00	38.00		37.00	37.00

OCT53	49.00	0.34	NOV53	38.50	0.17	DEC53	23.10	0.48
OCT54	53.00	0.23	NOV54	39.20	0.01	DEC54	28.60	0.13
OCT55	51.50	0.16	NOV55	38.30	0.30	DEC55	34.60	0.39
OCT56	50.10	0.25	NOV56	31.80	0.04	DEC56	27.90	0.00
OCT57	48.90	2.38	NOV57	34.10	0.73	DEC57	32.80	0.11
OCT58	50.00	1.72	NOV58	38.00	0.10	DEC58	34.00	0.14
OCT59	49.80	2.20	NOV59	37.60	0.40	DEC59	32.50	1.50
OCT60	48.00	2.79	NOV60	39.60	0.13	DEC60	26.60	0.79
OCT61	49.10	1.50	NOV61	36.30	0.57	DEC61	23.40	0.81
OCT62	51.60	1.07	NOV62	41.50	0.41	DEC62	31.60	0.46
OCT63	54.10	1.09	NOV63	40.70	0.69	DEC63	30.10	0.01
OCT64	51.00	0.05	NOV64	37.70	0.76	DEC64	31.10	0.68
OCT65	50.40	0.35	NOV65	41.60	0.50	DEC65	31.10	2.70
OCT66	49.90	0.15	NOV66	41.10	0.10	DEC66	29.10	0.51
OCT67	50.40	0.08	NOV67	41.20	0.11	DEC67	23.10	1.37
OCT68	50.90	0.73	NOV68	36.50	0.29	DEC68	27.10	0.49
OCT69	49.80	3.03	NOV69	37.60	0.39	DEC69	33.80	0.41
OCT70	45.50	1.42	NOV70	39.40	0.26	DEC70	30.40	0.18
OCT71	47.60	0.88	NOV71	37.70	0.25	DEC71	29.20	0.59
OCT72			NOV72			DEC72		
OCT73			NOV73			DEC73		
OCT74	50.90	3.12	NOV74	37.70	0.00	DEC74	25.70	0.54
OCT75		0.05	NOV75		0.29	DEC75	29.70	0.42
OCT76	45.90	0.08	NOV76	34.50	0.53	DEC76	23.70	0.10
OCT77	52.60	0.23	NOV77	39.90	0.77	DEC77	36.70	0.20
OCT78	53.60	0.95	NOV78	41.70	1.47	DEC78	28.70	0.56
OCT79	54.10	0.72	NOV79	34.70	1.36	DEC79	33.10	0.55
OCT80	48.50	0.23	NOV80	38.60	0.31	DEC80	37.40	0.54
OCT81	50.70	0.71	NOV81	42.20	0.23	DEC81	35.40	0.00
OCT82	47.70	0.06	NOV82	39.30	1.12	DEC82	30.70	1.52
OCT83	52.60	1.58	NOV83	40.90	0.91	DEC83	36.00	0.32
OCT84	46.20	1.59	NOV84	40.10	0.74	DEC84	32.40	1.12
OCT85	51.00	1.72	NOV85	40.50	0.53	DEC85	32.10	0.68
OCT86	48.70	1.55	NOV86	39.40	2.25	DEC86	32.40	1.35
OCT87	54.10	0.50	NOV87	38.80	0.82	DEC87	29.10	1.25
OCT88	54.60	0.85	NOV88	42.60	0.15	DEC88	30.20	0.13
OCT89	51.30	1.07	NOV89	39.80	0.05	DEC89	30.90	0.11
OCT90	52.90	1.27	NOV90	40.70	0.62	DEC90	24.60	1.59
OCT91	53.20	0.27	NOV91	39.90	1.33	DEC91	32.90	1.76
MEAN	50.53	1.00		38.88	0.53		30.32	0.66
MAX	54.60	3.12		42.60	2.25		37.40	2.70
MIN	45.50	0.05		31.80	0.00		23.10	0.00
COUNT	36.00	37.00		36.00	37.00		37.00	37.00

YEARLY TOTALS

	temp	ppt
1953		
1954	50.20	10.81
1955	47.80	9.01
1956	48.40	4.41
1957	49.20	11.67
1958	49.90	8.85
1959	49.70	11.06
1960		
1961	48.80	10.86
1962	50.00	7.35
1963	50.20	9.94
1964	47.40	9.21
1965	48.50	17.11
1966	48.80	10.89
1967	49.20	10.73
1968	48.10	7.89
1969	50.20	13.26
1970	48.50	7.85
1971	48.60	11.16
1972		
1973		
1974		
1975		9.53
1976	47.80	6.44
1977	49.80	9.20
1978		8.23
1979	49.70	11.71
1980	51.10	11.17
1981	51.80	10.22
1982	49.90	12.09
1983	50.40	12.01
1984	50.30	18.04
1985	50.60	10.93
1986	51.50	14.10
1987		13.76
1988	50.80	9.46
1989	51.70	6.31
1990	50.70	15.89
1991	50.50	11.55
MEAN	49.68	10.67
MAX	51.80	18.04
MIN	47.40	4.41
COUNT	31.00	34.00

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Appendix 3

EXAMPLES OF BLANK DATA FORMS USED FOR INVENTORY DATA

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY

Site Characteristics

Site Name:			
Site Code:			
Date Surveyed:			
Surveyed By:			
Descriptive Location:			
Specific Location (UTM):	North:		East:
USGS Quad. Map Name:			
Range:	Township:	Section:	
Size of Site (Ha or meters):			
Elevation (feet):			
Landform:			
Parent Material:			
Soil Description:			
Erosion Type:		Erosion Potential:	
Livestock Evidence:			
%Ground Cover:	Soil(<3mm):	Gravel(3mm-7.5cm):	Rock(>7.5cm):
	Leaf Litter:	Wood(>5mm):	Cryptogams:
	Basal vegetation:		Canopy Vegetation:
General Landscape Description:			
General Vegetation Description:			
Unusual Features:			
Additional Comments:			

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY

Vertebrate Animal Records

SITE:
DATE:

COMMON NAME	TAXA CODE	GROUP	COUNT	HABITS/HABITAT
COMMENTS:				

COMMON NAME	TAXA CODE	GROUP	COUNT	HABITS/HABITAT
COMMENTS:				

COMMON NAME	TAXA CODE	GROUP	COUNT	HABITS/HABITAT
COMMENTS:				

COMMON NAME	TAXA CODE	GROUP	COUNT	HABITS/HABITAT
COMMENTS:				

COMMON NAME	TAXA CODE	GROUP	COUNT	HABITS/HABITAT
COMMENTS:				

COMMON NAME	TAXA CODE	GROUP	COUNT	HABITS/HABITAT
COMMENTS:				

COMMON NAME	TAXA CODE	GROUP	COUNT	HABITS/HABITAT
COMMENTS:				

COMMON NAME	TAXA CODE	GROUP	COUNT	HABITS/HABITAT
COMMENTS:				

COMMON NAME	TAXA CODE	GROUP	COUNT	HABITS/HABITAT
COMMENTS:				

COMMON NAME	TAXA CODE	GROUP	COUNT	HABITS/HABITAT
COMMENTS:				

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY

Vegetation Records

SITE:	
DATE:	

FIELD CODE	COMMON NAME/DESCRIPTION	FORM	%COVER	TAXA CODE
COMMENTS:				

FIELD CODE	COMMON NAME/DESCRIPTION	FORM	%COVER	TAXA CODE
COMMENTS:				

FIELD CODE	COMMON NAME/DESCRIPTION	FORM	%COVER	TAXA CODE
COMMENTS:				

FIELD CODE	COMMON NAME/DESCRIPTION	FORM	%COVER	TAXA CODE
COMMENTS:				

FIELD CODE	COMMON NAME/DESCRIPTION	FORM	%COVER	TAXA CODE
COMMENTS:				

FIELD CODE	COMMON NAME/DESCRIPTION	FORM	%COVER	TAXA CODE
COMMENTS:				

FIELD CODE	COMMON NAME/DESCRIPTION	FORM	%COVER	TAXA CODE
COMMENTS:				

FIELD CODE	COMMON NAME/DESCRIPTION	FORM	%COVER	TAXA CODE
COMMENTS:				

FIELD CODE	COMMON NAME/DESCRIPTION	FORM	%COVER	TAXA CODE
COMMENTS:				

FIELD CODE	COMMON NAME/DESCRIPTION	FORM	%COVER	TAXA CODE
COMMENTS:				

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY

Off-Site Animal and Plant Records

Animal or Plant:		Group/Growth Form:	
Common Name:		Taxa Code:	Field Code:
Date:	Observer:		
Descriptive Location:			
Specific Location(UTM):	North:		East:
USGS Quad. Map Name:			
Range:	Township:		Section:
Elevation:			
Landform:			
Specific Habitat:			
General Landscape Description:			
General Vegetation Description:			
Addtional Comments:			

Animal or Plant:		Group/Growth Form:	
Common Name:		Taxa Code:	Field Code:
Date:	Observer:		
Descriptive Location:			
Specific Location(UTM):	North:		East:
USGS Quad. Map Name:			
Range:	Township:		Section:
Elevation:			
Landform:			
Specific Habitat:			
General Landscape Description:			
General Vegetation Description:			
Additional Comments:			

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Appendix 4

LIST OF TAXONOMIC EXPERTS WHO PROVIDED IDENTIFICATION SERVICES

APPENDIX 4.

TAXONOMIC SPECIALISTS WHO PORVIDED IDENTIFICATION SERVICES FOR PLANT AND ANIMAL SPECIMENS.

TAXA	NAME AND AFFILIATION
PLANTS	
Grasses	Dr. Kelly Alred, Department of Agronomy, New Mexico State Univesity.
Lichens and mosses	Dr. William A. Weber, Herbarium, University of Colorado.
ANIMALS	
Mammals	Bill Gannon, Museum of Southwestern Biology, Mammal Divison, University of New Mexico.
Arthropods	
Spiders (Aranea)	Dr. David B. Richman, Department ofEntomology and Plant Pathology, New Mexico State University.
Tarantulas (Mygalamorpha)	Rick C. West, Royal British Columbia Museum.
Harvestmen (Opiliones)	Dr. James C. Cokendolpher, Lubbock, Texas.
Scorpions (Scorpionida)	Dr. W. David Sissom, Department of Biology and Geosciences, West Texas State University.
Sunspiders (Solpugida)	Jack Brookhart, Englewood, Colorado.
Mites (Acari)	Dr. W. Calvin Welbourn, Acarology Laboratory, Ohio State University. (identifications not yet completed)
Millipedes and centipedes (Diplopoda and Chilopoda)	Dr. Rowland M. Shelly, North Carolina State Museum of Natural Resources.
Springtails (Collembola)	Dr. Richard J. Snider, Department of Zoology, Michigan State University.
Bristletails (Microcoryphia)	Dr. L. F. Mendes, Instituto de Investigacao Cientifica Tropical, Portugal.

Camel crickets (Raphidiphoridae)	Dr. Theodore J. Cohn, Insect Divison, Museum of Zoology, University of Michigan.
Crickets (Gryllidae and Stenopelmatidae)	Dr. David B. Weissman, Department of Entomology, California Academy of Sciences.
Crickets (Mogoplistinae)	Dr. Robert E. Love, Oakland, California.
Hemiptera	Systematic Entomology Laboratory, Beltsville, Maryland. (identifications not completed)
Homoptera	Systematic Entomology Laboratory, Beltsville, Maryland. (identifications not completed)
Cicadas (Cicadidae)	Dr. Thomas E. Moore, Insect Division, Museum of Zoology, University of Michigan. (identifications not completed)
Neuroptera	Ed Gage, Texas Museum of Entomology (identifications not completed)
Coleoptera	Ed Gage, Texas Museum of Entomology (identifications not completed)
Ground beetles (Carabidae)	Dr. George E. Ball and D. Shpeley, Department of Entomology, University of Alberta.
Darkling beetles (Tenebrionidae)	Dr. Charles A. Tripplehorn, Department of Entomology, Ohio State University.
Butterflies (Lepidoptera)	Gregory S. Forbes, Department of Biology, New Mexico State University.
Diptera	Sytematic Entomology Laboratory, Belstville, Maryland. (identifications not completed)
Robber flies (Asilidae)	Gregory S. Forbes, Department of Biology, New Mexico State University.
Hymenoptera	Ed Gage, Texas Museum of Entomology (identifications not completed)
Bees	Dr. Terry L. Griscold, USDA-ARS Bee Lab, Utah State University.
Spider wasps (Pompilidae)	Dr. Howard E. Evans, Department of Zoology and Entomology, Colorado State University.

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Appendix 5

INVENTORY SITE CODE LISTING

APPENDIX 5

EL MALPAIS VETETATION AND WILDLIFE INVENTORY SITE NAMES. LIST OF NAMES SORTED BY SITE CODE.

Site Code	Site Name	Geological Unit
AABA	Bandera Flow Aa Field	Bandera Flow
ACOM	Acoma Collapse	Bandera Flow
ALBA	Alluvial Basin	Alluvium
APCO	Apache Collapse Structure	Bandera Flow
BACA	Bat Cave	El Calderon Flow
BACR	Bandera Crater	Bandera Flow
BAWA	Bandera Wall	Bandera Flow
BHBF	Big Hole in the Wall Bandera Flow	Bandera Flow
BIHO	Big Hole in the Wall	Old Basalt Flows
BLTT	Big Lava Tubes Trail Head Area	Cerro Rendija
BRAI	Braided Cave	Hoya Flow
BRWI	Bridge Window Collapse	Bandera Flow
BSLC	Big Skylight Cave	Bandera Flow
BTKI	Big Tubes Kipuka	Old Basalt Flows
BWPH	Bandera Wall Pahoehoe Flow	Bandera Flow
CADU	Candelaria Dump	San Andres Limestone
CAND	Candelaria's Trading Post	Bandera Flow
CAPO	Cattle Pond	Old Basalt Flows
CEBA	Cerro Bandera	Bandera Flow
CEEN	Cerro Encierro	Old Basalt Flows
CJPA	Cerro de Jaspe Permian Abo Sandstone	Abo Sandstone
CO42	County Road 42	Alluvium
DOME	Dome Collapse	Bandera Flow
DOSI	Double Sinks	El Calderon Flow
ELCA	El Calderon	El Calderon Flow
ELCF	El Calderon Parking Area	El Calderon Flow
ENCO	End Collapse	Bandera Flow
ENDC	End Cave	Bandera Flow
ERHO	End Road Hoya Flow	Hoya Flow
FERN	Fern Sink	Cerro Rendija
FOUR	Four Windows Cave	Bandera Flow
GICE	Giant Ice Cave	Bandera Flow
HAFE	Hanging Fern Collapse	Bandera Flow
HIDD	Hidden Kipuka	Glorieta Sandstone
HOMC	Hoya Lava Flow Near LOME	Hoya Flow
HORO	Hole in the Roof Collapse	Bandera Flow
HOSW	Hoya Southwest	Hoya Flow
HOYA	Hoya Lava Flow near MEBL	Hoya Flow
HOYK	Hoya Flow at Old Basalt Kipukas	Hoya Flow
HOYM	Hoya Kipuka in McCartys Flow	Hoya Flow
HOYP	Hoya Flow at Prairie Dog Well	Hoya Flow
ICEP	Ice Pond Cave	Cerro Rendija

ICWA	Ice Water Collapse	Bandera Flow
INWA	Indian Water Collapse	Bandera Flow
IRIS	Iris	Twin Craters Flows
JUCA	Junction Cave	El Calderon Flow
KIHN	North Hoya Kipuka	Old Basalt Flows
KIHS	South Hoya Kipuka	Old Basalt Flows
LACR	Lava Crater	Lava Crater
LICO	Lichen Collapse	Bandera Flow
LOME	Los Medanitos Kipuka	Eolian Deposits
LOWO	Lost Woman Cone	Twin Craters Flows
MACO	Massive Collapse	Bandera Flow
MARC	Marchantia Ice Cave	Lava Crater
MARC-2	Marchantia Collapse 2	Lava Crater
MARC-3	Marchantia Collapse 3	Lava Crater
MARC-4	Marchantia Collapse 4	Lava Crater
MARC-5	Marchantia Collapse 5	Lava Crater
MARC-6	Marchantia Collapse 6	Lava Crater
MARC-7	Marchantia Collapse 7	Lava Crater
MARC-C	Marchantia Camp	Lava Crater
MCCA	McCartys Lava Flow near LOME	McCartys Flow
MCSW	McCartys Flow Southwest	McCartys Flow
MEBL	Mesita Blanca	San Andres Limestone
MTKI	Middle Three Kipukas	Eolian Deposits
NACO	Navajo Collapse and Cave	Bandera Flow
NAKI	Navajo Kipuka	Old Basalt Flows
NARR	McCartys Flow at North Narrows	McCartys Flow
NATH	Navajo Trailhead	Old Basalt Flows
NOMC	North McCartys Flow	McCartys Flow
NOPA	North Pasture	Alluvium
NOSR	North Pasture Sandstone Ridge	Zuni Sandstone
NPMC	North Pasture McCartys Flow	McCartys Flow
NPMS	North Pasture McCartys Flow South	McCartys Flow
NPPO	North Pasture Pond	Alluvium
NPSS	North Pasture Sandstone Ridge South	Zuni Sandstone
NSBR	North & South Bridges	Bandera Flow
NSHO	North Sandstone Bluffs Hoya Flow	Hoya Flow
NTKI	North Three Kipukas	Eolian Deposits
OARD	Oak Ridge Road	San Andres Limestone
OFSW	Old Lava Flow Southwest	Old Basalt Flows
OLBA	Old Basalt Flow near Los Cerros Ranch	Old Basalt Flows
PRWE	Prairie Dog Well	Old Basalt Flows
RASN	Rattlesnake Collapse	Bandera Flow
REND	Rendija Area	Cerro Rendija
SABL	Sandstone Bluffs	Zuni Sandstone
SEMC	Southeast McCartys Flow	McCartys Flow
SEPT	Southeast Point	McCartys Flow
STCO	Stadium Collapse	Bandera Flow
STKI	South Three Kipukas	Eolian Deposits
SUBR	Sunken Bridge	Bandera Flow
TPCO	Tree Pole Collapse	Bandera Flow
TRIA	Triangle Collapse	Bandera Flow
TW53	Twin Crates Flow near NM53	Twin Craters Flows

TWFL	Twin Craters Lava Flow	Twin Craters Flows
TWIS	Twin Craters Flow	Twin Craters Flows
ZABF	Zuni-Acoma Bandera Flow	Bandera Flow
ZAKI	Zuni-Acoma Kipuka	Yeso Limestone
ZATF	Zuni-Acoma Twin Craters Flow	Twin Craters Flows
ZATH	Zuni-Acoma Trailhead	El Calderon Flow
ZUNI	Zuni Collapse	Bandera Flow

Geological Unit	Site Code	Site Name
Abo Sandstone	CJPA	Cerro de Jaspe Permian Abo Sandstone
Alluvium	NOPA	North Pasture
Alluvium	NPPO	North Pasture Pond
Alluvium	ALBA	Alluvial Basin
Alluvium	CO42	County Road 42
Bandera Flow	HORO	Hole in the Roof Collapse
Bandera Flow	INWA	Indian Water Collapse
Bandera Flow	ICWA	Ice Water Collapse
Bandera Flow	HAFE	Hanging Fern Collapse
Bandera Flow	ENDC	End Cave
Bandera Flow	ENCO	End Collapse
Bandera Flow	GICE	Giant Ice Cave
Bandera Flow	FOUR	Four Windows Cave
Bandera Flow	LICO	Lichen Collapse
Bandera Flow	TPCO	Tree Pole Collapse
Bandera Flow	SUBR	Sunken Bridge
Bandera Flow	TRIA	Triangle Collapse
Bandera Flow	ZUNI	Zuni Collapse
Bandera Flow	ZABF	Zuni-Acoma Bandera Flow
Bandera Flow	NACO	Navajo Collapse and Cave
Bandera Flow	MACO	Massive Collapse
Bandera Flow	NSBR	North & South Bridges
Bandera Flow	STCO	Stadium Collapse
Bandera Flow	RASN	Rattlesnake Collapse
Bandera Flow	ACOM	Acoma Collapse
Bandera Flow	BRWI	Bridge Window Collapse
Bandera Flow	CAND	Candelaria's Trading Post
Bandera Flow	BHBF	Big Hole in the Wall Bandera Flow
Bandera Flow	BAWA	Bandera Wall
Bandera Flow	BACR	Bandera Crater
Bandera Flow	BSLC	Big Skylight Cave
Bandera Flow	BWPH	Bandera Wall Pahoehoe Flow
Bandera Flow	APCO	Apache Collapse Structure
Bandera Flow	AABA	Bandera Flow Aa Field
Bandera Flow	DOME	Dome Collapse
Bandera Flow	CEBA	Cerro Bandera
Cerro Rendija	BLTT	Big Lava Tubes Trail Head Area
Cerro Rendija	ICEP	Ice Pond Cave
Cerro Rendija	REND	Rendija Area
Cerro Rendija	FERN	Fern Sink
El Calderon Flow	BACA	Bat Cave
El Calderon Flow	JUCA	Junction Cave
El Calderon Flow	DOSI	Double Sinks
El Calderon Flow	ELCA	El Calderon
El Calderon Flow	ELCF	El Calderon Parking Area

El Calderon Flow	ZATH	Zuni-Acoma Trailhead
Eolian Deposits	MTKI	Middle Three Kipukas
Eolian Deposits	NTKI	North Three Kipukas
Eolian Deposits	LOME	Los Medanitos Kipuka
Eolian Deposits	STKI	South Three Kipukas
Glorieta Sandstone	HIDD	Hidden Kipuka
Hoya Flow	HOMC	Hoya Lava Flow Near LOME
Hoya Flow	BRAI	Braided Cave
Hoya Flow	HOYA	Hoya Lava Flow near MEBL
Hoya Flow	HOSW	Hoya Southwest
Hoya Flow	HOYP	Hoya Flow at Prairie Dog Well
Hoya Flow	ERHO	End Road Hoya Flow
Hoya Flow	HOYM	Hoya Kipuka in McCartys Flow
Hoya Flow	NSHO	North Sandstone Bluffs Hoya Flow
Hoya Flow	HOYK	Hoya Flow at Old Basalt Kipukas
Lava Crater	MARC-C	Marchantia Camp
Lava Crater	MARC-3	Marchantia Collapse 3
Lava Crater	MARC-4	Marchantia Collapse 4
Lava Crater	MARC-2	Marchantia Collapse 2
Lava Crater	LACR	Lava Crater
Lava Crater	MARC	Marchantia Ice Cave
Lava Crater	MARC-7	Marchantia Collapse 7
Lava Crater	MARC-6	Marchantia Collapse 6
Lava Crater	MARC-5	Marchantia Collapse 5
McCartys Flow	NPMC	North Pasture McCartys Flow
McCartys Flow	NPMS	North Pasture McCartys Flow South
McCartys Flow	SEMC	Southeast McCartys Flow
McCartys Flow	SEPT	Southeast Point
McCartys Flow	NARR	McCartys Flow at North Narrows
McCartys Flow	MCSW	McCartys Flow Southwest
McCartys Flow	MCCA	McCartys Lava Flow near LOME
McCartys Flow	NOMC	North McCartys Flow
Old Basalt Flows	NAKI	Navajo Kipuka
Old Basalt Flows	PRWE	Prairie Dog Well
Old Basalt Flows	KIHN	North Hoya Kipuka
Old Basalt Flows	KIHS	South Hoya Kipuka
Old Basalt Flows	CAPO	Cattle Pond
Old Basalt Flows	CEEN	Cerro Encierro
Old Basalt Flows	NATH	Navajo Trailhead
Old Basalt Flows	BIHO	Big Hole in the Wall
Old Basalt Flows	OLBA	Old Basalt Flow near Los Cerros Ranch
Old Basalt Flows	OFSW	Old Lava Flow Southwest
Old Basalt Flows	BTKI	Big Tubes Kipuka
San Andres Limestone	CADU	Candelaria Dump
San Andres Limestone	OARD	Oak Ridge Road
San Andres Limestone	MEBL	Mesita Blanca
Twin Craters Flows	TWFL	Twin Craters Lava Flow
Twin Craters Flows	ZATF	Zuni-Acoma Twin Craters Flow
Twin Craters Flows	TWIS	Twin Craters Flow
Twin Craters Flows	LOWO	Lost Woman Cone
Twin Craters Flows	IRIS	Iris
Twin Craters Flows	TW53	Twin Crates Flow near NM53

Yeso Limestone	ZAKI	Zuni-Acoma Kipuka
Zuni Sandstone	NPSS	North Pasture Sandstone Ridge South
Zuni Sandstone	SABL	Sandstone Bluffs
Zuni Sandstone	NOSR	North Pasture Sandstone Ridge

VEGETATION AND WILDLIFE INVENTORY

OF EL MALPAIS NATIONAL MONUMENT

Final Report

Appendix 6

INVENTORY SITE INFORMATION RECORDS

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: AABA SITE NAME: Bandera Flow Aa Field

INITIAL SURVEY DATE: 07/23/92 SURVEYORS: Bleakly

DESCRIPTIVE LOCATION: East of Cerro Bandera, 0.7 miles south of SR 53 and 0.25 miles east of CR 42.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 11 W TOWNSHIP: 9 N SECTION: 22

UTM ZONE: 12 N: 3876400E: 765500

LATITUDE 34 59' 49.8"

LONGITUDE 108 05' 27.8"

SIZE OF SITE: 4 ha ELEVATION: 7900'

LANDFORM: lava flow GEOLOGICAL UNIT: Bandera flow

PARENT MATERIAL: basalt SOIL: none

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 1 GRAVEL(3-7.5mm): 24 ROCK(>7.5mm): 75

PERCENT VEGETATION COVER

CANOPY: 5 BASAL: 2 CRYPTOGAMS: 30 WOOD: 1 LEAF LITTER: 1

GENERAL LANDSCAPE DESCRIPTION: Level aa lava flow with few depressions and cracks. Mostly barren, loose lava rocks.

GENERAL VEGETATION DESCRIPTION: Mostly isolated individual Douglas fir ocean spray, and Rocky Mountain juniper.

UNUSUAL FEATURES: Very patchy vegetation.

ADDITIONAL COMMENTS: none

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: ACOM SITE NAME: Acoma Collapse

INITIAL SURVEY DATE: 7/16/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: One half mile southwest of Bandera Crater.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 9 N SECTION: 22 se 1/4

UTM ZONE: 12 N: 3875500 E: 767350

LATITUDE 34 59' 18.9"

LONGITUDE 108 04' 16.0"

SIZE OF SITE: 1 ha ELEVATION: 7840'

LANDFORM: lava tube collapse GEOLOGICAL UNIT: Bandera flow

PARENT MATERIAL: basalt SOIL: sparse, sandy loam

EROSION TYPE: runon EROSION POTENTIAL: low

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 10 GRAVEL(3-7.5mm): 5 ROCK(>7.5mm): 85

PERCENT VEGETATION COVER

CANOPY: 25 BASAL: 5 CRYPTOGAMS: 70 WOOD: 2 LEAF LITTER: 5

GENERAL LANDSCAPE DESCRIPTION: Trough 120 by 30 meters. Sides gradually slope in. A deeper collapse in south end, 5 meters deeper, and 50 by 10 meters. Small overhangs at both north and south ends. Small cave in north end, cold inside, but no water or ice.

GENERAL VEGETATION DESCRIPTION: Dense vegetation cover relative to the surrounding lava flow. Several small Douglas firs, ocean spray, Rocky Mountain juniper, *Rhus*, and Apache plume. Mountain muhly in bottom. Orange lichen zonation in cave mouth, north end.

UNUSUAL FEATURES: Cave in north end with man-made rock wall across front. Scattered wood inside of cave.

ADDITIONAL COMMENTS: Many dead and down large ponderosa pine and Douglas fir trees.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: ALBA SITE NAME: Alluvial Basin

INITIAL SURVEY DATE: 6/4/92 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 1.5 miles northwest of El Calderon.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 11 W TOWNSHIP: 9 N SECTION: 29 w 1/2

UTM ZONE: 12 N: 3874800E: 771400

LATITUDE 34 58' 52.3"

LONGITUDE 108 01' 37.3"

SIZE OF SITE: 25 ha ELEVATION: 7420'

LANDFORM: alluvial basin GEOLOGICAL UNIT: Quaternary alluvium

PARENT MATERIAL: sandstone/basalt SOIL: silty-loam

EROSION TYPE: runoff/runon EROSION POTENTIAL: moderate

LIVESTOCK EVIDENCE: old cattle dung common

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 98 GRAVEL(3-7.5mm): 1 ROCK(>7.5mm): 1

PERCENT VEGETATION COVER

CANOPY: 75 BASAL: 40 CRYPTOGAMS: 1 WOOD: 1 LEAF LITTER: 1

GENERAL LANDSCAPE DESCRIPTION: Alluvial basin surrounded by Twin Craters basalt and Abo sandstone formation. Soil reddish, fine texutured. Basin flat and circular in shape. No distinct drainages.

GENERAL VEGETATION DESCRIPTION: Blue grama grassland with considerable cover of rabbitbrush. High diversity of grasses and forbs. Few small juniper and ponderosa pine scattered near edge.

UNUSUAL FEATURES: Open, flat grass/shrubland.

ADDITIONAL COMMENTS: Old road on west and east sides.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: APCO SITE NAME: Apache Collapse Structure

INITIAL SURVEY DATE: 06/16/92 SURVEYORS: Lightfoot, Viers

DESCRIPTIVE LOCATION: 2 miles northwest of Navajo Ice Cave.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 11 W TOWNSHIP: 8N SECTION: 15ne1/4

UTM ZONE 12 N: 3868850 E: 766050

LATITUDE 34 55' 48"

LONGITUDE 108 05' 07"

SIZE OF SITE: 1 ha ELEVATION: 7540'

LANDFORM: Lava tube collapse GEOLOGICAL UNIT: Bandera flow

PARENT MATERIAL: Basalt SOIL: fine loam, much litter.

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 5 GRAVEL(3-7.5mm): 20 ROCK(>7.5mm): 75

PERCENT VEGETATION COVER

CANOPY:65 BASAL:20 CRYPTOGAMS:70 WOOD:2 LEAF LITTER:3

GENERAL LANDSCAPE DESCRIPTION: Large lava tube collapse with cave entrance. Pahoehoe lava around rim. Sheer cliffs all around. Boulders in bottom. Large cave entrance on SE side, and cave entrance on NW side with large pond 15 m across. Ice about 0.5 m thick in pond under about 25 cm of water.

GENERAL VEGETATION DESCRIPTION: Ponderosa pine woodland on lava around rim, some pinon and juniper. Mountain muhly, pine droopseed, and blue grama dominant grasses. Ribes in collapse near pond. Distinct orange lichen and moss zones near ice pond.

UNUSUAL FEATURES: Large ice pond in cave entrance. Large cave entrance extending deep into lava tube across collapse from pond. Green algae in pond water.
ADDITIONAL COMMENTS: Outstanding ice pond and lava tube cave.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: BACA SITE NAME: Bat Cave

INITIAL SURVEY DATE: 8/16/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 0.75 miles northeast of El Calderon.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 11 W TOWNSHIP: 9 N SECTION: 33 center

UTM ZONE: 12 N: 3872500 E: 773400

LATITUDE 34 57' 35.8"

LONGITUDE 108 00' 21.2"

SIZE OF SITE: 1 ha ELEVATION: 7300'

LANDFORM: lava tube collapse & caves GEOLOGICAL UNIT: El Calderon flow

PARENT MATERIAL: basalt SOIL: fine loam

EROSION TYPE: runoff EROSION POTENTIAL: high

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 15 GRAVEL(3-7.5mm): 20 ROCK(>7.5mm): 65

PERCENT VEGETATION COVER

CANOPY: 25 BASAL: 5 CRYPTOGAMS: 40 WOOD: 0.5 LEAF LITTER: 1

GENERAL LANDSCAPE DESCRIPTION: Lava tube collapse with cave entrances at northeast and southwest ends. Collapse 10 by 20 meters, walls shallow, bottom filled with rock rubble. Main Bat Cave (ne end) extensive, going at least 1 km, sw end cave about 100 meters deep. Caves cold and dry.

GENERAL VEGETATION DESCRIPTION: *Pericome* abundant in collapse. Surrounding area blue grama/snakeweed, widely scattered pinon and juniper.

UNUSUAL FEATURES: Bat Cave extensive, with numerous small collapse openings further ne. Extensive bat colony with considerable guano present from about 50 to 200 meters from the cave mouth.

ADDITIONAL COMMENTS: Considerable soil erosion around collapse from people walking. Many footprints going into Bat Cave.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: BACR SITE NAME: Bandera Crater

INITIAL SURVEY DATE: 7/17/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 0.5 miles southeast of intersection of SR 53 and CR 42.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 9 N SECTION: 22, 23

UTM ZONE: 12 N: 3876500 E: 766200

LATITUDE 34 59' 52.4"

LONGITUDE 108 05' 00.1"

SIZE OF SITE: 100 ha ELEVATION: 7880-8309'

LANDFORM: volcano/cinder cone GEOLOGICAL UNIT: Bandera Crater

PARENT MATERIAL: basalt SOIL: cinders and sandy loam

EROSION TYPE: runoff EROSION POTENTIAL: high

LIVESTOCK EVIDENCE: old horse dung common

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 5 GRAVEL(3-7.5mm): 85 ROCK(>7.5mm): 10

PERCENT VEGETATION COVER

CANOPY: 15 BASAL: 2 CRYPTOGAMS: 2 WOOD: 1 LEAF LITTER: 2

GENERAL LANDSCAPE DESCRIPTION: Large volcanic crater in cinder cone. Crater 150 meters deep, 400 meters across. Steep cinder slopes all around. Basalt cliffs around inside of crater. Breach on SW side where Bandera Lava flow starts. Cinder ridge on top of crater.

GENERAL VEGETATION DESCRIPTION: Ponderosa pine woodland all around volcano. Ponderosa pine on all outside slopes, dense on north slope. Aspen on north slope, aspen and Douglas fir in crater. Apache plume, rabbitbrush, ocean spray, pinon pine common throughout. Dense bracken fern stand on east slope.

UNUSUAL FEATURES: Steep cinder slopes with little vegetation. Steep basalt cliffs in crater. Pinon pine trees on top flagged from wind. Some limber pines on top.

ADDITIONAL COMMENTS: Extensive fire scars on large ponderosa pine trees on top of volcano and on north side.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: BAWA SITE NAME: Bandera Wall

INITIAL SURVEY DATE: 7/2/92 SURVEYORS: Lightfoot, Viers

DESCRIPTIVE LOCATION: Edge of Bandera flow, about 1 mile northeast of Cerro Rendija

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 8 N SECTION: 4 center

UTM ZONE: 12 N: 3871800 E: 763800

LATITUDE 34 57' 22.3"

LONGITUDE 108 06' 40.0"

SIZE OF SITE: 2 ha ELEVATION: 7700'

LANDFORM: lava flow GEOLOGICAL UNIT: Bandera flow

PARENT MATERIAL: basalt SOIL: sparse fine loam

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 0.5 GRAVEL(3-7.5mm): 15 ROCK(>7.5mm): 85

PERCENT VEGETATION COVER

CANOPY: 10 BASAL: 2 CRYPTOGAMS: 75 WOOD: 0.25 LEAF LITTER: 0.5

GENERAL LANDSCAPE DESCRIPTION: Bandera aa lava flow. Edge of flow forms a large, high wall of lava about 10 meters above "old flow" to the southwest. Very rough aa flow with scattered ridges and spatter cones, many large basalt blocks.

GENERAL VEGETATION DESCRIPTION: Sparse, scattered pinon, juniper, ocean spray, rabbitbrush, occasional blue grama and mountain muhly grass patches on soil. Lichen cover high on lava.

UNUSUAL FEATURES: Aa flow with large blocks, high lava wall.

ADDITIONAL COMMENTS: Same area where very old Douglas fir trees found.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: BHBF SITE NAME: Big Hole in the Wall Bandera Flow

INITIAL SURVEY DATE: 7/1/92 SURVEYORS: Lightfoot, Viers

DESCRIPTIVE LOCATION: North side of Big Hole in the Wall, 2 miles east of Cerro Encierro.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 11 W TOWNSHIP: 8 N SECTION: 32

UTM ZONE: 12 N: 3863250 E: 772100

LATITUDE 34 52' 37.2"

LONGITUDE 108 01' 23.2"

SIZE OF SITE: 2 ha ELEVATION: 7200'

LANDFORM: lava flow GEOLOGICAL UNIT: Bandera flow

PARENT MATERIAL: basalt SOIL: sparse, fine loam

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 5 GRAVEL(3-7.5mm): 30 ROCK(>7.5mm): 65

PERCENT VEGETATION COVER

CANOPY: 48 BASAL: 22 CRYPTOGAMS: 75 WOOD: 3 LEAF LITTER: 25

GENERAL LANDSCAPE DESCRIPTION: Lava flow, generally flat pahoehoe with low pressure ridges and many small surface collapse structures. Soil sparse, best developed on open flat areas.

GENERAL VEGETATION DESCRIPTION: Open ponderosa pine woodland. Understory vegetation mostly blue grama and mountian muhly with *Heterotheca villosa*. Apache plum and ocean spray common shrubs, aspen common in collapses.

UNUSUAL FEATURES: Numerous small surface collapses with aspen.

ADDITIONAL COMMENTS: No evidence of logging. Considerable evidence (stumps) in Big Hole in the Wall.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: BIHO SITE NAME: Big Hole in the Wall

INITIAL SURVEY DATE: 7/1/92 SURVEYORS: Lightfoot, Viers

DESCRIPTIVE LOCATION: 0.25 miles northeast of Cerro Encierro.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 8 N SECTION: 36 ne 1/4

UTM ZONE: 12 N: 3864000 E: 769850

LATITUDE 34 53' 03.7"

LONGITUDE 108 02' 50.9"

SIZE OF SITE: 2 ha ELEVATION: 7350'

LANDFORM: lava flow GEOLOGICAL UNIT: Old basalt flow

PARENT MATERIAL: basalt SOIL: fine loam

EROSION TYPE: runoff EROSION POTENTIAL: moderate

LIVESTOCK EVIDENCE: cattle dung and tracks common

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 70 GRAVEL(3-7.5mm): 15 ROCK(>7.5mm): 15

PERCENT VEGETATION COVER

CANOPY: 80 BASAL: 30 CRYPTOGAMS: 10 WOOD: 0.5 LEAF LITTER: 30

GENERAL LANDSCAPE DESCRIPTION: Flat, slightly rolling with low basalt outcrop ridges. Soil well developed on low flat areas. Basalt outcrops generally less than 50 meters long and 1-2 meters high, common. Occassional low sink areas where ephemeral water collects, silty soil.

GENERAL VEGETATION DESCRIPTION: Open ponderosa pine woodland. Tress large and widely scattered. Blue grama, mountain muhly, and pine dropseed major grasses, forming fairly high cover. Rabbitbrush, *Heterotheca villosa*, and *Hymenoxys richardsonii* common shrubs. Many herb species.

UNUSUAL FEATURES: none

ADDITIONAL COMMENTS: Similar to landscape and vegetation of Little Hole in the Wall. Past logging evident from many stumps.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: BLTT SITE NAME: Big Lava Tubes Trailhead Area

INITIAL SURVEY DATE: 7/24/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 1 mile southeast of Cerro Rendija.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 8 N SECTION: 9 nw 1/4

UTM ZONE: 12 N: 3870550 E: 764150

LATITUDE 34 56' 41.4"

LONGITUDE 108 06' 27.7"

SIZE OF SITE: 4 ha ELEVATION: 7620'

LANDFORM: piedmont slope base GEOLOGICAL UNIT: Cerro Rendija volcanic debris & Bandera flow

PARENT MATERIAL: basalt SOIL: fine loam

EROSION TYPE: runoff EROSION POTENTIAL: moderate

LIVESTOCK EVIDENCE: cattle common

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 95 GRAVEL(3-7.5mm): 0.5 ROCK(>7.5mm): 5

PERCENT VEGETATION COVER

CANOPY: 70 BASAL: 45 CRYPTOGAMS: 8 WOOD: 5 LEAF LITTER: 35

GENERAL LANDSCAPE DESCRIPTION: Piedmont slope base, 2-3% slope. Well developed soil over basalt. Occassional low basalt outcrops.

GENERAL VEGETATION DESCRIPTION: Open pondersoa pine, pinon, juniper woodland. Understory blue grama, mountain muhly, pine dropseed grassland, *Heterotheca villosa* and *Hymenoxys richardsonii* common. Herbs diverse.

UNUSUAL FEATURES: none

ADDITIONAL COMMENTS: none

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: BRAI SITE NAME: Braided Cave

INITIAL SURVEY DATE: 6/24/92 SURVEYORS: Bleakly, Viers

DESCRIPTIVE LOCATION: South of Little Hole in the Wall, and 1.5 miles northwest of Hoya de Cibola.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 8 N SECTION: 28

UTM ZONE: 12 N: 3865000 E: 764680

LATITUDE 34 53' 41.0"

LONGITUDE 108 06' 13.1"

SIZE OF SITE: 2 ha ELEVATION: 7500'

LANDFORM: lava tube system GEOLOGICAL UNIT: Hoya flow

PARENT MATERIAL: basalt SOIL: fine loam

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 1 GRAVEL(3-7.5mm): 15 ROCK(>7.5mm): 84

PERCENT VEGETATION COVER

CANOPY: 3 BASAL: 2 CRYPTOGAMS: 40 WOOD: 1 LEAF LITTER: 1

GENERAL LANDSCAPE DESCRIPTION: Lava tube in Hoya lava flow. Tube with six collapses. Several interconnecting side tubes form braided pattern. Surrounding area Hoya lava flow, numerous low ridges and surfaces collapse structures. Cave tube 400-500 meters long.

GENERAL VEGETATION DESCRIPTION: Ponderosa pine woodland in surrounding area. Collapses with few forbs such as *Arabis* and *Woodsia*. Occassional *Ribes* and ocean spray. Pondersoa pine trees growing on top of lava tube. Understory of mountain muhly and pine dropseed.

UNUSUAL FEATURES: Long continous, interconnected lava tube cave. Several bighorn sheep remains found 200-400 meters back in cave. One skeleton still had dried flesh and skin on bones.

ADDITIONAL COMMENTS: Bat colony seen in side tube connecting 2nd and 3rd collapse.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: BRWI SITE NAME: Bridge Window Collapse

INITIAL SURVEY DATE: 7/16/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 0.4 miles southwest of Bandera Crater.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 9 N SECTION: 22 se 1/4

UTM ZONE: 12 N: 3875600 E: 766400

LATITUDE 34 59' 23.1"

LONGITUDE 108 04' 53.3"

SIZE OF SITE: 1 ha ELEVATION: 7840'

LANDFORM: lava tube collapse GEOLOGICAL UNIT: Bandera flow

PARENT MATERIAL: basalt SOIL: sparse, fine loam

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 0.5 GRAVEL(3-7.5mm): 5 ROCK(>7.5mm): 95

PERCENT VEGETATION COVER

CANOPY: 3 BASAL: 1 CRYPTOGAMS: 75 WOOD: 0.25 LEAF LITTER: 1

GENERAL LANDSCAPE DESCRIPTION: Lava tube collapse 100 by 60 meters, filled with rock rubble. Steep 5-10 meter basalt walls on east side. Picture window is a small adjacent collapse 15 meters in diameter. Small 5 meter diameter window between two collapses.

GENERAL VEGETATION DESCRIPTION: Few small juniper trees, one small Douglas fir, several ocean spray shrubs. Orange lichen moss zonation in picture window.

UNUSUAL FEATURES: Deep holes present on NE side of picture window. Cold air is present inside, and ice pool present in bottom of one hole.

ADDITIONAL COMMENTS: Distinctive zonation of yellow lichen/orange lichen/gray-green lichen and moss.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: BSLC SITE NAME: Big Skylight Cave

INITIAL SURVEY DATE: 7/25/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 1.5 miles east of Cerro Rendija.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 8 N SECTION: 4 se 1/4

UTM ZONE: 12 N: 3870580 E: 764800

LATITUDE 34 56' 41.8"

LONGITUDE 108 06' 02.1"

SIZE OF SITE: 2 ha ELEVATION: 7620'

LANDFORM: lava tube collapse and cave GEOLOGICAL UNIT: Bandera flow

PARENT MATERIAL: basalt SOIL: sparse, fine loam

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 0.5 GRAVEL(3-7.5mm): 10 ROCK(>7.5mm): 90

PERCENT VEGETATION COVER

CANOPY: 5 BASAL: 1 CRYPTOGAMS: 75 WOOD: 0.5 LEAF LITTER: 1

GENERAL LANDSCAPE DESCRIPTION: Large lava tube collapse in pahoehoe portion of Bandera flow. Tube about 25 meters diameter. Cave at south end of 60 meter long collapse. Cave about 200 meters deep. Skylight collapse, 10 meters diameter about 50 meters from cave mouth. Large boulders on cave floor.

GENERAL VEGETATION DESCRIPTION: Scattered ponderosa pine, pinon, juniper on surrounding lava flow. Rabbitbrush, *Rhus*, Apache plume common. Few plants in collapse. Zonation of lichens and moss at cave mouth. Moss garden on cave floor under skylight.

UNUSUAL FEATURES: Large cave with skylight and moss garden. Skeletons of bighorn sheep found buried among rock rubble about 100 meters inside of cave.

ADDITIONAL COMMENTS: No water or ice found in cave.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: BTKI SITE NAME: Big Tubes Kipuka

INITIAL SURVEY DATE: 7/31/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 1.3 miles southeast of Cerro Rendija.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 8 N SECTION: 9 ne 1/4

UTM ZONE: 12 N: 3869800 E: 764600

LATITUDE 34 56' 16.7"

LONGITUDE 108 06' 10.8"

SIZE OF SITE: 4 ha ELEVATION: 7560'

LANDFORM: kipuka GEOLOGICAL UNIT: Old basalt flow

PARENT MATERIAL: basalt SOIL: fine loam

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 90 GRAVEL(3-7.5mm): 5 ROCK(>7.5mm): 5

PERCENT VEGETATION COVER

CANOPY: 50 BASAL: 10 CRYPTOGAMS: 1 WOOD: 3 LEAF LITTER: 40

GENERAL LANDSCAPE DESCRIPTION: Small area of alluvium surrounded by Bandera lava flow. Level, fine loam soils.

GENERAL VEGETATION DESCRIPTION: Large scattered ponderosa pines, density and tree size greater than surrounding lava flow. Open parkland with dense layer of pine needles on soil. Mountain muhly, blue grama, and pine dropseed common grasses. *Hymenoxys richardsonii* common.

UNUSUAL FEATURES: Ponderosa pine trees larger than on surrounding lava.

ADDITIONAL COMMENTS: No obvious difference in grass or vegetation cover compared to areas west of the lava flow such as BLTT. No observable difference, except for large ponderosa pine trees; no logging evidence.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: BWPH SITE NAME: Bandera Wall Pahoehoe Flow

INITIAL SURVEY DATE: 7/2/92 SURVEYORS: Lightfoot, Viers

DESCRIPTIVE LOCATION: 2 miles northwest of Cerro Rendija.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 8 N SECTION: 4

UTM ZONE: 12 N: 3871800 E: 764150

LATITUDE 34 57' 22.0"

LONGITUDE 108 06' 26.3"

SIZE OF SITE: 2 ha ELEVATION: 7720'

LANDFORM: lava flow, pahoehoe GEOLOGICAL UNIT: Bandera flow

PARENT MATERIAL: basalt SOIL: none

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 5 GRAVEL(3-7.5mm): 15 ROCK(>7.5mm): 80

PERCENT VEGETATION COVER

CANOPY: 55 BASAL: 20 CRYPTOGAMS: 70 WOOD: 5 LEAF LITTER: 5

GENERAL LANDSCAPE DESCRIPTION: Pahoehoe lava flow. Series of low ridges and troughs. Some small surface collapse structures.

GENERAL VEGETATION DESCRIPTION: Open pondersoa pine, pinon, juniper, and Douglas fir woodland. *Rhus*, *Ribes*, *Holodiscus*, *Chrysothamnus* common. Blue grama and mountain muhly where soil present. Trees fairly large in size.

UNUSUAL FEATURES: Douglas fir common, growth stunted.

ADDITIONAL COMMENTS: Tree density and size greater than on surrounding aa flow.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: CADU SITE NAME: Candelaria Dump

INITIAL SURVEY DATE: 7/17/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 0.5 miles southeast of Bandera Crater.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 9 N SECTION: 23 sw 1/4

UTM ZONE: 12 N: 3875800 E: 767000

LATITUDE 34 59' 29.0"

LONGITUDE 108 04' 29.4"

SIZE OF SITE: 1 ha ELEVATION: 7820'

LANDFORM: alluvial slope below sandstone ridge GEOLOGICAL UNIT: Bandera Cinder Field

PARENT MATERIAL: sandstone/cinders SOIL: sandy loam/cinders

EROSION TYPE: runoff EROSION POTENTIAL: high

LIVESTOCK EVIDENCE: old cattle and horse dung common

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 95 GRAVEL(3-7.5mm): 5 ROCK(>7.5mm): 0.5

PERCENT VEGETATION COVER

CANOPY: 45 BASAL: 15 CRYPTOGAMS: 1 WOOD: 2 LEAF LITTER: 10

GENERAL LANDSCAPE DESCRIPTION: Base of Oak Ridge alluvial slope. Bandera lava flow nearby. Yellowish sandy loam with considerable amounts of Bandera cinder mixed in. Slope about 5%, site at base of slope. 20 by 50 meter area bulldozed, a 2 by 5 meter pit excavated for dumping trash.

GENERAL VEGETATION DESCRIPTION: Open ponderosa pine woodland, scattered Gambel oak, pinon, juniper, and some Douglas-fir. Mountain muhly and blue grama in area surrounding disturbed pit site. Weedy herbs on disturbed site.

UNUSUAL FEATURES: Concentration of weed species on disturbed soil.

ADDITIONAL COMMENTS: Similar to OARD except for disturbance.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: CAND SITE NAME: Candelaria's Trading Post

INITIAL SURVEY DATE: 7/17/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 0.5 miles southwest of Bandera Crater.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 9 N SECTION: 23 w 1/2

UTM ZONE: 12 N: 3875900 E: 766580

LATITUDE 34 59' 32.6"

LONGITUDE 108 04' 45.8"

SIZE OF SITE: 5 ha ELEVATION: 7860' GEOLOGICAL UNIT: Bandera Cinder Field

LANDFORM: alluvial slope at base of sandstone ridge, and edge of lava flow

PARENT MATERIAL: basalt/sandstone SOIL: sandy loam, cinders

EROSION TYPE: runoff EROSION POTENTIAL: moderate

LIVESTOCK EVIDENCE: old horse and cattle dung

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 65 GRAVEL(3-7.5mm): 20 ROCK(>7.5mm): 15

PERCENT VEGETATION COVER

CANOPY: 60 BASAL: 15 CRYPTOGAMS: 1 WOOD: 4 LEAF LITTER: 15

GENERAL LANDSCAPE DESCRIPTION: Relatively level area at base of Oak Ridge, and base of Bandera Crater, at edge of Bandera lava flow. Mixure of lava flow and alluvial soils. Cinders prevalent.

GENERAL VEGETATION DESCRIPTION: Open ponderosa pine woodland. Scattered pinon and juniper. Mountain muhly and blue grama grasses common.

UNUSUAL FEATURES: Human inhabited buildings. Considerable disturbance around buildings.

ADDITIONAL COMMENTS: Bird seed feeders and hummingbird feeders set out at trading post. Many birds, squirrels and chipmunks attracted to feeders.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: CAPO SITE NAME: Cattle Pond

INITIAL SURVEY DATE: SURVEYORS: Bleakly

DESCRIPTIVE LOCATION: 1.2 miles southwest of Cerro Bandera.
USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 9 N SECTION: 29ne1/4

UTM ZONE 12 N: 3874700 E: 762850

LATITUDE 34 58' 57"

LONGITUDE 108 07' 13"

SIZE OF SITE: 0.5 ha ELEVATION: 7720'

LANDFORM: Playa pond GEOLOGICAL UNIT: Old Basalt

PARENT MATERIAL: Basalt SOIL: fine silt

EROSION TYPE: runon EROSION POTENTIAL: moderate

LIVESTOCK EVIDENCE: cattle in area

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 90 GRAVEL(3-7.5mm): 5 ROCK(>7.5mm): 5

PERCENT VEGETATION COVER

CANOPY:10 BASAL:5 CRYPTOGAMS:0 WOOD:0 LEAF LITTER:3

GENERAL LANDSCAPE DESCRIPTION: Small ephemeral pond in silty sink on Old Basalt. Fine silty soil, cracked hardpan when dry, mud when wet. Scattered basalt rocks around edge of pond.

GENERAL VEGETATION DESCRIPTION: Surrounding area ponderosa pine woodland. Pond vegetation consisting of various ephemeral aquatic and semi-aquatic herbs.

UNUSUAL FEATURES: Ephemeral pond.

ADDITIONAL COMMENTS: Pond is adjacent to county road 42, and may receive runoff water from the dirt road.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: CEBA SITE NAME: Cerro Bandera

INITIAL SURVEY DATE: 7/18/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 0.75 miles southwest of Bandera Crater.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 9 N SECTION: 22 w 1/2

UTM ZONE: 12 N: 3876000 E: 765000

LATITUDE 34 59' 37.7"

LONGITUDE 108 05' 48.0"

SIZE OF SITE: 100 ha ELEVATION: 7900-8372'

LANDFORM: cinder cone GEOLOGICAL UNIT: Western cinder cone

PARENT MATERIAL: basalt SOIL: gravelly loam, cinders

EROSION TYPE: runoff EROSION POTENTIAL: high

LIVESTOCK EVIDENCE: occassional old horse and cattle dung

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 30 GRAVEL(3-7.5mm): 60 ROCK(>7.5mm): 10

PERCENT VEGETATION COVER

CANOPY: 45 BASAL: 5 CRYPTOGAMS: 2 WOOD: 5 LEAF LITTER: 30

GENERAL LANDSCAPE DESCRIPTION: Large cinder cone. Steep 30% slopes all around. A few outcrops of consolidated red cinder at top, no crater.

GENERAL VEGETATION DESCRIPTION: Pinon/juniper woodland throughout. Open ponderosa pine forest on top and north slope. Mountain muhly, pine dropseed, and blue grama common. Few plant species on lower slopes, diversity and cover higher on top.

UNUSUAL FEATURES: Many large isolated live and dead ponderosa pine trees on top. Extensive fire scars on ponderosa pine trees at top and west side of peak.

ADDITIONAL COMMENTS: none

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: CEEN SITE NAME: Cerro Encierro

INITIAL SURVEY DATE: 5/12/92 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: Northwest corner of Big Hole in the Wall.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 11 W TOWNSHIP: 8 N SECTION: 36 se 1/4

UTM ZONE: 12 N: 3863000 E: 769620

LATITUDE 34 52' 31.5"

LONGITUDE 108 03' 01.1"

SIZE OF SITE: 5 ha ELEVATION: 7400-7538'

LANDFORM: cinder cone GEOLOGICAL UNIT: Cinder cone, Old Basalt flow

PARENT MATERIAL: basalt SOIL: gravelly loam, cinders

EROSION TYPE: runoff EROSION POTENTIAL: high

LIVESTOCK EVIDENCE: considerable cattle and horse dung, many tracks, trails

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 20 GRAVEL(3-7.5mm): 75 ROCK(>7.5mm): 5

PERCENT VEGETATION COVER

CANOPY: 25 BASAL: 10 CRYPTOGAMS: 0.5 WOOD: 0.5 LEAF LITTER: 1

GENERAL LANDSCAPE DESCRIPTION: Small cinder cone with a crater. Crater is about 100 meters across, and 30 meters deep from brim of cone. Fine black cinders cover the ground surface. Slope gradual, 20%.

GENERAL VEGETATION DESCRIPTION: Blue grama grassland on slopes, pine dropseed and mountain muhly in crater. Pinon pine on crater rim, and ponderosa pine inside of crater. Apache plume also common on crater rim.

UNUSUAL FEATURES: none

ADDITIONAL COMMENTS: Heavy domestic livestock impacts. Grass grazed heavily, many tracks, trails and dung. Cattle appear to concentrate on cinder cone, relative to surrounding areas.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: CJPA SITE NAME: Cerro de Jaspe Permian Abo Sandstone

INITIAL SURVEY DATE: 6/4/92 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 1.5 miles north of El Calderon.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 11 W TOWNSHIP: 9 N SECTION: 29

UTM ZONE: 12 N: 3874700 E: 772100

LATITUDE 34 58' 48.4"

LONGITUDE 108 01' 09.8"

SIZE OF SITE: 20 ha ELEVATION: 7400-7575'

LANDFORM: sandstone ridge GEOLOGICAL UNIT: Abo Formation (Permian)

PARENT MATERIAL: sandstone SOIL: sandy loam, red

EROSION TYPE: runoff EROSION POTENTIAL: high

LIVESTOCK EVIDENCE: old cattle dung common

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 65 GRAVEL(3-7.5mm): 20 ROCK(>7.5mm): 15

PERCENT VEGETATION COVER

CANOPY: 70 BASAL: 20 CRYPTOGAMS: 2 WOOD: 5 LEAF LITTER: 10

GENERAL LANDSCAPE DESCRIPTION: Sandstone ridge trending northwest-southeast. Steep escarpment with cliffs on northeast side, gradual gravelly slope on southwest side.

GENERAL VEGETATION DESCRIPTION: Pinon pine woodland on top and southwest slope. Ponderosa pine woodland on steep northeast slope. Gambel oak dense on top and northeast slope. Blue grama on southwest slope, mountain muhly and pine dropseed on northeast slope. Many herb species.

UNUSUAL FEATURES: Steep red sandstone escarpment, rich lichen flora.

ADDITIONAL COMMENTS: Area had been heavily logged. Many stumps and cut logs.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: CO42 SITE NAME: County Road 42

INITIAL SURVEY DATE: 8/15/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 0 to 0.5 miles south of SR 53 along CR 42.

USGS 1:24,000 MAP NAME: Ice Caves, Paxton Springs

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 9 N SECTION: 15 s 1/2, 22 n 1/2

UTM ZONE: 12 N: 3877000 E: 765400

LATITUDE 35 00' 09.4"

LONGITUDE 108 05' 31.1"

SIZE OF SITE: 5 ha ELEVATION: 7840-7920'

LANDFORM: alluvial basin GEOLOGICAL UNIT: Quaternary alluvium

PARENT MATERIAL: basalt/sandstone SOIL: fine loam

EROSION TYPE: runoff EROSION POTENTIAL: moderate

LIVESTOCK EVIDENCE: considerable current grazing

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 75 GRAVEL(3-7.5mm): 15 ROCK(>7.5mm): 10

PERCENT VEGETATION COVER

CANOPY: 65 BASAL: 30 CRYPTOGAMS: 3 WOOD: 2 LEAF LITTER: 10

GENERAL LANDSCAPE DESCRIPTION: Relativel level basin with fine silty loam soil near bases of Oso Ridge, Bander Crater, and Cerro Bandera. Low sandstone hillslope to the west. Bandera lava flow bordering area on southeast. County road 42 traverses area; gravel road with drainage ditches.

GENERAL VEGETATION DESCRIPTION: Rabbitbrush/grama grassland flats with a high diversity of herb species. Many weed species along roadside.

UNUSUAL FEATURES: Disturbed roadside environment.

ADDITIONAL COMMENTS: Primarily a collecting location for roadside weeds.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: DOME SITE NAME: Dome Collapse

INITIAL SURVEY DATE: 7/18/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: Southwest base of Bandera Crater.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 9 N SECTION: 22 se 1/4

UTM ZONE: 12 N: 3875760 E: 765820

LATITUDE 34 59' 28.8"

LONGITUDE 108 05' 16.0"

SIZE OF SITE: 1 ha ELEVATION: 7880'

LANDFORM: lava tube collapse GEOLOGICAL UNIT: Bandera Crater

PARENT MATERIAL: basalt SOIL: none

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 0 GRAVEL(3-7.5mm): 5 ROCK(>7.5mm): 95

PERCENT VEGETATION COVER

CANOPY: 0.5 BASAL: 0.1 CRYPTOGAMS: 65 WOOD: 0 LEAF LITTER: 0

GENERAL LANDSCAPE DESCRIPTION: Small collapse structure on Bandera lava flow. Collapse is 15 meters across, rock rubble fills southside, steep rock wall and overhang on north side. Collapse 10 meters deep. Dome structures in surface of pahoehoe lava flow. Some water and ice in cracks at bottom of collapse.

GENERAL VEGETATION DESCRIPTION: Bare pahoehoe lava. A few scattered pinon pines, *Ribes*, and rabbitbrush in area. Zonation of yellow and orange lichen and moss at bottom of collapse.

UNUSUAL FEATURES: Large dome structure at top of rim of collapse on north side. Dome about 5 meters in diameter, and a 0.5 to 1 meter high ceiling. Man made rock wall and many pottery sherds inside.

ADDITIONAL COMMENTS: none

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: DOSI SITE NAME: Double Sinks

INITIAL SURVEY DATE: 8/16/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 1 mile northeast of El Calderon.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 11 W TOWNSHIP: 9 N SECTION: 33

UTM ZONE: 12 N: 3873200 E: 773450

LATITUDE 34 57' 58.5"

LONGITUDE 108 00' 18.4"

SIZE OF SITE: 1 ha ELEVATION: 7300'

LANDFORM: lava tube collapses GEOLOGICAL UNIT: El Calderon flow

PARENT MATERIAL: basalt SOIL: fine loam

EROSION TYPE: runoff EROSION POTENTIAL: moderate

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 5 GRAVEL(3-7.5mm): 15 ROCK(>7.5mm): 80

PERCENT VEGETATION COVER

CANOPY: 15 BASAL: 2 CRYPTOGAMS: 15 WOOD: 0 LEAF LITTER: 5

GENERAL LANDSCAPE DESCRIPTION: Double collapse structures. Collapse on west side about 10 meters across and 10 meters deep. Overhangs on northeast and southwest sides. East collapse about 15 meters across and 10 meters deep. Overhang shallow cave entrances on northeast and southwest sides.

GENERAL VEGETATION DESCRIPTION: *Pericome* common on rock walls and rims. Moss and ferns in bottoms, especially the west sink. Ocean spray and *Ribes* in bottoms, blue grama grassland and nakeweed in surrounding area.

UNUSUAL FEATURES: none

ADDITIONAL COMMENTS: Rim area eroded and disturbed by people.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: ELCA SITE NAME: El Calderon

INITIAL SURVEY DATE: 8/16/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 22 miles southeast of Grants, off SR 53.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 11 W TOWNSHIP: 9 N SECTION: 32 se 1/4

UTM ZONE: 12 N: 3872300 E: 772300

LATITUDE 34 57' 30.4"

LONGITUDE 108 01' 04.8"

SIZE OF SITE: 20 ha ELEVATION: 7400-7612'

LANDFORM: cinder cone/crater GEOLOGICAL UNIT: El Calderon Cone

PARENT MATERIAL: basalt SOIL: gravelly loam, cinders

EROSION TYPE: runoff EROSION POTENTIAL: moderate

LIVESTOCK EVIDENCE: old cattle dung common

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 15 GRAVEL(3-7.5mm): 80 ROCK(>7.5mm): 5

PERCENT VEGETATION COVER

CANOPY: 30 BASAL: 15 CRYPTOGAMS: 5 WOOD: 2 LEAF LITTER: 5

GENERAL LANDSCAPE DESCRIPTION: Large cinder cone with crater. Steep cinder slopes on all sides. Basalt flows extending from breach on northeast side of crater.

GENERAL VEGETATION DESCRIPTION: Pinon/juniper woodland on cinder cone, ponderosa pine woodland around base. Alligator juniper common on top. Blue grama and mountain muhly grasses common throughout. Many herb species growing on cinders.

UNUSUAL FEATURES: Large cinder cone crater with steep slopes.

ADDITIONAL COMMENTS: Open-pit cinder/gravel excavation site and road on northeast side. Many weedy plant species on that disturbed area.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: ELCF SITE NAME: El Calderon Parking Area

INITIAL SURVEY DATE: 08/16/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: El Calderon.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 11 W TOWNSHIP: 9 N SECTION: 33

UTM ZONE 12 N: 3873500 E: 773500

LATITUDE 34 58' 12"

LONGITUDE 108 00' 08"

SIZE OF SITE: 5 ha ELEVATION: 7300'

LANDFORM: Alluvial area GEOLOGICAL UNIT: El Calderon

PARENT MATERIAL: Basalt SOIL: fine loam

EROSION TYPE: runoff EROSION POTENTIAL: moderate

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 85 GRAVEL(3-7.5mm): 10 ROCK(>7.5mm): 5

PERCENT VEGETATION COVER

CANOPY: 20 BASAL: 10 CRYPTOGAMS: 1 WOOD: 0.1 LEAF LITTER: 3

GENERAL LANDSCAPE DESCRIPTION: Relatively flat or gently sloping landscape at the base of El Calderon lava flow and crater. Basalt mostly covered by fine loam soil.

GENERAL VEGETATION DESCRIPTION: Blue grama and wolf-tail grassland with snakeweed and rabbitbrush. Widely scattered pinon and juniper, ponderosa pine woodland to the north.

UNUSUAL FEATURES: none

ADDITIONAL COMMENTS: Area around parking lot, dirt roads, and trails, disturbed.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: ENCO SITE NAME: End Collapse

INITIAL SURVEY DATE: 6/16/92 SURVEYORS: Lightfoot, Viers

DESCRIPTIVE LOCATION: 3 miles southeast of Cerro Rendija.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 11 W TOWNSHIP: 8 N SECTION: 15 ne 1/4

UTM ZONE: 12 N: 3868590 E: 766490

LATITUDE 34 55' 35.7"

LONGITUDE 108 04' 57.8"

SIZE OF SITE: 1 ha ELEVATION: 7520'

LANDFORM: lava tube collapse GEOLOGICAL UNIT: Bandera flow

PARENT MATERIAL: basalt SOIL: fine loam

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 5 GRAVEL(3-7.5mm): 10 ROCK(>7.5mm): 85

PERCENT VEGETATION COVER

CANOPY: 20 BASAL: 3 CRYPTOGAMS: 65 WOOD: 0.5 LEAF LITTER: 3

GENERAL LANDSCAPE DESCRIPTION: Lava tube collapse 40 by 30 meters diameter. Upper level shelf on south side. Cave on west side connecting to Gunsight Collapse. Cave on east side extending far underground to east, end unknown.

GENERAL VEGETATION DESCRIPTION: Blue grama and mountain muhly on shelf, Douglas fir and *Ribes* in collapse.

UNUSUAL FEATURES: Several large Douglas fir on rim appear to be very old.

ADDITIONAL COMMENTS: none

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: ENDC SITE NAME: End Cave

INITIAL SURVEY DATE: 7/31/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 1.8 miles southeast of Cerro Rendija.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 8 N SECTION: 10 nw 1/4

UTM ZONE: 12 N: 3870000 E: 765400

LATITUDE 34 56' 22.4"

LONGITUDE 108 05' 39.1"

SIZE OF SITE: 1 ha ELEVATION: 7600'

LANDFORM: lava tube collapse and cave GEOLOGICAL UNIT: Bandera Flow

PARENT MATERIAL: basalt SOIL: sparse, fine loam

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 1 GRAVEL(3-7.5mm): 9 ROCK(>7.5mm): 90

PERCENT VEGETATION COVER

CANOPY: 10 BASAL: 3 CRYPTOGAMS: 80 WOOD: 1 LEAF LITTER: 2

GENERAL LANDSCAPE DESCRIPTION: Lava tube collapse and cave entrance. Mouth of cave at south end of collapse, and about 5 meters diameter. Inside cave diameter about 25 meters. Inside of cave cold and damp, ice present in back of cave.

GENERAL VEGETATION DESCRIPTION: Ocean spray scattered in collapse. Ponderosa pine and juniper on top around rim. Distinct zonation of orange lichens and mosses at mouth of cave.

UNUSUAL FEATURES: Ice cave with lichen/moss zonation at mouth.

ADDITIONAL COMMENTS: Did not explore to back of cave.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: ERHO SITE NAME: End Road Hoya Flow

INITIAL SURVEY DATE: 7/7/92 SURVEYORS: Lightfoot, Viers

DESCRIPTIVE LOCATION: 3 miles south of Big Hole in the Wall, and 1.5 miles east of the West Malpais Wilderness boundary gate at the end of road extending north from SR 117.

USGS 1:24,000 MAP NAME: Ice Caves SE

SPECIFIC LOCATION

RANGE: 11 W TOWNSHIP: 6 N SECTION: 6 nw 1/4

UTM ZONE: 12 N: 3852800 E: 770700

LATITUDE 34 46' 59.7"

LONGITUDE 108 02' 30.4"

SIZE OF SITE: 4 ha ELEVATION: 7150'

LANDFORM: lava flow GEOLOGICAL UNIT: Hoya flow

PARENT MATERIAL: basalt SOIL: sparse, fine loam

EROSION TYPE: none EROSION POTENTIAL: low

LIVESTOCK EVIDENCE: many cattle present, trails common

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 15 GRAVEL(3-7.5mm): 25 ROCK(>7.5mm): 60

PERCENT VEGETATION COVER

CANOPY: 65 BASAL: 30 CRYPTOGAMS: 20 WOOD: 15 LEAF LITTER: 50

GENERAL LANDSCAPE DESCRIPTION: Relatively level lava flow with numerous small ridges and surface collapses. Open flat areas with soil, ridges rocky.

GENERAL VEGETATION DESCRIPTION: Ponderosa pine woodland. Understory blue grama mountain muhly, pine dropseed. Many herb species. Dense pine needles on ground.

UNUSUAL FEATURES: Recent fire in area, within past 5 years. Many burned logs, and tree trunks burned around bases. Brown pine needles still present on fire killed lower branches. Ground fire only.

ADDITIONAL COMMENTS: Almost identical in appearance to Hoya flow areas near Mesita Blanca.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: FERN SITE NAME: Fern Sink

INITIAL SURVEY DATE: 7/31/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 0.75 miles east of Cerro Rendija cone.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 8 N SECTION: 4 sw 1/4

UTM ZONE: 12 N: 3870550 E: 763590

LATITUDE 34 56' 42.0"

LONGITUDE 108 06' 49.7"

SIZE OF SITE: 1 ha ELEVATION: 7730'

LANDFORM: lava tube collapse GEOLOGICAL UNIT: Volcanic debris, Cerro Rendija

PARENT MATERIAL: basalt SOIL: fine loam

EROSION TYPE: runon EROSION POTENTIAL: low

LIVESTOCK EVIDENCE: old cattle dung around collapse

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 40 GRAVEL(3-7.5mm): 10 ROCK(>7.5mm): 50

PERCENT VEGETATION COVER

CANOPY: 35 BASAL: 10 CRYPTOGAMS: 5 WOOD: 1 LEAF LITTER: 5

GENERAL LANDSCAPE DESCRIPTION: Lava tube collapse with overhanging rock walls all around. Collapse about 40 meters diameter, and 20 meters deep. No caves or openings to lava tube evident.

GENERAL VEGETATION DESCRIPTION: Grassy meadow, large ferns, *Ribes*, and ocean spray bottom.

UNUSUAL FEATURES: Damp meadow and ferns in collapse.

ADDITIONAL COMMENTS: Old wooden planks and a rubber tire in collapse. We could not enter collapse because of steep walls.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: FOUR SITE NAME: Four Windows Cave

INITIAL SURVEY DATE: 7/29/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 1.5 miles east of Cerro Rendija.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 8 N SECTION: 4 se 1/4

UTM ZONE: 12 N: 3870600 E: 764920

LATITUDE 34 56' 42.3"

LONGITUDE 108 05' 57.3"

SIZE OF SITE: 3 ha ELEVATION: 7620'

LANDFORM: lava tube collapse and cave GEOLOGICAL UNIT: Bandera Flow

PARENT MATERIAL: basalt SOIL: sparse, fine loam

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 1 GRAVEL(3-7.5mm): 9 ROCK(>7.5mm): 90

PERCENT VEGETATION COVER

CANOPY: 2 BASAL: 0.5 CRYPTOGAMS: 80 WOOD: 0.1 LEAF LITTER: 1

GENERAL LANDSCAPE DESCRIPTION: Lava tube collapse about 50 meters in diameter, and 10 meters deep. Steep rock walls all around. Cave mouth 25 meters diameter on north side. Cave mouth 15 meters high. Large cave with 4 small collapse windows in ceiling about 30 meters from mouth. Cave extending 570 meters to end.

GENERAL VEGETATION DESCRIPTION: Ponderosa pine, pinon/juniper woodland on surrounding lava flow. Few scattered ocean spray shrubs in collapse, some Douglas fir trees on rim. Dense lichen on rocks, moss gardens in cave under windows.

UNUSUAL FEATURES: Stacked tubes inside of cave, with 2-3 levels. Many bat skeletons found about 200-400 meters inside of cave.

ADDITIONAL COMMENTS: Cave cold and wet inside, no ice found.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: GICE SITE NAME: Giant Ice Cave

INITIAL SURVEY DATE: 7/30/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 1.5 miles east of Cerro Rendija.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 8 N SECTION: 4 se 1/4

UTM ZONE: 12 N: 3870700 E: 765000

LATITUDE 34 56′ 45.5"

LONGITUDE 108 05′ 54.0"

SIZE OF SITE: 1 ha ELEVATION: 7640′

LANDFORM: lava tube collapse and cave GEOLOGICAL UNIT: Bandera Flow

PARENT MATERIAL: basalt SOIL: sparse, fine loam

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): .5 GRAVEL(3-7.5mm): 10 ROCK(>7.5mm): 90

PERCENT VEGETATION COVER

CANOPY: 5 BASAL: 2 CRYPTOGAMS: 80 WOOD: 0.1 LEAF LITTER: 1

GENERAL LANDSCAPE DESCRIPTION: Lava tube collapse structure 50 meters wide and 15 meters deep. Large cave at north end, mouth of cave 20 meters diameter. Cave floor covered with boulders and rock rubble. Cave cold and wet inside. Back of cave about 100 meters from mouth.

GENERAL VEGETATION DESCRIPTION: Ponderosa pine, pinon/juniper woodland on lava flow around collapse. Few ocean spray shrubs in collapse. Lichen cover dense. Moss and lichen zonation at mouth of cave. Algae on rocks where water drips.

UNUSUAL FEATURES: none

ADDITIONAL COMMENTS: Little orange lichen in cave mouth.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: HAFE SITE NAME: Hanging Fern Collapse

INITIAL SURVEY DATE: 7/9/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 1 miles south of Bandera Crater.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 w TOWNSHIP: 9 N SECTION: 26 nw 1/4

UTM ZONE: 12 N: 3875000 E: 766600

LATITUDE 34 59' 03.4"

LONGITUDE 108 04' 46.1"

SIZE OF SITE: 0.5 ha ELEVATION: 7800'

LANDFORM: lava tube collapse and cave GEOLOGICAL UNIT: Bandera Flow

PARENT MATERIAL: basalt SOIL: sparse, fine loam

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 2 GRAVEL(3-7.5mm): 8 ROCK(>7.5mm): 90

PERCENT VEGETATION COVER

CANOPY: 20 BASAL: 4 CRYPTOGAMS: 70 WOOD: 1 LEAF LITTER: 5

GENERAL LANDSCAPE DESCRIPTION: Small, deep collapse. Collapse about 25 meters in diameter, and 20 meters deep on the south side where the cave mouth is, and 15 meters deep on north end. Spatter cone on north rim. Collapse slopes down into cave mouth at south end. Cold and wet inside of cave mouth. Cave 15 meters deep.

GENERAL VEGETATION DESCRIPTION: Ponderosa pine, pinon/juniper, and Douglas fir woodland on lava surrounding collapse. Blue grama and pine dropseed present. Several large ocean spray shrubs and a small Douglas fir in collapse. Dense moss on rocks in cave mouth. Orange lichen moss zonation at mouth.

UNUSUAL FEATURES: Dense moss garden and ferns in cave mouth. Cold damp air inside of cave and bottom of collapse.

ADDITIONAL COMMENTS: none

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: HIDD SITE NAME: Hidden Kipuka

INITIAL SURVEY DATE: 8/14/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 1 mile northwest of Big Hole in the Wall, and 1.5 miles northeast of Cerro Encierro.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 8 N SECTION: 26 ne 1/4

UTM ZONE: 12 N: 3865300 E: 768500

LATITUDE 34 53' 47.1"

LONGITUDE 108 03' 42.5"

SIZE OF SITE: 20 ha ELEVATION: 7400-7460'

LANDFORM: sandstone ridge and slopes; kipuka GEOLOGICAL UNIT: Glorieta Sandstone (Permian)

PARENT MATERIAL: sandstone SOIL: sandy loam

EROSION TYPE: runoff EROSION POTENTIAL: moderate

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 60 GRAVEL(3-7.5mm): 20 ROCK(>7.5mm): 20

PERCENT VEGETATION COVER

CANOPY: 65 BASAL: 30 CRYPTOGAMS: 20 WOOD: 10 LEAF LITTER: 60

GENERAL LANDSCAPE DESCRIPTION: Glorieta sandstone outcrop surrounded by Bandera and Hoya basalts. Hoya on west and Bandera on east. North end of kipuka with high sandstone bluffs on east side. Gradual slope on west side. South end a low ridge. Sandstone red to whitish.

GENERAL VEGETATION DESCRIPTION: Pinon/juniper, ponderosa pine woodland. Gambel oak common. Understory blue grama, mountian muhly, pine dropseed grassland, some open grassland areas present. High diversity of herbaceous plant species.

UNUSUAL FEATURES: Gravelly rock garden areas with unusual herb assemblages, e.g., *Tallinum*, etc. Tinajas in sandstone at top of sandstone bluffs at north end.

ADDITIONAL COMMENTS: Floristically similar to Mesita Blanca.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: HOMC SITE NAME: Hoya Lava Flow Near LOME.

INITIAL SURVEY DATE: 08/20/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 1 mile southwest of Sandstone Bluffs Overlook.

USGS 1:24,000 MAP NAME: Los Pilares

SPECIFIC LOCATION

RANGE: 9 W TOWNSHIP: 8 N SECTION: 12nw1/4

UTM ZONE 12 N: 3870300 E: 239300

LATITUDE 35 56' 30"

LONGITUDE 107 51' 15"

SIZE OF SITE: 1 ha ELEVATION: 6800'

LANDFORM: Lava flow GEOLOGICAL UNIT: Hoya flow

PARENT MATERIAL: Basalt SOIL: Sparse fine loam

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 5 GRAVEL(3-7.5mm): 10 ROCK(>7.5mm): 85

PERCENT VEGETATION COVER

CANOPY: 40 BASAL: 20 CRYPTOGAMS: 40 WOOD: 1 LEAF LITTER: 5

GENERAL LANDSCAPE DESCRIPTION: Broken and weathered Hoya lava field with low pressure ridges and troughs. Considerable broken rock rubble. Lava reddish-black in color.

GENERAL VEGETATION DESCRIPTION: Pinon/juniper woodland. Understory with moderate forb cover, mostly Verbena and Bahia. Blue grama sparse.

UNUSUAL FEATURES: Distinct difference in color between the black McCartys lava and reddish Hoya lava.

ADDITIONAL COMMENTS: Vegetation cover much higher on Hoya than McCartys, especially pinon/juniper and forbs.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: HORO SITE NAME: Hole in the Roof Collapse

INITIAL SURVEY DATE: 06/16/92 SURVEYORS: Lightfoot, Viers

DESCRIPTIVE LOCATION: 0.2 miles south of Navajo Ice Cave.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 11 W TOWNSHIP: 8N SECTION: 23ne1/4

UTM ZONE 12 N: 3866830 E: 761890

LATITUDE 34 54' 42"

LONGITUDE 108 03' 58"

SIZE OF SITE: 1 ha ELEVATION: 7420'

LANDFORM: Lava tube collapse GEOLOGICAL UNIT: Bandera flow

PARENT MATERIAL: Basalt SOIL: none

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 2 GRAVEL(3-7.5mm): 15 ROCK(>7.5mm): 83

PERCENT VEGETATION COVER

CANOPY: 0.5 BASAL: 0.5 CRYPTOGAMS: 70 WOOD: 0.1 LEAF LITTER: 1

GENERAL LANDSCAPE DESCRIPTION: Large, deep, lava tube collapse structure with sheer rock walls and overhangs all-around. Large cave mouth overhangs at northwest and southeast portions. Boulders and rock rubble in bottom.

GENERAL VEGETATION DESCRIPTION: No siginificant vegetation in collapse. Distinct band of moss and orange lichen across mouth of south cave. Vegetation around rim as at NACO.

UNUSUAL FEATURES: Impressive deep collapse. Cliffs too steep to enter. Old tree trunk leaning against cliff.

ADDITIONAL COMMENTS: none

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: HOSW SITE NAME: Hoya Southwest

INITIAL SURVEY DATE: 7/7/92 SURVEYORS: Lightfoot, Viers

DESCRIPTIVE LOCATION: 3.5 miles north of junction of CR 42 and SR 117.

USGS 1:24,000 MAP NAME: York Ranch

SPECIFIC LOCATION

RANGE: 11 W TOWNSHIP: 6 N SECTION: 18

UTM ZONE: 12 N: 3848700E: 771700

LATITUDE 34 44' 45.9"

LONGITUDE 108 01' 55.9"

SIZE OF SITE: 3 ha ELEVATION: 7120'

LANDFORM: lava flow GEOLOGICAL UNIT: Hoya Flow

PARENT MATERIAL: basalt SOIL: fine loam

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: many cattle present

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 25 GRAVEL(3-7.5mm): 45 ROCK(>7.5mm): 35

PERCENT VEGETATION COVER

CANOPY: 65 BASAL: 35 CRYPTOGAMS: 30 WOOD: 1 LEAF LITTER: 5

GENERAL LANDSCAPE DESCRIPTION: Level lava flow with infrequent cracks and ridges. Soil well developed on flat areas. Mostly flat, rocky ground.

GENERAL VEGETATION DESCRIPTION: Blue grama grassland with *Artemisia* and Apache plume common. Widely scattered pinon and juniper trees. Many trees dead, no apparent fire scars. Many species of herbs.

UNUSUAL FEATURES: Few trees and well developed soil relative to other Hoya flow areas.

ADDITIONAL COMMENTS: none

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: HOYA SITE NAME: Hoya Lava Flow

INITIAL SURVEY DATE: 8/14/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 1.2 miles northwest of Cerro Encierro, Big Hole in the Wall.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 8 N SECTION: 26

UTM ZONE: 12 N: 3865000E: 768000

LATITUDE 34 53' 37.9"

LONGITUDE 108 04' 02.5"

SIZE OF SITE: 20 ha ELEVATION: 7350'

LANDFORM: lava flow GEOLOGICAL UNIT: Hoya Flow

PARENT MATERIAL: basalt SOIL: sparse, fine loam

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 3 GRAVEL(3-7.5mm): 10 ROCK(>7.5mm): 87

PERCENT VEGETATION COVER

CANOPY: 45 BASAL: 10 CRYPTOGAMS: 65 WOOD: 5 LEAF LITTER: 15

GENERAL LANDSCAPE DESCRIPTION: Level lava flow with frequent pressure ridges, cracks, and surface collapses. Ridges generally 2-10 meters tall. Lava weathered, soil not well developed, best developed on flat areas.

GENERAL VEGETATION DESCRIPTION: Ponderosa pine woodland. Large and widely spaced pine trees. Many young trees present. Blue grama, mountain muhly, and pine dropseed grassland well developed. *Heterotheca villosa* common. Few pinon pines present, some aspen present along edges of flow at kipukas.

UNUSUAL FEATURES: none

ADDITIONAL COMMENTS: none

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: HOYK SITE NAME: Hoya Flow at Old Basalt Kipukas

INITIAL SURVEY DATE: 6/24/92 SURVEYORS: Bleakly, Viers

DESCRIPTIVE LOCATION: 2 miles southwest of Hoya de Cibola.

USGS 1:24,000 MAP NAME: Cerro Brillante

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 7 N SECTION: 6 e 1/2

UTM ZONE: 12 N: 3861500E: 761700

LATITUDE 34 51' 50.3"

LONGITUDE 108 08' 14.3"

SIZE OF SITE: 20 ha ELEVATION: 7450'

LANDFORM: lava flow GEOLOGICAL UNIT: Old Basalt Flow

PARENT MATERIAL: basalt SOIL: fine loam

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: occasional cattle dung

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 5 GRAVEL(3-7.5mm): 25 ROCK(>7.5mm): 70

PERCENT VEGETATION COVER

CANOPY: 45 BASAL: 20 CRYPTOGAMS: 40 WOOD: 5 LEAF LITTER: 10

GENERAL LANDSCAPE DESCRIPTION: Level lava flow. Frequent small surfaces collapses low ridges.

GENERAL VEGETATION DESCRIPTION: Ponderosa pine woodland. Scattered large pine trees. Understory blue grama, mountain muhly grassland. *Heterotheca villosa* common.

UNUSUAL FEATURES: Fire scars common on ponderosa pines. Recent fire on west portion of area.

ADDITIONAL COMMENTS: none

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: HOYM SITE NAME: Hoya Kipuka in McCartys Flow

INITIAL SURVEY DATE: 8/19/92 SURVEYORS: Bleakly

DESCRIPTIVE LOCATION: 1 mile northwest of the Narrows.

USGS 1:24,000 MAP NAME: Arrosa Ranch

SPECIFIC LOCATION

RANGE: 10 W TOWNSHIP: 8 N SECTION: 28 se 1/4

UTM ZONE: 13 N: 3864150E: 235000

LATITUDE 34 53' 13.1"

LONGITUDE 107 53' 58.5"

SIZE OF SITE: 1 ha ELEVATION: 6980'

LANDFORM: kipuka (lava flow) GEOLOGICAL UNIT: Hoya Flow

PARENT MATERIAL: basalt SOIL: fine loam

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 3 GRAVEL(3-7.5mm): 13 ROCK(>7.5mm): 85

PERCENT VEGETATION COVER

CANOPY: 30 BASAL: 10 CRYPTOGAMS: 30 WOOD: 1 LEAF LITTER: 1

GENERAL LANDSCAPE DESCRIPTION: Level Hoya lava flow surrounded by higher (1-2 meters) McCartys flow. Lava fractured into regular blocks.

GENERAL VEGETATION DESCRIPTION: Ponderosa pine, and pinon/juniper woodland. Herbs well developed, more so than on McCartys flow.

UNUSUAL FEATURES: At least 6 symmetrical circular pits in kipuka.

ADDITIONAL COMMENTS: Map indicates several other small kipukas in area. Not able to locate.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: HOYP SITE NAME: Hoya Lava Flow at Prairie Dog Well

INITIAL SURVEY DATE: 6/3/92 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 4.5 miles south-southeast of Hoya de Cibola, and 0.25 to 1 mile northeast of Prairie Dog Well.

USGS 1:24,000 MAP NAME: Ice Caves SE

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 7 N SECTION: 21 ne 1/4

UTM ZONE: 12 N: 3856800E: 765100

LATITUDE 34 49' 14.7"

LONGITUDE 108 06' 06.0"

SIZE OF SITE: 20 ha ELEVATION: 7240'

LANDFORM: lava flow GEOLOGICAL UNIT: Hoya Flow

PARENT MATERIAL: basalt SOIL: fine loam

EROSION TYPE: runoff EROSION POTENTIAL: low

LIVESTOCK EVIDENCE: many cattle present

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 75 GRAVEL(3-7.5mm): 10 ROCK(>7.5mm): 15

PERCENT VEGETATION COVER

CANOPY: 80 BASAL: 30 CRYPTOGAMS: 20 WOOD: 2 LEAF LITTER: 3

GENERAL LANDSCAPE DESCRIPTION: Level Hoya lava flow, numerous low ridges and small surface collapses. Lava tube on northeast portion with many small collapses, no caves found. Numerous gravel and soil flats.

GENERAL VEGETATION DESCRIPTION: Ponderosa pine woodland. Few pinon or juniper. Understory blue grama, mountain muhly and pine dropseed grassland well developed. *Heterotheca villosa* and rabbitbrush common.

UNUSUAL FEATURES: Several man-made rock walls found in small surface collapse structures, especially near Prairie Dog Well.

ADDITIONAL COMMENTS: Fire scars common on ponderosa pine trees, many old burnt logs on ground. Area is heavily grazed by cattle.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: ICEP SITE NAME: Ice Pond Cave

INITIAL SURVEY DATE: 7/31/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 1.2 miles southeast of Cerro Rendija.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 8 N SECTION: 9 w 1/2

UTM ZONE: 12 N: 3869600E: 764200

LATITUDE 34 56' 10.6"

LONGITUDE 108 06' 26.8"

SIZE OF SITE: 1 ha ELEVATION: 7580'

LANDFORM: lava tube collapse and cave GEOLOGICAL UNIT: Volcanic debris, Cerro Rendija

PARENT MATERIAL: basalt SOIL: fine loam

EROSION TYPE: runon EROSION POTENTIAL: moderate

LIVESTOCK EVIDENCE: cattle dung common

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 45 GRAVEL(3-7.5mm): 20 ROCK(>7.5mm): 35

PERCENT VEGETATION COVER

CANOPY: 35 BASAL: 15 CRYPTOGAMS: 15 WOOD: 1 LEAF LITTER: 10

GENERAL LANDSCAPE DESCRIPTION: Lava tube collapse structure with cave entrance on southeast side. Lava tube originating from Cerro Rendija. Collapse 40 meters in diameter, shallow, rubble filled. Cave mouth rubble filled, hole 2 meters diameter leading into cave. Large multilevel cave with water and ice.

GENERAL VEGETATION DESCRIPTION: Collapse grassy with mountain muhly and pine dropseed. Ocean spray and *Ribes* shrubs common. Cave mouth with orange lichen zonation.

UNUSUAL FEATURES: Extensive ice cave with several winding tunnels, and at least two levels. Large frozen pond in deepest portion.

ADDITIONAL COMMENTS: Many pottery sherds present in west side of collapse. Bighorn sheep bones piled in cave mouth.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: ICWA SITE NAME: Ice Water Collapse

INITIAL SURVEY DATE: 7/18/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 0.25 miles southwest of Bandera Crater.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 9 N SECTION: 22 se 1/4

UTM ZONE: 12 N: 3875800E: 765800

LATITUDE 34 59' 30.1"

LONGITUDE 108 05' 16.7"

SIZE OF SITE: 0.5 ha ELEVATION: 7880'

LANDFORM: lava tube collapse GEOLOGICAL UNIT: Bandera Flow

PARENT MATERIAL: basalt SOIL: none

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 0 GRAVEL(3-7.5mm): 5 ROCK(>7.5mm): 95

PERCENT VEGETATION COVER

CANOPY: 0.1 BASAL: 0.1 CRYPTOGAMS: 70 WOOD: 0 LEAF LITTER: 0

GENERAL LANDSCAPE DESCRIPTION: Lava tube collapse, 20 meters diameter, and 15 deep. West side filled with rock rubble, east side overhang and rock wall with a tiny pond in the bottom. Pool is 1 by 2 meters and about 0.25 meters deep. Ice is present under the water.

GENERAL VEGETATION DESCRIPTION: Scattered pinon/juniper and rabbitbrush on lava around collapse. Algae on surface of water in pond.

UNUSUAL FEATURES: Water surface algae as at Lichen Collapse.

ADDITIONAL COMMENTS: none

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: INWA SITE NAME: Indian Water Collapse

INITIAL SURVEY DATE: 7/10/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 1 mile south of Bandera Crater.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 9 N SECTION: 27 ne 1/4

UTM ZONE: 12 N: 3874800E: 766400

LATITUDE 34 58' 57.1"

LONGITUDE 108 04' 54.2"

SIZE OF SITE: 1 ha ELEVATION: 7780'

LANDFORM: lava tube collapse GEOLOGICAL UNIT: Bandera Flow

PARENT MATERIAL: basalt SOIL: sparse, fine loam

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 0.5 GRAVEL(3-7.5mm): 1 ROCK(>7.5mm): 99

PERCENT VEGETATION COVER

CANOPY: 2 BASAL: 1 CRYPTOGAMS: 0.1 WOOD: 0 LEAF LITTER: 1

GENERAL LANDSCAPE DESCRIPTION: Lava tube collapse 100 meters by 30 meters diameter. Collapse is filled with rock boulders, no soil development. Rock overhang on east side with small cave entrances. Ice present in caves. Water dripping from seeps on east and south rock walls.

GENERAL VEGETATION DESCRIPTION: Ponderosa pine, pinon, juniper, and Douglas fir on surrounding pahoehoe lava flow. One small aspen and small ponderosa pine in collapse. Scattered mountain muhly and pine dropseed. Moss and orange lichens in cave mouths and near seeps.

UNUSUAL FEATURES: Ice seeps at bases of cliffs and overhangs. Air is cold in overhang areas. Ice in the form of icicles, some 15 cm thick.

ADDITIONAL COMMENTS: Boulder rubble in collapse appears to hinder soil and vegetation development, in contrast to other nearby collapses such as Rattlesnake Collapse.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: IRIS SITE NAME: Iris

INITIAL SURVEY DATE: 6/4/92 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 1 mile northeast of El Calderon.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 11 W TOWNSHIP: 9 N SECTION: 29

UTM ZONE: 12 N: 3874800E: 772000

LATITUDE 34 58' 51.8"

LONGITUDE 108 01' 13.6"

SIZE OF SITE: 5 ha ELEVATION: 7400'

LANDFORM: stream drainage GEOLOGICAL UNIT: Quaternary alluvium & Twin Craters Flow

PARENT MATERIAL: Basalt/sandstone SOIL: fine loam (alluvium)

EROSION TYPE: runoff EROSION POTENTIAL: moderate

LIVESTOCK EVIDENCE: occasional old cattle dung

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 60 GRAVEL(3-7.5mm): 15 ROCK(>7.5mm): 25

PERCENT VEGETATION COVER

CANOPY: 70 BASAL: 30 CRYPTOGAMS: 5 WOOD: 2 LEAF LITTER: 10

GENERAL LANDSCAPE DESCRIPTION: Small drainage running between Twin Craters lava flow and sandstone bluff. Water in drainage ephemeral. Channel about 10 meters wide with lava rock substrate.

GENERAL VEGETATION DESCRIPTION: Ponderosa pine woodland. Scattered pinon and juniper. Area previously logged. Most ponderosa pine trees are young, probably 30 years. Understory of pine dropseed and mountain muhly. Many herb species.

UNUSUAL FEATURES: This site is one of the very few drainages located with the Monument boundaries. This drainage, which is normally dry, flowed heavily during spring 1993 runoff.

ADDITIONAL COMMENTS: none

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: JUCA SITE NAME: Junction Cave

INITIAL SURVEY DATE: 8/16/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 1 mile northeast of El Calderon.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 11 W TOWNSHIP: 9 N SECTION: 33 center

UTM ZONE: 12 N: 3873500E: 773500

LATITUDE 34 58' 08.2"

LONGITUDE 108 00' 16.1"

SIZE OF SITE: 0.5 ha ELEVATION: 7300'

LANDFORM: lava tube collapse and cave GEOLOGICAL UNIT: El Calderon Flow

PARENT MATERIAL: basalt SOIL: fine loam

EROSION TYPE: runoff EROSION POTENTIAL: moderate

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 10 GRAVEL(3-7.5mm): 15 ROCK(>7.5mm): 75

PERCENT VEGETATION COVER

CANOPY: 15 BASAL: 3 CRYPTOGAMS: 10 WOOD: .5 LEAF LITTER: 5

GENERAL LANDSCAPE DESCRIPTION: Double lava tube collapse structure with cave in between. Landscape El Calderon flow with well developed soil. Collapses about 15 meters diameter, cave 30 meters long, 5-15 meters diameter. Cave dry.

GENERAL VEGETATION DESCRIPTION: Surrounding area blue grama grassland with snakeweed and many herb species. Rabbitbrush, *Rhus*, and mountain muhly also common.

UNUSUAL FEATURES: none

ADDITIONAL COMMENTS: none

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: KIHN SITE NAME: North Hoya Kipuka

INITIAL SURVEY DATE: 6/23/92 SURVEYORS: Bleakly, Viers

DESCRIPTIVE LOCATION: 1.75 miles south of Hoya de Cibola.

USGS 1:24,000 MAP NAME: Cerro Brillante

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 7 N SECTION: 5 sw 1/4

UTM ZONE: 12 N: 3861000E: 762200

LATITUDE 34 51' 33.6"

LONGITUDE 108 07' 55.2"

SIZE OF SITE: 20 ha ELEVATION: 7430' GEOLOGICAL UNIT: Old Basalt Flow

LANDFORM: old lava flow kipuka surrounded by new Hoya flow

PARENT MATERIAL: basalt SOIL: fine loam

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: old cattle dung

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 40 GRAVEL(3-7.5mm): 20 ROCK(>7.5mm): 40

PERCENT VEGETATION COVER

CANOPY: 80 BASAL: 30 CRYPTOGAMS: 2 WOOD: 1 LEAF LITTER: 5

GENERAL LANDSCAPE DESCRIPTION: Rocky, mostly level terrain. Soil quite well-developed.

GENERAL VEGETATION DESCRIPTION: Blue grama grassland with snakeweed and brush. Widely scattered ponderosa pine, pinon pine and juniper.

UNUSUAL FEATURES: Pinon and juniper more abundant than on surrounding Hoya flow.

ADDITIONAL COMMENTS: none

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: KIHS SITE NAME: South Hoya Kipuka

INITIAL SURVEY DATE: 6/24/92 SURVEYORS: Bleakly, Viers

DESCRIPTIVE LOCATION: 2.0 miles south of Hoya de Cibola.

USGS 1:24,000 MAP NAME: Cerro Brillante

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 7 N SECTION: 8 sw 1/4

UTM ZONE: 12 N: 3859700 E: 762400

LATITUDE 34 50′ 51.3"

LONGITUDE 108 07′ 48.8"

SIZE OF SITE: 0.255 km^2 ELEVATION: 7350′

LANDFORM: old lava flow kipuka in Hoya flow GEOLOGICAL UNIT: Old Basalt Flow

PARENT MATERIAL: basalt SOIL: fine loam

EROSION TYPE: none EROSION POTENTIAL: slight

LIVESTOCK EVIDENCE: limited old cow and horse droppings

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 40 GRAVEL(3-7.5mm): 20 ROCK(>7.5mm): 40

PERCENT VEGETATION COVER

CANOPY: 75 BASAL: 35 CRYPTOGAMS: 2 WOOD: <1 LEAF LITTER: 3

GENERAL LANDSCAPE DESCRIPTION: Larger than KIHN. Generally slopes slightly north to south. Mostly open grassy area with some rocky outcrops.

GENERAL VEGETATION DESCRIPTION: Open, grassy area with some shrubs, juniper, pinon, ponderosa. Shrubs typical of the monument, such as *Mahonia repens*, mostly on rocky outcrops

UNUSUAL FEATURES: none

ADDITIONAL COMMENTS: Site recently closed to vehicular traffic. Probably not grazed within last 2-3 years, maybe longer.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: LACR SITE NAME: Lava Crater

INITIAL SURVEY DATE: 7/3/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 1.4 miles southeast of Bandera Crater.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 9 N SECTION: 25 nw 1/4

UTM ZONE: 12 N: 3874500 E: 768200

LATITUDE 34 58' 45.7"

LONGITUDE 108 03' 43.7"

SIZE OF SITE: 10 ha ELEVATION: 7900-8100'

LANDFORM: volcanic crater/cinder cone GEOLOGICAL UNIT: Twin Craters Flow

PARENT MATERIAL: basalt SOIL: fine loam

EROSION TYPE: runoof-runon EROSION POTENTIAL: low

LIVESTOCK EVIDENCE: some old cattle dung

PERCENT GROUND SURFACE COVER

SOIL (<3mm): <1 GRAVEL(3-7.5mm): 60 ROCK(>7.5mm): 40

PERCENT VEGETATION COVER

CANOPY: 10 BASAL: <1 CRYPTOGAMS: 50 WOOD: <1 LEAF LITTER: <1

GENERAL LANDSCAPE DESCRIPTION: Volcanic crater. Rim composed of various basalt layers. Inner slope of crater is rubble and cinder slopes (appx 30%) to bottom. Outer slopes cinders and lava outcrops.

GENERAL VEGETATION DESCRIPTION: Sparse mountain muhly, scattered juniper and *Holodiscus*. Large stand of aspen (appx 0.5 ha) on south side (north slope) of crater interior. Several large Douglas fir in crater. Scattered ponderosa, pinon, and juniper around cone. Extensive lichen cover on rocks.

UNUSUAL FEATURES: Small areas, about 1 m square, located along crater rim, appear to have been struck by lightning. The evidence is blownup look of the sites, the fresh rock surfaces visible, and the lack of lichens.

ADDITIONAL COMMENTS: none

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: LICO SITE NAME: Lichen Collapse

INITIAL SURVEY DATE: 7/16/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 0.3 miles south of Bandera Crater.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 9 N SECTION: 22 se 1/4

UTM ZONE: 12 N: 3875800 E: 766200

LATITUDE 34 59' 29.7"

LONGITUDE 108 05' 00.9"

SIZE OF SITE: 1 Ha ELEVATION: 7860'

LANDFORM: lava tube collapse GEOLOGICAL UNIT: Bandera Flow

PARENT MATERIAL: basalt SOIL: fine loam

EROSION TYPE: runoff, runon EROSION POTENTIAL: low

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 1 GRAVEL(3-7.5mm): 2 ROCK(>7.5mm): 97

PERCENT VEGETATION COVER

CANOPY: 5 BASAL: <1 CRYPTOGAMS: 65 WOOD: <1 LEAF LITTER: 2

GENERAL LANDSCAPE DESCRIPTION: Collapsed lava tube, opening about 30 m in diameter. North side of collapse steeply sloped and covered with rubble. Pool in bottom at south side under deep overhang that is about 25 m tall. Pool about 3 x 10 m in size. Bottom very cold, but no ice.

GENERAL VEGETATION DESCRIPTION: Few *Juniperus scopulorum*, one small Douglas fir and several dead ones in the collapse. Scattered *Holodiscus* and *Fallugia*. Dense band (about 5 m wide) of moss near bottom of collapse, below the overhang. No liverworts seen. Many lichen species with a band of bright orange lichen just below the moss. A yellow lichen/fungus on rocks within overhang.

UNUSUAL FEATURES: Large permanent pool of water in bottom of collapse that is covered witha bloom of green algae.

ADDITIONAL COMMENTS: none

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: LOME SITE NAME: Los Medanitos Kipuka

INITIAL SURVEY DATE: 8/21/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 2 miles west of Sandstone Bluffs Overlook.

USGS 1:24,000 MAP NAME: Los Pilares

SPECIFIC LOCATION

RANGE: 10 W TOWNSHIP: 8 N SECTION: 11 nw 1/4

UTM ZONE: 13 N: 3869800 E: 238500

LATITUDE 34 56' 19.6"

LONGITUDE 108 51' 47.1"

SIZE OF SITE: 50 ha ELEVATION: 6800-6831'

LANDFORM: Hoya kipuka in McCartys flow GEOLOGICAL UNIT: Hoya flow & Quaternary eolian deposits

PARENT MATERIAL: basalt; eolian SOIL: sand, sandy loam

EROSION TYPE: runoff, runon EROSION POTENTIAL: low

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 98 GRAVEL(3-7.5mm): <1 ROCK(>7.5mm): <1

PERCENT VEGETATION COVER

CANOPY: 60 BASAL: 20 CRYPTOGAMS: <1 WOOD: 5 LEAF LITTER: 10

GENERAL LANDSCAPE DESCRIPTION: flat, sandy area probably on a Hoya flow base that is now surrounded by McCartys lava; some low sandy hills or old dunes.

GENERAL VEGETATION DESCRIPTION: sandsage and *Bouteloua gracilis* with scatter pinon/juniper. Several small stands of tall ponderosa. High density of *Yucca baccata*.

UNUSUAL FEATURES: Many dean pinon and juniper, possibly several decades old, all blown down towards the east. High density of *Yucca baccata*.

ADDITIONAL COMMENTS: Vegetation structure and composition very much like SABL. Lack of grazing has caused no noticeable difference in the vegetation. There is considerable bare, sandy ground with snakeweed.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: LOWO SITE NAME: Lost Woman Cone

INITIAL SURVEY DATE: 5/13/92 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 2.5 mi south of Bandera Crater.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 11 W TOWNSHIP: 9 N SECTION: 34 e 1/2 & 35 w 1/2

UTM ZONE: 12 N: 3872600 E: 766400

LATITUDE 34 57' 45.8"

LONGITUDE 108 04' 56.7"

SIZE OF SITE: 30 ha ELEVATION: 7500-8066'

LANDFORM: cinder cone with crater GEOLOGICAL UNIT: Twin Craters Flow Cinder Cone

PARENT MATERIAL: basalt & cinders SOIL: cinders; sandy loam

EROSION TYPE: runoff EROSION POTENTIAL: high

LIVESTOCK EVIDENCE: some old horse droppings

PERCENT GROUND SURFACE COVER

SOIL (<3mm): <10 GRAVEL(3-7.5mm): 70 ROCK(>7.5mm): 20

PERCENT VEGETATION COVER

CANOPY: 30 BASAL: 10 CRYPTOGAMS: 20 WOOD: 5 LEAF LITTER: 10

GENERAL LANDSCAPE DESCRIPTION: Large cinder double cone with steep sides and two craters. Cinders small and reddish-black. Twin craters flow surrounds the cones. Breach to the southeast. On the southeast are also some steep basalt slopes and cliffs.

GENERAL VEGETATION DESCRIPTION: Open pinon and ponderosa woodland. Extensive grass cover of mostly mountain muhly and blue gramma, particularly on sides and the north side. Stunted pinons and Apache plume on rim. *Echinocereus triglochidiatus melanacanthus* common on rim, also.

UNUSUAL FEATURES: Many large mounds, some with hundreds of stems, of *Echinocereus triglochidiatus melanacanthus* on and near the rim.

ADDITIONAL COMMENTS: Fire line or old road cut along of nw rim. Road near north base of the cone near a cabin. Considerable evidence of tree cutting on flats to the north. Many large fire scars on the large ponderosas, especially on the north side of the cone

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: MACO SITE NAME: Massive Collapse

INITIAL SURVEY DATE: 6/16/92 SURVEYORS: Lightfoot, Viers

DESCRIPTIVE LOCATION: 3 miles southeast of Cerro Rendija.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 11 W TOWNSHIP: 8 N SECTION: 15 ne 1/4

UTM ZONE: 12 N: 3868680E: 766300

LATITUDE 34 55' 38.8"

LONGITUDE 108 05' 05.2"

SIZE OF SITE: 1 ha ELEVATION: 7520'

LANDFORM: lava tube collapse and caves GEOLOGICAL UNIT: Bandera Flow

PARENT MATERIAL: basalt SOIL: none

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 0.1 GRAVEL(3-7.5mm): 5 ROCK(>7.5mm): 95

PERCENT VEGETATION COVER

CANOPY: 0 BASAL: 0 CRYPTOGAMS: 30 WOOD: 0 LEAF LITTER: 0

GENERAL LANDSCAPE DESCRIPTION: Large lava tube collapse 40 by 70 meters diameter. Large cave 10 by 30 meters diameter at east end, smaller cave mouth at west end. Caves at both ends connect to adjacent collapses either direction.

GENERAL VEGETATION DESCRIPTION: No vegetation in collapse.

UNUSUAL FEATURES: none

ADDITIONAL COMMENTS: none

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: MARC SITE NAME: Marchantia Ice Cave #1

INITIAL SURVEY DATE: 7/1-7/3/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 1.2 mi southeast of Bandera Crater.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 9 N SECTION: 25 nw 1/4

UTM ZONE: 12 N: 3874900 E: 768500

LATITUDE 34 58' 58.4"

LONGITUDE 108 03' 31.4"

SIZE OF SITE: 1 ha ELEVATION: 7750'

LANDFORM: lava tube collapse GEOLOGICAL UNIT: Twin Craters Flow

PARENT MATERIAL: basalt SOIL: fine loam and cinders

EROSION TYPE: ronoff-runon EROSION POTENTIAL: moderate to high

LIVESTOCK EVIDENCE: considerable old cattle and horse droppings

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 20 GRAVEL(3-7.5mm): 10 ROCK(>7.5mm): 70

PERCENT VEGETATION COVER

CANOPY: 30 BASAL: 10 CRYPTOGAMS: 40 WOOD: 10 LEAF LITTER: 15

GENERAL LANDSCAPE DESCRIPTION: Lava tube collapse in Lava Crater flow. The surface is partially covered with cinders. Collapse is about 50 m across with steep, layered walls about 30 m tall at the top. Steep, rocky slope leads to cave entrance at lowest point at south side. Ice present at mouth of cave.

GENERAL VEGETATION DESCRIPTION: Ponderosa pine woodland with blue grama surrounds the collapse. *Yucca baccata* and *Echinocereus triglochidiatus melanacanthus* on south-facing walls of collapse. Dense stand of *Holodiscus* and *Ribes* in bottom of collapse. Dense mat of moss and *Marchantia* near ice at mouth of cave. Blue grama, pine dropseed, and mountain muhly are the dominant grasses.

UNUSUAL FEATURES: Air temperature near mouth of cave very cold. During afternoon of 1 July, air temperature of 78° F 10 m from cave mouth, 46° F at mouth of cave, and 32 F in cave near the ice. Cold air is blowing from cave mouth. The only known population of *Ribes inerme* in the monument grows near the mouth of the cave.

ADDITIONAL COMMENTS: Ice at the mouth of the cave seems to be maintained by the cold air blowing from the depths of the cave.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: MARC-C SITE NAME: Marchantia Camp

INITIAL SURVEY DATE: 7/1-7/3/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 1.2 miles southeast of Bandera Crater

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 9 N SECTION: 25 nw 1/4

UTM ZONE: 12 N: 3875100 E: 768200

LATITUDE 34 59' 05.1"

LONGITUDE 108 03' 43.0"

SIZE OF SITE: 1 ha ELEVATION: 7700'

LANDFORM: alluvium & cinders at base of lava flow GEOLOGICAL UNIT: Twin Craters Flow

PARENT MATERIAL: basalt SOIL: fine loam

EROSION TYPE: runoff-runon EROSION POTENTIAL: moderate to high

LIVESTOCK EVIDENCE: considerable old droppings; livestock trails apparent

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 90 GRAVEL(3-7.5mm): 5 ROCK(>7.5mm): 5

PERCENT VEGETATION COVER

CANOPY: 40 BASAL: 20 CRYPTOGAMS: <1 WOOD: 5 LEAF LITTER: 10

GENERAL LANDSCAPE DESCRIPTION: Gentle slope of 1-2 % to northwest. Camp located at base of lava flow. Soil well-developed with some cinders.

GENERAL VEGETATION DESCRIPTION: Ponderosa & pinon/juniper woodland. Trees widely spaced. Considerable blue grama, pine dropseed, *Aristida*, and mountain muhly. Many herbaceous taxa.

UNUSUAL FEATURES: none

ADDITIONAL COMMENTS: Many MARC plants collected here. Vegetation in the camp area is similar found around all the MARC sites.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: MARC-2 SITE NAME: Marcantia Collapse #2

INITIAL SURVEY DATE: 7/3/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 1.2 miles southeast of Bandera Crater. This site is just north of MARC.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 9 N SECTION: 25 nw 1/4

UTM ZONE: 12 N: 3875000 E: 768500

LATITUDE 34 59' 01.6"

LONGITUDE 108 03' 31.3"

SIZE OF SITE: 1 ha ELEVATION: 7740'

LANDFORM: lava tube collapse GEOLOGICAL UNIT: Twin Craters Flow

PARENT MATERIAL: basalt SOIL: fine loam, cinders

EROSION TYPE: runoff-runon EROSION POTENTIAL: moderate to high

LIVESTOCK EVIDENCE: old cattle droppings around rim

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 25 GRAVEL(3-7.5mm): 15 ROCK(>7.5mm): 60

PERCENT VEGETATION COVER

CANOPY: 30 BASAL: 10 CRYPTOGAMS: 20 WOOD: 5 LEAF LITTER: 15

GENERAL LANDSCAPE DESCRIPTION: Collapse about 25 m across with steep rock walls about 25 m tall below the rim. Cave and overhang on nw side; the cave extends to MARC-3, to the north. No ice or water present in collapse or cave.

GENERAL VEGETATION DESCRIPTION: Two large Douglas fir and 2 ponderosa are growing from the bottom of the collapse. Common shrubs present, but no moss or liverworts found. The large fern, *Dryopterus filix-mas* is growing in the collapse.

UNUSUAL FEATURES: Small spatter cone on south rim.

ADDITIONAL COMMENTS: This site is located just north and down-tube of MARC.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: MARC-3 SITE NAME: Marchantia Collapse #3

INITIAL SURVEY DATE: 7/3/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 1.2 miles southeast of Bandera Crater; this site is just north of MARC-2 and south of MARC-4.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 9 N SECTION: 25 nw 1/4

UTM ZONE: 12 N: 3875000 E: 768500

LATITUDE 34 59' 01.6"

LONGITUDE 108 03' 31.3"

SIZE OF SITE: 1 ha ELEVATION: 7720'

LANDFORM: lava tube collapse GEOLOGICAL UNIT: Twin Craters Flow

PARENT MATERIAL: basalt SOIL: fine loam, cinders

EROSION TYPE: runoff-runon EROSION POTENTIAL: moderate to high

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 40 GRAVEL(3-7.5mm): 10 ROCK(>7.5mm): 50

PERCENT VEGETATION COVER

CANOPY: 25 BASAL: 5 CRYPTOGAMS: 30 WOOD: 10 LEAF LITTER: 25

GENERAL LANDSCAPE DESCRIPTION: Collapse about 30 m across and 25 m deep with steep rock walls on all sides. Overhang and cave on south side, which connects to MARC-2. Large rock-filled overhang on north side. No water or ice present.

GENERAL VEGETATION DESCRIPTION: No pine or Douglas fir but one very large *Juniperus scopulorum* growing in the middle of the collapse. *Holodiscus* and *Ribes* common.

UNUSUAL FEATURES: none

ADDITIONAL COMMENTS: none

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: MARC-4 SITE NAME: Marchantia Collapse #4 (Dripping Lava)

INITIAL SURVEY DATE: 7/3/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 1.2 miles southeast of Bandera Crater

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 9 N SECTION: 25 nw 1/4

UTM ZONE: 12 N: 3875100 E: 768400

LATITUDE 34 59' 04.9"

LONGITUDE 108 03' 35.1"

SIZE OF SITE: 1 ha ELEVATION: 7700'

LANDFORM: lava tube collapse GEOLOGICAL UNIT: Twin Craters Flow

PARENT MATERIAL: basalt SOIL: fine loam

EROSION TYPE: runoff-runon EROSION POTENTIAL: moderate to high

LIVESTOCK EVIDENCE: none in collapse, cattle evidence in surrounding woodland

PERCENT GROUND SURFACE COVER
SOIL (<3mm): 20 GRAVEL(3-7.5mm): 10 ROCK(>7.5mm): 70

PERCENT VEGETATION COVER

CANOPY: 30 BASAL: 10 CRYPTOGAMS: 45 WOOD: 5 LEAF LITTER: 30

GENERAL LANDSCAPE DESCRIPTION: Collapse about 20 m across with steep rock wall about 5 m tall on se side and 30 m tall on nw side. A steep, rocky slope leads under a huge overhang on nw side whose opening is about 15 m high and wide. Entrance to long tube/cave at bottom of collapse beneath overhang.

GENERAL VEGETATION DESCRIPTION: *Juniperus scopulorum* growing in middle of collapse along with *Holodiscus* and *Ribes*. Good grass cover of mountain muhly and pine dropseed in upper, sunny part. No moss communities, water, or ice found.

UNUSUAL FEATURES: The remains of a builtup trail leads under the overhang. There are traces of vehicle roads in the area and around the collpses. Probably local residents and/or tour groups from Zuni Ice Cave Trading Post probably drove up to the edges of the collpses in the past.

ADDITIONAL COMMENTS: The cave/tube continues to approximately the north from the bottom of MARC-4. Initial access is through a rather small hole and down a trimmed tree ladder to a steep slope and the rest of the tube.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: MARC-5 SITE NAME: Marchantia Collapse #5

INITIAL SURVEY DATE: 7/3/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 1.4 miles southeast of Bandera Crater.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 9 N SECTION: 25 nw 1/4

UTM ZONE: 12 N: 3874700E: 768500

LATITUDE 34 58' 51.9"

LONGITUDE 108 03' 31.6"

SIZE OF SITE: 1 ha ELEVATION: 7800'

LANDFORM: Lava tube collapse GEOLOGICAL UNIT: Twin Craters Flow

PARENT MATERIAL: basalt SOIL: fine loam

EROSION TYPE: runon/runoff EROSION POTENTIAL: high

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 10 GRAVEL(3-7.5mm): 30 ROCK(>7.5mm): 60

PERCENT VEGETATION COVER

CANOPY: 50 BASAL: 15 CRYPTOGAMS: 30 WOOD: 2 LEAF LITTER: 10

GENERAL LANDSCAPE DESCRIPTION: Lava tube collapse about 25 meters across. Steep slope into collapse on west side. Large overhang on east side forming cave mouth. Water dripping from ceiling, cold inside, no ice observed.

GENERAL VEGETATION DESCRIPTION: Douglas-fir on slope in collapse, *Ribes* in bottom. Ocean spray and mountain muhly throughout. Moss on rocks were water is dripping under overhangs.

UNUSUAL FEATURES: Large overhang cave mouth 15 meters high, 20 meters across, and 20 meters deep. No ice, but air very cold.

ADDITIONAL COMMENTS: Water dripping from points on ceiling form algal/moss patches on rocks.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: MARC-6 SITE NAME: Marchantia Collapse #6

INITIAL SURVEY DATE: 7/3/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 1.4 miles southeast of Bandera Crater.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 9 N SECTION: 25 nw 1/4

UTM ZONE: 12 N: 3874700 E: 768400

LATITUDE 34 58' 52.0"

LONGITUDE 108 03' 35.5"

SIZE OF SITE: 1 ha ELEVATION: 7820'

LANDFORM: lava tube collapse GEOLOGICAL UNIT: Twin Craters Flow

PARENT MATERIAL: basalt SOIL: fine loam

EROSION TYPE: runon/runoff EROSION POTENTIAL: moderate

LIVESTOCK EVIDENCE: old cattle dung

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 50 GRAVEL(3-7.5mm): 15 ROCK(>7.5mm): 35

PERCENT VEGETATION COVER

CANOPY: 40 BASAL: 10 CRYPTOGAMS: 30 WOOD: 5 LEAF LITTER: 30

GENERAL LANDSCAPE DESCRIPTION: Lava tube collapse mostly filled with rock rubble. Soil well developed. One small overhang on northeast side.

GENERAL VEGETATION DESCRIPTION: Douglas fir and ponderosa pine growing in collapse. Moutain muhly and pine dropseed understory.

UNUSUAL FEATURES: none

ADDITIONAL COMMENTS: No cave entraces, water, or ice.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: MARC-7 SITE NAME: Marchantia Collapse #7

INITIAL SURVEY DATE: 7/3/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 1.4 miles southeast of Bandera Crater.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 9 N SECTION: 25 nw 1/4

UTM ZONE: 12 N: 3874700 E: 768400

LATITUDE 34 58' 52.0"

LONGITUDE 108 03' 35.5"

SIZE OF SITE: 1 ha ELEVATION: 7820'

LANDFORM: lava tube collapse GEOLOGICAL UNIT: Twin Craters Flow

PARENT MATERIAL: basalt SOIL: fine loam

EROSION TYPE: runon/runoff EROSION POTENTIAL: moderate

LIVESTOCK EVIDENCE: old cattle dung

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 40 GRAVEL(3-7.5mm): 20 ROCK(>7.5mm): 40

PERCENT VEGETATION COVER

CANOPY: 40 BASAL: 5 CRYPTOGAMS: 25 WOOD: 5 LEAF LITTER: 20

GENERAL LANDSCAPE DESCRIPTION: Lava tube collapse, shallow and mostly filled with rubble and soil. No rim rock or overhangs. Steep rocky slopes.

GENERAL VEGETATION DESCRIPTION: Ponderosa pine and several Douglas fir. Mountain muhly and pine dropseed understory.

UNUSUAL FEATURES: none

ADDITIONAL COMMENTS: none

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: MCCA SITE NAME: McCartys Lava Flow Near LOME.

INITIAL SURVEY DATE: 08/20/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 1.5 miles southwest of Sandstone Bluffs Overlook.

USGS 1:24,000 MAP NAME: Los Pilares

SPECIFIC LOCATION

RANGE: 9 W TOWNSHIP: 8 N SECTION: 11ne1/4

UTM ZONE 12 N: 3870300 E: 238800

LATITUDE 35 56' 32"

LONGITUDE 107 51' 28"

SIZE OF SITE: 1 ha ELEVATION: 6800'

LANDFORM: Lava flow GEOLOGICAL UNIT: McCartys flow

PARENT MATERIAL: Basalt SOIL: none

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 0 GRAVEL(3-7.5mm): 5 ROCK(>7.5mm): 95

PERCENT VEGETATION COVER

CANOPY: 25 BASAL: 15 CRYPTOGAMS: 10 WOOD: 0 LEAF LITTER: 1

GENERAL LANDSCAPE DESCRIPTION: Flat pahoehoe lava flow with low pressure ridges, troughs, and many crevices. Lava surface recent and black.

GENERAL VEGETATION DESCRIPTION: Widely scattered apache plume and juniper, few rabbitbrush and Rhus bushes. Scattered side-oats grama grass.

UNUSUAL FEATURES: Barren, black, pahoehoe lava field.

ADDITIONAL COMMENTS: none

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: MCSW SITE NAME: McCartys Flow Southwest

INITIAL SURVEY DATE: 7/7/92 SURVEYORS: Lightfoot, Viers

DESCRIPTIVE LOCATION: 3.5 miles north of the junction of NM-117 and CR 42.

USGS 1:24,000 MAP NAME: York Ranch

SPECIFIC LOCATION

RANGE: 11 W TOWNSHIP: 6 N SECTION: 17 w 1/2

UTM ZONE: 12 N: 3849000E: 772500

LATITUDE 34 44' 54.8"

LONGITUDE 108 01' 24.1"

SIZE OF SITE: 2 ha ELEVATION: 7150'

LANDFORM: lava flow GEOLOGICAL UNIT: McCartys Flow

PARENT MATERIAL: basalt SOIL: sparse, fine loam

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 0.5 GRAVEL(3-7.5mm): 10 ROCK(>7.5mm): 90

PERCENT VEGETATION COVER

CANOPY: 40 BASAL: 15 CRYPTOGAMS: 80 WOOD: 0.2 LEAF LITTER: 1

GENERAL LANDSCAPE DESCRIPTION: Level pahoehoe flow. Many pressure ridges, cracks, and surface collapses. Lava surface cracked and covered with jagged plates.

GENERAL VEGETATION DESCRIPTION: Apache plume shrubland with sparse, scattered dwarf ponderosa pine, pinon, and juniper. Blue grama and little bluestem most common grasses. Lichen cover high.

UNUSUAL FEATURES: none

ADDITIONAL COMMENTS: Typical McCartys flow.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: MEBL SITE NAME: Mesita Blanca

INITIAL SURVEY DATE: 8/14/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 1.5 miles northwest of Cerro Encierro.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 8 N SECTION: 26 sw 1/4

UTM ZONE: 12 N: 3864300E: 767500

LATITUDE 34 53' 15.6"

LONGITUDE 108 04' 23.0"

SIZE OF SITE: 50 ha ELEVATION: 7360-7425'

LANDFORM: sedimentary kipukaGEOLOGICAL UNIT: San Andres Limestone (Permian)

PARENT MATERIAL: sandstone/limestoneSOIL: sandy loam

EROSION TYPE: runoff EROSION POTENTIAL: moderate

LIVESTOCK EVIDENCE: old cattle dung common

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 75 GRAVEL(3-7.5mm): 15 ROCK(>7.5mm): 10

PERCENT VEGETATION COVER

CANOPY: 60 BASAL: 20 CRYPTOGAMS: 15 WOOD: 10 LEAF LITTER: 20

GENERAL LANDSCAPE DESCRIPTION: Ridge of San Andres limestone surrounded by Hoya lava flow. Ridge highest at center, all slopes gradual. Occasional areas of exposed limestone. No large rocks or rock outcrops.

GENERAL VEGETATION DESCRIPTION: Pinon/juniper, ponderosa pine woodland. Pinon and juniper dominant in rocky areas on top, ponderosa on developed soil. Blue grama, mountain muhly, pine dropseed, and western wheatgrass major grasses. Many species of herbs.

UNUSUAL FEATURES: Flat rocky areas with succulent *Talinum* plants.

ADDITIONAL COMMENTS: Well developed grassland. Little evidence of grazing. Indian sweathouse found on top of ridge.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: MTKI SITE NAME: Middle Three Kipukas

INITIAL SURVEY DATE: 8/27/91 SURVEYORS: Lightfoot

DESCRIPTIVE LOCATION: 1 mile south of the Narrows.

USGS 1:24,000 MAP NAME: North Pasture

SPECIFIC LOCATION

RANGE: 10 W TOWNSHIP: 7 N SECTION: 17 sw 1/4

UTM ZONE 13 N: 3858000E: 233000

LATITUDE 34 49' 51.9"

LONGITUDE 108 55' 10.1"

SIZE OF SITE: 30 ha ELEVATION: 7100-7155'

LANDFORM: sandstone kipuka GEOLOGICAL UNIT: Clay Mesa Tongue of Mancos Shale & lower part of Dakota Sandstone (Cretaceous); Zuni Sandstone & Wanakah Formation (Jurassic)

PARENT MATERIAL: sandstone SOIL: sandy loam

EROSION TYPE: runoff EROSION POTENTIAL: moderate

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 95 GRAVEL(3-7.5mm): 1 ROCK(>7.5mm): 4

PERCENT VEGETATION COVER

CANOPY: 40 BASAL: 15 CRYPTOGAMS: 15 WOOD: 3 LEAF LITTER: 5

GENERAL LANDSCAPE DESCRIPTION: Large sandy kipuka surrounded by McCartys lava flow. Sandstone Zuni and Dakota sandstones. High sandstone escarpment at north end. Gradual slope to south end. Escarpment cliffs 10-20 meters high. Soils very sandy.

GENERAL VEGETATION DESCRIPTION: Pinon/juniper woodland throughout. Few large ponderosa pine trees at south end, and scattered ponderosa at cliffs. Blue and hairy grama understory, snakeweed and *Hymenoxys richardsonii* common. High density of *Yucca baccata*, many dead, down pinon trees.

UNUSUAL FEATURES: High densities of *Yucca baccata* relative to other similar kipuka areas. Many dead down pinon trees, at least several decades old. Steep sandstone cliffs at north end provide unusual environments at base.

ADDITIONAL COMMENTS: No evident fire scars on ponderosa pine trees. No evident difference in vegetation from lack of grazing.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: NACO SITE NAME: Navajo Collapse and Cave

INITIAL SURVEY DATE: 6/16/92 SURVEYORS: Lightfoot, Viers

DESCRIPTIVE LOCATION: 4.5 miles southeast of Cerro Rendija.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 11 W TOWNSHIP: 8 N SECTION: 23 ne 1/4

UTM ZONE: 12 N: 3867050E: 767900

LATITUDE 34 54' 44.4"

LONGITUDE 108 04' 04.1"

SIZE OF SITE: 0.5 ha ELEVATION: 7460'

LANDFORM: lava tube collapse and cave GEOLOGICAL UNIT: Bandera Flow

PARENT MATERIAL: basalt SOIL: sparse, fine loam

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 3 GRAVEL(3-7.5mm): 15 ROCK(>7.5mm): 82

PERCENT VEGETATION COVER

CANOPY: 42 BASAL: 10 CRYPTOGAMS: 78 WOOD: 1 LEAF LITTER: 2

GENERAL LANDSCAPE DESCRIPTION: Lava tube collapse 60 by 20 meters, 10 to 15 meters deep. Sheer cliffs all around. Overhang cave mouths at west and east ends. Lower level mouth of Navajo Cave in middle, cave heading east. Cave entrance small, passage narrow and winding, with large rooms. Cave extends about 100 meters deep. Much ice in cave.

GENERAL VEGETATION DESCRIPTION: Open ponderosa woodland in area. Apache plume dominant shrub. Scattered blue grama and mountain muhly. Orange lichen/moss zonation across mouth of Navajo Cave.

UNUSUAL FEATURES: Extensive amounts of ice in Navajo Cave. Ice ponds and thick ice flows on floor. Large ice crystals on walls and ceiling. Many charcoal and burnt wood piles in cave.

ADDITIONAL COMMENTS: Large area of *Xanthoparmelia* lichen die-off on rocks at southeast rim of collapse.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: NAKI SITE NAME: Navajo Kipuka

INITIAL SURVEY DATE: 6/13/92 SURVEYORS: Lightfoot, Viers

DESCRIPTIVE LOCATION: 5 miles southeast Cerro Rendija.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 11 W TOWNSHIP: 8 N SECTION: 13 sw 1/4

UTM ZONE: 12 N: 3867400E: 768600

LATITUDE 34 54' 55.1"

LONGITUDE 108 03' 36.1"

SIZE OF SITE: 15 ha ELEVATION: 7400'

LANDFORM: kipuka GEOLOGICAL UNIT: Bandera Flow

PARENT MATERIAL: basalt SOIL: fine loam

EROSION TYPE: runoff EROSION POTENTIAL: moderate

LIVESTOCK EVIDENCE: horse dung common

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 85 GRAVEL(3-7.5mm): 5 ROCK(>7.5mm): 10

PERCENT VEGETATION COVER

CANOPY: 86 BASAL: 35 CRYPTOGAMS: 5 WOOD: 3 LEAF LITTER: 10

GENERAL LANDSCAPE DESCRIPTION: Old lava flow kipuka surrounded by Bandera flow. Flat terrain with few basalt outcrops. Soil well developed.

GENERAL VEGETATION DESCRIPTION: Blue grama grassland, scattered ponderosa pine, pinon, and juniper. *Chrysothamnus*, *Tetradymia*, *Artemisia* common. Mountian muhly and pine dropseed common, many species of herbs.

UNUSUAL FEATURES: Remains of old, dead pine dropseed clumps common, especially in open areas.

ADDITIONAL COMMENTS: Area has been logged, many old stumps.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: NARR SITE NAME: McCartys Flow at North Narrows

INITIAL SURVEY DATE: 8/19/92 SURVEYORS: Bleakly

DESCRIPTIVE LOCATION: 1/2 mile west of north end of the Narrows.

USGS 1:24,000 MAP NAME: Arrosa Ranch

SPECIFIC LOCATION

RANGE: 10 W TOWNSHIP: 8 N SECTION: 33

UTM ZONE: 13 N: 3863800E: 235400

LATITUDE 34 53' 02.2"

LONGITUDE 107 53' 42.3"

SIZE OF SITE: 5 ha ELEVATION: 7000'

LANDFORM: lava flow GEOLOGICAL UNIT: McCartys Flow

PARENT MATERIAL: basalt SOIL: sparse fine loam

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 0.5 GRAVEL(3-7.5mm): 5 ROCK(>7.5mm): 95

PERCENT VEGETATION COVER

CANOPY: 20 BASAL: 5 CRYPTOGAMS: 40 WOOD: 0 LEAF LITTER: 1

GENERAL LANDSCAPE DESCRIPTION: Pahoehoe lava flow with large pressure ridges, cracks, and surface collapses. Soil only in small depressions.

GENERAL VEGETATION DESCRIPTION: Few scattered ponderosa pine, pinon, and juniper, all stunted. Sparse shrubs, grasses, and annuals.

UNUSUAL FEATURES: none

ADDITIONAL COMMENTS: Lava flow barren, a few small kipukas in area, probably Hoya flow.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: NATH SITE NAME: Navajo Trail Head

INITIAL SURVEY DATE: 6/16/92 SURVEYORS: Lightfoot, Viers

DESCRIPTIVE LOCATION: 4.5 miles southeast of Cerro Rendija.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 11 W TOWNSHIP: 8 N SECTION: 23 nw 1/4

UTM ZONE: 12 N: 3866600E: 767250

LATITUDE 34 54' 30.5"

LONGITUDE 108 04' 30.2"

SIZE OF SITE: 5 ha ELEVATION: 7400'

LANDFORM: lava flow GEOLOGICAL UNIT: Bandera Flow; Old Basalt Flow

PARENT MATERIAL: basalt SOIL: fine loam

EROSION TYPE: runoff EROSION POTENTIAL: moderate

LIVESTOCK EVIDENCE: cattle dung common

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 70 GRAVEL(3-7.5mm): 15 ROCK(>7.5mm): 15

PERCENT VEGETATION COVER

CANOPY: 86 BASAL: 40 CRYPTOGAMS: 3 WOOD: 1 LEAF LITTER: 15

GENERAL LANDSCAPE DESCRIPTION: Level old lava flow area at edge of Bandera flow. Well developed soil, occassional low basalt outcrops. Lava broken, many small rocks scattered on ground

GENERAL VEGETATION DESCRIPTION: Blue grama grassland, *Artemisia frigida* common. Many species of herbs.

UNUSUAL FEATURES: Several tree casts in lava in Bandera flow near Navajo trailhead.

ADDITIONAL COMMENTS: Vegetation more diverse than at Navajo Kipuka. Grass cover appears to be less than at NAKI, though. Grazing impact more apparent than at NAKI.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: NOMC SITE NAME: North McCarys Flow

INITIAL SURVEY DATE: 8/21/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 0.75 miles north of Sandstone Bluffs Overlook.

USGS 1:24,000 MAP NAME: Los Pilares

SPECIFIC LOCATION

RANGE: 10 W TOWNSHIP: 8 N SECTION: 12 n 1/2

UTM ZONE: 13 N: 3870500E: 239200

LATITUDE 34 56' 42.9"

LONGITUDE 107 51' 20.4:"

SIZE OF SITE: 5 ha ELEVATION: 6800'

LANDFORM: lava flow GEOLOGICAL UNIT: McCartys Flow

PARENT MATERIAL: basalt SOIL: sparse, fine loam

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 0.5 GRAVEL(3-7.5mm): 5 ROCK(>7.5mm): 95

PERCENT VEGETATION COVER

CANOPY: 25 BASAL: 2 CRYPTOGAMS: 20 WOOD: 0.1 LEAF LITTER: 1

GENERAL LANDSCAPE DESCRIPTION: Level pahoehoe lava flow. Scattered low ridges, cracks and surface collapses. Very little soil.

GENERAL VEGETATION DESCRIPTION: Sparse, mostly scattered Apache plume, rabbitbrush, and dwarfed ponderosa pine, pinon, and juniper. Lichens sparse.

UNUSUAL FEATURES: Dwarfed trees.

ADDITIONAL COMMENTS: Barren black lava.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: NOPA SITE NAME: North Pasture

INITIAL SURVEY DATE: 8/22/91 SURVEYORS: Lightfoot

DESCRIPTIVE LOCATION: 3 miles south of The Narrows, west of SR 117.

USGS 1:24,000 MAP NAME: North Pasture

SPECIFIC LOCATION

RANGE: 10 W TOWNSHIP: 7 N SECTION: 30, 31 e 1/2's

UTM ZONE: 13 N: 3854500 E: 232000

LATITUDE 34 47' 57.4"

LONGITUDE 107 55' 45.4"

SIZE OF SITE: 30 ha ELEVATION: 7070-7100'

LANDFORM: alluvial basin GEOLOGICAL UNIT: Quaternary alluvium

PARENT MATERIAL: sandstone SOIL: sandy, silty, loams

EROSION TYPE: runon EROSION POTENTIAL: high

LIVESTOCK EVIDENCE: heavily grazed by cattle

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 99 GRAVEL(3-7.5mm): 0.5 ROCK(>7.5mm): 0.5

PERCENT VEGETATION COVER

CANOPY: 35 BASAL: 10 CRYPTOGAMS: 1 WOOD: 0 LEAF LITTER: 5

GENERAL LANDSCAPE DESCRIPTION: Flat sandy basin at base of sandstone ridges and cliffs composed of Zuni and Dakota sandstones. McCartys lava flow contacts southwest and northwest portion. Silty clay basin in southern portion. Permanent water stock tank at south end.

GENERAL VEGETATION DESCRIPTION: Blue grama, western wheatgrass, *Muhlenbergia* and *Sporobolus* grassland. Fourwing saltbush and rabbitbrush common. Many species of herbs. *Psoralea* on sandy areas.

UNUSUAL FEATURES: Whitetail prairie dog town on northeast side near SR 117. Sandy and clay areas.

ADDITIONAL COMMENTS: Old homestead on northwest side. Cattle tank with permanent water at south end.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: NOSR SITE NAME: North Pasture Sandstone Ridge

INITIAL SURVEY DATE: 8/26/91 SURVEYORS: Lightfoot

DESCRIPTIVE LOCATION: 3 miles southwest of The Narrows, on the west side of North Pasture.

USGS 1:24,000 MAP NAME: North Pasture

SPECIFIC LOCATION

RANGE: 10 W TOWNSHIP: 7 N SECTION: 30 nw 1/4

UTM ZONE: 13 N: 3856000 E: 231500

LATITUDE 34 48' 45.6"

LONGITUDE 107 56' 06.8"

SIZE OF SITE: 30 ha ELEVATION: 7100-7293'

LANDFORM: sandstone ridge GEOLOGICAL UNIT: Clay Mesa Tongue of Mancos Shale & Lower part of Dakota Sandstone (Cretaceous); Zuni Sandstone & Wanakah Formation (Jurassic)

PARENT MATERIAL: sandstone SOIL: sandy loam

EROSION TYPE: runoff EROSION POTENTIAL: high

LIVESTOCK EVIDENCE: old cattle dung common

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 55 GRAVEL(3-7.5mm): 30 ROCK(>7.5mm): 15

PERCENT VEGETATION COVER

CANOPY: 45 BASAL: 10 CRYPTOGAMS: 5 WOOD: 2 LEAF LITTER: 5

GENERAL LANDSCAPE DESCRIPTION: North-south trending sandstone ridge, composed of Zuni and Dakota sandstone. Steep sandstone escarpment on west side, gradual slope on east side.

GENERAL VEGETATION DESCRIPTION: Pinon/juniper woodland with blue and hairy grama mountain muhly understory. Many herb species. Some large ponderosa pine trees at northwest end bordering McCartys lava flow.

UNUSUAL FEATURES: none

ADDITIONAL COMMENTS: none

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: NPMC SITE NAME: North Pasture McCartys Flow

INITIAL SURVEY DATE: 8/26/91 SURVEYORS: Lightfoot

DESCRIPTIVE LOCATION: 2 miles southwest of south end of The Narrows.

USGS 1:24,000 MAP NAME: North Pasture

SPECIFIC LOCATION

RANGE: 10 W TOWNSHIP: 7 N SECTION: 19 cent.

UTM ZONE: 13 N: 3857000 E: 232000

LATITUDE 34 49' 18.5"

LONGITUDE 107 55' 48.3"

SIZE OF SITE: 5 ha ELEVATION: 7100'

LANDFORM: lava flow GEOLOGICAL UNIT: McCartys Flow

PARENT MATERIAL: basalt SOIL: none

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 0 GRAVEL(3-7.5mm): 5 ROCK(>7.5mm): 95

PERCENT VEGETATION COVER

CANOPY: 20 BASAL: 2 CRYPTOGAMS: 30 WOOD: 0.5 LEAF LITTER: 1

GENERAL LANDSCAPE DESCRIPTION: Level pahoehoe McCartys lava flow with numerous low ridges, cracks, and surface collapses.

GENERAL VEGETATION DESCRIPTION: Widely scattered dwarf ponderosa pine, pinon, and juniper. Apache plume fairly common. Few herbs.

UNUSUAL FEATURES: none

ADDITIONAL COMMENTS: Higher cover of ponderosa pine than NOMC.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: NPMS SITE NAME: North Pasture McCartys Flow South

INITIAL SURVEY DATE: 9/26/92 SURVEYORS: Lightfoot

DESCRIPTIVE LOCATION: 3.5 miles southwest of south end of The Narrows.

USGS 1:24,000 MAP NAME: North Pasture

SPECIFIC LOCATION

RANGE: 11 W TOWNSHIP: 7 N SECTION: 36 ne 1/4

UTM ZONE: 13 N: 3853800E: 230300

LATITUDE 34 47' 33.1"

LONGITUDE 107 56' 51.4"

SIZE OF SITE: 5 ha ELEVATION: 7160'

LANDFORM: lava flow GEOLOGICAL UNIT: McCartys Flow

PARENT MATERIAL: basalt SOIL: none

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 0.2 GRAVEL(3-7.5mm): 2 ROCK(>7.5mm): 98

PERCENT VEGETATION COVER

CANOPY: 45 BASAL: 10 CRYPTOGAMS: 20 WOOD: 2 LEAF LITTER: 1

GENERAL LANDSCAPE DESCRIPTION: Pahoehoe lava flow with numerous low pressure ridges, large cracks, and surface collapses. Lava black.

GENERAL VEGETATION DESCRIPTION: Widely scattered stunted ponderosa pine trees and pinon and juniper. Apache plume, *Heterotheca villosa*, and blue grama sparsely scattered.

UNUSUAL FEATURES: Extensive pahoehoe lava field with many large, deep, cracks and surface collapses.

ADDITIONAL COMMENTS: none

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: NPSS SITE NAME: North Pasture Sandstone Ridge South

INITIAL SURVEY DATE: 8/26/92 SURVEYORS: Lightfoot

DESCRIPTIVE LOCATION: 3.5 miles south of south end of The Narrows.

USGS 1:24,000 MAP NAME: North Pasture

SPECIFIC LOCATION

RANGE: 11 W TOWNSHIP: 7 N SECTION: 36 ne 1/4

UTM ZONE: 13 N: 3853850 E: 230500

LATITUDE 34 47' 34.9"

LONGITUDE 107 56' 43.6"

SIZE OF SITE: 5 ha ELEVATION: 7170'

LANDFORM: sandstone ridge GEOLOGICAL UNIT: Clay Mesa Tongue of Mancos Shale & Lower part of Dakota Sandstone (Cretaceous); Zuni Sandstone & Wanakah Formation (Jurassic)

PARENT MATERIAL: sandstone SOIL: sandy loam

EROSION TYPE: runoff EROSION POTENTIAL: high

LIVESTOCK EVIDENCE: cattle dung common

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 80 GRAVEL(3-7.5mm): 5 ROCK(>7.5mm): 15

PERCENT VEGETATION COVER

CANOPY: 65 BASAL: 20 CRYPTOGAMS: 10 WOOD: 5 LEAF LITTER: 2

GENERAL LANDSCAPE DESCRIPTION: Sandstone ridge with steep escarpment on west side and gradual alluvial slope on east side. Exposed Dakota sandstone cliffs on escarpment. Bordered by McCartys lava flow on west side.

GENERAL VEGETATION DESCRIPTION: Open pinon/juniper woodland with blue and hairy grama understory. Rabbitbrush and Heterotheca villosa common. Large ponderosa pine trees at edge of McCartys lava flow.

UNUSUAL FEATURES: Sandstone cliffs. Large ponderosa pine tree adjacent to lava.

ADDITIONAL COMMENTS: none

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: NSBR SITE NAME: North & South Bridges

INITIAL SURVEY DATE: 7/31/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 1.7 miles southeast of Cerro Rendija.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 8 N SECTION: 9 ne 1/4

UTM ZONE: 12 N: 3870300 E: 765200

LATITUDE 34 56' 32.3"

LONGITUDE 108 05' 46.6"

SIZE OF SITE: 2 ha ELEVATION: 7620'

LANDFORM: lava tube collapses and bridges GEOLOGICAL UNIT: Bandera Flow

PARENT MATERIAL: basalt SOIL: sparse, fine loam

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 0.5 GRAVEL(3-7.5mm): 10 ROCK(>7.5mm): 90

PERCENT VEGETATION COVER

CANOPY: 5 BASAL: 1 CRYPTOGAMS: 80 WOOD: 0.5 LEAF LITTER: 0.5

GENERAL LANDSCAPE DESCRIPTION: Large lava tube collapse with remnant roof spans forming two bridges. Area under bridges open and dry.

GENERAL VEGETATION DESCRIPTION: Ponderosa pine and juniper around rims of collapse. Dry under bridges; no mosses.

UNUSUAL FEATURES: Lava tube bridges.

ADDITIONAL COMMENTS: none

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: NSHO SITE NAME: North Sandstone Bluffs Hoya Flow

INITIAL SURVEY DATE: 8/21/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 1 mile west of Sandstone Bluffs overlook.

USGS 1:24,000 MAP NAME: Los Pilares

SPECIFIC LOCATION

RANGE: 10 W TOWNSHIP: 8 N SECTION: 12 nw 1/4

UTM ZONE: 13 N: 3870000E: 239500

LATITUDE 34 56' 27.0"

LONGITUDE 107 51' 08.0"

SIZE OF SITE: 20 ha ELEVATION: 6800

LANDFORM: lava flow GEOLOGICAL UNIT: Hoya Flow

PARENT MATERIAL: basalt SOIL: sparse, fine loam

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 20 GRAVEL(3-7.5mm): 20 ROCK(>7.5mm): 60

PERCENT VEGETATION COVER

CANOPY: 40 BASAL: 10 CRYPTOGAMS: 20 WOOD: 3 LEAF LITTER: 5

GENERAL LANDSCAPE DESCRIPTION: Level Hoya lava flow with soil developed in low flat areas. Pahoehoe lava with numerous low ridges, cracks, and surface collapses. Basalt dark reddish brown in color, adjacent McCartys black.

GENERAL VEGETATION DESCRIPTION: Pinon/juniper woodland, few scattered ponderosa pine trees. Blue grama major grass. Dense herb layer on thin soil.

UNUSUAL FEATURES: Extensive pressure ridges.

ADDITIONAL COMMENTS: Vegetation cover much higer than on adjacent McCartys flow.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: NTKI SITE NAME: North Three Kipukas

INITIAL SURVEY DATE: 8/27/91 SURVEYORS: Lightfoot

DESCRIPTIVE LOCATION: 0.25 miles south of of south end of The Narrows.

USGS 1:24,000 MAP NAME: North Pasture

SPECIFIC LOCATION

RANGE: 10 W TOWNSHIP: 7 N SECTION: 17 nw 1/4

UTM ZONE: 13 N: 3858400E: 233200

LATITUDE 34 50' 05.0"

LONGITUDE 107 55' 02.7"

SIZE OF SITE: 6 ha ELEVATION: 7080'

LANDFORM: sedimentary kipuka GEOLOGICAL UNIT: Clay Mesa tongue of Mancos Shale & Lower part of Dakota Sandstone (Cretaceous); Zuni Sandstone & Wanakah Formation (Jurassic)

PARENT MATERIAL: sandstone SOIL: sandy loam

EROSION TYPE: runoff EROSION POTENTIAL: low

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 98 GRAVEL(3-7.5mm): 1 ROCK(>7.5mm): 1

PERCENT VEGETATION COVER

CANOPY: 30 BASAL: 10 CRYPTOGAMS: 5 WOOD: 1 LEAF LITTER: 2

GENERAL LANDSCAPE DESCRIPTION: Flat sandy area surrounded by McCartys lava flow. No elevated sandstone outcrops.

GENERAL VEGETATION DESCRIPTION: Scattered pinon and juniper, a few ponderosa pine trees. Sparse blue grama. Much bare sandy ground. High density of *Yucca baccata*. Many dead, down pinon pine trees, several decades old.

UNUSUAL FEATURES: High density of yucca, and many dead pinon pine trees.

ADDITIONAL COMMENTS: none

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: OARD SITE NAME: Oak Ridge Road

INITIAL SURVEY DATE: 7/9/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 1 mile southeast of Bandera Crater.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 9 N SECTION: 23 s 1/2

UTM ZONE: 12 N: 3875400E: 767000

LATITUDE 34 59' 16.0"

LONGITUDE 108 04' 29.9"

SIZE OF SITE: 5 ha ELEVATION: 7780-7960'

LANDFORM: limestone ridge and alluvial slope GEOLOGICAL UNIT: San Andres Limestone (Permian); Bandera Cinder Field

PARENT MATERIAL: limestone SOIL: cindery loam

EROSION TYPE: runoff EROSION POTENTIAL: high

LIVESTOCK EVIDENCE: occassional old dung

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 40 GRAVEL(3-7.5mm): 40 ROCK(>7.5mm): 20

PERCENT VEGETATION COVER

CANOPY: 60 BASAL: 20 CRYPTOGAMS: 15 WOOD: 3 LEAF LITTER: 20

GENERAL LANDSCAPE DESCRIPTION: Limestone ridge and slope meeting Bandera lava flow on west side. Ridge slope about 20%, southwest aspect. Lava flow about 2 meters above soil at base of ridge. Considerable amount of Bandera pumice and cinders on soil.

GENERAL VEGETATION DESCRIPTION: Ponderosa pine woodland, open understory of blue grama and mountain muhly. Scattered pinon and juniper, Gambel oak common, especially near top of ridge. Douglas fir and aspen common along edge of lava.

UNUSUAL FEATURES: Douglas fir and aspen most common at edge of lava flow.

ADDITIONAL COMMENTS: Dirt road runs along base of ridge near and parallel to lava flow.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: OFSW SITE NAME: Old Lava Flow Southwest

INITIAL SURVEY DATE: 7/7/92 SURVEYORS: Lightfoot, Viers

DESCRIPTIVE LOCATION: 3.5 miles north of junction of SR 117 and CR 42.

USGS 1:24,000 MAP NAME: York Ranch

SPECIFIC LOCATION

RANGE: 11 W TOWNSHIP: 6 N SECTION: 18 w 1/2

UTM ZONE: 12 N: 3848700E: 770850

LATITUDE 34 44' 46.7"

LONGITUDE 108 02' 29.3"

SIZE OF SITE: 4 ha ELEVATION: 7080'

LANDFORM: old lava flow GEOLOGICAL UNIT: Old Basalt Flow

PARENT MATERIAL: basalt SOIL: fine loam

EROSION TYPE: runoff EROSION POTENTIAL: high

LIVESTOCK EVIDENCE: many cattle present

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 95 GRAVEL(3-7.5mm): 4 ROCK(>7.5mm): 1

PERCENT VEGETATION COVER

CANOPY: 60 BASAL: 40 CRYPTOGAMS: 10 WOOD: 0 LEAF LITTER: 10

GENERAL LANDSCAPE DESCRIPTION: Level old lava flow mostly covered by fine soil. Scattered rocks on surface, and occasional low basalt outcrops.

GENERAL VEGETATION DESCRIPTION: Blue grama grassland with rabbitbrush.

UNUSUAL FEATURES: none

ADDITIONAL COMMENTS: Area heavily grazed by cattle. Stock tank nearby.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: OLBA SITE NAME: Old Basalt Flow near Los Cerros Ranch

INITIAL SURVEY DATE: 6/24/92 SURVEYORS: Bleakly

DESCRIPTIVE LOCATION: 2.5 miles south of Los Cerros Ranch.

USGS 1:24,000 MAP NAME: Cerro Hueco

SPECIFIC LOCATION

RANGE: 13 W TOWNSHIP: 8 N SECTION: 36 ne 1/4

UTM ZONE: 12 N: 3863800E: 760300

LATITUDE 34 53' 06.2"

LONGITUDE 108 09' 06.8"

SIZE OF SITE: 10 ha ELEVATION: 7490'

LANDFORM: old lava flow GEOLOGICAL UNIT: Old Basalt Flow

PARENT MATERIAL: basalt SOIL: fine loam

EROSION TYPE: runoff EROSION POTENTIAL: low

LIVESTOCK EVIDENCE: cattle present

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 85 GRAVEL(3-7.5mm): 10 ROCK(>7.5mm): 5

PERCENT VEGETATION COVER

CANOPY: 60 BASAL: 30 CRYPTOGAMS: 1 WOOD: 1 LEAF LITTER: 2

GENERAL LANDSCAPE DESCRIPTION: Undulating lava plain, old lava flow largely covered by soil.

GENERAL VEGETATION DESCRIPTION: Blue grama grassland, scattered pinon and juniper rabbitbrush common. Many herb species.

UNUSUAL FEATURES: none

ADDITIONAL COMMENTS: Old flow generally quite good, eolian soil cover which allows some deeper-rooted plants to grow.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: PRWE SITE NAME: Prairie Dog Well

INITIAL SURVEY DATE: 6/2/92 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 5.5 miles southeast of Hoya de Cibola.

USGS 1:24,000 MAP NAME: Ice Caves SE

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 7 N SECTION: 21 s 1/2

UTM ZONE: 12 N: 3856100E: 764600

LATITUDE 34 48' 52.5"

LONGITUDE 108 06' 26.4"

SIZE OF SITE: 10 ha ELEVATION: 7200'

LANDFORM: old lava flow GEOLOGICAL UNIT: Old Basalt Flow

PARENT MATERIAL: basalt SOIL: fine loam

EROSION TYPE: runoff EROSION POTENTIAL: moderate

LIVESTOCK EVIDENCE: many cattle present

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 92 GRAVEL(3-7.5mm): 5 ROCK(>7.5mm): 3

PERCENT VEGETATION COVER

CANOPY: 50 BASAL: 20 CRYPTOGAMS: 1 WOOD: 0 LEAF LITTER: 2

GENERAL LANDSCAPE DESCRIPTION: Level terrain with few low ridges and hills. Old weathered basalt flow, mostly covered by soil. Some basalt outcrops. Several small depressions with playas and ephemeral ponds. Playas less than 1 ha in size.

GENERAL VEGETATION DESCRIPTION: Blue grama grassland with snakeweed and rabbitbrush. Distinctive flora associated with playas. Scattered juniper, mostly on basalt outcrops.

UNUSUAL FEATURES: Extensive aeolian deposits and playas. Large whitetail prairie dog town in aeolian area. Windmill with stock tank present.

ADDITIONAL COMMENTS: Area greatly impacted by cattle.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: REND SITE NAME: Rendija Area

INITIAL SURVEY DATE: 07/24/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 0.5 miles north of Cerro Rendija.

USGS 1:24,000 MAP NAME: Cerro Hueco

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 8 N SECTION: 4sw1/4

UTM ZONE 12 N: 3872200 E: 761250

LATITUDE 34 57' 28"

LONGITUDE 108 07' 48"

SIZE OF SITE: 20 ha ELEVATION: 7670'

LANDFORM: Alluvial area GEOLOGICAL UNIT: Rendija

PARENT MATERIAL: Basalt SOIL: fine loam

EROSION TYPE: runoff EROSION POTENTIAL: moderate

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 90 GRAVEL(3-7.5mm): 6 ROCK(>7.5mm): 4

PERCENT VEGETATION COVER

CANOPY: 30 BASAL: 15 CRYPTOGAMS: 1 WOOD: 1 LEAF LITTER: 5

GENERAL LANDSCAPE DESCRIPTION: Gently sloping to flat landscape at the north base of Cerro Rendija. Fine loamy soils deposited over old Rendija basalts, and Old Basalt.

GENERAL VEGETATION DESCRIPTION: Open pinon/juniper woodland and blue grama grassland with snakeweed and rabbitbrush.

UNUSUAL FEATURES: none

ADDITIONAL COMMENTS: none

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: RASN SITE NAME: Rattlesnake Collapse

INITIAL SURVEY DATE: 7/11/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 0.75 miles south of Bandera Crater.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 9 N SECTION: 26 nw 1/4

UTM ZONE: 12 N: 3875200E: 766600

LATITUDE 34 59' 09.9"

LONGITUDE 108 04' 45.9"

SIZE OF SITE: 3 ha ELEVATION: 7760'

LANDFORM: lava flow GEOLOGICAL UNIT: Bandera Flow

PARENT MATERIAL: basalt SOIL: sparse, fine loam

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 3 GRAVEL(3-7.5mm): 2 ROCK(>7.5mm): 95

PERCENT VEGETATION COVER

CANOPY: 65 BASAL: 20 CRYPTOGAMS: 70 WOOD: 10 LEAF LITTER: 40

GENERAL LANDSCAPE DESCRIPTION: Large shallow lava tube collapse in Bandera pahoehoe flow. Sides of collapse gentle. Collapse forms long trough with deepest portion in south end.

GENERAL VEGETATION DESCRIPTION: Mixed conifer woodland. Douglas fir, ponderosa pine, pinon, and juniper common. Aspen abundant, especially in south end. Ocean spray and *Ribes* abundant. Dominant grasses are mountain muhly and pine dropseed, blue grama on rim. Cryptogam cover high on rocks.

UNUSUAL FEATURES: Vegetation, especially tree cover much higher than surrounding areas. Douglas fir and aspen common.

ADDITIONAL COMMENTS: Edge of collapse with large slumped plates of lava rather than drop-offs or overhangs.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: SABL SITE NAME: Sandstone Bluffs

INITIAL SURVEY DATE: 8/20/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 0.5 miles north of Sandstone Bluffs Overlook

USGS 1:24,000 MAP NAME: Los Pilares

SPECIFIC LOCATION

RANGE: 9 W TOWNSHIP: 8 N SECTION: 6 w 1/2

UTM ZONE: 13 N: 3871500E: 241500

LATITUDE 34 57' 17.5"

LONGITUDE 107 49' 50.9"

SIZE OF SITE: 20 ha ELEVATION: 6700-6900'

LANDFORM: sandstone ridge GEOLOGICAL UNIT: Quaternary Alluvium; Quaternary Eolian; Clay Mesa tongue of Mancos Shale & Lower part of Dakota Sandstone (Createous); Zuni Sandstone & Wanakah Formation (Jurassic)

PARENT MATERIAL: sandstone SOIL: sandy loam

EROSION TYPE: runoff EROSION POTENTIAL: high

LIVESTOCK EVIDENCE: many cattle present

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 70 GRAVEL(3-7.5mm): 30 ROCK(>7.5mm): 5

PERCENT VEGETATION COVER

CANOPY: 30 BASAL: 5 CRYPTOGAMS: 2 WOOD: 1 LEAF LITTER: 3

GENERAL LANDSCAPE DESCRIPTION: Large north-south trending sandstone ridge with steep escarpment on west side, gradual slope on east side. Extensive Zuni sandstone outcrops on escarpment. East slope of sandy soil, some old stabilized sand dunes.

GENERAL VEGETATION DESCRIPTION: Sandsage shrubland with blue grama common. Scatterd pinon and juniper, mostly at top, a few ponderosa pines. Gambel oak common. Many species of herbs present.

UNUSUAL FEATURES: Tinajas common on sandstone escarpment.

ADDITIONAL COMMENTS: Area around overlook trampled by people.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: SEMC SITE NAME: Southeast McCartys Flow

INITIAL SURVEY DATE: 9/25/91 SURVEYORS: Lightfoot

DESCRIPTIVE LOCATION: 3 miles northeast of junction of SR 117 and CR 42.

USGS 1:24,000 MAP NAME: Sand Canyon

SPECIFIC LOCATION

RANGE: 11 W TOWNSHIP: 6 N SECTION: 22

UTM ZONE: 12 N: 3847000E: 227000

LATITUDE 34 43' 49.5"

LONGITUDE 107 58' 53.2"

SIZE OF SITE: 10 ha ELEVATION: 7100-7110'

LANDFORM: lava flow GEOLOGICAL UNIT: McCartys Flow

PARENT MATERIAL: basalt SOIL: none

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 0.1 GRAVEL(3-7.5mm): 3 ROCK(>7.5mm): 97

PERCENT VEGETATION COVER

CANOPY: 25 BASAL: 5 CRYPTOGAMS: 30 WOOD: 0.5 LEAF LITTER: 1

GENERAL LANDSCAPE DESCRIPTION: Pahoehoe McCartys lava flow. Numerous pressure ridges, cracks, and surface collapses.

GENERAL VEGETATION DESCRIPTION: Apache plume shrubland with New Mexico olive, and *Rhus trilobata*. Few scattered pinon and juniper. No ponderosa pine near edge of flow, a few stunted pines 0.5 miles from edge.

UNUSUAL FEATURES: Relatively barren, black, pahoehoe flow.

ADDITIONAL COMMENTS: none

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: SEPT SITE NAME: Southeast Point

INITIAL SURVEY DATE: 9/25/91 SURVEYORS: Lightfoot

DESCRIPTIVE LOCATION: 2.5 miles northeast of junction of SR 117 and CR 42.

USGS 1:24,000 MAP NAME: Sand Canyon

SPECIFIC LOCATION

RANGE: 11 W TOWNSHIP: 6 N SECTION: 22 se 1/4

UTM ZONE: 13 N: 3847000E: 227500

LATITUDE 34 43' 50.0"

LONGITUDE 107 58' 33.5"

SIZE OF SITE: 10 ha ELEVATION: 7100-7120'

LANDFORM: alluvial slope GEOLOGICAL UNIT: Quaternary Alluvium

PARENT MATERIAL: sandstone SOIL: sandy loam

EROSION TYPE: runoff EROSION POTENTIAL: moderate

LIVESTOCK EVIDENCE: many cattle present

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 98 GRAVEL(3-7.5mm): 1 ROCK(>7.5mm): 1

PERCENT VEGETATION COVER

CANOPY: 45 BASAL: 20 CRYPTOGAMS: 1 WOOD: 0 LEAF LITTER: 3

GENERAL LANDSCAPE DESCRIPTION: Lower alluvial slopes of Tes Hermanos sandstone ridges to the east. Bottom of slope borders McCartys lava flow. Sandy soil with some gravel upslope, silt at bottom. Flat silty areas where water collects next to lava flow.

GENERAL VEGETATION DESCRIPTION: Blue grama grassland with rabbitbrush and snakeweed. Few scattered pinon and juniper, more so up slope.

UNUSUAL FEATURES: none

ADDITIONAL COMMENTS: Area heavily overgrazed.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: STCO SITE NAME: Stadium Collapse

INITIAL SURVEY DATE: 6/16/92 SURVEYORS: Lightfoot, Viers

DESCRIPTIVE LOCATION: 3 miles southeast of Cerro Rendija.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 11 W TOWNSHIP: 8 N SECTION: 15 ne 1/4

UTM ZONE: 12 N: 3868700E: 766250

LATITUDE 34 55' 39.5"

LONGITUDE 108 05' 07.1"

SIZE OF SITE: 1 ha ELEVATION: 7520'

LANDFORM: lava tube collapse GEOLOGICAL UNIT: Bandera Flow

PARENT MATERIAL: basalt SOIL: none

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 1 GRAVEL(3-7.5mm): 10 ROCK(>7.5mm): 89

PERCENT VEGETATION COVER

CANOPY: 2 BASAL: 1 CRYPTOGAMS: 75 WOOD: 0 LEAF LITTER: 1

GENERAL LANDSCAPE DESCRIPTION: Large lava tube collapse 150 by 50 meters diameter, 15 meters deep with sheer rock walls all around. Bottom filled with boulders. Large cave mouths at both ends.

GENERAL VEGETATION DESCRIPTION: Only a few mountain muhly, some *Ribes*, and one juniper in collapse. Surrounding area pinon/juniper, ponderosa pine woodland on Bandera Pahoehoe flow.

UNUSUAL FEATURES: Old tree trunk fence built across mouth of cave at west end. Small side caves on north side of main cave mouths at both ends. Bones (mountain sheep?) found in both side caves.

ADDITIONAL COMMENTS: Large collapse and large caves.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: STKI SITE NAME: South Three Kipukas

INITIAL SURVEY DATE: 8/27/91 SURVEYORS: Lightfoot

DESCRIPTIVE LOCATION: 1.5 miles southwest of south end of The Narrows.

USGS 1:24,000 MAP NAME: North Pasture

SPECIFIC LOCATION

RANGE: 10 W TOWNSHIP: 7 N SECTION: 19 se 1/4

UTM ZONE: 13 N: 3856600E: 232400

LATITUDE 34 49' 05.9"

LONGITUDE 107 55' 32.1"

SIZE OF SITE: 5 ha ELEVATION: 7100'

LANDFORM: kipuka GEOLOGICAL UNIT: Clay Mesa tongue of Mancos Shale & Lower part of Dakota Sandstone (Cretaceous); Zuni Sandstone & Wanakah Formation (Jurassic)

PARENT MATERIAL: sandstone SOIL: sandy loam

EROSION TYPE: runon EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 98 GRAVEL(3-7.5mm): 1 ROCK(>7.5mm): 1

PERCENT VEGETATION COVER

CANOPY: 35 BASAL: 10 CRYPTOGAMS: 10 WOOD: 2 LEAF LITTER: 5

GENERAL LANDSCAPE DESCRIPTION: Flat sandy kipuka surrounded by McCartys lava flow.

GENERAL VEGETATION DESCRIPTION: Scatterd pinon/juniper with blue and hairy grama understory. Large ponderosa pines on south and west edges near lava flow. Snakeweed and *Yucca baccata* common. Many dead, down pinon trees, several decades old.

UNUSUAL FEATURES: Large numbers of dead, down pinon trees.

ADDITIONAL COMMENTS: No evident lack of grazing effect on vegetation, except maybe the high density of *Yucca baccata*. No evident fire scars on ponderosas.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: SUBR SITE NAME: Sunken Bridge

INITIAL SURVEY DATE: 7/31/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 1.7 miles southeast of Cerro Rendija

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 8 N SECTION: 9 ne 1/4

UTM ZONE: 12 N: 3870200E: 765400

LATITUDE 34 56' 28.9"

LONGITUDE 108 05' 38.9"

SIZE OF SITE: 1 ha ELEVATION: 7600'

LANDFORM: lava tube collapse and bridge GEOLOGICAL UNIT: Bandera Flow

PARENT MATERIAL: basalt SOIL: none

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 0 GRAVEL(3-7.5mm): 10 ROCK(>7.5mm): 90

PERCENT VEGETATION COVER

CANOPY: 3 BASAL: 1 CRYPTOGAMS: 80 WOOD: 0 LEAF LITTER: 1

GENERAL LANDSCAPE DESCRIPTION: Lava tube collapse with natural bridge on lower level. Bridge 30 meters across, 20 meters wide, and 15 meters high. Cold and wet under bridge. Essentially small cave with two ends open.

GENERAL VEGETATION DESCRIPTION: Few ponderosa pine and juniper on top of bridge. Distinctive zonation of yellow, orange lichens and moss at north cave mouth.

UNUSUAL FEATURES: Lava tube bridge.

ADDITIONAL COMMENTS: none

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: TPCO SITE NAME: Tree Pole Collapse

INITIAL SURVEY DATE: 6/16/92 SURVEYORS: Lightfoot, Viers

DESCRIPTIVE LOCATION: 3 miles southeast of Cerro Rendija.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 11 W TOWNSHIP: 8 N SECTION: 15 ne 1/4

UTM ZONE: 12 N: 3868590 E: 766480

LATITUDE 34 55' 35.7"

LONGITUDE 108 04' 58.2"

SIZE OF SITE: 0.5 ha ELEVATION: 7520'

LANDFORM: lava tube collapse GEOLOGICAL UNIT: Bandera Flow

PARENT MATERIAL: basalt SOIL: sparse, fine loam

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 3 GRAVEL(3-7.5mm): 5 ROCK(>7.5mm): 92

PERCENT VEGETATION COVER

CANOPY: 1 BASAL: 0.2 CRYPTOGAMS: 75 WOOD: 0 LEAF LITTER: 1

GENERAL LANDSCAPE DESCRIPTION: Lava tube collapse 20 meters diameter and 20 meters deep. Steep overhanging rock walls all around. Boulder rubble in bottom. Large cave mouths on northwest and southeast sides.

GENERAL VEGETATION DESCRIPTION: Several large *Ribes* shrubs, mountain muhly and pine dropseed in collapse. Large Douglas fir trees around rim. Lichen and moss band around base of cliffs in collapse bottom.

UNUSUAL FEATURES: Deep collapse with caves.

ADDITIONAL COMMENTS: none

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: TRIA SITE NAME: Tiangle Collapse

INITIAL SURVEY DATE: 7/11/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 0.75 miles south of Bandera Crater.

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 9 N SECTION: 23 sw 1/4

UTM ZONE: 12 N: 3875300 E: 766500

LATITUDE 34 59' 13.2"

LONGITUDE 108 04' 49.7"

SIZE OF SITE: 2 ha ELEVATION: 7760'

LANDFORM: lava tube collapse GEOLOGICAL UNIT: Bandera Flow

PARENT MATERIAL: basalt SOIL: sparse, fine loam

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 1 GRAVEL(3-7.5mm): 4 ROCK(>7.5mm): 95

PERCENT VEGETATION COVER

CANOPY: 20 BASAL: 3 CRYPTOGAMS: 75 WOOD: 1 LEAF LITTER: 3

GENERAL LANDSCAPE DESCRIPTION: Large collapse, 50 by 75 meters, 5-10 meters deep. Gradual slope on east side, steep walls with overhangs on west side. Water seeps and cold air at base of overhangs.

GENERAL VEGETATION DESCRIPTION: Scattered ponderosa pine, pinon and juniper. Ocean spray common. Pine dropseed and blue grama grasses scattered.

UNUSUAL FEATURES: On west and south rims, surface tubes are trianglar in cross section. Old campfire and rock arrangement in south rim cave.

ADDITIONAL COMMENTS: none

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: TWFL SITE NAME: Twin Craters Lava Flow

INITIAL SURVEY DATE: 5/13/92 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 2.5 miles southeast of Bandera Crater

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 11 W TOWNSHIP: 9 N SECTION: 35

UTM ZONE: 12 N: 3872900 E: 767200

LATITUDE 34 57' 54.8"

LONGITUDE 108 04' 24.9"

SIZE OF SITE: 10 ha ELEVATION: 7660'

LANDFORM: lava flow GEOLOGICAL UNIT: Twin Craters Flow

PARENT MATERIAL: basalt SOIL: fine loam

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 15 GRAVEL(3-7.5mm): 20 ROCK(>7.5mm): 65

PERCENT VEGETATION COVER

CANOPY: 60 BASAL: 30 CRYPTOGAMS: 65 WOOD: 10 LEAF LITTER: 10

GENERAL LANDSCAPE DESCRIPTION: Relatively level lava flow area. Occasional ridges cracks, and surface collapses. Soil developed on low areas.

GENERAL VEGETATION DESCRIPTION: Ponderosa pine woodland with mountain muhly and pine dropseed understory.

UNUSUAL FEATURES: none

ADDITIONAL COMMENTS: Many old stumps from former logging. Area had been heavily logged.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: TWIS SITE NAME: Twin Craters Flow

INITIAL SURVEY DATE: 8/14/92 SURVEYORS: Bleakly

DESCRIPTIVE LOCATION: 1.5 miles south of Twin Craters cones and 0.5 miles east of Lost Woman cone

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 8 N SECTION: 2 ne 1/4

UTM ZONE: 12 N: 3872200 E: 767900

LATITUDE 34 57' 31.4"

LONGITUDE 108 03' 58.1"

SIZE OF SITE: 10 ha ELEVATION: 7620'

LANDFORM: lava flow GEOLOGICAL UNIT: Twin Craters Flow

PARENT MATERIAL: basalt SOIL: sparse, aeolian fine loam

EROSION TYPE: none EROSION POTENTIAL: none or low

LIVESTOCK EVIDENCE: rare old horse droppings

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 2 GRAVEL(3-7.5mm): 18 ROCK(>7.5mm): 80

PERCENT VEGETATION COVER

CANOPY: 30 BASAL: 10 CRYPTOGAMS: 20 WOOD: 5 LEAF LITTER: 1

GENERAL LANDSCAPE DESCRIPTION: Mostly pahoehoe lava flow with irregular, undulating surface with a few small collapses and rocky "outcrops" or pressure ridges.

GENERAL VEGETATION DESCRIPTION: Vegetation fairly well developed. Mostly open, sparse ponderosa woodland with some pinon and juniper. Many grasses and legumes (*Lotus wrightii* and *Lupinus kingii* most common). Ponderosas range in size from saplings to fairly large trees. Aspens at edges

UNUSUAL FEATURES: none

ADDITIONAL COMMENTS: none

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: TW53 SITE NAME: Twin Craters Flow near NM-53

INITIAL SURVEY DATE: SURVEYORS: Bleakly, Lightfoot, Viers

DESCRIPTIVE LOCATION: 1.5 miles north of El Calderon; between IRIS (qv) and NM-53

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 11 W TOWNSHIP: 9 N SECTION: 29 e 1/2

UTM ZONE: 12 N: 3874600 E: 772600

LATITUDE 34 58' 44.7"

LONGITUDE 108 00' 50.2"

SIZE OF SITE: 0.5 km ^{2} ELEVATION: 7350'

LANDFORM: lava flow GEOLOGICAL UNIT: Twin Craters Flow

PARENT MATERIAL: basalt SOIL: fine silty loam

EROSION TYPE: none EROSION POTENTIAL: none or low

LIVESTOCK EVIDENCE: frequent old cattle droppings

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 35 GRAVEL(3-7.5mm): 20 ROCK(>7.5mm): 45

PERCENT VEGETATION COVER

CANOPY: 55 BASAL: 20 CRYPTOGAMS: 20 WOOD: 5 LEAF LITTER: 10

GENERAL LANDSCAPE DESCRIPTION: Old lava flow running east-west between granitic ridge to north and sandstone ridge to south. Most of the basalt covered with soil. There is a conspicuous lava tube with numerous collapse structures in the flow.

GENERAL VEGETATION DESCRIPTION: Ponderosa pine woodland with pine dropseed and mountain muhly the dominant grasses. Diverse herb flora with the usual common shrubs.

UNUSUAL FEATURES: Lava tube with collapses.

ADDITIONAL COMMENTS: Area logged in the past with many old stumps and abandoned cut logs.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: ZABF SITE NAME: Zuni-Acoma Bandera Flow (near west trailhead)

INITIAL SURVEY DATE: 7/14/92 SURVEYORS: Lightfoot, Viers

DESCRIPTIVE LOCATION: about 2 miles sse of parking lot of Zuni-Acoma trailhead, south of ZATF

USGS 1:24,000 MAP NAME: Arrosa Ranch

SPECIFIC LOCATION

RANGE: 10 W TOWNSHIP: 8 N SECTION: 7 south center

UTM ZONE: 13 N: 3868900 E: 232500

LATITUDE 34 55' 44.8"

LONGITUDE 107 55' 42.3"

SIZE OF SITE: 1 ha ELEVATION: 6900'

LANDFORM: lava flow GEOLOGICAL UNIT: Bandera Flow

PARENT MATERIAL: basalt SOIL: sparse, fine silty loam

EROSION TYPE: none EROSION POTENTIAL: none

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 3 GRAVEL(3-7.5mm): 17 ROCK(>7.5mm): 80

PERCENT VEGETATION COVER

CANOPY: 45 BASAL: 20 CRYPTOGAMS: 60 WOOD: 5 LEAF LITTER: 25

GENERAL LANDSCAPE DESCRIPTION: Relatively flat lava flow, mostly pahoehoe but surface broken and some aa. Frequent collapse structures but no large ones or deep cracks.

GENERAL VEGETATION DESCRIPTION: Open ponderosa woodland with large trees and many dead, down trees. Pinon and juniper uncommon but Gambel oak common. *Heterotheca villosa* and *Artemisia carruthii* common as well as blue gramma, little bluestem, and mountain muhly. Lichen cover well-developed.

UNUSUAL FEATURES: none

ADDITIONAL COMMENTS: Bandera flow is higher and overrides the Twin Craters flow.The general appearance is like the Hoya flow at MEBL, that is, with a well-developed ponderosa woodland.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: ZAKI SITE NAME: Zuni-Acoma Kipuka (near west side trailhead)

INITIAL SURVEY DATE: 6/9/92 SURVEYORS: Lightfoot, Viers

DESCRIPTIVE LOCATION: south of Zuni-Acoma trailhead (west end) parking lot about 1 mile

USGS 1:24,000 MAP NAME: Arrosa Ranch

SPECIFIC LOCATION

RANGE: 10 W TOWNSHIP: 8 N SECTION: 7 nw 1/4

UTM ZONE: 13 N: 3870300 E: 232100

LATITUDE 34 56' 29.8"

LONGITUDE 107 55' 59.7"

SIZE OF SITE: 500 x 200 m ELEVATION: 6900-7054'

LANDFORM: kipuka GEOLOGICAL UNIT: Yeso Formation (Permiant)

PARENT MATERIAL: sandy limestone SOIL: silty loam

EROSION TYPE: runoff EROSION POTENTIAL: high

LIVESTOCK EVIDENCE: occasional cow droppings

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 60 GRAVEL(3-7.5mm): 30 ROCK(>7.5mm): 10

PERCENT VEGETATION COVER

CANOPY: 75 BASAL: 30 CRYPTOGAMS: 5 WOOD: 5 LEAF LITTER: 10

GENERAL LANDSCAPE DESCRIPTION: Limestone ridge surrounded by Twin Craters basalt flow. Ridge aligned north-south with high end on south and low saddle in middle. Spine of limestone along center of ridge with rocks and gravel on upper slopes. Silty soil on lower slopes. Some rock faces 1-2 m high.

GENERAL VEGETATION DESCRIPTION: pinon/juniper woodland, especially on upper portions of ridge. Predominantly blue gramma grassland around base.

UNUSUAL FEATURES: Relative isolated limestone ridge surrounded by Twin Craters basalt.

ADDITIONAL COMMENTS: none

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: ZATF SITE NAME: Zuni-Acoma (trailhead, west) Twin Craters Flow

INITIAL SURVEY DATE: 6/18/92 SURVEYORS: Lightfoot, Viers

DESCRIPTIVE LOCATION: about 1.5 miles south of Zuni-Acoma trailhead (west end), south of ZAKI

USGS 1:24,000 MAP NAME: Arrosa Ranch

SPECIFIC LOCATION

RANGE: 10 W TOWNSHIP: 8N SECTION: 7

UTM ZONE: 13 N: 3870000 E: 232300

LATITUDE 34 56' 20.3"

LONGITUDE 107 55' 51.5"

SIZE OF SITE: 1 ha ELEVATION: 6900'

LANDFORM: lava flow GEOLOGICAL UNIT: Twin Craters Flow

PARENT MATERIAL: basalt SOIL: fine silty loam

EROSION TYPE: runoff EROSION POTENTIAL: moderate

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 10 GRAVEL(3-7.5mm): 25 ROCK(>7.5mm): 65

PERCENT VEGETATION COVER

CANOPY: 65 BASAL: 30 CRYPTOGAMS: 50 WOOD: 5 LEAF LITTER: 15

GENERAL LANDSCAPE DESCRIPTION: Mainly flat lava flow with low, undulating ridges and basalt outcrops. Surface mostly broken and composed of small rocks. A few small collapse structures filled with rubble. Occasional open aa areas.

GENERAL VEGETATION DESCRIPTION: Ponderosa pine woodland with juniper and a few pinons. *Rhus trilobata*, Apache plume, Gambel oak, and *Ribes* common shrubs. Blue grama, sideoats grama, mountain muhly common grasses. Many herbs, especially *Hymenoxys* and *Artemisia*. Lichens abundant and similar in composition to Lava Crater Flow.

UNUSUAL FEATURES: none

ADDITIONAL COMMENTS: Area formerly logged, many old stumps.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: ZATH SITE NAME: Zuni-Acoma Trailhead (west end)

INITIAL SURVEY DATE: 6/9/92 SURVEYORS: Lightfoot, Viers

DESCRIPTIVE LOCATION: Near mouth of Bonita Canyon, near west end of Zuni-Acoma trailhead and upper part of trail, mostly on lava flats.

USGS 1:24,000 MAP NAME: Arrosa Ranch

SPECIFIC LOCATION

RANGE: 11 W TOWNSHIP: 8 N SECTION: 1 ne 1/4

UTM ZONE: 13 N: 3872100 E: 231500

LATITUDE 34 57' 27.6"

LONGITUDE 107 56' 25.4"

SIZE OF SITE: 1 ha ELEVATION: 6940'

LANDFORM: lava flow GEOLOGICAL UNIT: El Calderon Flow

PARENT MATERIAL: basalt, alluvium SOIL: fine silty loam

EROSION TYPE: runoff EROSION POTENTIAL: low

LIVESTOCK EVIDENCE: frequent, recent cow droppings and tracks in some areas

PERCENT GROUND SURFACE COVER

SOIL (<3mm): 75 GRAVEL(3-7.5mm): 10 ROCK(>7.5mm): 15

PERCENT VEGETATION COVER

CANOPY: 85 BASAL: 60 CRYPTOGAMS: 10 WOOD: <1 LEAF LITTER: 20

GENERAL LANDSCAPE DESCRIPTION: Old lava flow (El Calderon) covered with eolian soil. Terrain flat with occasional basalt outcrops, pressure ridges, and deep cracks (2 m wide x 5 m deep)

GENERAL VEGETATION DESCRIPTION: Mostly blue grama grassland with numerous other grasses and forbs. Scattered pinon and juniper, usually associated with basalt ridges. Extensive lichen cover on lava. Moss and lichens in cracks. Many weedy species in parking area.

UNUSUAL FEATURES: Deep cracks in basalt ridges.

ADDITIONAL COMMENTS: Many weedy plant species in parking lot area. Trash (cans, bottles, etc.) thrown into cracks in basalt in the parking area.

EL MALPAIS NATIONAL MONUMENT, VEGETATION AND WILDLIFE INVENTORY
INVENTORY SITE INFORMATION

SITE CODE: ZUNI SITE NAME: Zuni Collapse (Ice Cave, Candelaria Ice Cave)

INITIAL SURVEY DATE: 7/16/91 SURVEYORS: Bleakly, Lightfoot

DESCRIPTIVE LOCATION: 0.3 miles south of Bandera Crater

USGS 1:24,000 MAP NAME: Ice Caves

SPECIFIC LOCATION

RANGE: 12 W TOWNSHIP: 9 N SECTION: 22 se 1/4

UTM ZONE: 12 N: 3875700 E: 766300

LATITUDE 34 59' 26.4"

LONGITUDE 107 04' 57.1"

SIZE OF SITE: 1 ha ELEVATION: 7860'

LANDFORM: lava tube collapse GEOLOGICAL UNIT: Bandera Flow

PARENT MATERIAL: basalt SOIL: very sparse fine loam in rock pockets

EROSION TYPE: runon EROSION POTENTIAL: low

LIVESTOCK EVIDENCE: none

PERCENT GROUND SURFACE COVER
SOIL (<3mm): <1 GRAVEL(3-7.5mm): 2 ROCK(>7.5mm): 98

PERCENT VEGETATION COVER
CANOPY: <1 BASAL: <1 CRYPTOGAMS: 75 WOOD: <1 LEAF LITTER: <1

GENERAL LANDSCAPE DESCRIPTION: Lava tube collapse (100 x 40 m) with large opening (20m wide x 10 m tall) facing approximately south. Deep overhang at north end with large amount of permanent ice at bottom. Bottom of collapse filled with boulders and rubble. A steep, rubbly slope leads down to the ice.

GENERAL VEGETATION DESCRIPTION: Very few *Holodiscus*, small juniper, and Douglas fir in the collapse. Lichen composition as at LICO (qv). Yellow, powdery lichen sparse on cave roof. Thin, broken band of orange lichen and moss near overhang mouth.

UNUSUAL FEATURES: Large permanent mass of ice in accessible collapse structure. Mass up to 3 m thick and 15 m wide. Shallow pool &/or ice pond across front of lowest part colored with algae (as at LICO).

ADDITIONAL COMMENTS: Covered wood stairway located on east side of collapse structure. Numerous footpaths and trampling around collapse and ice cave mouth. Considerable trash in area, also. Many rocks have been removed and some have been thrown into the collapse, mostly from the east rim (evident from state of lichen development). There is a tiny collapse just off the se side of ZUNI, 15 m in diameter with sheer 10-15 m walls on all sides. Rubble pile in middle. Moss and orange lichen bands near bottom and around pile in middle. Water seeps on se side.

VEGETATION AND WILDLIFE INVENTORY

OF EL MALPAIS NATIONAL MONUMENT

Final Report

Appendix 7

LIST OF VASCULAR PLANT TAXA
OF EL MALPAIS NATIONAL MONUMENT

APPENDIX 7.

CHECKLIST OF PLANT SPECIES OF EL MALPAIS NATIONAL MONUMENT, SCIENTIFIC AND COMMON NAMES.

Refer to annotated plant list (Appendix 8) for additional information.

FAM.= plant family, see annotated list.

SCIENTIFIC NAME	COMMON NAME	FAM.
Abronia elliptica	sand verbena,fragrant	NYC
Abronia fragrans	sand verbena,sweet	NYC
Acalypha neomexicana	copperleaf,New Mexico	EUP
Achillea millefolium lanulosa	yarrow	AST
Agastache pallidiflora hybrid	none	LAM
Agrostis scabra	bentgrass,rough	POA
Allium cernuum	onion,nodding	LIL
Amaranthus albus	pigweed,pale	AMA
Amaranthus blitoides	pigweed,prostrate	AMA
Amaranthus retroflexus	pigweed,redroot	AMA
Ambrosia artemisiifolia	ragweed,common	AST
Andropogon gerardii gerardii	bluestem,big	POA
Andropogon gerardii paucipilus	bluestem,sand	POA
Androsace septent. glandulosa	rock jasmine,northern	PRI
Antennaria parvifolia	pussytoes	AST
Anthericum torreyi	amberlily,Torrey	LIL
Apocynum sp.	dogbane	APO
Arabis fendleri fendleri	rockcress,Fendler	BRA
Arabis fendleri spatifolia	rockcress,Fendler	BRA
Arabis perennans	rockcress,common	BRA
Arceuthobium vaginatum crytopodum	dwarf-mistletoe,SW	LOR
Arenaria fendleri fendleri	sandwort,Fendler	CAR
Arenaria lanuginosa saxosa	sandwort,spreading	CAR
Aristida arizonica	threeawn,Arizona	POA
Aristida havardii	threeawn,Havard	POA
Aristida purpurea fendleriana	threeawn,Fendler	POA
Aristida purpurea longiseta	threeawn,red	POA
Aristida purpurea purpurea	threeawn,purple	POA
Artemisia campestris pacifica	sagewort,western	AST
Artemisia carruthii	wormwood,Carruth	AST
Artemisia dracunculus	wormwood,silky	AST
Artemisia filifolia	sagebrush,sand	AST
Artemisia frigida	sagebrush,fringed	AST
Artemisia ludoviciana	wormwood,Louisiana	AST
Asclepias asperula asperula	milkweed,spider	ASC
Asclepias subverticillata	milkweed,whorled	ASC
Asclepias tuberosa terminalis	milkweed,orange	ASC
Asplenium septentrionale	grass fern	ASP

Asplenium trichomanes	spleenwort,maidenhair	ASP
Aster falcatus commutatus	daisy	AST
Astragalul wootonii wootonii	milkvetch,Wooton	FAB
Astragalus brandegei	milkvetch,Brandegee	FAB
Astragalus calycosus scaposus	milkvetch,Torrey	FAB
Astragalus ceramicus ceramicus	milkvetch,painted	FAB
Astragalus egglestonii	milkvetch,Eggleston	FAB
Astragalus humistratus humistratus	milkvetch,groundcover	FAB
Astragalus humistratus humivagans	milkvetch,groundcover	FAB
Astragalus mollissimus matthewsii	milkvetch,woolly	FAB
Astragalus praelongus praelongus	milkvetch,stinking	FAB
Atriplex canescens	saltbush,fourwing	CHE
Bahia dissecta	cutleaf	AST
Berberis fendleri	barberry,Fendler	BER
Blepharoneuron tricholepis	dropseed,pine	POA
Bothriochloa laguroides torreyana	bluestem,silver	POA
Bouteloua curtipendula	grama,sideoats	POA
Bouteloua gracilis	grama,blue	POA
Bouteloua hirsuta	grama,hairy	POA
Bouteloua simplex	grama,mat	POA
Brickellia brachyphylla	brickellbush,plume	AST
Brickellia chlorolepis	khunia,southwest	AST
Brickellia grandiflora grandiflora	tasselflower	AST
Bromus anomalus	brome,nodding	POA
Bromus lanatipes	brome	POA
Bromus tectorum	cheatgrass	POA
Bulbostylis capillaris	hairsedge	CYP
Calliandra humilis	calliandra,dwarf	FAB
Carex filifolia	sedge,threadleaf	CYP
Carex geophila	sedge	CYP
Carex occidentalis	sedge,western	CYP
Castilleja integra	paintbrush	SCR
Ceanothus fendleri	buckbrush,Fendler	RHA
Celtis reticulata	hackberry,netleaf	ULM
Centaurea repens	knapweed,Russian	AST
Ceratoides lanata	winterfat	CHE
Cercocarpus montanus montanus	mountain mahogany	ROS
Chaetopappa ericoides	aster,white	AST
Chamaesaracha coronopus	nightshade,green false	SOL
Chamaesyce fendleri chaetocalyx	spurge,Fendler	EUP
Chamaesyce fendleri fendleri	spurge,Fendler	EUP
Chamaesyce revoluta	euphorbia,threadstem	EUP
Chamaesyce serpyllifolia	spurge,thymeleaf	EUP
Cheilanthes feei	lipfern,slender	ADI
Cheilanthes fendleri	lipfern,Fendler's	ADI
Chenopodium capitatum	blite,strawberry	CHE
Chenopodium dessicatum	goosefoot,desert	CHE
Chenopodium fremontii	goosefoot,Fremont	CHE
Chenopodium graveolens	goosefoot,ragleaf	CHE
Chenopodium leptophyllum	goosefoot,narrowleaf	CHE
Chloris verticillata	grass,tumble-windmill	POA
Chrysoth. nauseosus bigelovii	rabbitbrush,Bigelow's	AST

Chrysoth. nauseosus consimilis	rabbitbrush,rubber	AST
Chrysoth. nauseosus nauseosus	rabbitbrush,rubber	AST
Chrysoth. parryi attenuatus	rabbitbrush,Parry's	AST
Chrysoth. viscidiflorus lanceolatus	rabbitbrush,viscid	AST
Chrysoth. v. stenophyllus	rabbitbrush,viscid	AST
Chrysothamnus depressus	rabbitbrush,dwarf	AST
Cirsium neomexicanum	thistle,New Mexico	AST
Cirsium ochrocentrum	thistle,yellowspine	AST
Cirsium vulgare	thistle,bull	AST
Cirsium wheeleri	thistle,Wheeler	AST
Clematis ligusticifolia	clematis,western	RAN
Cleome serrulata	bee plant,Rocky Mountain	CAP
Commelina dianthifolia longispatha	dayflower,birdbill	CMM
Commelina erecta angustifolia	dayflower,narrowleaf	CMM
Convolvulus arvensis	bindweed,field	CON
Convolvulus equitans	bindweed,gray	CON
Conyza canadensis	horseweed	AST
Cordylanthus wrightii	clubflower,Wright's	SCR
Coreopsis tinctoria tinctoria	coreopsis,plains	AST
Corydalis aurea	goldensmoke	FUM
Coryphantha vivipara arizonica	cactus,pincushion	CAC
Cosmos parviflorus	cosmos,Southwest	AST
Cryptantha cinerea	hiddenflower,James	BOR
Cryptantha crassisepala	hiddenflower,plains	BOR
Cryptantha fendleri	hiddenflower,Fendler	BOR
Cuscuta umbellata	dodder	CON
Cymopterus fendleri	spring-parsley,Fendler's	API
Cymopterus purpurascens	spring-parsley,widewing	API
Cyperus aristatus	flatsedge,bearded	CYP
Cyperus fendlerianus fenderianus	flatsedge,tuber-root	CYP
Dalea candida oligophylla	prairie-clover,white	FAB
Dalea compacta	prairie-clover,plains	FAB
Dalea exigua	none	FAB
Dalea leporina	none	FAB
Delphinium nuttallianum nutt.	larkspur,Nelson	RAN
Delphinium virescens wootonii	larkspur,prairie	RAN
Descurainia obtusa brevisiliqua	tansy-mustar,desert	BRA
Descurainia pinnata halictorum	tansy-mustard,pinnate	BRA
Descurainia richardsonii incisa	tansy-mustard,Richardson	BRA
Dexcurainia obtusa obtusa	tansy-mustard,desert	BRA
Dimorphocarpa wislizenii	spectaclepod	BRA
Draba cuneifolia	draba,wedgeleaf	BRA
Dryopteris felix-mas	male fern	ASP
Echinocereus fendleri	cactus,Fendler hedgehog	CAC
Echinocereus tri. melanacanthus	cactus,claret cup	CAC
Echinocereus tri. triglochidiatus	cactus,claret cup	CAC
Echinochloa muricata microstachya	cockspur	POA
Eleocharis acicularis	spikerush	CYP
Eleocharis macrostachya	spikerush	CYP
Elymus canadensis	wildrye,Canada	POA
Elymus longifolius	squirreltail,longleaf	POA
Elymus smithii	wheatgrass,western	POA

Elymus trachycaulus	wheatgrass,slender	POA
Elymus trachycaulus X smithii	wheatgrass,hybrid	POA
Eragrostis curvula	lovegrass,weeping	POA
Eragrostis lehmanniana	lovegrass,Lehmann	POA
Eragrostis pectinacea	lovegrass,Carolina	POA
Erig. formosissimus formosissimus	daisy,pretty	AST
Erigeron canus	daisy,hoary	AST
Erigeron colomexicanus	fleabane	AST
Erigeron divergens	daisy,spreading	AST
Erigeron flagellaris	daisy,trailing	AST
Erigeron speciosus	daisy,Oregon	AST
Erigeron vetensis	fleabane,La Veta	AST
Eriogonum alatum	buckwheat,winged wild	PGN
Eriogonum annuum	buckwheat,annual wild	PGN
Eriogonum cernuum	buckwheat,nodding wild	PGN
Eriogonum jamesii jamesii	buckwheat,James wild	PGN
Eriogonum racemosum	buckwheat,redroot wild	PGN
Erodium cicutarium	filaria	GER
Erysimum capitatum	wallflower,western	BRA
Eupatorium herbaceum	thoroughwort,white	AST
Euphorbia bilobata	euphorbia,blackseed	EUP
Euphorbia lurida	spurge,shorthorned	EUP
Fallugia paradoxa	Apache plume	ROS
Festuca arizonica	fescue,Arizona	POA
Forestiera neomexicana	olive,New Mexico	OLE
Frasera speciosa	elkweed	GEN
Fraxinus cuspidata	ash,fragrant	OLE
Gaillardia pinnatifida	blanket-flower,Hopi	AST
Gaura coccinea	gaura,scarlet	ONA
Gaura hexandra gracilis	gaura	ONA
Gaura parvifolia	gaura	ONA
Gayophytum ramosissimum	none	ONA
Geranium caespitosum	geranium,tufted	GER
Geranium lentum	geranium	GER
Gilia pinnatifida	none	POL
Gilia sinuata	none	POL
Glandularia wrightii	vervain,Wright's	VER
Grindelia aphanactis	gumweed,mountain	AST
Gutierrezia sarothrae	snakeweed,broom	AST
Hedeoma drummondii	false pennyroyal,Drummond	LAM
Hedeoma nanum	false pennyroyal,low	LAM
Helianthella quinquenervis	sunflower,fivenerve	AST
Helianthus annuus	sunflower,common	AST
Helianthus ciliaris	blueweed	AST
Helianthus petiolaris	sunflower,prairie	AST
Heterosperma pinnatum	heterosperma,fineleaf	AST
Heterotheca villosa villosa	golden-aster,hairy	AST
Hieracium fendleri fendleri	hawkweed,Fendler	AST
Holodiscus dumosus	mountain spray	ROS
Hordeum jubatum	barley,foxtail	POA
Houstonia wrightii	bluets	RUB
Hymenopap. flav. canotomentosus	none	AST

Hymenopappus filifolius cinereus	woolywhite	AST
Hymenopappus flav. flavescens	none	AST
Hymenoxys argentea	bitterweed	AST
Hymenoxys bigelovii	bitterweed	AST
Hymenoxys richardsonii	rubberweed,Colorado	AST
Ipomoea costellata	none	CON
Ipomoea cristulata	none	CON
Ipomoea plummerae	none	CON
Ipomopsis aggregata formosissima	skyrocket	POL
Ipomopsis longiflora	ipomopsis,whiteflower	POL
Ipomopsis multiflora	ipomopsis	POL
Iris missouriensis	iris,Missouri	IRI
Juniperus deppeana pachyphloea	juniper,alligator	CUP
Juniperus monosperma	juniper,one-seed	CUP
Juniperus scopulorum	juniper,Rocky Mountain	CUP
Kochia scoparia	fireweed	CHE
Koeleria macrantha	junegrass	POA
Lactuca serriola	prickly lettuce	AST
Lappula redowskii	stickseed	BOR
Lepidium densiflorum	pepperweed,prairie	BRA
Lepidium ramosissimum	pepperweed,bushy	BRA
Lesquerella rectipes	bladderpod,Colorado	BRA
Linum aristatum	flax,awned	LIN
Linum lewisii	flax,blue	LIN
Linum neomexicanum	flax,New Mexico	LIN
Lithospermum cobrense	gromwell,mountain	BOR
Lithospermum incisum	gromwell,narrowleaf	BOR
Lithospermum multiflorum	gromwell,manyflower	BOR
Lotus wrightii	deervetch,Wright's	FAB
Lupinus argenteus argenteus	lupine,silvery	FAB
Lupinus kingii kingii	lupine,King	FAB
Lycium pallidum	wolfberry,pale	SOL
Lycurus setosus	wolftail	POA
Machaeranthera australis	none	AST
Macheranthera gracilis	goldenweed	AST
Macheranthera linearis	none	AST
Macheranthera tanacetifolia	aster,tansyleaf	AST
Mahonia haematocarpa	barberry,red	BER
Mahonia repens	Oregon grape	BER
Malacothrix fendleri	none	AST
Mammillaria heyderi meiacantha	cactus,pincushion	CAC
Mammillaria wrightii wrightii	cactus,Wright fishhook	CAC
Marrubium vulgare	horehound	LAM
Marsilea mollis	water-clover	MRS
Medicago lupulina	medic,black	FAB
Medicago officinalis	sweet clover,yellow	FAB
Melilotus alba	sweet clover,white	FAB
Menodora scabra scabra	menodora,rough	OLE
Mentzelia ablicaulis	mentzelia	LOA
Mentzelia multiflora	mentzelia,desert	LOA
Mentzelia pumila	mentzelia	LOA
Microsteris gracilis	none	POL

Mimulus floribundus	none	SCR
Mirabilis diffusa	four-o'clock	NYC
Mirabilis glabra	four-o'clock,smooth	NYC
Mirabilis linearis	four-o'clock	NYC
Mirabilis multiflora	four-o'clock,Colorado	NYC
Mollugo cerviana	carpetweed,threadstem	AIZ
Monarda pectinata	beebalm,plains	LAM
Monarda punctata lasiodonta	beebalm,dotted	LAM
Monnina wrightii	none	PGL
Monolepis nuttalliana	povertyweed,Nuttall	CHE
Muhlenbergia brevis	muhly,short	POA
Muhlenbergia dubia	muhly,pine	POA
Muhlenbergia fragilis	muhly,delicate	POA
Muhlenbergia minutissima	muhly,least	POA
Muhlenbergia montana	muhly,mountain	POA
Muhlenbergia pauciflora	muhly,New Mexico	POA
Muhlenbergia pungens	muhly,pungent	POA
Muhlenbergia repens	muhly,creeping	POA
Muhlenbergia torreyi	muhly,ring	POA
Muhlenbergia wrightii	muhly,spike	POA
Munroa squarrosa	buffalograss,false	POA
Myosurus cupulatus	mousetail,horseshoe	RAN
Myosurus minimus	mousetail,tiny	RAN
Nama dichotomum	nama,erect	HYD
Oenothera albicaulis	evening-primrose,pale	ONA
Oenothera caespitosa marginata	evening-primrose,tufted	ONA
Oenothera coronopifolia	evening-primrose,combleaf	ONA
Oenothera laciniata	evening-primrose,cutleaf	ONA
Opuntia imbricata	cholla,walkingstick	CAC
Opuntia macrorhiza	prickly pear,plains	CAC
Opuntia phaeacantha	prickly pear,brownspine	CAC
Opuntia polyacantha	prickly pear,plains	CAC
Orobanche ludoviciana multiflora	broomrape,Louisiana	ORO
Orobanche uniflora	cancer-root,one-flower	ORO
Orthocarpus purpureo-albus	owl clover	SCR
Oryzopsis hymenoides	ricegrass,Indian	POA
Oryzopsis micrantha	ricegrass,littleseed	POA
Oxalis corniculata	woodsorrel,creeping	OXA
Panicum bulbosum	panicum,bulb	POA
Panicum capillare brevifolium	witchgrass	POA
Panicum hirticaule	witchgrass,Mexican	POA
Parthenocissus inserta	thicket creeper	VIT
Pennellia micrantha	none	BRA
Penstemon ambiguus laevissimus	penstemon,bush	SCR
Penstemon barbatus torreyi	penstemon,scarlet	SCR
Penstemon linaroides coloradoensis	penstemon	SCR
Penstemon ophianthus	penstemon	SCR
Penstemon virgatus	penstemon	SCR
Pericome caudata	taperleaf	AST
Phacelia alba	phacelia	HYD
Phacelia serrata	phacelia,cinders	HYD
Phaseolus angustissimus latus	bean,slimleaf	FAB

Phoradendron juniperinum	mistletoe,juniper	LOR
Phragmites australis	reed,common	POA
Phyla cuneifolia	frogfruit,wedgeleaf	VER
Physalis hederaefolia cordifolia	ground cherry,prairie	SOL
Picradeniopsis woodhousei	none	AST
Pinus edulis	pinyon	PIN
Pinus flexilis	pine,limber	PIN
Pinus ponderosa	pine,ponderosa	PIN
Plantago argyrea	plantain,silvery	POA
Plantago patagonica	plantain,bristle-bract	POA
Pleuraphis jamesii	galleta	POA
Poa bigelovii	bluegrass,Bigelow	POA
Poa fendleriana	muttongrass	POA
Polygala alba	milkwort,white	PGL
Polygonum aviculare	knotweed	PGN
Polygonum erectum	knotweed,erect	PGN
Polygonum racemosum	knotweed,bushy	PGN
Populus deltoides wislizenii	cottonwood,Rio Grande	SAL
Populus tremuloides	aspen,quaking	SAL
Portulaca oleracea	purslane,common	POR
Portulaca parvula	purslane	POR
Potentilla crinita	cinquefoil,hairtuft	ROS
Potentilla hippiana diffusa	cinquefoil,Hipp	ROS
Potentilla pennsylvanica	cinquefoil	ROS
Potentilla subviscosa	cinquefoil	ROS
Prunus virginiana melanocarpa	chokecherry	ROS
Pseudocymopterus montanus	parsley,mountain	API
Pseudotsuga menziesii menziesii	Douglas fir	PIN
Psilostrophe tagetina	paperflower,woolly	AST
Psoralea lanceolata	scurfpea,lemon	FAB
Psoralea tenuiflora bigelovii	alfalfa,wild	FAB
Pteridium aquilinum pubescens	bracken	DEN
Pterospera andromedea	pinedrops	ERI
Quercus X pauciloba	oak,wavyleaf	FAG
Quercus gambelii	oak,Gambel	FAG
Quercus grisea	oak,gray	FAG
Ratibida columnifera	coneflower,prairie	AST
Rhus glabra	sumac,smooth	ANA
Rhus trilobata trilobata	skunkbush	ANA
Ribes cerium	currant,wax	GRO
Ribes inerme	gooseberry,whitestem	GRO
Rorippa microtites	yellowcress	BRA
Rorippa sinuata	yellowcress,spreading	BRA
Rosa sp.	rose	ROS
Rubus strigosus arizonicus	raspberry,red	ROS
Rubus strigosus strigosus	raspberry,red	ROS
Rumex crispus	dock,curly	PGN
Rumex triangulivalvis	dock	PGN
Salix drummondiana	willow,Drummond	SAL
Salsola iberica	thistle,Russian	CHE
Salsola paulsenii	thistle,Russian	CHE
Salvia reflexa	sage,Rocky Mountain	LAM

Salvia subincisa	sage,sawtooth	LAM
Sanvitalia abertii	none	AST
Schedonnardus paniculatus	tumblegrass	POA
Schistophragma intermedia	none	SCR
Schizachyrium scoparium scoparium	bluestem,little	POA
Schkuhria multiflora	threadleaf	AST
Scirpus americanus	threesquare	CYP
Scirpus pungens	threesquare,common	CYP
Selaginella densa	spikemoss	SEL
Senecio douglasii longilobus	groundsel,Douglas	AST
Senecio multicapitatus	groundsel	AST
Senecio multilobatus	groundsel,Uinta	AST
Senecio neomexicanus mutabilis	groundsel	AST
Setaria viridis	foxtail,green	POA
Silene lacinata	catchfly,Mexican	CAR
Silene scouleri scouleri	catchfly,Scouler	CAR
Sisymbrium altissimum	tumble-mustard	BRA
Sisyrinchium demissum	blue-eyed grass	IRI
Solanum elaeagnifolium	nightshade,silverleaf	SOL
Solanum jamesii	potato,wild	SOL
Solanum triflorum	nightshade,cutleaf	SOL
Solidago sparsiflora	goldenrod,three-nerved	AST
Solidago wrightii adenophora	goldenrod	AST
Sonchus asper	sow thistle,spiny	AST
Sophora nuttalliana	loco,white	FAB
Spheralcea coccinea	globemallow,scarlet	MAL
Spheralcea digitata digitata	globemallow,juniper	MAL
Spheralcea fendleri	globemallow,thicket	MAL
Sporobolus contractus	dropseed,spike	POA
Sporobolus cryptandrus	dropseed,sand	POA
Stachys rothrockii	betony	LAM
Stephanomeria pauciflora pauciflora	wirelettuce,fewflower	AST
Stephanomeria tenuifolia	wirelettuce,slender	AST
Stipa comata	needle-and-thread	POA
Stipa neomexicana	feathergrass,New Mexico	POA
Stipa scribneri	needlegrass,Scribner	POA
Suckleya suckleyana	suckleya,poison	CHE
Tagetes micrantha	marigold,licorice	AST
Tagetes papposa	marigold,fetid	AST
Talinum confertiflorum	talinum	POR
Talinum pulchellum	talinum	POR
Tamarix chinensis	saltcedar	TAM
Taraxacum officinale	dandelion,common	AST
Tetradymia canescens	horsebrush,gray	AST
Thalictrum fendleri	meadowrue,Fendler	RAN
Thelesperma megapotamicum	Hopi tea	AST
Thelpyodium wrightii	telypody,Wright	BRA
Thelypodiopsis linearifolia	none	BRA
Thermopsis rhombifolia montana	pea,golden	FAB
Thlaspi montanum fendleri	pennycress	BRA
Townsendia exscapa	daisy,Easter	AST
Townsendia incana	daisy	AST

VEGETATION AND WILDLIFE INVENTORY

OF EL MALPAIS NATIONAL MONUMENT

Final Report

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I. Introduction.

1. Research Plan.

This report summarizes the findings of a three-year biological inventory of El Malpais National Monument, Cibola County, New Mexico. The purposes of this inventory were to determine what plant and animal species occur at El Malpais National Monument (ELMA) and to identify and define habitats and biotic communities at ELMA. An additional effort was made to search for federal and New Mexico state listed threatened or endangered plant and animal species.

A research plan was drafted in 1992 outlining the goals and rationale for this inventory. A copy of that research plan is presented in Appendix 1. In summary, the two principal goals of this project as outlined in the research plan were to 1) provide information on vegetation and wildlife species and habitats for the National Park Service (NPS) to enhance resource management, and 2) to provide information on the flora, fauna, and biotic communities for future ecological monitoring projects.

2. Geographic Location and Physiographic Setting.

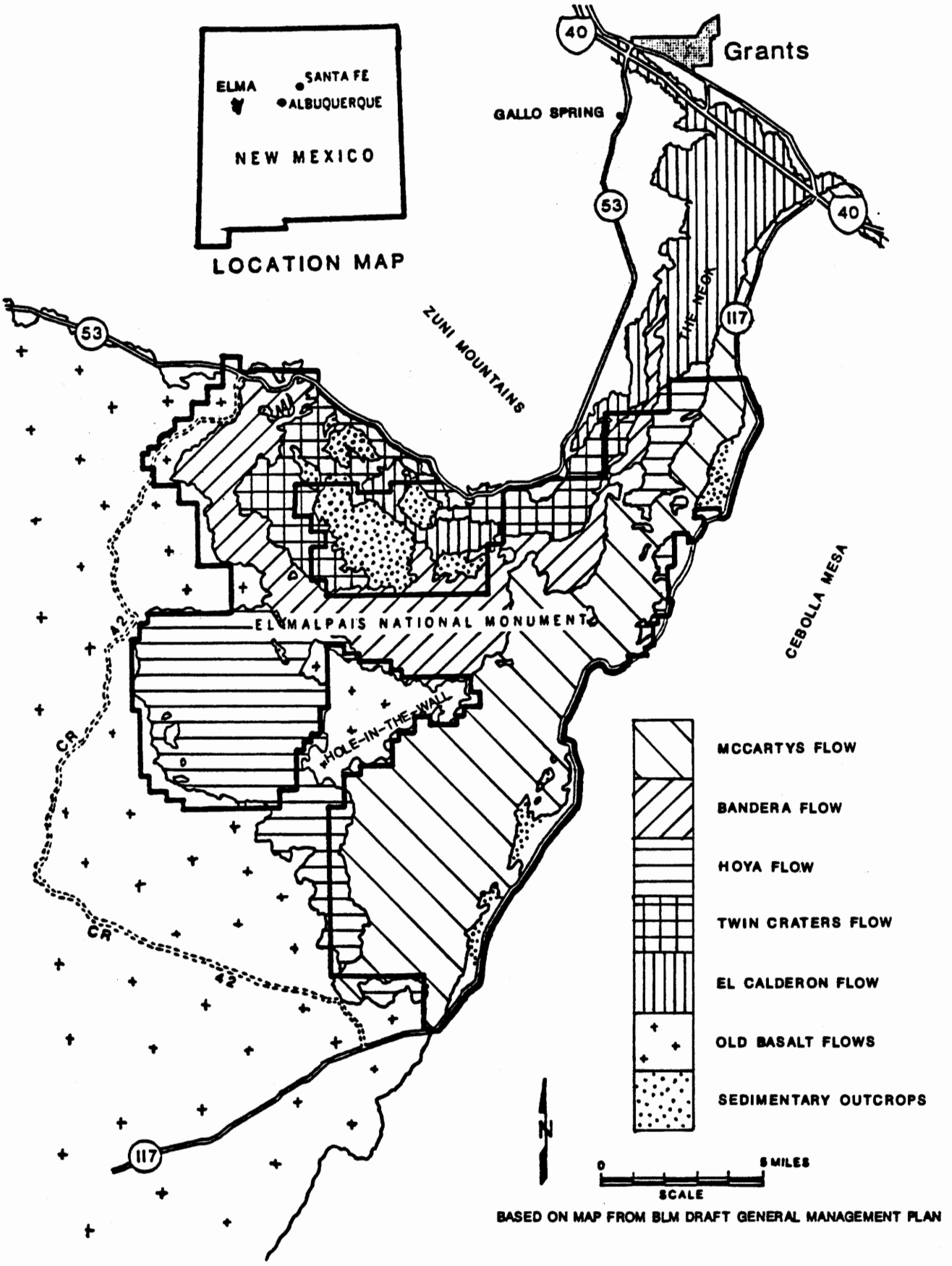
El Malpais National Monument is located in Cibola County, southwest of Grants, New Mexico, about 120-145 km (75-90 mi) west of Albuquerque, in the west-central part of the state (Figure 1). "El Malpais" is Spanish for "badlands" and in the Southwest typically refers to recent, rough lava flows; many of which blanket most of the monument. ELMA is located near the southeastern edge of the Colorado Plateau physiographic province in the Datil Section (Fenneman and Johnson 1946).

ELMA is covered almost entirely by lava flows of recent geological age although the entire extent of these flows is not contained within the monument boundaries (Maxwell 1986). Small portions extend from the northeast edge of ELMA and extensive, closely-related "old basalts" lie almost entirely off the monument to the south and west. In addition, areas of non-lava substrate (e.g., sedimentary outcrops, alluvial deposits) and kipukas ("islands" of lava or non-lava material surrounded by newer lava flows) are scattered throughout the monument.

State highway 117 (NM-117) skirts the eastern edge of the flows. The northern and part of the western limits of the basalt are roughly paralleled by State highway 53 (NM-53). Part of the western and southern boundary is followed by Cibola County Road 42 (CO-42). A majority of the lava flow edges are near a road. Travel into the lava fields is limited to few rough roads and foot trails in certain areas; vehicular travel is otherwise impossible and walking is slow and tiring.

Immediately to the north of the monument area are the Zuni Mountains, a small, ancient uplift with a core of Precambrian rocks and a mantle of Mesozoic and Paleozoic sediments. The highest point, Mount Sedgwick, is 2821 m (9255 ft) in elevation.

Figure 1. EL MALPAIS NATIONAL MONUMENT AREA



BASED ON MAP FROM BLM DRAFT GENERAL MANAGEMENT PLAN

III. Results

1. Study Site Locations.

A total of 101 study sites were established over the course of this inventory. These sites were distributed over the major geological or morphological surfaces that we could identify from Maxwell's (1986) geologic map of the ELMA region. A list of the study sites and the geologic areas or specific environments that they represent is given in Appendix 5 and a map of the study site locations is presented in Figure 2. Detailed information for each study site, obtained from site characteristic data forms, is presented in Appendix 6. A greater proportion of study sites were located on the Bandera lava flow than any other geologic surface because of the large number of lava tube caves and collapse structures present.

Abbreviations of the names of collection sites visited during this study are often used in the text. See Appendix 5 for a list and "translation" of these abbreviations (e.g., HIDD = Hidden Kipuka).

Most study sites were visited several times at different seasons over the three-year period. Sites at or near camping areas, pitfall trap locations, and lava-tube caves tended to receive more visits than other sites. Remote sites were the least often visited.

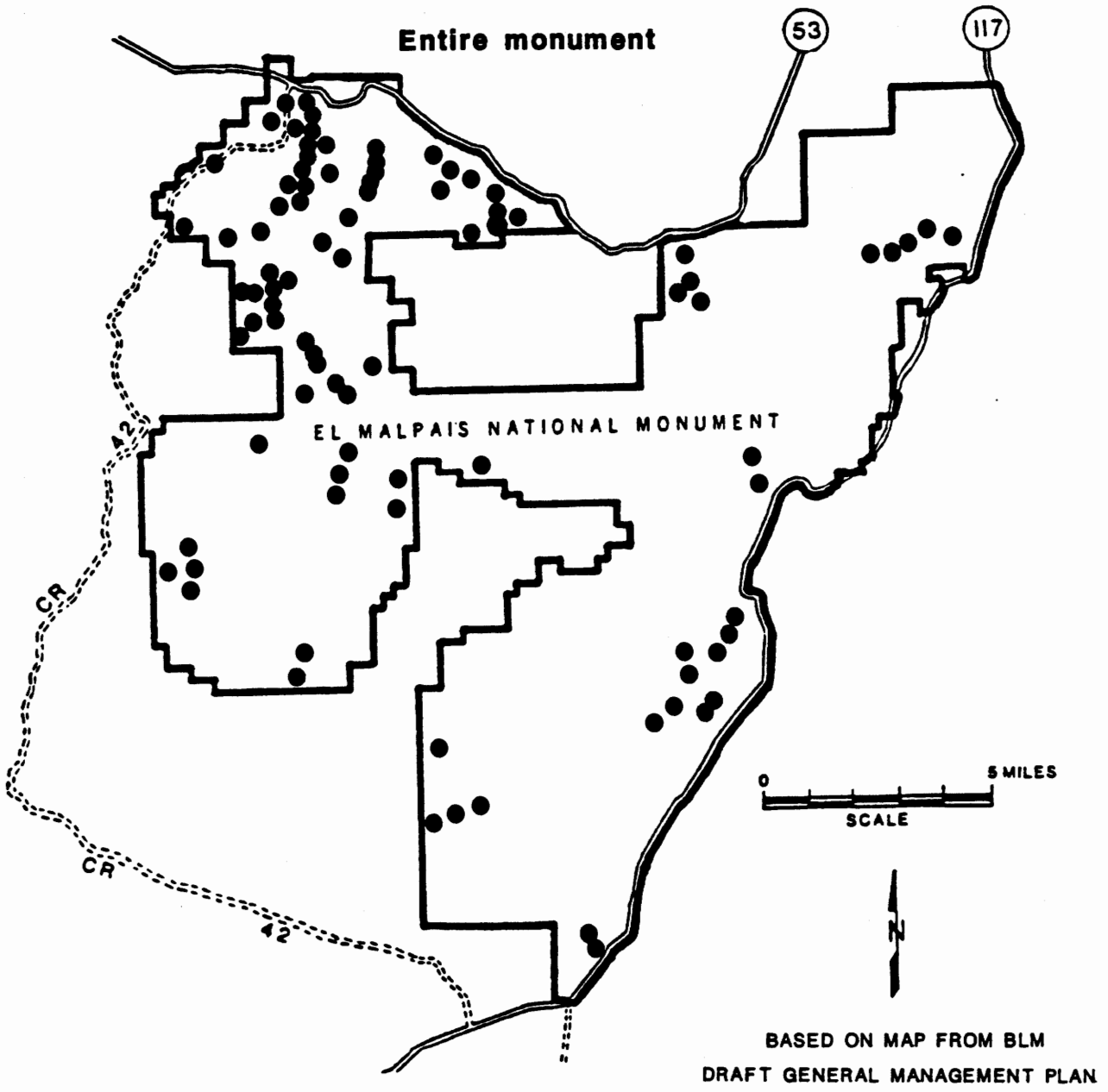
2. Vegetation.

A. Species Lists.

424 vascular plant species and 167 species of cryptogams (151 lichens, and 16 mosses) were identified during this study from the El Malpais National Monument area (Appendices 7, 8 and 9). 28 of the vascular plant taxa identified were aliens (about 6.6%; Appendix 10). Essentially all of these were weedy, in some sense of the term, and many of them were found exclusively or predominantly along roadsides. 109 vascular plant taxa and 93 species of cryptogams (77 lichens and 16 mosses) were newly identified for the ELMA area (see Appendices 9 and 11). These species were not found in the previously cited studies. 258 vascular plant taxa and 25 species of cryptogams were identified by the previously cited investigators, but were not found during this study (Appendices 9 and 12). In most cases, this is to be expected since the majority of those reported from previous studies were found in the Zuni Mountains.

A list of all plant species known from ELMA, including scientific and common names, is presented in Appendix 7. Scientific names are used throughout the report, so the reader may refer to Appendix 7 for common names of plants. An annotated plant species list, with information on all plant species, is presented in Appendix 8.

Figure 2a. INVENTORY SITE LOCATIONS



APPENDIX 7.

CHECKLIST OF PLANT SPECIES OF EL MALPAIS NATIONAL MONUMENT, SCIENTIFIC AND COMMON NAMES.

Refer to annotated plant list (Appendix 8) for additional information.

FAM.= plant family, see annotated list.

SCIENTIFIC NAME	COMMON NAME	FAM.
Abronia elliptica	sand verbena,fragrant	NYC
Abronia fragrans	sand verbena,sweet	NYC
Acalypha neomexicana	copperleaf,New Mexico	EUP
Achillea millefolium lanulosa	yarrow	AST
Agastache pallidiflora hybrid	none	LAM
Agrostis scabra	bentgrass,rough	POA
Allium cernuum	onion,nodding	LIL
Amaranthus albus	pigweed,pale	AMA
Amaranthus blitoides	pigweed,prostrate	AMA
Amaranthus retroflexus	pigweed,redroot	AMA
Ambrosia artemisiifolia	ragweed,common	AST
Andropogon gerardii gerardii	bluestem,big	POA
Andropogon gerardii paucipilus	bluestem,sand	POA
Androsace septent. glandulosa	rock jasmine,northern	PRI
Antennaria parvifolia	pussytoes	AST
Anthericum torreyi	amberlily,Torrey	LIL
Apocynum sp.	dogbane	APO
Arabis fendleri fendleri	rockcress,Fendler	BRA
Arabis fendleri spatifolia	rockcress,Fendler	BRA
Arabis perennans	rockcress,common	BRA
Arceuthobium vaginatum crytopodum	dwarf-mistletoe,SW	LOR
Arenaria fendleri fendleri	sandwort,Fendler	CAR
Arenaria lanuginosa saxosa	sandwort,spreading	CAR
Aristida arizonica	threeawn,Arizona	POA
Aristida havardii	threeawn,Havard	POA
Aristida purpurea fendleriana	threeawn,Fendler	POA
Aristida purpurea longiseta	threeawn,red	POA
Aristida purpurea purpurea	threeawn,purple	POA
Artemisia campestris pacifica	sagewort,western	AST
Artemisia carruthii	wormwood,Carruth	AST
Artemisia dracunculus	wormwood,silky	AST
Artemisia filifolia	sagebrush,sand	AST
Artemisia frigida	sagebrush,fringed	AST
Artemisia ludoviciana	wormwood,Louisiana	AST
Asclepias asperula asperula	milkweed,spider	ASC
Asclepias subverticillata	milkweed,whorled	ASC
Asclepias tuberosa terminalis	milkweed,orange	ASC
Asplenium septentrionale	grass fern	ASP

Asplenium trichomanes	spleenwort,maidenhair	ASP
Aster falcatus commutatus	daisy	AST
Astragalul wootonii wootonii	milkvetch,Wooton	FAB
Astragalus brandegei	milkvetch,Brandegee	FAB
Astragalus calycosus scaposus	milkvetch,Torrey	FAB
Astragalus ceramicus ceramicus	milkvetch,painted	FAB
Astragalus egglestonii	milkvetch,Eggleston	FAB
Astragalus humistratus humistratus	milkvetch,groundcover	FAB
Astragalus humistratus humivagans	milkvetch,groundcover	FAB
Astragalus mollissimus matthewsii	milkvetch,woolly	FAB
Astragalus praelongus praelongus	milkvetch,stinking	FAB
Atriplex canescens	saltbush,fourwing	CHE
Bahia dissecta	cutleaf	AST
Berberis fendleri	barberry,Fendler	BER
Blepharoneuron tricholepis	dropseed,pine	POA
Bothriochloa laguroides torreyana	bluestem,silver	POA
Bouteloua curtipendula	grama,sideoats	POA
Bouteloua gracilis	grama,blue	POA
Bouteloua hirsuta	grama,hairy	POA
Bouteloua simplex	grama,mat	POA
Brickellia brachyphylla	brickellbush,plume	AST
Brickellia chlorolepis	khunia,southwest	AST
Brickellia grandiflora grandiflora	tasselflower	AST
Bromus anomalus	brome,nodding	POA
Bromus lanatipes	brome	POA
Bromus tectorum	cheatgrass	POA
Bulbostylis capillaris	hairsedge	CYP
Calliandra humilis	calliandra,dwarf	FAB
Carex filifolia	sedge,threadleaf	CYP
Carex geophila	sedge	CYP
Carex occidentalis	sedge,western	CYP
Castilleja integra	paintbrush	SCR
Ceanothus fendleri	buckbrush,Fendler	RHA
Celtis reticulata	hackberry,netleaf	ULM
Centaurea repens	knapweed,Russian	AST
Ceratoides lanata	winterfat	CHE
Cercocarpus montanus montanus	mountain mahogany	ROS
Chaetopappa ericoides	aster,white	AST
Chamaesaracha coronopus	nightshade,green false	SOL
Chamaesyce fendleri chaetocalyx	spurge,Fendler	EUP
Chamaesyce fendleri fendleri	spurge,Fendler	EUP
Chamaesyce revoluta	euphorbia,threadstem	EUP
Chamaesyce serpyllifolia	spurge,thymeleaf	EUP
Cheilanthes feei	lipfern,slender	ADI
Cheilanthes fendleri	lipfern,Fendler's	ADI
Chenopodium capitatum	blite,strawberry	CHE
Chenopodium dessicatum	goosefoot,desert	CHE
Chenopodium fremontii	goosefoot,Fremont	CHE
Chenopodium graveolens	goosefoot,ragleaf	CHE
Chenopodium leptophyllum	goosefoot,narrowleaf	CHE
Chloris verticillata	grass,tumble-windmill	POA
Chrysoth. nauseosus bigelovii	rabbitbrush,Bigelow's	AST

Chrysoth. nauseosus consimilis	rabbitbrush,rubber	AST
Chrysoth. nauseosus nauseosus	rabbitbrush,rubber	AST
Chrysoth. parryi attenuatus	rabbitbrush,Parry's	AST
Chrysoth. viscidiflorus lanceolatus	rabbitbrush,viscid	AST
Chrysoth. v. stenophyllus	rabbitbrush,viscid	AST
Chrysothamnus depressus	rabbitbrush,dwarf	AST
Cirsium neomexicanum	thistle,New Mexico	AST
Cirsium ochrocentrum	thistle,yellowspine	AST
Cirsium vulgare	thistle,bull	AST
Cirsium wheeleri	thistle,Wheeler	AST
Clematis ligusticifolia	clematis,western	RAN
Cleome serrulata	bee plant,Rocky Mountain	CAP
Commelina dianthifolia longispatha	dayflower,birdbill	CMM
Commelina erecta angustifolia	dayflower,narrowleaf	CMM
Convolvulus arvensis	bindweed,field	CON
Convolvulus equitans	bindweed,gray	CON
Conyza canadensis	horseweed	AST
Cordylanthus wrightii	clubflower,Wright's	SCR
Coreopsis tinctoria tinctoria	coreopsis,plains	AST
Corydalis aurea	goldensmoke	FUM
Coryphantha vivipara arizonica	cactus,pincushion	CAC
Cosmos parviflorus	cosmos,Southwest	AST
Cryptantha cinerea	hiddenflower,James	BOR
Cryptantha crassisepala	hiddenflower,plains	BOR
Cryptantha fendleri	hiddenflower,Fendler	BOR
Cuscuta umbellata	dodder	CON
Cymopterus fendleri	spring-parsley,Fendler's	API
Cymopterus purpurascens	spring-parsley,widewing	API
Cyperus aristatus	flatsedge,bearded	CYP
Cyperus fendlerianus fenderianus	flatsedge,tuber-root	CYP
Dalea candida oligophylla	prairie-clover,white	FAB
Dalea compacta	prairie-clover,plains	FAB
Dalea exigua	none	FAB
Dalea leporina	none	FAB
Delphinium nuttallianum nutt.	larkspur,Nelson	RAN
Delphinium virescens wootonii	larkspur,prairie	RAN
Descurainia obtusa brevisiliqua	tansy-mustar,desert	BRA
Descurainia pinnata halictorum	tansy-mustard,pinnate	BRA
Descurainia richardsonii incisa	tansy-mustard,Richardson	BRA
Dexcurainia obtusa obtusa	tansy-mustard,desert	BRA
Dimorphocarpa wislizenii	spectaclepod	BRA
Draba cuneifolia	draba,wedgeleaf	BRA
Dryopteris felix-mas	male fern	ASP
Echinocereus fendleri	cactus,Fendler hedgehog	CAC
Echinocereus tri. melanacanthus	cactus,claret cup	CAC
Echinocereus tri. triglochidiatus	cactus,claret cup	CAC
Echinochloa muricata microstachya	cockspur	POA
Eleocharis acicularis	spikerush	CYP
Eleocharis macrostachya	spikerush	CYP
Elymus canadensis	wildrye,Canada	POA
Elymus longifolius	squirreltail,longleaf	POA
Elymus smithii	wheatgrass,western	POA

Elymus trachycaulus	wheatgrass,slender	POA
Elymus trachycaulus X smithii	wheatgrass,hybrid	POA
Eragrostis curvula	lovegrass,weeping	POA
Eragrostis lehmanniana	lovegrass,Lehmann	POA
Eragrostis pectinacea	lovegrass,Carolina	POA
Erig. formosissimus formosissimus	daisy,pretty	AST
Erigeron canus	daisy,hoary	AST
Erigeron colomexicanus	fleabane	AST
Erigeron divergens	daisy,spreading	AST
Erigeron flagellaris	daisy,trailing	AST
Erigeron speciosus	daisy,Oregon	AST
Erigeron vetensis	fleabane,La Veta	AST
Eriogonum alatum	buckwheat,winged wild	PGN
Eriogonum annuum	buckwheat,annual wild	PGN
Eriogonum cernuum	buckwheat,nodding wild	PGN
Eriogonum jamesii jamesii	buckwheat,James wild	PGN
Eriogonum racemosum	buckwheat,redroot wild	PGN
Erodium cicutarium	filaria	GER
Erysimum capitatum	wallflower,western	BRA
Eupatorium herbaceum	thoroughwort,white	AST
Euphorbia bilobata	euphorbia,blackseed	EUP
Euphorbia lurida	spurge,shorthorned	EUP
Fallugia paradoxa	Apache plume	ROS
Festuca arizonica	fescue,Arizona	POA
Forestiera neomexicana	olive,New Mexico	OLE
Frasera speciosa	elkweed	GEN
Fraxinus cuspidata	ash,fragrant	OLE
Gaillardia pinnatifida	blanket-flower,Hopi	AST
Gaura coccinea	gaura,scarlet	ONA
Gaura hexandra gracilis	gaura	ONA
Gaura parvifolia	gaura	ONA
Gayophytum ramosissimum	none	ONA
Geranium caespitosum	geranium,tufted	GER
Geranium lentum	geranium	GER
Gilia pinnatifida	none	POL
Gilia sinuata	none	POL
Glandularia wrightii	vervain,Wright's	VER
Grindelia aphanactis	gumweed,mountain	AST
Gutierrezia sarothrae	snakeweed,broom	AST
Hedeoma drummondii	false pennyroyal,Drummond	LAM
Hedeoma nanum	false pennyroyal,low	LAM
Helianthella quinquenervis	sunflower,fivenerve	AST
Helianthus annuus	sunflower,common	AST
Helianthus ciliaris	blueweed	AST
Helianthus petiolaris	sunflower,prairie	AST
Heterosperma pinnatum	heterosperma,fineleaf	AST
Heterotheca villosa villosa	golden-aster,hairy	AST
Hieracium fendleri fendleri	hawkweed,Fendler	AST
Holodiscus dumosus	mountain spray	ROS
Hordeum jubatum	barley,foxtail	POA
Houstonia wrightii	bluets	RUB
Hymenopap. flav. canotomentosus	none	AST

Hymenopappus filifolius cinereus	woolywhite	AST
Hymenopappus flav. flavescens	none	AST
Hymenoxys argentea	bitterweed	AST
Hymenoxys bigelovii	bitterweed	AST
Hymenoxys richardsonii	rubberweed,Colorado	AST
Ipomoea costellata	none	CON
Ipomoea cristulata	none	CON
Ipomoea plummerae	none	CON
Ipomopsis aggregata formosissima	skyrocket	POL
Ipomopsis longiflora	ipomopsis,whiteflower	POL
Ipomopsis multiflora	ipomopsis	POL
Iris missouriensis	iris,Missouri	IRI
Juniperus deppeana pachyphloea	juniper,alligator	CUP
Juniperus monosperma	juniper,one-seed	CUP
Juniperus scopulorum	juniper,Rocky Mountain	CUP
Kochia scoparia	fireweed	CHE
Koeleria macrantha	junegrass	POA
Lactuca serriola	prickly lettuce	AST
Lappula redowskii	stickseed	BOR
Lepidium densiflorum	pepperweed,prairie	BRA
Lepidium ramosissimum	pepperweed,bushy	BRA
Lesquerella rectipes	bladderpod,Colorado	BRA
Linum aristatum	flax,awned	LIN
Linum lewisii	flax,blue	LIN
Linum neomexicanum	flax,New Mexico	LIN
Lithospermum cobrense	gromwell,mountain	BOR
Lithospermum incisum	gromwell,narrowleaf	BOR
Lithospermum multiflorum	gromwell,manyflower	BOR
Lotus wrightii	deervetch,Wright's	FAB
Lupinus argenteus argenteus	lupine,silvery	FAB
Lupinus kingii kingii	lupine,King	FAB
Lycium pallidum	wolfberry,pale	SOL
Lycurus setosus	wolftail	POA
Machaeranthera australis	none	AST
Macheranthera gracilis	goldenweed	AST
Macheranthera linearis	none	AST
Macheranthera tanacetifolia	aster,tansyleaf	AST
Mahonia haematocarpa	barberry,red	BER
Mahonia repens	Oregon grape	BER
Malacothrix fendleri	none	AST
Mammillaria heyderi meiacantha	cactus,pincushion	CAC
Mammillaria wrightii wrightii	cactus,Wright fishhook	CAC
Marrubium vulgare	horehound	LAM
Marsilea mollis	water-clover	MRS
Medicago lupulina	medic,black	FAB
Medicago officinalis	sweet clover,yellow	FAB
Melilotus alba	sweet clover,white	FAB
Menodora scabra scabra	menodora,rough	OLE
Mentzelia ablicaulis	mentzelia	LOA
Mentzelia multiflora	mentzelia,desert	LOA
Mentzelia pumila	mentzelia	LOA
Microsteris gracilis	none	POL

Mimulus floribundus	none	SCR
Mirabilis diffusa	four-o'clock	NYC
Mirabilis glabra	four-o'clock,smooth	NYC
Mirabilis linearis	four-o'clock	NYC
Mirabilis multiflora	four-o'clock,Colorado	NYC
Mollugo cerviana	carpetweed,threadstem	AIZ
Monarda pectinata	beebalm,plains	LAM
Monarda punctata lasiodonta	beebalm,dotted	LAM
Monnina wrightii	none	PGL
Monolepis nuttalliana	povertyweed,Nuttall	CHE
Muhlenbergia brevis	muhly,short	POA
Muhlenbergia dubia	muhly,pine	POA
Muhlenbergia fragilis	muhly,delicate	POA
Muhlenbergia minutissima	muhly,least	POA
Muhlenbergia montana	muhly,mountain	POA
Muhlenbergia pauciflora	muhly,New Mexico	POA
Muhlenbergia pungens	muhly,pungent	POA
Muhlenbergia repens	muhly,creeping	POA
Muhlenbergia torreyi	muhly,ring	POA
Muhlenbergia wrightii	muhly,spike	POA
Munroa squarrosa	buffalograss,false	POA
Myosurus cupulatus	mousetail,horseshoe	RAN
Myosurus minimus	mousetail,tiny	RAN
Nama dichotomum	nama,erect	HYD
Oenothera albicaulis	evening-primrose,pale	ONA
Oenothera caespitosa marginata	evening-primrose,tufted	ONA
Oenothera coronopifolia	evening-primrose,combleaf	ONA
Oenothera laciniata	evening-primrose,cutleaf	ONA
Opuntia imbricata	cholla,walkingstick	CAC
Opuntia macrorhiza	prickly pear,plains	CAC
Opuntia phaeacantha	prickly pear,brownspine	CAC
Opuntia polyacantha	prickly pear,plains	CAC
Orobanche ludoviciana multiflora	broomrape,Louisiana	ORO
Orobanche uniflora	cancer-root,one-flower	ORO
Orthocarpus purpureo-albus	owl clover	SCR
Oryzopsis hymenoides	ricegrass,Indian	POA
Oryzopsis micrantha	ricegrass,littleseed	POA
Oxalis corniculata	woodsorrel,creeping	OXA
Panicum bulbosum	panicum,bulb	POA
Panicum capillare brevifolium	witchgrass	POA
Panicum hirticaule	witchgrass,Mexican	POA
Parthenocissus inserta	thicket creeper	VIT
Pennellia micrantha	none	BRA
Penstemon ambiguus laevissimus	penstemon,bush	SCR
Penstemon barbatus torreyi	penstemon,scarlet	SCR
Penstemon linaroides coloradoensis	penstemon	SCR
Penstemon ophianthus	penstemon	SCR
Penstemon virgatus	penstemon	SCR
Pericome caudata	taperleaf	AST
Phacelia alba	phacelia	HYD
Phacelia serrata	phacelia,cinders	HYD
Phaseolus angustissimus latus	bean,slimleaf	FAB

Phoradendron juniperinum	mistletoe,juniper	LOR
Phragmites australis	reed,common	POA
Phyla cuneifolia	frogfruit,wedgeleaf	VER
Physalis hederaefolia cordifolia	ground cherry,prairie	SOL
Picradeniopsis woodhousei	none	AST
Pinus edulis	pinyon	PIN
Pinus flexilis	pine,limber	PIN
Pinus ponderosa	pine,ponderosa	PIN
Plantago argyrea	plantain,silvery	POA
Plantago patagonica	plantain,bristle-bract	POA
Pleuraphis jamesii	galleta	POA
Poa bigelovii	bluegrass,Bigelow	POA
Poa fendleriana	muttongrass	POA
Polygala alba	milkwort,white	PGL
Polygonum aviculare	knotweed	PGN
Polygonum erectum	knotweed,erect	PGN
Polygonum racemosum	knotweed,bushy	PGN
Populus deltoides wislizenii	cottonwood,Rio Grande	SAL
Populus tremuloides	aspen,quaking	SAL
Portulaca oleracea	purslane,common	POR
Portulaca parvula	purslane	POR
Potentilla crinita	cinquefoil,hairtuft	ROS
Potentilla hippiana diffusa	cinquefoil,Hipp	ROS
Potentilla pennsylvanica	cinquefoil	ROS
Potentilla subviscosa	cinquefoil	ROS
Prunus virginiana melanocarpa	chokecherry	ROS
Pseudocymopterus montanus	parsley,mountain	API
Pseudotsuga menziesii menziesii	Douglas fir	PIN
Psilostrophe tagetina	paperflower,woolly	AST
Psoralea lanceolata	scurfpea,lemon	FAB
Psoralea tenuiflora bigelovii	alfalfa,wild	FAB
Pteridium aquilinum pubescens	bracken	DEN
Pterospera andromedea	pinedrops	ERI
Quercus X pauciloba	oak,wavyleaf	FAG
Quercus gambelii	oak,Gambel	FAG
Quercus grisea	oak,gray	FAG
Ratibida columnifera	coneflower,prairie	AST
Rhus glabra	sumac,smooth	ANA
Rhus trilobata trilobata	skunkbush	ANA
Ribes cerium	currant,wax	GRO
Ribes inerme	gooseberry,whitestem	GRO
Rorippa microtites	yellowcress	BRA
Rorippa sinuata	yellowcress,spreading	BRA
Rosa sp.	rose	ROS
Rubus strigosus arizonicus	raspberry,red	ROS
Rubus strigosus strigosus	raspberry,red	ROS
Rumex crispus	dock,curly	PGN
Rumex triangulivalvis	dock	PGN
Salix drummondiana	willow,Drummond	SAL
Salsola iberica	thistle,Russian	CHE
Salsola paulsenii	thistle,Russian	CHE
Salvia reflexa	sage,Rocky Mountain	LAM

Salvia subincisa	sage,sawtooth	LAM
Sanvitalia abertii	none	AST
Schedonnardus paniculatus	tumblegrass	POA
Schistophragma intermedia	none	SCR
Schizachyrium scoparium scoparium	bluestem,little	POA
Schkuhria multiflora	threadleaf	AST
Scirpus americanus	threesquare	CYP
Scirpus pungens	threesquare,common	CYP
Selaginella densa	spikemoss	SEL
Senecio douglasii longilobus	groundsel,Douglas	AST
Senecio multicapitatus	groundsel	AST
Senecio multilobatus	groundsel,Uinta	AST
Senecio neomexicanus mutabilis	groundsel	AST
Setaria viridis	foxtail,green	POA
Silene lacinata	catchfly,Mexican	CAR
Silene scouleri scouleri	catchfly,Scouler	CAR
Sisymbrium altissimum	tumble-mustard	BRA
Sisyrinchium demissum	blue-eyed grass	IRI
Solanum elaeagnifolium	nightshade,silverleaf	SOL
Solanum jamesii	potato,wild	SOL
Solanum triflorum	nightshade,cutleaf	SOL
Solidago sparsiflora	goldenrod,three-nerved	AST
Solidago wrightii adenophora	goldenrod	AST
Sonchus asper	sow thistle,spiny	AST
Sophora nuttalliana	loco,white	FAB
Spheralcea coccinea	globemallow,scarlet	MAL
Spheralcea digitata digitata	globemallow,juniper	MAL
Spheralcea fendleri	globemallow,thicket	MAL
Sporobolus contractus	dropseed,spike	POA
Sporobolus cryptandrus	dropseed,sand	POA
Stachys rothrockii	betony	LAM
Stephanomeria pauciflora pauciflora	wirelettuce,fewflower	AST
Stephanomeria tenuifolia	wirelettuce,slender	AST
Stipa comata	needle-and-thread	POA
Stipa neomexicana	feathergrass,New Mexico	POA
Stipa scribneri	needlegrass,Scribner	POA
Suckleya suckleyana	suckleya,poison	CHE
Tagetes micrantha	marigold,licorice	AST
Tagetes papposa	marigold,fetid	AST
Talinum confertiflorum	talinum	POR
Talinum pulchellum	talinum	POR
Tamarix chinensis	saltcedar	TAM
Taraxacum officinale	dandelion,common	AST
Tetradymia canescens	horsebrush,gray	AST
Thalictrum fendleri	meadowrue,Fendler	RAN
Thelesperma megapotamicum	Hopi tea	AST
Thelpyodium wrightii	telypody,Wright	BRA
Thelypodiopsis linearifolia	none	BRA
Thermopsis rhombifolia montana	pea,golden	FAB
Thlaspi montanum fendleri	pennycress	BRA
Townsendia exscapa	daisy,Easter	AST
Townsendia incana	daisy	AST

Townsendia exscapa	daisy,Easter	AST
Townsendia incana	daisy	AST
Tradescantia occident. scopulorum	spiderwort,prairie	CMM
Tragia ramosa	noseburn,catnip	EUP
Tragopogon dubius	salsify,western	AST
Tragopogon pratensis	salsify,meadow	AST
Tribulus terrestris	goathead	ZYG
Typha latifolia	cattail,broadleaf	TYP
Ulmus pumila	elm,Siberian	ULM
Verbascum thapsus	mullein,woolly	SCR
Verbena bracteata	vervain,prostrate	VER
Verbena macdougalii	vervain,New Mexico	VER
Verbesina encelioides encelioides	crownbeard,golden	AST
Verbesina encelioides exauriculata	crownbeard,golden	AST
Veronica peregrina	speedwell	SCR
Vicia americana minor	vetch,American	FAB
Viguiera multiflora var. *nevadensis*	goldeneye,showy	AST
Vitis arizonica	grape,canyon	VIT
Vulpia octoflora	fescue,sixweeks	POA
Woodsia plummerae	woodsia,Plummer's	ASP
Xanthium strumarium canadense	cocklebur	AST
Yucca baccata	yucca,banana	AGA
Yucca baileyi X Y. glauca	yucca,narrowleaf	AGA
Zinnia grandiflora	zinnia,Rocky Mountain	AST

VEGETATION AND WILDLIFE INVENTORY

OF EL MALPAIS NATIONAL MONUMENT

Final Report

Appendix 8

ANNOTATED LIST OF VASCULAR PLANT TAXA OF EL MALPAIS NATIONAL MONUMENT

APPENDIX 8.

ANNOTATED LIST OF VASCULAR PLANT TAXA FROM EL MALPAIS NATIONAL MONUMENT

Four hundred and twenty-four (424) vascular plant taxa were identified from El Malpais National Monument area, NM, during this study. Twenty-eight (28) species are introduced (alien) and are indicated by asterisk (*) and listed separately in Appendix 10. One hundred and ten (110) taxa that were not identified in previously published reports are marked by a "plus sign" (+) and listed separately in Appendix 11. The list of species found in earlier studies but not found during this study are listed in Appendix 12.

Taxa are placed into three groups with the ferns and *Selaginella* first, followed by the gymnosperms, and the angiosperns last. Within each group, the families, genera, species, and lower taxa are arranged alphabetically. Dicot and monocot families are not listed separately. Plants were identified by using primarily state floras: Martin and Hutchins (1980), Great Plains Flora Association (1986), Correll and Johnston (1979), Kearney, Peebles, and collaborators (1960), and Welsh et al. (1987). The choice of family name and affiliation of genera usually follows Kartesz and Kartesz (1980) except, for example, the Fumariaceae which is considered to be a separate family. In some cases, more recent monographic or other treatments of some groups supercede Kartesz and Kartesz (1980). For example, the treatment of the grasses follows Allred (1993). The family abbreviation used in this document follows the family name; some families have alternative names in parenthesis.

Abundance, in this document, is simply the number of sites at which a taxon is present (see below of explanation of terms used here). A taxon's abundance within a site (number of plants or canopy cover) may vary and is commented on in general terms for only some taxa. Many taxa are probably more common, that is, found at more sites, than is indicated in this list. However, the relative abundance of each taxon would presumably remain similar after a more detailed study.

The sequence of information for each taxon:

1. currently accepted scientific binomial in **bold** followed by the authority;
2. common synonym(s) in *italics* within parenthesis; many synonyms are those used by earlier workers; others reflect recent changes in nomenclature;
3. longevity and habit;
4a. relative abundance within the monument area:
   rare = seen at one or two sites, usually few individuals seen
   uncommon = seen at a few sites (3-6)
   fairly common = seen at several sites (7-15)

common = often seen (16-25 sites)
very common = seen very often, sometimes a dominant or abundant in numbers of individuals or canopy cover (>25 sites);

b. distribution within the monument area;
c. substrate(s);

5. range;
6. other comments.

* before the taxon means that the plant is INTRODUCED (alien)

+ before the taxon means that the plant is NEW to the species list of the area (has not been previously identified from the monument or surrounding area)

Abbreviations:

substrates:

lava = usually basalt on bare rock or areas with little soil accumulation

deep soil lava = usually refers to the old basalt of Maxwell (1986) but may indicate parts of the older of the newer flows; similar to sed in some ways; includes sites OLBA, KIHN, KIHS, & PRWE

sed = usually alluvium or sediments derived from sandstone

cinders = found mostly on or near cones; similar to sed, in certain respects

directions:

c = central	ec = east-central	ne = northeast(ern)
e = east(ern)	nc = north-central	nw = northwest(ern)
n = north(ern)	sc = south-central	se = southeast(ern)
s = south(ern)	wc = west-central	sw = southwest(ern)
w = west(ern)		

states abbreviations are those used by the Postal Service, plus:

BC = British Columbia (Canada)
CN = Canada
CP = Colorado Plateau
GP = Great Plains
MX = Mexico
NA = North America
NH = Northern Hemisphere (not New Hampshire)
RM = Rocky Mountains
US = United States
eg., wcCN = west-central Canada

See Appendix 5 for the full names of the four-letter site accronyms, and Appenix 6 for detailed site information.

ADIANTACEAE (ADI) (SINOPTERIDACEAE)

Cheilanthes feei T. Moore; slender lipfern; perennial; uncommon, scattered in shady locations on most flows; throughout wNA

Ch. fendleri Hook.; Fendler's lipfern; perennial; uncommon, on sed, including Hidden Kipuka in shady locations; swUS & nMX

ASPLENIACEAE (ASP) (POLYPODIACEAE)

Asplenium septentrionale (L.) Hoffman; grass fern, forked spleenwort; grasslike, clumped, perennial; uncommon; often found in approximately n-s oriented cracks in the McCartys & occasionally on the Bandera flow; wUS and NH

A. trichomanes L.; maidenhair spleenwort; perennial; rare; collected at MTKI, a sedimentary kipuka but may also be associated with the McCartys flow; throughout NH; a unique occurrence of this taxon was described by Lindsey (1945) at a location that was destroyed by construction of I-40

Dryopteris filix-mas (L.) Schott; male fern; large, perennial; uncommon; seen at bottom of some of the more mesic collapse structures such as two of the Marchantia system, but also on surface of other flows; throughout NH

Woodsia plummerae Lemmon; Plummer woodsia; perennial; very common, the most frequently encountered fern in the monument; on most of the flows in sheltered spots; wTX to AZ & nMX

DENNSTAEDTIACEAE (DEN)

Pteridium aquilinum (L.) Kuhn var. **pubescens** Underw.; bracken; large, perennial; rare, found only on Bandera Cone, where it is abundant; throughout western North America; this genus has one species with several varieties; it is the most wide-spread vascular plant in the world and is essentially cosmopolitan

MARSILEACEAE (MRS)

+ **Marsilea mollis** Robinson & Fernald; water-clover, pepperwort; perennial, aquatic fern; rare, found only in 1991 in one of the natural ephemeral ponds at PRWE; AZ & wTX into MX; spores were probably brought in by migrating waterfowl, but the plant was apparently unable to establish itself and was not seen in 1992 or 1993

SELAGINELLACEAE (SEL)

Selaginella densa Rydb.; spikemoss, selaginella; matted or tufted perennial; rare, collected only on north face of MTKI; AK thru wNA; member of an ancient group of vascular plants

CUPRESSACEAE (CUP)

Juniperus deppeana Steud. var. **pachyphloea** (Torr.) Martinez (*J. pachyphloea* Torr.); alligator juniper; uncommon, but may be common at certain sites; upper Bandera flow; lava & sed; cAZ & NM to nMX; ELMA is near the northern edge of its distribution.

J. monosperma (Engelm.) Sarg.; one-seed juniper; small tree; very common; found at most sites, but commoner at lower elevations in the east; lava & sed; throughout the Southwest except CA

J. scopulorum Sarg.; Rocky Mountain juniper; tree; fairly common; northwestern part of the monument at the higher ends of the flows; mostly lava; not seen on McCartys; BC to NM & AZ

PINACEAE (PIN)

Pinus edulis Engelm.; Colorado pinyon; small tree; very common; usually seen in all areas; often dominant with Ponderosa pine; lava & sed; CP & immediately adjacent areas; this tree is sometimes found stunted &/or distorted into "bonsai" shapes, particularly on the McCartys flow

P. flexilis James; limber pine; medium-sized tree; rare, found only on Bandera Cone where it is uncommon; one large tree may be seen above the trail to the breech, several others are on the more mesic north side of the cone; found in the Zunis; scattered in RM and GB; unusual at this low elevation

P. ponderosa Dougl. ex P. & C. Lawson; ponderosa pine; usually a large tree; very common, often dominant with pinyon; lava & sed; BC to CA, NB, and Chihuahua; largest trees and densest stands are in the more mesic northern and western parts of the monument; some trees are remarkably twisted and stunted, particularly on the McCartys and parts of the Bandera

Pseudotsuga menziesii (Mirb.) Franco var. **menziesii**; inland Douglas fir; usually a large tree; fairly common, but only in the highest, northwestern part of the monument where they may be quite common; lava only; some trees on the Bandera flow east of Cerro Rendija are the oldest of this taxon in North America; these trees can be very stunted but rarely contorted; BC to CA and nMX

AGAVACEAE (AGA)

Yucca baileyi W. & S. X **Y. glauca** Nutt. ex Fraser; narrowleaf yucca; narrow-leafed, acaulescent perennial; uncommon, lava and sed; the narrow-leafed yuccas in the monument area are probably hybrids between Y. baileyi (centered in higher areas of the se Colorado Plateau) and Y. glauca (mostly from the Great Plains) or Y. angustissima (sw Colorado Plateau)

Y. baccata Torr. var. **baccata**; datil, banana yucca; broad-leafed, acaulescent perennial; common; lava & sed; the most widespread yucca in the west and the monument; from sNV, UT, & CO s to nAZ, most of NM & wTX

AIZOACEAE (AIZ) (Molluginaceae)

+ **Mollugo cerviana** (L.) Ser.; threadstem carpetweed; weedy, annual herb; uncommon; widely separated collections on lava & sed; sTX to CA; may be adventive from warm temperate or tropical regions

AMARANTHACEAE (AMA)

* **Amaranthus albus** L. (*A. graecizans* authors, not L.); pale amaranth; annual weedy herb; uncommon, nw part of area; lava & sed; temperate NA; adventive from tropical America

* **Amaranthus blitoides** S. Wats. (*A. graecizens* authors, not L.); prostrate pigweed; weedy, annual herb; uncommon; nw part of the monument; sed & lava; apparently adventive from tropical America; widespread in temperate NA

* + **A. retroflexus** S. Wats.; redroot pigweed, rough pigweed, quelite; annual, weedy herb; rare, collected only at NPPO; adventive from Central America; widespread in NA

ANACARDIACEAE (ANA)

Rhus glabra L.; smooth sumac; shrub; uncommon; small, disjunct stands on Bandera and Hoya flows, west side; widespread in NA

R. trilobata (Nutt.) A. Gray var. **trilobata**; skunkbush; low shrub; very common, found at most sites; on all substrates and most flows; widespread in the wUS

APIACEAE (API) (UMBELLIFERAE)

+ **Cymopterus fendleri** A. Gray; chimaya, Fendler's springparsley; low perennial herb; rare; found only at SABL; cTX through CO & NM to nUT & AZ

C. purpurascens (A. Gray) M.E. Jones; widewing spring-parsley; low perennial herb; rare, but probably more common due to its early flowering and inconspicuous habit; collected only at Rendija & JUNC; seID to seCA and nwNM

Pseudocymopterus montanus (Gray) Coult. & Rose; mountain parsley; perennial herb; uncommon, in higher parts of monument, lava & sed; wTX & MX to AZ, sUT & WY

APOCYNACEAE (APO)

+ **Apocynum** sp.; dogbane; perennial herb; rare; three populations seen in the nw part of the monument, including BACR and Cerrito de Jaspe; no flowers or fruits collected

ASCLEPIADACEAE (ASC)

Asclepias asperula (Dcne.) Woodson ssp. **asperula**; spider milkweed, antelope horns; perennial herb; fairly common, mostly on lava; sID to sCA & sTX to nMX; the commonest milkweed in the study area

A. subverticillata (Gray) Vail; whorled, horsetail, or poison milkweed; perennial herb; rare, seen only along NM-53 roadside near mouth of Bonito Canyon; sUT, CO, TX, NM, AZ, nMX

A. tuberosa L. ssp. **terminalis** Woodson; orange milkweed, butterfly weed; perennial herb; rare, seen only on Bandera Crater; MI & MN to TX, AZ & nMX

ASTERACEAE (AST) (COMPOSITAE)

Achillea millefolium L. var. **lanulosa** (Nutt.) Piper (*A. lanulosa* Nutt.); yarrow; perennial herb; uncommon, in highest area of monument, on sed; widespread in NA & circumboreal

+ **Ambrosia artemisiifolia** L.; common ragweed; annual weedy herb; uncommon, mostly in disturbed, alluvial areas; widespread in NA

Antennaria parvifolia Nutt. (*A. aprica* Greene, *A. marginata* Greene); pussytoes; perennial, mat-forming herbs; uncommon, on deep soil lava & sed; sCN to NM & AZ

Artemisia campestris L. ssp. **pacifica** (Nutt.) H. & C. (*A. pacifica* Nutt.); western sagewort, field wormwood; perennial or biennial, odorless herb; fairly common, widely separated collections, lava & sed; from WY & NM to the Pacific

A. carruthii Wood ex Carruthers (*A. c.* var. *wrightii* (A. Gray) Blake; *A. wrightii* A. Gray); Carruth wormwood; perennial, suffrutescent herbs; very common, the most frequently seen Artemisia, mostly on lava; wKS to AZ, NM, & TX

A. dracunculus L. (*A. dracunculoides* Pursh); silky wormwood, tarragon; perennial herb; fairly common, widespread, lava & sed; wcCN to IL, TX, MX and westward, also Eurasia

A. filifolia Torr.; sand sagebrush; shrub; rare, on sand only on east side (SABL & LOME); SD & TX west to sUT, NV, AZ, & nMX

A. frigida Willd.; fringed sagebrush; low, spreading shrublet; common, in most areas with better-developed soils, not on McCartys or Bandera flows; widespread in NA and Eurasia

A. ludoviciana Nutt.; Louisiana wormwood, white sagebrush, western mugwort; perennial herb; uncommon; in most areas on sed & deep soil lava; widespread in temperate NA

Aster falcatus Lindl. ssp. **commutatus** (T. & G.) A.G. Jones (*A. commutatus* (T. & G.) A. Gray; perennial, rhizomatous herb; rare, collected only at junction of CO42; Manitoba to IA to nMX, AZ & se UT

Bahia dissecta (Gray) Britt.; cutleaf; annual; very common, one of the most frequently seen herbs; on all substrates, sometimes in vast numbers; WY to NV & CA and through nMX to TX; appeared to become less abundant each year from 1991 through 1993

Brickellia brachyphylla (A. Gray) A. Gray; plume brickellbush; perennial herb; fairly common, widespread, on lava & sed; wTX, sCO, & eAZ through NM

+ **B. chlorolepis** (W. & S.) Shinners (*Kuhnia chlorolepis* W. & S.); false boneset, southwest kuhnia; perennial, clump-forming herbs; uncommon; nw part of monument on cinders & sed; w TX to CO & AZ & south to c MX

B. grandiflora (Hook.) Nutt. var. **grandiflora**; tasselflower; perennial herb; rare, found only at BACR; most of wUS into MX

* + **Centaurea repens** L.; Russian knapweed; perennial, colony-forming, weedy herbs; rare, collected only along NM-53 near mouth of Bonita Canyon; widespread in NA; from Eurasia

Chaetopappa ericoides (Torr.) Nesom (*Leucelene ericoides* (Torr.) Greene); white aster; low perennial herb; very common, lava & sed in most areas; CA & NV to KS & TX and s into MX; recently renamed

(Chrysothamnus note: Rabbitbrush species are frequently encountered and widespread in the monument area but were not often collected or identified. Thus the abundance information related below may not accurately reflect the plants' actual abundance. The most common taxon appears to be Chrysothamnus nauseosus consimilis.)

+ **Chrysothamnus depressus** Nutt.; dwarf rabbitbrush; low, spreading shrubs; uncommon, west side, lava & sed; NV, UT, CO, AZ, & NM

C. nauseosus (Pallas) Britt. ssp. **bigelovii** (A. Gray) H. & C.; Bigelow's rubber rabbitbrush; shrub; rare, collected only on CO-42 near south end; seUT, CO, NM, & AZ

C. n. ssp. consimilis (Greene) H. & C. (*C. n.* var *pinifolius* (Greene) H. & C.); rubber rabbitbrush; shrub; fairly common, all areas, lava & sed; OR to WY & s to CA, AZ and NM; the most commonly encountered rabbitbrush in the area

C. n. ssp. nauseosus; rubber rabbitbrush; shrub; rare, collected only at OARD; MT to nTX, NM, CO, & UT

+ **C. parryi** (A. Gray) Greene ssp. **attenuatus** (M.E. Jones) H.& C.; Parry's rabbitbrush; shrub; uncommon; widespread on lava; WY & NB to UT, AZ, & NM

C. viscidiflorus (Hook.) Nutt. ssp. **lanceolatus** (Nutt.) H. & C.; lanceleaf rabbitbrush; shrub; rare, collected only along lower NM-117; throughout wUS

C. v. ssp. stenophyllus (A. Gray) H.& C.; viscid rabbitbrush; shrub; rare; southern part of area on sed or deep soil lava; OR & WY to CO, NM, AZ, NV, & UT

(Cirsium note: This genus is commonly encountered & widespread in the monument area, but it was not often collected or identified. Thus the abundance information related below will not accurately reflect the plants' actual abundance.)

Cirsium neomexicanum Gray; New Mexico thistle; biennial herb; uncommon; lava & sed; UT, NV, AZ & NM; may be the most common thistle in the monument area

+ **C. ochrocentrum** (Gray) Gray; yellowspine thistle; perennial herb; rare; collected only near Los Cerros Ranch; NB & TX to NM & AZ

* + **C. vulgare** (Savi) Tenore; bull thistle; weedy biennial herb; rare; collected only along upper NM-53 roadside, but quite common there; MN to MT, s to OK, NM, AZ & WY; from Europe

C. wheeleri (Gray) Petrak; Wheeler thistle; perennial or biennial herb; rare; collected only at CO-42; CO, NM, & AZ

Conyza canadensis (L.) Cronq. (*Erigeron canadensis* L.); horseweed; weedy annual herb; uncommon, mostly roadsides along lower NM-53 & NM-117; widespread in NA

Coreopsis tinctoria Nutt. var. **tinctoria** (*C. cardaminefolia* (DC.) Nutt.); plains coreopsis, manzanilla silvestre; annual herb; uncommon, nw part of monument on deep soil lava or sed in seasonally damp or disturbed areas; widespread in cUS, scattered in west; commonly grown as an ornamental

Cosmos parviflorus (Jacq.) H.B.K.; southwest cosmos; annual herb; rare; collected only at 53UP; CO to TX, NM, & AZ, s into MX

Erigeron canus Gray; hoary daisy; perennial herb; uncommon; both substrates, west side of monument; WY & SD to AZ & NM

E. colomexicanus A. Nels. (*E. nudiflorus* Buckl.); biennial herb; fairly common; widespread, mostly on deep soil lava & sed; sNV, CO, TX to n MX & AZ

E. divergens T. & G.; spreading daisy; biennial, possibly annual or short-lived perennial herb; fairly common; scattered on lava & sed; widespread in wNA from BC to MX

E. flagellaris Gray; trailing daisy, running fleabane; biennial or short-lived perennial herb; very common; throughout the monument, lava & sed; widespread in wNA from BC to AZ & wTX; the most commonly seen Erigeron, sometimes in large, tangled patches

E. formosissimus Greene var. **formosissimus**; pretty daisy; perennial herb; rare; collected at CO42 and TWIS; widespread in wNA from Alberta to AZ & NM

E. speciosus (Lindl.) DC.; Oregon daisy; perennial herb; rare; found only at LACR; throughout wNA from sCN to SD to AZ & NM

E. vetensis Rydb.; La Veta fleabane; perennial herb; rare; collected only at NOPA; wGP & WY to nNM; named for La Veta Pass, CO (veta is Spanish for a mineral vein)

Eupatorium herbaceum (Gray) Greene; white thoroughwort; perennial herb or subshrub; fairly common; scattered throughout the monument, lava & sed; UT & CO to wTX & AZ

Gaillardia pinnatifida Torr.; Hopi blanket-flower; perennial, occasionally biennial or annual herb; uncommon; scattered in the monument in deep soil lava & sed; UT & CO to OK, TX, s to nMX, w to AZ

Grindelia aphanactis Rydb.; mountain gumweed; weedy biennial herb; fairly common; scattered throughout the monument, lava & sed, also roadsides; UT & CO to AZ & TX

Gutierrezia sarothrae (Pursh.) Britt. & Rusby; broom snakeweed; perennial, rounded subshrub; common; in deep soil lava & sed; widespread in wNA from CN to MX

+ **Helianthella quinquenervis** (Hook.) Gray; false sunflower, fivenerve sunflower; perennial herb; rare, collected at HIDD; OR to SD s to NV, AZ & NM

+ **Helianthus annuus** L.; common sunflower, mirasol; large, stout annual herb; rare, NM-53 roadsides on n edge of monument; widespread in US, CN, & MX

+ **H. ciliaris** DC.; blueweed; rhizomatous perennial; rare; collected only at OFSW; KS to TX, w NM & AZ, s into MX

H. petiolaris Nutt.; prairie sunflower, plains sunflower; annual herb; rare, collected only at SABL & NOPA ; widespread in US

+ **Heterosperma pinnatum** Cav.; fineleaf heterosperma; annual herb; rare, collected only at NOPA; wTX to AZ s to cMX

Heterotheca villosa (Pursh) Shinners var. **villosa** (*Chrysopsis villosa* (Pursh) Nutt. ex DC.); hairy golden-aster; perennial herb; very common; found at most sites; widespread in wUS

Hieracium fendleri Schultz-Bip. var. **fendleri**; Fendler hawkweed; perennial herb; uncommon; higher areas of nw, lava; NM, CO, AZ, TX, & Chihuahua

Hymenopappus filifolius Hook. var. **cinereus** (Rydb.) I.M. Johnston; hyaline herb, woollywhite, white ragweed; perennial herb; common; lava & sed; NM, CO, UT, AZ, TX; this is the most common variety of this complex species in the Southwest

H. flavescens Gray var. **canotomentosus** A. Gray; yellow woollywhite; perennial herb; uncommon; scattered in deep soil lava & sed; NM, TX, AZ, Chihuahua

H. f. var. **flavescens**; yellow woollywhite; biennial herb; rare, collected only along NM-117; TX to KS & w to cNM

Hymenoxys argentea (Gray) K. F. Parker; bitterweed; perennial herb; fairly common; widespread, sed & cinders; NM & eAZ

+ **H. bigelovii** (Gray) Parker; bitterweed; perennial herb; rare; collected only on REND; wNM to n & cAZ

H. richardsonii (Hook.) Cockerell; pingue, Colorado rubberweed; subshrub perennial; very common; widespread & sometimes dominant, lava & sed; Alberta & Saskatchewan to AZ & TX; this plant may indicate overgrazing & it is poisonous to sheep

* **Lactuca serriola** L.; prickly lettuce; weedy, biennial or winter annual herb; uncommon; widespread on all substrates; widespread in US; from Europe

Machaeranthera australis (Greene) Shinners (*Haplopappus spinulosus* (Pursh) DC. *australis* (Greene) Hall); perennial herb; rare; collected only along upper CO-42; CO & OK to NM, TX & nMX

M. gracilis (Nutt.) Shinners (*Haplopappus gracilis* (Nutt.) Gray); goldenweed; annual herb; uncommon; sed or deep soil lava; CA to UT & wTX south to nMX

M. linearis Greene; annual or biennial herb; rare; collected only at SABL; GP to UT, AZ, & nMX

M. tanacetifolia (H.B.K.) Nees; tansyleaf aster, Tahoka daisy; somewhat weedy annual herb; rare; sed of SABL & NM-117 roadside; sCN to ncMX

Malacothrix fendleri A. Gray; annual herb; rare, collected only at OFSW; wTX to sNM & sAZ, into nMX

Pericome caudata A. Gray; taperleaf; suffrutescent perennial; very common; widespread, usually only on rough lava outcrops; swGP to wTX, CA, nMX; a monotypic genus

Picradeniopsis woodhousei (Gray) Rydb. (*Bahia woodhousei* (Gray) Gray); rhizomatous perennial herb; rare; collected only at OFSW; KS & TX w to CO & AZ

Psilostrophe tagetina (Nutt.) Greene; woolly paperflower; perennial herb; uncommon; sed only; AZ to UT, wTX, & nMX

Ratibida columnifera (Nutt.) W. & S. (*R. columnaris* Pursh); prairie coneflower; perennial herb; uncommon; sed & deep soil lava; BC to MN, south to AZ, TX, & nMX

+ **Sanvitalia abertii** Gray; annual herb; rare, collected only on SABL & MEBL (sed); AZ to TX and nMX

Schkuhria multiflora Hook. & Arn. (*Bahia neomexicana* Gray); threadleaf; annual herb; uncommon; widespread, sed & deep soil lava; CO to NM, TX, AZ, & nMX, also South America

Senecio douglasii DC. var. **longilobus** (Benth.) L. Benson; Douglas groundsel; perennial herb; uncommon; all substrates; UT & AZ to TX

S. multicapitatus Greenm.; rare; collected at SABL & SEPT (mostly sed); CO & UT to AZ & wTX

S. multilobatus T. & G. ex Gray; Uinta groundsel; perennial or biennial herb; very common; widespread on all substrates; ID & WY to CA & NM

S. neomexicanus Gray var. **mutabilis** (Greene) T.M. Barkl.; perennial or biennial herb; uncommon; lava only; CO, NM, AZ, UT

+ **Solidago sparsiflora** Gray; three-nerved or alcove goldenrod; perennial, rhizomatous herb; uncommon; higher parts of the monument area, lava & sed; Great Plains to UT, AZ, & TX

S. wrightii Gray var. **adenophora** Blake; perennial herb; rare; collected only at SABL; wTX to sAZ

* + **Sonchus asper** (L.) Hill; spiny sow thistle; weedy annual; rare; collected along road at Gallo Spring; widespread in NA & Eurasia; from Eurasia

+ **Stephanomeria pauciflora** (Torr.) Nutt. var. **pauciflora** (*S. neomexicana* (Greene) Cory); fewflower wirelettuce; perennial herb; fairly common; widespread on all substrates; KS to CA, TX & nMX

+ **S. tenuifolia** (Torr.) Hall; slender wirelettuce; perennial herb; rare, collected only at CEBA; nGP to TX & west to BC & CA

+ **Tagetes micrantha** Cav.; licorice marigold; delicate, aromatic annual herb; rare; collected only at HOYA; AZ to TX into MX

T. papposa Vent. (*Dyssodia papposa* (Vent.) A.S. Hitchc.); fetid marigold, mayweed, pappose glandweed; weedy annual herb; rare; collected at 53UP & MEBL (sed); widespread in US & MX

Taraxacum officinale Weber; common dandelion; weedy perennial herb; fairly common; lava & sed; for some reason this almost ubiquitous introduction from Eurasia is not particularly common in the study area

Tetradymia canescens DC.; gray horsebrush; perennial low shrub; common to very common; widespread, lava & sed; BC & MT south to CA & NM

Thelesperma megapotamicum (Spreng.) Kuntze; greenthread, Hopi tea; perennial herb; uncommon; widespread, lava & sed; Great Plains to UT, AZ, TX, MX, & to South America

Townsendia exscapa (Richards.) Porter; Easter daisy; acaulescent perennial; fairly common; sed & deep soil lava; BC to Manitoba south to NV, TX, & MX; probably more than common than indicated since it blooms early

+ **T. incana** Nutt.; perennial herb; rare; collected only at SABL; WY to NV, UT, AZ, & NM

* **Tragopogon dubius** Scop.; goat's beard, western salsify; biennial or short-lived perennial; very common; widespread, lava & sed; throughout NA; from Europe

* + **T. pratensis** L.; meadow salsify; biennial or short-lived perennial; rare; collected at ELCA & MEBL; widespread but infrequent in NA; from Europe

Verbesina encelioides (Cav.) Benth. & Hook. ssp. **encelioides**; golden crownbeard; annual herb; rare; collected only at SABL; MT to CA & TX

V. e. ssp. **exauriculata** Robins.; golden crownbeard; often weedy, annual herb; rare; collected only at PRWE; MT to CA & TX

Viguiera multiflora (Nutt.) Blake var. **nevadensis** (A. Nels.) Blake; showy goldeneye; perennial herb; uncommon; widespread, lava & sed; WY to CO, NM, & AZ

+ **Xanthium strumarium** L. var. **canadense** (Mill.) T. & G.; cocklebur; annual, weedy herb; rare; collected only in wash near NM-117 in Los Pilares area; widespread in NA; seedlings are poisonous to livestock & produce dermatitus in some people

+ **Zinnia grandiflora** Nutt.; Rocky Mountain zinnia; perennial herb; uncommon; sed only, mostly east side; swGreat Plains to TX, AZ, & nMX

BERBERIDACEAE (BER)

+ **Berberis fendleri** Gray; Fendler barberry; shrub; rare; collected only on Bandera Crater; CO & NM

+ **M. haematocarpa** (Woot.) Fedde (*Berberis haematocarpa* Woot.); red barberry; shrub; rare; collected only at TW53; AZ to wTX & MX

Mahonia repens (Lindl.) G. Don (*Berberis repens* Lindl.); Oregon grape, creeping mahonia; low, spreading shrub; fairly common to common; widespread on lava & sed; throughout wUS

BORAGINACEAE (BOR)

Cryptantha cinerea (Greene) Cronq. (*C. jamesii* (Torr.) Payson; James hiddenflower; perennial herb; very common; widespread on lava & sed; throughout wUS; nomenclature recently corrected

C. crassisepala (T. & G.) Greene; plains cryptanth; annual herb; uncommon; sed only; KS & TX to UT, AZ, & nMX

C. fendleri (Gray) Greene; Fendler hiddenflower; annual herb; rare; collected only NOSR; wGreat Plains & throughout wUS

Lappula redowskii (Hornem.) Greene; stickseed; annual, weedy herb; common; widespread on lava & sed; throughout NA, east of Cascades

Lithospermum cobrense Greene; mountain gromwell (groomwell) or puccoon; perennial herb; rare; collected only at CO42; TX to AZ & s into nMX

L. incisum Lehm.; narrowleaf gromwell or puccoon, showy stoneseed; perennial herb; uncommon; at higher locations on sed, cinders, or deep soil lava; Great Plains & Rocky Mountains, from sCN to nMX

L. multiflorum Torr. ex Gray; manyflower gromwell or puccoon, pretty stoneseed; perennial herb; uncommon; mostly higher locations on lava & sed; CO to TX, AZ, & nMX

BRASSICACEAE (BRA) (CRUCIFERAE)

(Arabis note: This genus is very common & widespread in cracks on lava, but the three taxa were not often distinguished in the field or collected. Thus, the abundances & distributions indicated below is not complete or entirely accurate. Some Arabis showed infection by Puccinia [see Roy 1993])

Arabis fendleri (S. Wats.) Greene var. **fendleri**; Fendler rockcress; perennial herb; fairly common; widespread on lava only; CO to NV & south to AZ, TX & nMX; relatively inconspicuous early-bloomer

+ **A. f.** var. **spatifolia** (Rydb.) Rollins; Fendler rockcress; perennial herb; fairly common; widespread on lava only; sWY to NM & eUT

A. perennans S. Wats.; common rockcress; perennial herb; uncommon, lava only; CO & NM to NV, CA, & Baja California

Descurainia obtusa (Greene) O.E. Schulz ssp. **obtusa**; desert tansy-mustard; rare; collected only at DOSI & BATC; swCO to AZ & NM

+ **D. o.** ssp. **brevisiliqua** Detling; desert tansy-mustard; uncommon; at higher elevations in western part, lava only; swCO to AZ & NM

D. pinnata (Walt.) Britt. var. **halictorum** (Cockerell) Detling; pinnate tansy-mustard; uncommon; in cinders & deep soil lava; throughout US, sCN, & nMX

D. richardsonii (Sweet) O.E. Schulz ssp. **incisa** (Engelm.) Detling; Richardson tansy-mustard; biennial; uncommon; lava; Yukon to nMX

Dimorphocarpa wislizenii (Engelm.) Rollins (*Dithyrea wislizenii* Engelm.); spectaclepod; annual or biennial herb; uncommon, but may be fairly common at a location; sed only, on east side; NV & UT to KS & south to nMX

Draba cuneifolia Nutt. ex T. & G.; wedgeleaf draba or whitlow grass; annual herb; rare; lava or cinders; widespread in NA

Erysimum capitatum (Dougl.) Greene; plains or western wallflower, prairie rocket; biennial or perennial herb; fairly common; mostly sed but also deep soil lava; widespread in c & w US

Lepidium densiflorum Schrad.; prairie pepperweed or peppergrass, densecress; annual herb; uncommon; mostly sed but also lava; throughout US

+ **L. ramosissimum** A. Nels.; bushy peppergrass; annual herb; rare; only from CADU; Manitoba to Alberta, s to ND & NM

Lesquerella rectipes W. & S.; Colorado bladderpod; perennial herb; fairly common; sed & sed kipukas; AZ, CO, NM

+ **Pennellia micrantha** (Gray) Nieuwl. (*Thelypodium micrantha* (Gray) S. Wats.); biennial or perennial herb; uncommon; widespread on lava & sed; CO to AZ, NM, wTX, & nMX

Rorippa microtites (Robins.) Rollins; yellowcress; annual herb; rare; collected only at CAPO; AZ & NM to Chihuahua

R. sinuata (Nutt.) A.S. Hitchc.; spreading yellowcress; perennial herb; rare; collected only near Los Cerros Ranch & at OFSW; widespread in wUS

* **Sisymbrium altissimum** L.; tumble-mustard; anuual weed; uncommon; mostly higher areas, roadsides; US, CN, & Europe; from Europe

Thelypodiopsis linearifolia (Gray) Al-Shehbaz (*Sisymbrium linearifolium* (A. Gray) Payson; *Schenocrambe linearifolia* (A. Gray) Rollins); perennial herb; common to very common; widespread, all substrates; UT to CO & TX, south to MX

Thelypodium wrightii Gray; Wright telypody; biennial herb; uncommon; scattered on lava & sed; CO to AZ, TX & nMX

Thlaspi montanum L. var. **fendleri** (Gray) P. Holmgren (*Thlaspi alpestre* L.); pennycress; perennial herb; uncommon, but probably commoner because of small stature & early blooming; mostly in higher parts of monument in sed or deeper soils; WA to MT, s to CA & TX, also Eurasia

CACTACEAE (CAC)

Coryphantha vivipara var. **arizonica** (Engelm.) W.T. Marshall; pincushion cactus; ball-like with 1-few stems; common; sed & deep soil lava; NV to CO, south to AZ & NM

Echinocereus fendleri (Engelm.) Engelm. ex Rumpl.; Fendler hedgehog cactus; 1(-few) cylinders; fairly common; sed & deep soil lava; UT & CO to Az & TX

E. triglochidiatus Engelm. var. **melanacanthus** (Engelm.) L. Benson (*E. coccineus* (Engelm.) Engelm.); claret cup cactus; short cylinders in small clusters to large mounds; very common; almost

exclusively on lava, often on bare basalt, sometimes in huge mounds on cinders (eg. Lost Woman); sNV & wCO to AZ, TX, & nMX

E. t. var. **triglochidiatus**; claret cup cactus; 1-few stems with few spines; rare, found only at SABL; NM, swCO, ne AZ

+ **Mammillaria heyderi** Muhlenpfordt var. **meiacantha** (Engelm.) L. Benson (*M. meiacantha* Engelm.); rare; seen only at NOSR & NPSS; wTX, NM, & seAZ

+ **M. wrightii** Engelm. var. **wrightii**; Wright fishhook or pincushion cactus; solitary, small, ball-like stems with hooked central spines; uncommon; found at NOSR, NPSS, on alluvium at ZATH, & 53UP; this taxon found only in NM & is listed as Endangered in the state

Opuntia imbricata (Haw.) DC. (*O. arborescens* Engelm.); walkingstick cholla, tree cholla, coyonostle; fairly common; commoner in n & ne part of monument, lava & sed; sCO to seAZ, cTX & nMX

O. macrorhiza Engelm.; plains prickly pear; fairly common; lower elevations of the s & e, lava & sed; sID to sWI south to AZ, TX & nMX

O. phaeacantha Engelm.; brownspine prickly pear; fairly common; mostly lower elevations, lava & sed; sUT,CO, & KS to sCA, cTX, & nMX

O. polyacantha Haw.; plains prickly pear; very common, the most frequently encountered cactus in the monument area; widespread on lava & sed; widespread in wUs: sCN south to s & eCA & wTX

CAPPARACEAE (CAP)

Cleome serrulata Pursh; Rocky Mountain bee plant, bee spiderflower; annual herb; uncommon; mostly disturbed areas on the west side; WA to MN south to AZ & TX; a white-flowered morph was found at Cerrito de Jaspe

CARYOPHYLLACEAE (CAR)

Arenaria fendleri Gray var. **fendleri**; Fendler sandwort; perennial herb; rare; found only at MTKI, may be commoner due to its inconspicuous grasslike habit; WY & UT south to AZ & TX

+ **A. lanuginosa** (Michx.) Rohrb. ssp. **saxosa** (Gray) Maguire (*S. saxosa* var. *mearnsii* (W. & S.) K. & P.); spreading sandwort; perennial herb; uncommon; lava & sed, mostly at higher elevations in the monument; sUS to CO & NM then south to MX & SA

Silene laciniata Cav.; Mexican campion or catchfly; perennial herb; uncommon; sed & ciners (BACR); CA to TX & south into MX

Silene scouleri (Eastw.) C.L. Hitchc. & Maguire ssp. **scouleri**; Scouler catchfly; perennial herb; rare; found only in sed in North Pasture area (NOPA & NOSR); BC to MT, south to CA & NM

CHENOPODIACEAE (CHE)

Atriplex canescens (Pursh) Nutt.; fourwing saltbush; shrub; uncommon; sed at lower elevations in the ne part of monument area; ND to eOR south TX, AZ, & MX

Ceratoides lanata (Pursh) J.T. Howell (*Eurotia lanata* (Pursh) Moq.); winter fat, white sage; uncommon; scattered on sed; ND to eWA south to KS, NM, & sCA

+ **Chenopodium capitatum** (L.) Asch.; strawberry blite or spinach; annual herb; rare; found only at CADU; US & Eurasia

+ **C. dessicatum** A. Nels.; desert or thickleaf goosefoot; annual herb; uncommon; scattered mostly on sed; wUS

C. fremontii S. Wats.; Fremont goosefoot; annual herb; uncommon; sed & cinders; US but more common in swUS

C. graveolens Willd.; ragleaf goosefoot; annual herb; uncommon; mostly higher elevations, lava & cinders; sCO to wTX & AZ & south to Central America

C. leptophyllum (Moq.) Nutt. ex S. Wats.; narrowleaf goosefoot or lambsquarters; annual herb; uncommon; scattered lava & sed; w & swUS

* **Kochia scoparia** (L.) Schrad.; fireweed, summer or mock cypress; annual weed; uncommon; mostly higher elevations, sed; cosmopolitan, Asia & Europe; from Europe

+ **Monolepis nuttalliana** (Roemer & Schultes) Greene; Nuttall povertyweed; annual herb; rare; collected only near Mechenbier (Los Cerros) Ranch; BC to Manitoba & south CA, TX, MX & elsewhere

* **Salsola iberica** Sannen & Pau (*S. kali* L.; *S. pestifer* A. Nels., *S. tragus* L.); Russian thistle, tumbleweed; annual weed; uncommon; mostly sed & disturbed ground; w & cNA; from Eurasia

* + **S. paulsenii** Litv.; barbwire Russian thistle; annual weed; rare; collected only along southern NM-117; swUS & Eurasia; from Eurasia

+ **Suckleya suckleyana** (Torr.) Rydb.; poison suckleya; annual, succulent herb; rare; collected at NPPO & PRWE; MT to CO, TX, NM

COMMELINACEAE (CMM)

Commelina dianthifolia Delile var. **longispatha** (Torr.) Brashier; birdbill dayflower; perennial herb; uncommon; widespread, sed only; TX to AZ

C. erecta L. var. **angustifolia** (Michx.) Fern.; hierba del pollo, narrowleaf dayflower; rare; collected only at HIDD & SABL; most of US except Pacific coast states

Tradescantia occidentalis (Britt.) Smyth var. **scopulorum** (Rose) Anderson & Woods.; prairie spiderwort; perennial herb; rare; only found at SABL & LOME; ND to MT, south to AZ & TX

CONVOLVULACEAE (CON)

* **Convolvulus arvensis** L.; field bindweed; perennial weedy vine; uncommon, sed & roadsides, often abundant when encountered; temperate US & Europe; from Eurasia

+ **C. equitans** Benth.; gray bindweed; perennial vine; rare; collected only along NM-53 roadside; CO & KS s to TX, AZ, & MX

+ **Cuscuta umbellata** H.B.K.; dodder, lovevine; annual, parasitic vining herb; rare; collected only at NOPA; sUS, West Indies, MX, & nSouth America; the hosts were Portulaca sp. & Chenopodium graveolens

+ **Ipomoea costellata** Torr.; annual trailing herb; rare; collected only at HOYA; wTX to AZ

I. cristulata Hallier f. (*I. coccinea* L.); annual vining herb; rare; found only at SABL; TX & AZ south into MX

+ **I. plummerae** Gray; perennial vining herb; uncommon; mostly in nw part, sed only; AZ, NM, & nMX

CYPERACEAE (CYP)

+ **Bulbostylis capillaris** (L.) C.B. Clarke; hairsedge; tiny, annual, grasslike herb; rare; collected only on McCartys near SABL; all US except nw part

+ **Carex filifolia** Nutt.; threadleaf sedge; perennial, grasslike herb; rare; found only at ZAKI; Yukon to MN, TX & CA

C. geophila Mackenz.; perennial, grasslike herb; rare; collected only at HAFE; CO to NM, AZ, & MX

C. occidentalis Bailey; western sedge; perennial, grasslike herb; uncommon; scattered, mostly older lavas & north, but some sed; WY, CO, UT to CA, AZ, NM

+ **Cyperus aristatus** Rottb.; bearded flatsedge; annual, grasslike herbs; rare; collected at BLTT & HOYA; almost cosomopolitan

C. fendlerianus Boeckl. var. **fendlerianus**; tuber-root flatsedge; perennial, grasslike herb; uncommon; scattered, sed or cinders; highlands of swUS & MX

+ **Eleocharis acicularis** (L.) R.& S.; perennial, grasslike herb; rare; collected only at CAPO; circumboreal, s to FL & MX

E. macrostychya Britton; spikerush; perennial herb; rare; collected only at CAPO & NPPO; wUS

+ **Scirpus americanus** Pers. (*S. olneyi* Gray); perennial, aquatic herb; rare; collected only at Gallo Spring; sCN & US

+ **S. pungens** Vahl; common threesquare; perennial, aquatic herb; rare; found only at Gallo Spring; US & sCN

ERICACEAE (ERI)

Pterospora andromedea Nutt.; pinedrops; perennial, parasitic herb; rare; collected only at BACR & CO42; w 3/4 US into MX

EUPHORBIACEAE (EUP)

+ **Acalypha neomexicana** Muell.-Arg.; New Mexico copperleaf or three-seeded mercury; annual herb; rare, found only at NSHO & HOYA, but probably more common due to its obscure stature & late blooiming; NM, AZ, nMX

Chamaesyce fendleri (T. & G.) Small var. **fendleri** (*Euphorbia fendleri* T. & G.); Fendler spruge or euphorbia; perennial herb; uncommon, scattered on sed & deeper-soil lava; KS to WY, south to UT, NM, TX

C. fendleri T.& G. var. **chaetocalyx** Boiss.(*Chamaesyce chaetocalyx* (Boiss.) Woot. & Standl.); spurge; perennial herb; rare; sed only at SABL & ZAKI; TX to CA

+ **C. revoluta** (Engelm.) Small (*Euphorbia revoluta* Engelm.); threadstem euphorbia; annual herb; rare, only from BACR; CO to AZ south to MX

C. serpyllifolia (Pers.) Small (*Euphorbia serpyllifolia* Pers.); thymeleaf spurge; annual herb; uncommon, widespread, sed & lava; wUS & nMX

+ **Euphorbia bilobata** Engelm.; blackseed euphorbia; annual herb; rare, only from BACR; AZ to TX

E. lurida Engelm.; shorthorned spurge; perennial herb; fairly common, widespread, lava & sed; CO, UT, NM, AZ, TX, & Chihuahua

+ **Tragia ramosa** Torr.; catnip noseburn; perennial herb with stinging hairs; fairly common, scattered, lava & sed; sc & swUS & nMX

FABACEAE (FAB) (LEGUMINOSAE)

Astragalus brandegei Porter; Brandegee milkvetch or locoweed; perennial herb; rare, from OARD only; CO, NM, AZ, UT

A. calycosus Torr. ex Wats. var. **scaposus** (Gray) Jones; Torrey milkvetch; perennial herb; rare, collected MEBL & ZAKI; GB & CP

+ **A. ceramicus** Sheldon var. **ceramicus**; painted milkvetch; perennial herb; rare, only from SABL, but fairly common in season; mostly CP of NM, AZ, CO, UT

A. egglestonii (Rydb.) K. & P.; Eggleston milkvetch; perennial herb; uncommon, lava & sed in higher part of monument; wcNM & adjacent AZ

A. humistratus Gray var. **humistratus**; groundcover milkvetch; perennial herb; uncommon, mostly on deeper soils of old basalt; swCO, NM, seAZ, wTX, nMX

A. h. var. **humivagans** (Rydb.) Barneby; groundcover milkvetch; perennial herb; rare, only from OARD; wcNM, AZ, swUT, sNV

A. mollissimus Torr. var. **matthewsii** (S. Wats.) Barneby; woolly locoweed; perennial herb; uncommon, scattered, lava & sed; wc & nwNM

A. praelongus Sheldon var. **praelongus**; stinking milkvetch, straight-stem locoweed; perennial herb; rare, collected along NM-117 roadside; southern CP

+ **A. wootonii** Sheldon var. **wootonii**; Wooton milkvetch; winter annual or biennial; rare, only from ELCF; AZ, NM, wTX, nMX

Calliandra humilis Benth.; dwarf calliandra; perennial herb; rare, only from BLTT & NPSS; AZ, NM, TX & south into MX

Dalea candida (Michx.) Willd. var. **oligophylla** (Torr.) Shinners (*Petalostemum candidum* (Willd.) Michx.); white prairie-clover; perennial herb; rare, nw part of monument area, lava & sed; sCN thru wUS into n MX

+ **D. compacta** Spreng. (*P. compactum* (Spreng.) Swezey); plains prairie-clover; rare, from HOYA & SABL only; WY & NB to NM & TX

+ **D. exigua** Barneby (*P. exile* Gray); annual herb; rare, only from OARD; sNM, sAZ, nMX

+ **D. leporina** (Ait.) Bullock; annual herb; rare, collected only at HOYA; AZ & NM to Central America

Lotus wrightii (Gray) Greene; Wright deervetch or trefoil; perennial herb; very common, widespread, lava, sed, & cinders (may be very abundant at certain sites); CO, AZ, NM

Lupinus argenteus Pursh var. **argenteus**; silvery lupine; perennial herb; rare, collected only at SEMC and nearby roadside; most of wUS

L. kingii S. Wats. var. **kingii**; King lupine; annual herb; very common, one commonest, most widespread plants in the monument, lava & sed; NV, AZ, NM, CO

* **Medicago lupulina** L.; black medic, hopclover, nonesuch; annual weed; rare, collected only at IRIS & nearby roadside; most temperate areas of world; from Eurasia

* **Melilotus alba** Medic.; white sweet clover; annual or biennial weed; rare, from 53UP (NM-53 roadside) only; most of NA, Eurasia; from Eurasia

* **M. officinalis** (L.) Pallas; yellow sweet clover; annual or biennial weed; rare, from 53UP & CO42 only; most of NA, Eurasia; from Eurasia

Phaseolus angustissimus Gray var. **latus** M.E. Jones; slimleaf bean; perennial, trailing herb; uncommon, nw part of monument, on lava & cinders; TX, NM, AZ, Chihuahua

Psoralea lanceolata Pursh; lemon scurfpea; perennial herb; rare, found only at NOPA; sCN & wUS

+ **P. tenuiflora** Pursh var. **bigelovii** (Rydb.) Macbr.; wild alfalfa, scurfpea; perennial herb; uncommon, west side, lava & cinders; IL to MT, AZ & TX

Sophora nuttalliana B.L. Turner (*S. sericea* Nutt.); white loco, silky sophora; perennial herb; uncommon, west side, sed; SD to AZ, NM, TX

Thermopsis rhombifolia (Pursh) Richardson var. **montana** (Nutt.) Isely (*T. pinetorum* Greene); golden or yellow pea; perennial herb; uncommon, higher areas of monument, lava & sed; wUS, mostly west of continental divide, except Pacific states

Vicia americana Muhl. ex Willd. ssp. **minor** (Hook.) C.R. Gunn; American vetch; perennial herb; fairly common, higher areas, sed only; BC to Manitoba south to MN, NM, AZ, eNV

FAGACEAE (FAG)

Quercus gambelii Nutt.; Gambel oak; clonal, deciduous shrub; common, west side only, lava & sed; WY & CO thru NV & TX & south to MX

Q. grisea Liebm.; gray oak; deciduous shrub; uncommon, scattered on west side, lava & sed; wTX, NM, AZ, Chihuahua

Q. X pauciloba Rydb. (*Q. undulata* Torr.) (gambelii X grisea); wavyleaf oak; clonal, deciduous shrub; uncommon, scattered, lava & sed; CO to wTX, AZ, NV, & nMX

FUMARIACEAE (FUM)

Corydalis aurea Willd.; goldensmoke, golden corydalis, scrambled eggs; winter annual (to biennial or perennial); uncommon, west side, lava & sed; throughout NA

GENTIANACEAE (GEN)

Frasera speciosa Dougl. ex Griseb. (*Swertia radiata* (Kellogg) Kuntze); elkweed; tall perennial herb; uncommon, in MARC-IRIS area only, lava; wUS & MX

GERANIACEAE (GER)

* **Erodium cicutarium** (L.) L'Her.; filaria, stork's-bill; weedy, winter annual; uncommon (but probably commoner due to inconspicuous habit and early blooming), widespread, sed & cinders; c &wUs, MX; from Europe

Geranium caespitosum James; tufted or small-leaf geranium; fairly common, nw part of monument on lava, cinders, & sed; CO, NM, AZ, TX

G. lentum W. & S.; perennial herb; very common, throughout monument, on lava only; TX to AZ south into MX

GROSSULARIACEAE (GRO)

(Ribes sometimes in placed in Saxifragaceae)
Ribes cereum Dougl. (includes R. inebrians); wax or squaw currant; unarmed shrub; very common, ubiquitous, one of the most commonly encountered plants in the monument, on all substrates; throughout wUS & sCN; the two species are sometimes considered to be distinct, but our plants range from both extremes through everything in between

R. inerme Rydb.; whitestem or wine gooseberry; prickly shrub; rare, found only near bottom of MARC; BC to MT south to CA & NM

HYDROPHYLLACEAE (HPH)

+ **Nama dichotomum** (Ruiz & Pavon) Choisy; erect nama; annual herb; rare, found only at OARD & MEBL (sed); CO south to AZ & TX, into MX & South America

Phacelia alba Rydb. (*P. neomexicana* var. *alba*); annual herb; rare, found (in the monument area) on disturbed ground at PRWE & CADU; WY & UT south to AZ & NM

+ **P. serrata** J. Voss; cinders phacelia; annual herb; rare, found only on cinders in the BACR area; this species was formerly found only in the San Francisco volcanic field area of northern Arizona in similar habitats; it has recently been listed as a federal candidate species (C2)

IRIDACEAE (IRI)

Iris missouriensis Nutt.; Missouri iris; perennial herb; rare, found only at ALBA & IRIS in sed; throughout wUS

Sisyrinchium demissum Greene; blue-eyed grass; perennial herb; rare, found only at MEBL; NV & UT, south to AZ, NM, TX and into MX

LAMIACEAE (LAM) (LABIATAE)

Agastache pallidiflora (Heller) Rydb. ssp. **pallidiflora** var. **gilensis** R. Sanders X var. **greenei** (Briquet) R. Sanders (*A. p.* ssp. *neomexicana* (Briq.) Lint & Epling); perennial herb; fairly common, scattered, lava; wNM

Hedeoma drummondii Benth.; Drummond false pennyroyal; perennial herb; rare, collected at HIDD & MEBL only; wND to MT south to sTX & swCA & into MX

+ **H. nanum** (Torr.) Briq.; low mock pennyroyal; annual or perennial herb; rare, BRAI & MCCA, lava only; sUT & sNV to AZ, TX & into cMX

* **Marrubium vulgare** L.; horehound; weedy perennial herb; fairly common, w & nw parts of ELMA, lava or sed; most NA, from Europe

Monarda pectinata Nutt.; plains beebalm, pink horesemint; annual herb; rare, only at CO42 & OLBA; SD to sUT to AZ, NM & cTX

M. punctata L. var. **lasiodonta** Gray; dotted beebalm, spotted horsemint; annual herb; uncommon, found only on eastside seds; swKS to cTX & NM

Salvia reflexa Hornem.; Rocky Mountain or lanceleaf sage; weedy perennial herb; rare, collected only at CO42; WI to MT south to AZ, TX & MX

S. subincisa Benth.; sawtooth sage; annual herb; rare, HOYA, LOME & SABL; wTX to AZ & nMX

+ **Stachys rothrockii** Gray; betony, hedgenettle; perennial herb; rare, deep soil lava on west side at OLBA & PRWE only; NM & AZ

LILIACEAE (LIL)

Allium cernuum Roth; nodding onion; perennial herb; fairly common, nw part of monument, mostly sed, but also cinders (BACR) & OLBA; much of US & into MX

Anthericum torreyi Baker; Torrey amberlily or craiglily; perennial herb; uncommon, w side of monument, lava & sed; TX to AZ & nMX

LINACEAE (LIN)

Linum aristatum Engelm.; awned flax; annual herb; fairly common, mostly w side (but also SABL), lava & sed; sUT, swCO, neAZ & NM

L. lewisii Pursh (*L. perenne* L. ssp. *lewisii* (Pursh) Hulten); Lewis flax, prairie flax, blue flax; perennial herb; fairly common, west side, lava & sed; wNA

+ **L. neomexicanum** Greene; New Mexico flax; annual herb; fairly common, west side, lava & sed; NM, AZ & nMX

LOASACEAE (LOA)

Mentzelia albicaulis (Dougl. ex Hook.) T. & G.; annual herb; rare, collected only at CEEN; BC to Baja CA west to wNB & wTX

M. multiflora (Nutt.) Gray (*M. rusbyi* Wooton); desert mentzelia; perennial herb; rare, collected at CADU; CA to WY s to TX & MX

+ **M. pumila** (Nutt.) T. & G.; biennial or short-lived perennial; rare, collected at BACR & CEBA; WY thru UT to seCA & NM into MX

LORANTHACEAE (LOR)

(Note: The following taxa are not as rare as the accounts would indicate, they were mostly overlooked; these genera are sometimes considered to be members of the Viscaceae)

Arceuthobium vaginatum (Willd.) Presl ssp. **cryptopodum** (Engelm.) Hawksworth & Wiens; southwestern dwarf-mistletoe; perennial parasites on tree/shrub branches (on ponderosa mostly in ELMA); rare, collected at FOUR; CO & UT s to AZ & TX & into MX

Phoradendron juniperinum Engelm. ex Gray; juniper mistletoe; perennial parasites on juniper; uncommon, widespread; OR s to CA, NV, UT, NM, AZ, wTX, & MX

MALVACEAE (MAL)

Spheralcea coccinea (Nutt.) Rydb.; scarlet globemallow, red false mallow, common globemallow; perennial herb; uncommon, mostly on deeper soils on older flows, west & north; sCN s to AZ, NM, & TX

S. digitata (Greene) Rydb. ssp. **digitata**; juniper globemallow; perennial herb; very common, the most commonly seen globemallow, sed & lava; UT s to AZ, TX, nMX

S. fendleri Gray; thicket globemallow; perennial herb; uncommon but widespread, lava & sed; KS to CO s to AZ, TX, & nMX

NYCTAGINACEAE (NYC)

+ **Abronia elliptica** A. Nels.; fragrant sand verbena; perennial herb; rare, NOSR only; WY s to nwNM & cNV; this species is very similar to the following & may not be distinct

A. fragrans Nutt. ex Hook.; sweet or fragrant sand verbena, snowball; perennial herb; uncommon, east side seds; most of wUS to nMX except Pacific coast states

Mirabilis diffusa (Heller) C.F.Reed; four-o'clock; perennial herb; uncommon, nw part, lava & sed; ND to KS & TX, west to WY, AZ & NM

M. glabra (S. Wats.) Standl. (*Oxybaphus glaver* Wats.); smooth four-o'clock; perennial herb; rare, collected at SABL; KS to UT, NM, TX & MX

M. linearis (Pursh) Heimerl (*Oxybaphus linearis* (Pursh) B.L. Robins.); perennial herb; uncommon, scattered on west side, sed or deep soil lava; MN & MT thru MO to TX, NM, & AZ & into MX

M. multiflora (Torr.) Gray; Colorado or large four-o'-clock; perennial herb; fairly common, mostly sed on e side, but also on west side on old basalt; CO & sUT s thru sCA, AZ, NM, wTX to nMX

OLEACEAE (OLE)

Forestiera neomexicana Gray; New Mexico olive; shrub; very common, one of the most commonly-encountered plants in the area, mostly on lava, but also sed; CA & UT to AZ, NM, sTX, s to MX

Fraxinus cuspidata Torr.; fragrant or flowering ash; shrub to small tree with showy, fragrant flowers; uncommon, on both sides of the "neck" & upper part of NM-117 on lava & sed; AZ to wTX

Menodora scabra (Engelm.) Gray var. **scabra**; rough menodora; perennial herb; uncommon, sed on east side & El Calderon area; sCO & UT s to NM, TX & nMX

ONAGRACEAE (ONA)

Gaura coccinea Pursh; scarlet gaura, willowherb gaura, smooth gaura; fairly common, widespread, on sed or deep soil lava; sCN & wUS to sMX

G. hexandra Ortega ssp. **gracilis** (W. & S.) Raven & Gregory; annual herb; uncommon, higher elevations on sed, sed kipukas, deep-soil lava; AZ to wTX & nMX

G. parvifolia Dougl.; annual herb; rare, MD53 only; seWA to IN s to AZ, TX & nMX

Gayophytum ramosissimum Nutt. ex T. & G.; slender annual herb; uncommon, deep soils on older lava, north & west; WA & MT s to AZ & NM

Oenothera albicaulis Pursh; whitestem, pale, or prairie evening-primrose; annual herb; fairly common, mostly west side on deep soil lava, but also SABL ; MT to ND s to AZ, TX, & nMX

O. caespitosa Nutt. var. **marginata** (Nutt.) Munz; tufted or gumbo evening-primrose, morning-lily, gumbo lily; perennial herb; fairly common, sed, cinders or deep soil lava, north & west; WA to WY, s to CA, TX, MX

O. coronopifolia T. & G.; combleaf evening primrose; perennial herb; rare, CO42 & NOSR (sed); ID to SD s to AZ & NM

O. laciniata Hill; cutleaf, downy, or sinuate-leaf evening primrose; annual herb; rare, CO42 only; c & eUS

OROBANCHACEAE (ORO)

Orbanche ludoviciana Nutt. ssp. **multiflora** (Nutt.) Collins (*O. multiflora* Nutt.); Louisiana broomrape; parasitic, perennial herb; uncommon, sed; WA & WY s to CA, TX, & MX

+ **O. uniflora** L.; one-flower cancer-root, naked broomrape; parasitic, perennial herb; uncommon, widespread, lava & sed; most of NA

OXALIDACEAE (OXA)

* + **Oxalis corniculata** L.; creeping woodsorrel, agrito, jocoyote; perennial herb; rare, from IRIS & rim of El Calderon only; widespread in US; from Europe

PLANTAGINACEAE (PLA)

Plantago argyrea Morris; silvery plantain; annual herb; uncommon, scattered, mostly sed but some lava, & SABL; AZ & NM

P. patagonica Jacq. (*P. purshii* Roemer & Schultes); bristle-bract plantain; annual herb; common, widespread, lava & sed; wUS

POACEAE (POA)

Agrostis scabra Willd.; rough bentgrass, ticklegrass, zacate de piedras escabro; perennial; rare, widespread, lava; all NA

Andropogon gerardii Vitman var. **gerardii**; big bluestem; perennial; uncommon, widespread, lava & sed; US w of Rockies, nMX

+ **A. g.** var. **paucipilus** (Nash) Fern. (*A. hallii* Hack.); sand bluestem, tallo azul arenoso; rare, collected at NOPA only; ND & MT s to IA, TX, & AZ

Aristida arizonica Vasey; Arizona threeawn; perennial; fairly common widespread, sometimes abundant (eg. OARD, NOSR), sed & deep soil lava; swUS, TX, MX

+ **A. havardii** Vasey (*A. barbata* Fourn.); Havard threeawn, tres aristas barbado; perennial; rare, collected only at ZATH; seCO to TX & AZ to cMX

A. purpurea Nutt. var. **fendleriana** (Steud.) Vasey (*A. fendleriana* Steud.); Fendler threeawn; perennial; uncommon, widespread, sed & deep soil lava; ND to MT s to NV, sCA, Baja, & nMX

A. p. var. **longiseta** (Steud.) Vasey (*A. longiseta* Steud.); red threeawn; rare, east side on sed; wUS

+ **A. p.** var. **purpurea**; purple threeawn, tres aristras morado; perennial; common, sed or deep soil lava; UT, CO & KS s to from AZ to TX & s into nMX

Blepharoneuron tricholepis (Torr.) Nash; pine or hairy dropseed, pastillo del pinar; perennial; common, widespread, sometimes abundant, sed & mostly deep soil lava; UT, CO, AZ, NM, TX, & MX

+ **Bothriochloa laguroides** (DC.) Herter ssp. **torreyana** (Steud.) Allred & Gould (*Andropogon saccharoides* of numerous authors; *Bothriochloa saccharoides* (Sw.) Rydb.); silver bluestem, poptillo plateado; perennial; rare, collected only at 53MD; CO & MO to AL, TX, NM, AZ, & CA, into MX

Bouteloua curtipendula (Michx.) Torr.; sideoats grama; perennial; fairly common, widespread, lava & sed; scCN, US, MX, South America

B. gracilis (Willd. ex H.B.K.) Lag. ex Steud.; blue grama; perennial; very common, widespread, lava & sed; swCN, sw & cUS to MX; the mostly commonly encountered grass, often very abundant

B. hirsuta Lag.; hairy grama; perennial; uncommon, sed on east side; WY to WI s to swUS & LA, MX

+ **B. simplex** Lag.; mat grama; annual; rare, collected only at OARD; WY & CO s to UT, AZ, NM, TX, & MX, Argentina

Bromus anomalus Rupr. ex Fourn.; nodding brome, bromo dormilon; perennial; rare, collected at BACR & FOUR; swCN, wUS, MX

B. lanatipes (Shear) Rydb. (*B. anomalus* var. *lanatipes* (Shear) A.S. Hitchc.); perennial; uncommon, west side, lava & sed; CO, NM

* **B. tectorum** L.; cheatgrass, downy brome; annual; uncommon, northwest part of area, often near roads, lava, sed, cinders; US, South America, circumboreal; from Eurasia

Chloris verticillata Nutt.; tumble-windmill grass; perennial; rare, collected only at ZATH; IN to LA & w to swUS

+ **Echinochloa muricata** (Beauv.) Fern. var. **microstachya** Wiegan; cockspur; annual; rare, collected only at CAPO & NPPO; widespread in NA

+ **Elymus canadensis** L.; Canada wildrye, centeno silvestre de canada; perennial; rare, collected only NM-117; widespread in NA

E. longifolius (J.G. Smith) Gould (*Sitanion hystrix* J.G.Smith in part); longleaf squirreltail, triguillo desertico; perennial; very common, widespread, lava & sed; sw & scCN, w & cUS, MX; this species was recently placed in this genus

E. smithii (Rydb.) Gould (*Agropyron smithii* Rydb.); western wheatgrass; perennial; uncommon, widespread, sed; AK s to sCN, c & wUS

E. trachycaulus (Link) Shinners (*A. trachycaulum* (Link) Malte); slender wheatgrass; perennial; uncommon; widespread, lava & sed; NA

+ **E. trachycaulus** X **smithii** ?; perennial; rare, collected only at ZATH; this plant is apparently a hybrid between these two taxa

* + **Eragrostis curvula** (Schrader) Nees; weeping lovegrass; perennial; rare, collected only at ZATH; s & swUS, South America, from South Africa

* + **E. lehmanniana** Nees; Lehmann lovegrass; perennial; rare, collected only at SABL; UT, OK, NM, TX, AZ, & Sonora, MX, from South Africa

+ **E. pectinacea** (Michx.) Nees; Carolina lovegrass; annual; rare, collected only at OARD; sCN, US, MX, central America

Festuca arizonica Vasey; Arizona fescue, canuela borreguera; perennial; uncommon, sed & cinders; NV to CO, s to AZ & TX

Hordeum jubatum L.; foxtail barley; perennial; rare, southern part on sed or old lava; NA except se states, Siberia

Koeleria macrantha (Ledeb.) Schultes (*K. cristata* (L.) Pers.; *K. pyramidata* (Lam.) Beauv.); junegrass; perennial; fairly common, west side, lava & sed; circumboreal into MX & Eurasia

+ **Lycurus setosus** (Nutt.) Reeder; wolftail, zacate lobero; perennial; fairly common, widespread, deep-soil lava & sed; CO & UT, s to AZ, TX, & MX; closely related to Lycurus phleoides H.B.K.

+ **Muhlenbergia brevis** C.O. Goodding; short muhly; annual; uncommon, east side, sed & lava; CO, AZ, NM, TX, MX

M. dubia Fourn.; pine muhly; perennial; rare, collected only at SABL; TX & NM to cMX

M. fragilis Swallen; delicate muhly; annual; uncommon, scattered on lava & sed; AZ & TX to sMX

M. minutissima (Steud.) Swallen; least or sixweeks muhly; annual; common, widespread on lava; wUS into MX

M. montana (Nutt.) A.S. Hitchc.; mountain muhly; perennial; very common, widespread except in highest, northwest part, lava & sed; wUS to sMX

M. pauciflora Buckl.; New Mexico muhly; perennial; uncommon, northern part; CO & UT to TX & nMX & Baja

M. pungens Thurb.; pungent or sandhill muhly; perennial; rare, collected only at SABL; wUS except Pacific coast states

+ **M. repens** (Presl) A.S. Hitchc.; creeping or red muhly; perennial; rare, widespread, sed only; AZ to TX to sMX

+ **M. torreyi** (Knuth) A.S. Hitchc. ex Bush; ring muhly or ring-grass; perennial; fairly common, widespread, lava & sed; WY & KS to AZ & TX

M. wrightii Vasey; spike muhly; perennial; rare, collected only at MEBL; CO, AZ, NM, MX

Munroa squarrosa (Nutt.) Torr.; false buffalograss; perennial; uncommon, widespread, lava & sed; swCN, wUS (except Pacific coast states) to nMX

Oryzopsis hymenoides (Roem. & Schultes) Ricker; Indian ricegrass; perennial; uncommon, widespread, lava & sed; sw &scCN to nMX

O. micrantha (Trin. & Rupr.) Thurb.; littleseed ricegrass; perennial; common, widespread, mostly on lava; sCN & wUS

Panicum bulbosum H.B.K.; bulb panicum; perennial; rare, collected only at HIDD; AZ to TX to sMX

P. capillare L. var. **brevifolium** Rydb. & Shear; witchgrass; weedy annual; rare, grazed areas east & south; sCN, US, & MX

+ **P. hirticaule** Presl; Mexican or roughstalk witchgrass, panizo cauchin; annual; rare, widespread, lava & sed; TX to CA s to Argentina

Phragmites australis (Cav.) Trin. ex Steud.; common reed; perennial aquatic; rare, only at Gallo Spring; nearly cosmopolitan

Pleuraphis jamesii Torr. (*Hilaria jamesii* (Torr.) Benth.); galleta; perennial; uncommon, widespread, lava & sed; WY & UT to CA & TX

+ **Poa bigelovii** Vasey & Scribner; Bigelow bluegrass; annual; uncommon; widespread on lava & deep soil; CO & OK to sCA, TX & MX

P. fendleriana (Steud.) Vasey; muttongrass, mutton or Fendler bluegrass; perennial; fairly common, widespread, lava & sed; sCN, wUS to wTX & AZ

+ **Schedonnardus paniculatus** (Nutt.) Trel.; tumblegrass; perennial; widespread except highest, northwest part, sed & deep soil lava; scCN into MX, South America

Schizachyrium scoparium (Michx.) Nash var. **scoparium** (*Andropogon scoparius* Michx.); little bluestem; perennial; common, widespread, mostly sed but some lava; BC to Nova Scotia thru wUS & Great Plains to AZ & TX

* **Setaria viridis** (L.) Beauv.; green foxtail; annual; rare, collected only at NOPA & 53UP; circumboreal, sCN, US, MX, South America; from Eurasia

+ **Sporobolus contractus** A.S.Hitchc.; spike dropseed; perennial; rare, sed in east & north parts; CO to TX & CA, s into MX

S. cryptandrus (Torr.) Gray; sand dropseed; perennial; rare, east side, sed only; BC to Quebec thru US (except se) into MX

Stipa comata Trin. & Rupr.; needle-and-thread; perennial; uncommon, widespread, mostly sed & cinder; AK to Ontario s thru wUS & Great Plains to AZ & TX

S. neomexicana (Thurb.) Scribn.; New Mexico feathergrass, barba blanca, flechilla neomexicana; perennial; rare, collected only at ZAKI; WY s to AZ & TX, into MX

S. scribneri Vasey; Scribner needlegrass; perennial; rare, collected only at SABL; NM, AZ, & CO

Vulpia octoflora (Walt.) Rydb. (*Festuca octoflora* Walt.); sixweeks fescue; annual; uncommon, widespread, mostly sed; BC to Quebec thru US & into MX

POLEMONIACEAE (POL)

+ **Gilia pinnatifida** Nutt.; annual or biennial to short-lived perennial herb; rare, BAWA & BACR only; UT & WY e to NB & s to NM

G. sinuata Dougl. ex Benth.; annual herb; uncommon, northern & northwestern part, sed & cinder; wUS & nMX

Ipomopsis aggregata (Pursh) V. Grant ssp. **formosissima** (Greene) Wherry (*Gilia aggregata* (Pursh) Spreng.); scarlet ipomopsis, skyrocket; perennial herb; fairly common, higher parts of area, lava, sed, & cinders; BC to WY, CA, wTX, & nMX

I. longiflora (Torr.) V. Grant; whiteflower ipomopsis; annual to biennial herb; uncommon, east side, sed or deep soil lava only; UT to NB s to AZ & TX

I. multiflora (Nutt.) V. Grant; perennial herb; uncommon, east & south, sed only or deep soil lava; NM, AZ, & sNV

Microsteris gracilis (Hook.) Greene; small, annual herb; uncommon, w. side, sed & deep soil lava; BC, wUS, MX, & S.Amer.

POLYGALACEAE (PGL)

+ **Monnina wrightii** Gray; annual herb; rare, collected only at HOYA; AZ, NM & into nwMX; apparently near northern edge of its distribution in the monument

Polygala alba Nutt.; white milkwort; perennial herb; rare, collected only at ZAKI; WA to MN s to AZ & TX, MX

POLYGONACEAE (PGN)

Eriogonum alatum Torr.;winged wild buckwheat; perennial herb; fairly common, widespread, lava & sed; WY to NB, to AZ & TX, & into MX

E. annuum Nutt.; annual wild buckwheat; annual herb; uncommon, east side, sed only; wUS into MX

E. cernuum Nutt.; nodding wild buckwheat; annual herb; rare, collected near se end of McCartys flow only; wUS

E. jamesii Benth. var. **jamesii**; James wild buckwheat; perennial herb; very common, the commonest wild buckwheat in the monument area; widespread, lava & sed; WY to KS s into MX

E. racemosum Nutt.; redroot wild buckwheat; perennial herb; fairly common, widespread, lava & sed; NV, CO, AZ, NM

Polygonum aviculare L.; knotweed, chivalry-grass, dishwater-grass; weedy annual herb; uncommon, higher areas, sed; almost cosmopolitan

+ **P. erectum** L.; erect knotweed; rare, only collected at NPPO; US & sCN

+ **P. ramosissimum** Michx.; bushy knotweed; annual herb; rare collected only along CO-42; US & sCN

* **Rumex crispus** L.; curly dock; perennial herb; rare, collected only along upper NM-53; throughout NA; from Eurasia

R. triangulivalvis (Danser) Rech. f.; dock; perennial herb; uncommon, widespread, lava & sed; sCN & US, except se states

PORTULACACEAE (POR)

+ **Portulaca oleracea** L.; common purslane, pusley, mother-of-millions; weedy, fleshy, annual herb; rare, collected only at SABL & NPPO; cosmopolitan

+ **P. parvula** Gray; weedy, fleshy, annual herb; rare, collected only at SABL; OK & TX s to seAZ & nMX

+ **Talinum confertiflorum** Greene; small, perennial herb; very common, widespread, lava & sed; c & wNM

+ **T. pulchellum** W. & S.; perennial, fleshy herb; rare, found only at MEBL & HIDD; wTX & NM

PRIMULACEAE (PRI)

Androsace septentrionalis L. var. **glandulosa** (W. & S.) St. John; northern or glandular rock jasmine; annual herb; fairly common, west & northwest part of area, lava & sed; circumboreal, NA

RANUNCULACEAE (RAN)

Clematis ligusticifolia Nutt.; western or white clematis or virgin's bower; semiwoody vine; uncommon, northern & northwestern areas of monument, lava & sed; BC to ND s to CA & NM

Delphinium nuttallianum Pritz. ex Walp. var. **nuttallianum** (*D. nelsoni* Greene); Nelson or blue larkspur; perennial herb; rare, collected only at CO42; swCN & wUS

D. virescens Nutt. subsp. **wootonii** (Rydb.) Ewan; prairie, plains, or white larkspur; perennial herb; rare, collected only at SABL; OK to TX, NM, AZ, & CO

+ **Myosurus cupulatus** S. Wats.; horseshoe mousetail; tiny annual herb; rare, collected only at BSLC; seCA, UT, AZ, CO, & NM

M. minimus L.; tiny mousetail; tiny annual herb; rare, collected only at CAPO & PRWE; much of NA, circumboreal; extremely common in the spring in the mud at temporary pond edges

Thalictrum fendleri Engelm. ex Gray; Fendler meadowrue; dioecious pernnial herb; uncommon, widespread, sed or cinders; OR to WY s to CA thru TX & into MX

RHAMNACEAE (RHA)

Ceanothus fendleri Gray; Fendler mountain-lilac, deerbrier, or buckbrush; small shrub; rare, seen only at OARD & CO42/CEBA area; WY to SD s to AZ, NM, & TX

ROSACEAE (ROS)

Cercocarpus montanus Raf. var. **montanus**; alderleaf mountain mahogany; shrub; rare, collected only at SABL; OR to WY & s to MX

Fallugia paradoxa (D. Don) Endl.; Apache plume; shrub; very common, one of the commonest plants in the monument area; widespread, lava, sed, & cinders; CO & UT to CA, s to AZ, NM, TX, & nMX

Holodiscus dumosus (Nutt.) Heller; mountain spray, rock spirea; shrub; very common, but not as common as Fallugia; widespread, lava, rare elsewhere; OR to WY, s to CA, NV, AZ, & NM

+ **Potentilla crinita** Gray; hairtuft cinquefoil; perennial herb; rare, scattered on west side, deep soil lava; NV, UT, CO, AZ, NM

P. hippiana Lehm.var. **diffusa** Lehm.; Hipp or woolly cinquefoil; perennial herb; uncommon, west side, mostly sed; BC & wUS

P. pensylvanica L.; cinquefoil; perennial herb; fairly common, west side, lava & sed; wNA from AK into MX

+ **P. subviscosa** Greene; cinquefoil; perennial herb; uncommon, northwest area, mostly sed, some lava; AZ & NM

Prunus virginiana L. var. **melanocarpa** (A. Nels.) Sarg.; chokecherry; shrub to small tree; uncommon, northwestern part, lava, sed, cinders; wNA; this plant is often seen at edges of flows where reproductive individuals may be remarkably stunted

Rosa sp.; rose; rare, found only on north side of upper BACR; no flowers or fruit collected; may be R. woodsii Lindl. var. woodsii (*R. fendleri* Crepin) that was collected by Riffle (1973)

Rubus strigosus Michx. var. **arizonicus** (Greene) K. & P.; red raspberry; shrub; fairly common, west half, lava & sed; CO, NM, & AZ

R. s. var. **strigosus**; red raspberry; shrub; rare, collected only at HOYK; NA except seUS

RUBIACEAE (RUB)

Houstonia wrightii Gray (*Hedyotis pygmaea* Roem. & Schult.); bluets; perennial herb; fairly common, west & north areas, lava & sed; AZ & NM to swTX & to cMX

SALICACEAE (SAL)

+ **Populus deltoides** Bartram ex Marshall ssp. **wislizenii** (S. Wats.) Eckenwelder (*Populus fremontii* S. Wats. var. *wislizenii* (Torr.) S. Wats.); Rio Grande cottonwood; tree; rare, collected at Gallo Spring (also found near Grants & along Rio San Jose); NM, swCO, eUT, neAZ

P. tremuloides Michx.; quaking aspen; tree; common, northwest part, lava, cinders & rare sed; NA; usually seen growing at edges of flows

+ **Salix drummondiana** Barratt ex Hook. (*S. subcoerulea* (Piper) Ball); Drummond willow; small tree; rare, collected only from one small collapse in the Twin Craters Flow; BC & Alberta to CA & NM; incomplete specimen, so identification may be incorrect

SCOPHULARIACEAE (SCR)

Castilleja integra Gray; wholeleaf (Indian) paintbrush; perennial herb; very common, widespread, lava & sed; seCO to wTX, NM, AZ, & nMX

Cordylanthus wrightii Gray in Emory; Wright's clubflower or birdbeak; annual herb; rare, collected only near NM-117 in sed; wTX, NM, AZ, UT, CO

+ **Mimulus floribundus** Dougl.; delicate, annual herb; rare, collected only at BSLC; wUS

Orthocarpus purpureo-albus Gray; owl clover; annual herb; fairly common, widespread, but mostly north & west, lava & sed; seUT, CO, NM, AZ; sometimes in large stands

+ **Penstemon ambiguus** Torr. var. **laevissimus** (Keck) N. Holmgren; bush or gilia penstemon; perennial herb; rare, east side at SABL & LOME; NV, UT, CO, KS, & OK, s from AZ to TX & into MX

P. barbatus (Cav.) Roth ssp. **torreyi** (Benth.) Keck; scarlet or beardlip penstemon; perennial herb; common, west & north, lava, sed, & cinders; cRocky Mts. & MX

+ **P. linarioides** Gray ssp. **coloradoensis** (A. Nels.) Keck; perennial herb; uncommon, northwestern part, sed only; swCO & nwNM

P. ophianthus Pennell (*P. jamesii* Benth. ssp. *ophianthus* (Pennel) Keck; perennial herb; rare, collected only on OLBA near Los Cerros Ranch; CO, AZ, NM

P. virgatus Gray; perennial herb; rare, collected only at CO42; NM & AZ

Schistophragma intermedia (Gray) Pennell; small annual herb; rare, collected only at HAFE; NM, sAZ, & nMX; probably more common than indicated due to its inconspicuous stature

* **Verbascum thaspus** L.; woolly mullein; robust, weed biennial herb; very common, widespread, lava, sed, & cinders; scattered in temperate NA, Europe; introduced from Europe

Veronica peregrina L.; speedwell; annual herb; uncommon, sed & deep soil lava, west & north areas; many areas of temperate NA & Eurasia

SOLANACEAE (SOL)

+ **Chamaesaracha coronopus** (Donal) Gray; green false nightshade; perennial herb; rare, collected only at SABL; UT to KS, s from AZ to TX & into MX

Lycium pallidum Miers; pale wolfberry; spiny shrub; uncommon, east & northeastern parts, sed only; UT & CO, s to AZ thru TX

Physalis hederifolia Gray var. **cordifolia** (Gray) Waterfall; prairie or ivyleaf ground cherry; perennial herb; uncommon, SABL, CEBA, OLBA (sed & cinders); swUS, OK, TX, & CA

+ **Solanum elaeagnifolium** Cav.; silverleaf nightshade; prickly, weedy, perennial herb; rare, along NM-53; sc & swUS & adventive elsewhere

S. jamesii Torr.; wild potato; perennial herb; rare, collected only at SABL; UT to NB, s from AZ to TX, & cMX

S. triflorum Nutt.; cutleaf nightshade; weedy, annual herb; uncommon, scattered, sed or deep soil lava; nc & wUS

TAMARICACEAE (TAM)

* **Tamarix chinensis** Lour. (*T. pentandra* Pall.); salt cedar, tamarisk; shrub or small tree; rare, collected near Grants, where it may be abundant along the Rio San Jose; widespread in CN & US; from Eurasia

TYPHACEAE (TYP)

+ **Typha latifolia** L.; broadleaf cattail; perennial, aquatic herb; rare, collected only at Gallo Spring; NA, MX, Eurasia, Africa

ULMACEAE (ULM)

Celtis reticulata Torr.; netleaf hackberry; small tree; rare, collected only on east side of the "neck"; wUS into MX

* **Ulmus pumila** L.; Siberian elm; weedy tree; rare, collected only at Gallo Spring (also near San Rafael & along NM-53); scattered in c & swUS; from Asia

VERBENACEAE (VER)

Glandularia wrightii (Gray) Umber (*Verbena wrightii* Gray); Wright or desert vervain or verbena; annual herb; very common, widespread, lava & sed; CO, wTX, & AZ; although one of the most common plants in the monument area, it appeared to decline in numbers from 1991 to 1993

+ **Phyla cuneifolia** (Torr.) Greene (*Lippia cuneifolia* (Torr.) Steud.); wedgeleaf frogfruit or fogfruit; prostrate, weedy, perennial herb; rare, collected only at PRWE, where it is abundant; WY to SD, s from AZ to TX, & MX

Verbena bracteata Lag. & Rodr.; prostrate vervain; weedy annual or perennial herb; uncommon, moslty sed & deep soil lava; NA & MX

V. macdougalii Heller; New Mexico vervain; tall, perennial herb; rare, collected only at MARC; WY, UT, CO, AZ, NM, wTX

VITACEAE (VIT)

Parthenocissus inserta (Kerner) Fritsch (*P. vitacea* (Knerr) A.S. Hitchc.); thicket creeper, woodbine; woody vine; uncommon, widespread, lava & cinders; MT to Quebec, s to WY, UT, AZ, &TX

Vitis arizonica Engelm.; canyon grape; woody vine; fairly common, northern & western parts, mostly lava; NV, UT, CO, AZ, NM, TX, MX

ZYGOPHYLLACEAE (ZYG)

* **Tribulus terrestris** L.; puncture vine, goathead, caltrop; prostrate, annual, weedy herb; rare, seen only along CO42; US; from Asia

VEGETATION AND WILDLIFE INVENTORY

OF EL MALPAIS NATIONAL MONUMENT

Final Report

Appendix 9

CRYPTOGRAM SPECIES LISTINGS FOR EL MALPAIS NATIONAL MONUMENT AND SOURCE OF RECORDS INFORMATION

APPENDIX 7A.

LIST OF CRYPTOGAM SPECIES AT EL MALPAIS NATIONAL MONUMENT.

LICHENS

GENUS, SPECIES, AUTHORITY

Acarospora badiofusca (Nyl.) Th.Fries
Acarospora chlorophana (Ach.) Massal.
Acarospora fuscata (Nyl.) Arnold
Acarospora schleicheri (Ach.) Massal.
Acarospora smaragdula (Wahlenb. in Ach.) Massal.
Aspicilia alphoplaca (Ach.) Poelt & Leuckert
Aspicilia caesiocinerea (Nyl. ex Malbr.) Arnold
Aspicilia cinera (L.) Korber Mereschk.
Aspicilia desertorum (Krempelh.)
Aspicilia quartzitica Weber
Bryoria fuscenscens (Gyelnik) Brodo & D.Hawksw.
Buellia novomexicana B. de Lesd.
Buellia punctata (Hoffm.) Massal.
Buellia retrovertens Tuck.
Buellia spuria (Schaerer) Anzi
Caloplaca cerina (Ehrh.ex Hedwig) Th.Fr.
Caloplaca citrina (Hoffm.) Th.Fr.
Caloplaca epithallina Lynge
Caloplaca flavorubescens (Huds.) Laundon
Caloplaca flavovirescens (Wolfen) Dalla Torre & Sarnth.
Caloplaca modesta (Zahlbr.) Fink
Caloplaca sp.aff. *lamprocheila* (DC.) Flagey
Caloplaca variabilis (Pers.) Mull. Arg.
Caloplaca vitellinula (Nyl.) H.Oliver
Candelariella aurella (Hoffm.) Zahlbr.
Candelariella rosulans (Mull. Arg.) Zahlbr.
Candelariella spraguei (Tuck.) Zahlbr.
Candelina submexicana (B. de Lesd.) Poelt
Catapyrenium lachneum (Ach.) R.Sant.
Cetraria coralligera (Weber) Hale
Cladonia cariosa (Ach.) Spreng.
Cladonia chlorophaea (Florke ex. Sommerf.) Sprengel.
Cladonia pyxidata (L.) Hoffm.
Collema polycarpon Hoffm.
Collema texanum Tuck.
Collema thamnodes Riddle
Dermatocarpon miniatum (L.) Mann.
Dermatocarpon moulinsii (Mont.) Zahlbr.
Dimelaena oreina (Ach.) Norman
Diploschistes actinostomus (Pers.) Zahlbr.
Diploschistes scruposus (Schreber) Norman
Flavoparmelia baltimorensis (Gyelnik & Foriss) Hale
Flavoparmelia caperata (L.) Hale

Flavopunctelia flaventior (Stirt.) Hale
Flavopunctelia praesignis (Nyl.) Hale
Flavopunctelia soredica (Nyl.) Hale
Glaucomaria rupicola (L.) Choisy
Heppia lutosa (Ach.) Nyl.
Heterodermia obscurata (Nyl.) Trevisan
Heterodermia pseudospeciosa (Kurok.) Culb
Imshaugia placorodia (Ach.) S.F.Meyer
Lasallia papulosa (Ach.) Llano.
Lasallia pennsylvanica (Hoffm.) Llano.
Lecanora agropholis (Ach.) Ach.
Lecanora caesiorubella Ach.
Lecanora cenisea Ach.
Lecanora dispersa (Pers.) Sommerf.
Lecanora garovaglii (Koerb.) Zahlbr.
Lecanora meridionalis Magnusson
Lecanora nashii Ryan ined.
Lecanora novomexicana (B. de Lesd.) Zahlbr.
Lecidea atrobrunnea (Raymond in Lam. & DC.) Schaerer
Lecidea elabens E. Fries
Lecidea tesselata Floerke.
Lecidella carpathica Korber
Lecidella euphorea (Florke) Hertel
Lecidella stigmatea (Ach.) Hertel & Leuck
Lepraria incana (L.) Ach.
Leproloma membranacea (Dick.) Vain
Leptogium denticulatum Tuck.
Leptogium furfuraceum (Harm.) Sierk
Leptogium gelatinosum (With.) Laundon
Leptogium papillosum (B. de Lesd.) Dodge
Melanelia elegantula (Zahlb.) Essl.
Melanelia subargentifera (Nyl.) Essl.
Melanelia subolivacea (Nyl. in Hasse) Essl.
Melanelia substygia (Rasanen) Essl.
Neofuscelia ahtii (Essl.) Essl.
Neofuscelia occidentalis (Essl.) Essl.
Neofuscelia subhosseana (Essl.) Essl.
Normandina pulchella (Borrer) Nyl.
Ochrolechia subisidiata Brodo unpubl.
Pachyospora mutabilis (Ach.) Massal.
Pannaria leucophaea (M.Vahl.) Jorg.
Pannaria praetermissa Nyl.
Pannaria tavaresii P. Jorg.
Parmelia fraudans (Nyl.) Nyl.
Parmelia sulcata Taylor
Parmotrema reticulatum (Taylor) M.Choisy
Peccania arizonica (Tuck.) Herre
Peltigera rufescens (Weiss.) Humb.
Pertusaria saximontana Wetm.
Pertusaria sp. nov.
Phaeophyscia cernohorskyi (Nadv.) Essl.
Phaeophyscia ciliata (Hoffm.) Moberg

Phaeophyscia hispidula (Ach.) Essl.
Physcia aipolia (Ehrh ex Humb.) Furnr.
Physcia biziana (Massal.) Zahlbr.
Physcia caesia (Hoff.) Furnr.
Physcia callosa Nyl.
Physcia dubia (Hoffm.) Lett.
Physcia mexicana B. de Lesd.
Physcia phaea (Tuck.) Thomson
Physcia stellaris (L.) Nyl.
Physciella melanchra (Hue) Essl.
Physconia detersa (Nyl.) Poelt
Physconia grisea (Lam.) Poelt
Physconia muscigena (Ach.) Poelt
Placynthium nigrum (Huds.) Gray
Protoparmeliopsis muralis (Schreber) Choisy
Psora crenata (Taylor) Reinke
Psora decipeins (Hedwig) Hoffm.
Psora icterica (Mont.) Mull. Arg.
Psora tuckermanii R.Anderson ex Timdal
Psorula rufonigra (Tuck.) G.Schneider
Punctelia hypoleucites (Nyl.) Krog
Punctelia rudecta (Ach.) Krog
Punctelia semansiana (Culb. & C.Culb.) Krog
Punctelia stricta (Durby) Krog
Ramalina obtusata (Arnold) Bitter
Ramalina pollinaria (Westr.) Ach.
Rhizocarpon disporum (Naeg. ex Hepp) Mull. Arg.
Rhizocarpon geminatum Korber
Rhizocarpon geographicum (L.) DC.
Rhizoplaca chrysoleuca (Sm.) Zopf
Rhizoplaca melanophthalma (DC. in Lam. & DC.) Leuck & Poelt
Rinodina castanomela (Nyl.) Arnold
Spilonema revertens Nyl.
Staurothele areolata (Ach.) Lettau
Staurothele fuscocuprea (Nyl.) Zsch.
Staurothele drummondii (Tuck.) Tuck.
Staurothele elenkinii Oxner
Toninia tristes (Th.Fr.) Th.Fr.
Tuckermannopsis fendleri (Nyl.) Hale
Tuckermannopsis pinastri (Scopoli) Hale
Umbilicaria vellea (L.) Ach.
Usnea subfloridana Stirton
Verrucaria calciseda DC.
Xanthoparmelia chlorochroa (Tuck) Hale
Xanthoparmelia conspersa (Ehrh. ex Ach.) Hale
Xanthoparmelia cumberlandia (Gyelnik) Hale
Xanthoparmelia hypopsila (Mull. Arg.) Hale
Xanthoparmelia lineola (Berry) Hale
Xanthoparmelia mexicana (Gyelnik) Hale
Xanthoparmelia novomexicana (Gyelnik) Hale
Xanthoparmelia plittii (Gyelnik ex D.Dietr.) Hale
Xanthoparmelia taractica (Kremkpelh.) Hale

Xanthoparmelia wyomingica (Gyelnik) Hale
Xanthoria elegans (Link) Th.Fr.
Xanthoria fallax (Hepp in Arnold) Arnold
Xanthoria polycarpa (Hoffm.) Reiber

MOSSES

GENUS, SPECIES, AUTHORITY

Bryum argenteum Hedw.
Bryum pseudotriquetrum (Hedw.) Gaertn.
Ceratodon purpureus (Hedw.) Bird.
Grimmia pulvinata (Hedw.) J.E.Sm.
Grimmia affinis Hornsch.
Hypnum cupressiforme Hedw.
Neckera pennata Hedw.
Orthodicranum rhabdocarpum (Sull.) Holz.
Orthotrichum pellucidum Lindb.
Pohlia cruda (Hedw.) Lindb.
Polytrichum juniperinum Willd. es Hedw.
Rhytidium rugosum (Hedw.) Kindb.
Selaginella densa Rydb.
Timmia austriaca Hedw.
Timmia megapolitana (Hedw.)
Tortula ruralis (Hedw.) GMS

APPENDIX 9B.

LIST OF CRYPTOGAM SPECIES AT EL MALPAIS NATIONAL MONUMENT.

Source refers to study from which record originated and who identified the taxa.

Source Codes:

DL: UNM inventory, determined by David Lightfoot
DL/WW: UNM inventory, determined by William Weber
ED: DeBruin (1988)

GENUS	SPECIES	SOURCE
Acarospora	*badiofusca*	DL/WW
Acarospora	*chlorophana*	DL,ED
Acarospora	*fuscata*	DL/WW
Acarospora	*schleicheri*	DL
Acarospora	*smaragdula*	DL/WW,ED
Aspicilia	*alphoplaca*	DL/WW,ED
Aspicilia	*caesiocinerea*	DL/WW,ED
Aspicilia	cf. *cinera*	ED
Aspicilia	*desertorum*	DL/WW
Aspicilia	*quartzitica*	DL/WW
Bryoria	*fuscenscens*	DL/WW
Buellia	*novomexicana*	DL/WW,ED
Buellia	*punctata*	DL/WW
Buellia	*retrovertens*	ED
Buellia	*spuria*	DL/WW
Caloplaca	*cerina*	DL/WW
Caloplaca	*citrina*	DL/WW
Caloplaca	*epithallina*	DL/WW
Caloplaca	*flavorubescens*	DL/WW
Caloplaca	*flavovirescens*	DL/WW
Caloplaca	*modesta*	DL/WW
Caloplaca	sp.aff. *lamprocheila*	DL/WW
Caloplaca	*variabilis*	DL/WW
Caloplaca	*vitellinula*	DL/WW
Candelariella	*aurella*	DL/WW
Candelariella	*rosulans*	DL/WW
Candelariella	*spraguei*	DL/WW,ED
Candelina	*submexicana*	DL/WW
Catapyrenium	*lachneum*	ED
Cetraria	*coralligera*	DL/WW,ED
Cladonia	*cariosa*	DL,ED
Cladonia	*chlorophaea*	DL,ED
Cladonia	*pyxidata*	DL,ED
Collema	*polycarpon*	ED
Collema	*texanum*	DL/WW
Collema	*thamnodes*	ED
Dermatocarpon	*miniatum*	DL/WW,ED

Dermatocarpon	*moulinsii*	DL/WW,ED
Dimelaena	*oreina*	DL/WW,ED
Diploschistes	*actinostomus*	DL/WW
Diploschistes	*scruposus*	DL,ED
Flavoparmelia	*baltimorensis*	DL/WW,ED
Flavoparmelia	*caperata*	DL/WW
Flavopunctelia	*flaventior*	DL/WW,ED
Flavopunctelia	*praesignis*	DL/WW
Flavopunctelia	*soredica*	DL/WW,ED
Glaucomaria	*rupicola*	DL/WW
Heppia	*lutosa*	DL,ED
Heterodermia	*obscurata*	ED
Heterodermia	*pseudospeciosa*	DL/WW
Imshaugia	*placorodia*	DL/WW
Lasallia	*papulosa*	DL,ED
Lasallia	*pennsylvanica*	DL,ED
Lecanora	*agropholis*	DL/WW,ED
Lecanora	*caesiorubella*	DL/WW,ED
Lecanora	*cenisea*	DL/WW
Lecanora	*dispersa*	DL/WW
Lecanora	*garovaglii*	ED
Lecanora	*meridionalis*	DL/WW
Lecanora	*nashii*	ED
Lecanora	*novomexicana*	DL/WW,ED
Lecidea	*atrobrunnea*	DL/WW
Lecidea	*elabens*	DL/WW
Lecidea	*tesselata*	DL/WW,ED
Lecidella	*carpathica*	DL/WW
Lecidella	*euphorea*	DL/WW
Lecidella	*stigmatea*	DL/WW
Lepraria	cf. *incana*	ED
Leproloma	*membranacea*	DL/WW
Leptogium	*denticulatum*	ED
Leptogium	*furfuraceum*	ED
Leptogium	*gelatinosum*	DL/WW
Leptogium	*papillosum*	DL/WW
Melanelia	*elegantula*	DL/WW
Melanelia	*subargentifera*	DL/WW
Melanelia	*subolivacea*	DL/WW,ED
Melanelia	*substygia*	DL/WW,ED
Neofuscelia	*ahtii*	ED
Neofuscelia	*occidentalis*	ED
Neofuscelia	*subhosseana*	DL/WW
Normandina	*pulchella*	DL/WW
Ochrolechia	*subisidiata*	DL/WW
Pachyospora	*mutabilis*	DL/WW
Pannaria	*leucophaea*	DL/WW
Pannaria	*praetermissa*	DL/WW
Pannaria	*tavaresii*	DL/WW
Parmelia	*fraudans*	DL/WW
Parmelia	*sulcata*	DL/WW,ED
Parmotrema	*reticulatum*	ED

Peccania	*arizonica*	DL/WW
Peltigera	*rufescens*	ED
Pertusaria	*saximontana*	DL/WW
Pertusaria	sp. *nov.*	DL/WW
Phaeophyscia	*cernohorskyi*	DL/WW
Phaeophyscia	*ciliata*	DL/WW
Phaeophyscia	*hispidula*	DL/WW,ED
Physcia	*aipolia*	DL/WW
Physcia	*biziana*	DL/WW
Physcia	*caesia*	DL/WW,ED
Physcia	*callosa*	DL/WW
Physcia	*dubia*	ED
Physcia	*mexicana*	ED
Physcia	*phaea*	DL/WW
Physcia	*stellaris*	DL/WW
Physciella	*melanchra*	DL/WW
Physconia	*detersa*	ED
Physconia	*grisea*	DL/WW
Physconia	*muscigena*	ED
Placynthium	*nigrum*	DL/WW
Protoparmeliopsis	*muralis*	DL/WW
Psora	*crenata*	DL,ED
Psora	*decipeins*	DL,ED
Psora	*icterica*	DL,ED
Psora	*tuckermanii*	DL/WW
Psorula	*rufonigra*	DL/WW
Punctelia	*hypoleucites*	DL/WW
Punctelia	*rudecta*	ED
Punctelia	*semansiana*	ED
Punctelia	*stricta*	ED
Ramalina	*obtusata*	DL/WW
Ramalina	*pollinaria*	DL,ED
Rhizocarpon	*disporum*	ED
Rhizocarpon	*geminatum*	DL/WW
Rhizocarpon	*geographicum*	DL
Rhizoplaca	*chrysoleuca*	DL/WW,ED
Rhizoplaca	*melanophthalma*	DL/WW
Rinodina	*castanomela*	DL/WW
Spilonema	*revertens*	DL/WW
Staurothele	*areolata*	DL/WW
Staurothele	cf. *fuscocuprea*	ED
Staurothele	*drummondii*	DL/WW
Staurothele	*elenkinii*	DL/WW
Toninia	*tristes*	ED
Tuckermannopsis	*fendleri*	DL/WW
Tuckermannopsis	*pinastri*	DL
Umbilicaria	*vellea*	ED
Usnea	*subfloridana*	DL,ED
Verrucaria	*calciseda*	DL/WW
Xanthoparmelia	*chlorochroa*	DL,ED
Xanthoparmelia	*conspersa*	DL,ED
Xanthoparmelia	*cumberlandia*	DL,ED

Xanthoparmelia	*hypopsila*	ED
Xanthoparmelia	*lineola*	DL,ED
Xanthoparmelia	*mexicana*	DL,ED
Xanthoparmelia	*novomexicana*	DL,ED
Xanthoparmelia	*plittii*	DL,ED
Xanthoparmelia	*taractica*	DL,ED
Xanthoparmelia	*wyomingica*	DL
Xanthoria	*elegans*	DL,ED
Xanthoria	*fallax*	DL,ED
Xanthoria	*polycarpa*	DL,ED

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Appendix 10

INTRODUCED VASCULAR PLANT SPECIES OF EL MALPAIS NATIONAL MONUMENT

APPENDIX 10.

INTRODUCED VASCULAR PLANT SPECIES, EL MALPAIS NATIONAL MONUMENT.

Alphabetical by family and species, with area of origin.

SPECIES	FAMILY	GEOGRAPHIC ORIGIN
Amaranthus albus	(AMA)	tropical America
A. blitoides	(AMA)	tropical America
A. retroflexus	(AMA)	Central America
Centaurea repens	(AST)	Eurasia
Cirsium vulgare	(AST)	Europe
Lactuca serriola	(AST)	Europe
Sonchus asper	(AST)	Eurasia
Tragopogon dubius	(AST)	Europe
T. pratensis	(AST)	Europe
Sisymbrium altissimum	(BRA)	Europe
Salsola iberica	(CHE)	Eurasia
S. paulsenii	(CHE)	Eurasia
Convolvulus arvensis	(CON)	Eurasia
Medicago lupulina	(FAB)	Eurasia
Melilotus alba	(FAB)	Eurasia
M. officinalis	(FAB)	Eurasia
Erodium cicutarum	(GER)	Europe
Marrubium vulgare	(LAM)	Europe
Oxalis corniculata	(OXA)	Europe
Bromus tectorum	(POA)	Eurasia
Eragrostis curvula	(POA)	South Africa (purposeful)
E. lehmanniana	(POA)	South Africa (purposeful)
Setaria viridis	(POA)	Eurasia
Rumex crispus	(PGN)	Eurasia
Verbascum thaspus	(SCR)	Europe
Tamarix chinensis	(TAM)	Eurasia
Ulmus pumila	(ULM)	Asia
Tribulus terrestris	(ZYG)	Asia

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Appendix 11

VASCULAR PLANT TAXA NEWLY IDENTIFIED AT EL MALPAIS NATIONAL MONUMENT

APPENDIX 11.

VASCULAR PLANT TAXA NEWLY IDENTIFIED FROM EL MALPAIS NATIONAL MONUMENT AREA

FAMILY/SPECIES

AIZOACEAE
Mollugo cerviana (L.) Ser.

AMARANTHACEAE
Amaranthus retroflexus S. Wats.

APIACEAE
Cymopterus fendleri A. Gray

APOCYNACEAE
Apocynum sp.

ASTERACEAE
Ambrosia artemisiifolia L.
Brickellia chlorolepis (Woot. & Standl.) Shinners (*Kuhnia chlorolepis* Woot. & Standl.)
Centauria repens L.
Chrysothamnus depressus Nutt.
C. parryi (A. Gray) Greene ssp. **attenuata** (M.E. Jones) Hall & Clements
Cirsium ochrocentrum (Gray) Gray
C. vulgare (Savi) Tenore
Helianthella quinquenervis (Hook.) A. Gray
Helianthus annuus L.
H. ciliaris DC.
Heterosperma pinnatum Cav.
Hymenoxys bigelovii (Gray) Parker
Sanvitalia abertii Gray
Solidago sparsiflora A. Gray
Sonchus asper (L.) Hill
Stephanomeria pauciflora (Torr.) Nutt. var. **pauciflora** (*S. neomexicana* (Greene) Cory)
S. tenuifolia (Torr.) Hall
Tagetes micrantha Cav.
Townsendia incana Nutt.
Tragopogon pratensis L.
Xanthium strumarium L. var. **canadense** (Mill.) T. & G.
Zinnia grandiflora Nutt.

BERBERIDACEAE
Berberis fendleri A. Gray
Mahonia haematocarpa (Woot.) Fedde (*Berberis haematocarpa* Woot.)

BRASSICACEAE
Arabis fendleri (S. Wats.) Greene var. **spatifolia** (Rydb.) Rollins

Descurania obtusa (Greene) O.E. Schulz ssp. **brevisiliqua** Detling
Lepidium ramosissimum A. Nels.
Pennellia micrantha (A. Gray) Nieuwl. (*Thelypodium micranthum* (A. Gray) S. Wats.)

CACTACEAE
Mammillaria heyderi Muhlenpfordt var. **meiacantha** (Engelm.) L.Benson (*M. meiacantha* Engelm.)
Mammillaria wrightii Engelm. var. **wrightii**

CARYOPHYLLACEAE
Arenaria lanuginosa (Michx.) Rhrb. ssp. **saxosa** (A. Gray) Maguire (*S. saxosa* var. *mearnsii* (Woot. & Standl.) Kearny & Peebles)

CHENOPODIACEAE
Chenopodium capitatum (L.) Asch.
C. dessicatum A. Nels.
Monolepis nuttalliana (Roemer & Schultes) Greene
Salsola paulsenii Litv.
Suckleya suckleynana (Torr.) Rydb.

CONVOLVULACEAE
Convolvulus equitans Benth.
Cuscuta umbellata H.B.K.
Ipomoea costellata Torr.
I. plummerae A. Gray

CYPERACEAE
Bulbostylis capillaris (L.) C.B. Clarke
Carex filifolia Nutt.
Cyperus aristatus Rottb.
Eleocharis acicularis (L.) R.& S.
Scirpus americanus Pers. (*S. olneyi* Gray)
S. pungens Vahl

EUPHORBIACEAE
Acalypha neomexicana Muell.-Arg.
Chamaesyce revoluta (Engelm.) Small
Euphorbia bilobata Engelm.
Tragia ramosa Torr.

FABACEAE
Astragalus ceramicus Sheldon var. **ceramicus**
A. wootonii Sheldon var. **wootonii**
Dalea compacta Spreng. (*Petalostemum compactum* (Spreng.) Swezey)
D. exigua Barneby (*Petalostemum exile* A. Gray)
D. leporina (Ait.) Bullock
Psoralea lanceolata Pursh

HYDROPHYLLACEAE
Nama dichotomum (Ruiz & Pavon) Choisy
Phacelia serrata J. Voss

LAMIACEAE
Hedeoma nanum (Torr.) Briq.
Stachys rothrockii A. Gray

LINACEAE
Linum neomexicanum Greene

LOASACEAE
Mentzelia pumila (Nutt.) T. & G.

MARSILEACEAE
Marsillea mollis Robinson & Fernald

NYCTAGINACEAE
Abronia elliptica A. Nels.

OROBANCHACEAE
Orobanche uniflora L.

OXALIDACEAE
Oxalis corniculata L.

POACEAE
Andropogon gerardii Vitman var. **paucipilus** (Nash) Fern. (*A. hallii* Hack.)
Aristida harvardii Vasey (*A. barbata* Fourn.)
A. purpurea Nutt. var. **purpurea**
Bouteloua simplex Lag.
Dasyochloa puchella (H.B.K.) Steud. (*Erioneuron pulchellum* (H.B.K.) Tateoka; *Tridens pulchellus* (H.B.K.) A.S.Hitchc.)
Echinochloa muricata (Beauv.) Fern. var. **microstachya** Wiegan
Eragrostis curvula (Schrad.) Nees
E. lehmanniana Nees
E. pectinaceae (Michx.) Nees
Elymus canadensis L.
E. trachycaulus X **smithii**
Lycurus setosus (Nutt.) Reeder
Muhlenbergia brevis C.O. Goodding
M. repens (Presl) A.S. Hitchc.
M. torreyi (Knuth) A.S. Hitchc. ex Bush
Panicum hirticaule Presl
Poa bigelovii Vasey & Scribn.
Schedonnardus paniculatus (Nutt.) Trel.
Sporobolus contractus A.S.Hitchc.

POLEMONIACEAE
Gilia pinnatifida Nutt.

POLYGALACEAE
Monnina wrightii Gray

POLYGONACEAE

Polygonum erectum L.
P. ramosissimum Michx.

PORTULACACEAE
Portulaca oleracea L.
P. parvula Gray
Talinum brevefolium Torr.
T. conferiflorum Greene

RANUNCULACEAE
Myosurus cupulatus S. Wats.

ROSACEAE
Potentilla crinita A. Gray
P. subviscosa Greene

SALICACEAE
Populus deltoides Bartram ex Marshall ssp. **wislizenii** (S. Wats.) Eckenwalder (*P. fremontii* S. Wats. var. *wislizenii* (Torr.) S. Wats.)
Salix drummondiana Barratt ex Hook. (*S. subcoerulea* (Piper) Ball)

SCROPHULARIACEAE
Mimulus floribundus Dougl.
Penstemon ambiguus Torr. var. **laevissimus** (Keck) N.Holmgren
P. linarioides A. Gray ssp. **coloradoensis** (A. Nels.) Keck

SOLANACEAE
Chamaesaracha coronopus (Donal) A. Gray
Solanum elaeagnifolium Cav.

TYPHACEAE
Typha latifolia L.

VERBENACEAE
Phyla cuneifolia (Torr.) Greene

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Appendix 12

VASCULAR PLANT TAXA PREVIOUSLY IDENTIFIED IN EL MALPAIS NATIONAL MONUMENT AREA AND NOT FOUND DURING THIS SURVEY

APPENDIX 12.

VASCULAR PLANT TAXA PREVIOUSLY IDENTIFIED IN EL MALPAIS AREA AND NOT FOUND DURING THIS SURVEY

Six botanists worked in the El Malpais National Monument area during the last forty-odd years who prepared or published lists or reports. Earlier or other collections were not consulted for this compilation. Lindsey (1951), Spellenberg (1979), and DeBruin (1988) worked primarily within the monument proper. Riffle (1973) collected in the Mount Sedgewick area of the Zuni Mountains; McCallum (1981) and Stoltz (1986) worked in El Morro National Monument, located a few miles to the west.

KEY TO NUMBERS IN PARENTHESIS:
(1) Lindsey (1951)
(2) Riffle (1973)
(3) Spellenberg (1979)
(4) McCallum (1981)
(5) Stoltz (1986)
(6) DeBruin (1988)

FAMILY/SPECIES

ADIANTACEAE
Cheilanthes eatonii Baker (6)
Pellaea atropurpurea (L.) Link. (6)

AGAVACEAE
Yucca angustissima Engelm. ex Trel. (4,5,6); this narrow-leaf yucca is probably the hybrid noted in Appendix 6

AMARANTHACEAE
Amaranthus hybridus L. (2,4,5); members of this taxon have been divided between *A. gracilis* Desf. and *A. lividus* L.
A. viridus L. (4,5)

ANACARDIACEAE
Toxicodenron radicans (L.) Kuntze (*Rhus radicans* L.) (2)

APIACEAE
Ligusticum porteri Coult. & Rose (misidentified by Riffle as *Conioselinum scopulorum* (A. Gray) Coult. & Rose) (2)
Cymopterus bulbosus A. Nels. (3)
Osmorhiza obtusa (Coult. & Rose) Fern. (4,5)

ASCLEPIADACEAE
Asclepias asperula (Dcne.) Woodson ssp. **capricornu** Woodson (*A. capricornu* Woodson) (2); *Aslepias asperula* ssp. *asperula* was identified during this study
A. involucrata Engelm. (4,5)

ASTERACEAE

Agoseris aurantiaca (Hook.) Greene (2)
Agoseris glauca var. **laciniata** (D.C. Eat.) Smiley (*A. glauca* var. *parviflora* (Nutt.) Rydb.) (2)
Ambrosia acanthocarpa Hook. (*Franseria a.* (Hook.) Coville) (2,4,5)
Anaphalis margaritaceae (L.) A. Gray (2)
Antennaria plantaginifolia var. **ambigens** (Greene) Cronq. (6)
A. rosulata Rydb. (2)
Arnica chamissonis Less. ssp. **foliosa** (Nutt.) Maguire (*A. foliosa* Nutt.) (2)
Artemisia tridentata Nutt. (4)
Aster subulatus Michx. var. **ligulatus** Shinners (*A. exilis* Ell.) (2)
Brickellia californica (Torr. & Gray) A. Gray (1,6)
B. fendleri A. Gray (2)
Chrysothamnus greenei (A. Gray) Greene (5)
C. nauseosus ssp. **albicaulis** (Nutt.) Hall & Clements (6)
C. n. var. **graveolens** (Nutt.) Piper (2,4)
C. pulchellus (A. Gray) Greene (4,5)
Cirsium undulatum (Nutt.) Spreng. (*C. megacephalum* (A. Gray) Cocker.) (1)
C. parryi (A. Gray) Petrak (2)
Conyza schiedeana (Less.) Cronq. (*Erigeron schiedeana* Less.) (2)
Erigeron caespitosus Nutt. (2)
E. eximus Greene (*E. superbus* Greene) (2)
E. pumilis Nutt. (4,5)
Gnaphalium exilifolium A. Nels. (*G. grayi* A. Nels. & Macbr.) (2)
G. pringlei A. Gray (4,5)
Haplopappus parryi A. Gray (2)
Helenium hoopesii A. Gray (2)
Helianthella parryi A. Gray (2)
Heterotheca canescens (DC.) Shinners (*Chrysopsis canescens* (DC.) T. & G.) (4,5)
H. villosa (Pursh) Shinners var. **hispida** (Hook.) Harms (*Chrysopsis hispida* (Hook.) DC.) (2)
H. v. var. **foliosa** (Nutt.) Harms (*Chrysopsis foliosa* f. (Nutt.) Shinners) (2)
Hymenopappus filifolius Hook. var. **lugens** (Greene) Jeps. (2)
Machaeranthera canescens (Pursh) A. Gray (4,5)
M. mucronata Greene (*Aster adenolepis* Blake) (2)
M. pinnatifida (Hook.) Sinners var. **pinnatifida** (*Haplopappus spinulosus* (Pursh) DC. ssp. *spinulosus*) (6)
Malacothrix fendleri A. Gray (4,5)
Melampodium longicorne A. Gray (2)
Psilostrophe sparsiflora (A. Gray) A. Nels. (6)
Ratibida tagetes (James) Barnhart (2,4,5)
Senecio bigelovii A. Gray (2)
S. eremophilus var. **macdougalii** (Heller) Cronq. (*S. macdougalii* Heller) (2)
S. riddellii T. & G. (6)
S. wootonii Greene (2)
Solidago canadensis L. var. **scabra** (Muhl.) T. & G. (*S. altissima* L.) (2)

S. missouriensis Nutt. (2)
S. spathulata DC. ssp. **spathulata** var. **nana** (*S. decumbens* Greene) (2)
Sonchus oleraceus L. (6)
Stephanomeria exigua Nutt. (4,5)
Taraxacum laevigatum (Willd.) DC. (2)
Thelyspermum subnudum A. Gray (4,5)
Townsendia leptotes (A. Gray) Osterhout (6)
Viguiera annua (M.E. Jones) Blake (6)

BORAGINACEAE
Cryptantha flava (A. Nels.) Payson (6)
Hackelia pinetorum (Greene) Johnst. (2)
Mertensia franciscana Heller (2)

BRASSICACEAE
Capsella bursa-pastoris (L.) Medic. (2,4,5)
Descurania californica (A. Gray) O.E. Schulz (4,5)
Descurania sofia (L.) Webb ex Prantl (6)
Draba aurea Vahl (4,5)
Draba helleriana Greene (2)
Lepidium virginicum L. (*L. medium* Greene) (2,3)
Lesqerella fendleri (A. Gray) S. Wats. (2,4,5,6)
L. intermedia (S. Wats.) Heller (2,6)
Rorippa curvipes Greene (*R. obtusa* (Nutt.) Britton) (2)
Thelypodium longifolium (Benth.) S. Wats. (4,5)

CACTACEAE
Opuntia fragilis (Nutt.) Haw. (4,5)
O. humifusa (Raf.) Raf. var. **humifusa** (*O. rafinesquei* Engelm.) (5)

CAMPANULACEAE
Campanula parryi A. Gray (2)
C. rotundifolia L. (2)

CAPRIFOLIACEAE
Lonicera arizonica Rehder (2)
Symphoricarpos oreophilus A. Gray var. **utahensis** Rydb. (*S. utahensis* Rydb.) (2,4,5,6)

CARYOPHYLLACEAE
Arenaria lanuginosa (Michx.) Rohrb. ssp. **lanuginosa** var. **longipedunculata** Duncan (*A. confusa* Rydb.) (4,6)
Cerastium arvense L. (2)
Silene scouleri (Eastw.) C.L. Hitchc. & Maguire ssp. **pringlei** (S. Wats.) C.L. Hitchc. & Maguire var. **leptophylla** C.L. Hitchc. & Maguire (2)
Stellaria jamesiana Torr. (2)

CELASTRACEAE
Pachistima myrsinites (Pursh) Raf. (2)

CHENOPODIACEAE
Bassia hyssopifolia (Pall.) Kuntze (6)
Chenopodium albescens Small (2,6)
C. ambrosiodes L. (4,5)
C. incisum Porr. (2)
C. bushianum Aellen var. **bushianum** (*C. paganum* Reichb.) (4,5)
C. rubrum L. (2)

CONVOLVULACEAE
Cuscuta salina Engelm. (4,5)

CRASSULACEAE
Sedum stelliforme S. Wats. (2)

CYPERACEAE
Carex eleocharis Bailey (6)
C. festivella Mackenz. (2)
C. foenea Willd. (*C. siccata* Dewey) (2)
C. lanuginosa Michx. (2)
C. microptera Mackenz. (4,5)
C. nebraskensis Dewey (2)
C. pityophylla Mackenz. (1)
Cyperus schweinitzii Torr. (6)
Eleocharis acicularis (L.) Roem. & Schult. (2)
E. montana (H.B.K.) Roem. & Schult. (2)

EQUISETACEAE
Equisetum arvense L. (2)

FABACEAE
Astragalus accumbens Sheldon (2)
A. missouriensis Nutt. var. **missouriensis** (1)
Dalea formosa Torr. (6)
Lathyrus arizonicus Britton (2)
L. graminifolius (S. Wats.) White (2,4,5)
Lotus X nummularis (M.E. Jones) Tides. (6)
Oxytropis lambertii Pursh (2)
Trifolium gymnocarpon Torr. (*T. subcaulescens* A. Gray) (2,4,5)
T. lacerum Greene (2)
T. longipes Nutt. (2)
T. repens L. (4,5)

FAGACEAE
Quercus turbinella Greene (5)

GENTIANACEAE
Gentiana heterosepala Engelm. (2)
G. strictiflora (Rydb.) A. Nels. (2)

GERANIACEAE
Geranium atropurpureum Heller (1)
G. eremophilum Woot. & Standl. (2,4,6)

G. fremontii Torr. ex A. Gray (1)
G. richardsonii Fisch. & Trautv. (2)

GROSSULARIACEAE
Ribes leptanthum A. Gray (2)
R. pinetorum Greene (2)

GUTTIFERAE
Hypericum formosum H.B.K. (2)

HYDRANGEACEAE
Fendlera wrightii (A. Gray) Heller (*F. rupicola* var. *wrightii* A. Gray) (2,6)

HYDROPHYLLACEAE
Phacelia coerulea Greene (6)
P. integrifolia Torr. (3)
P. intermedia Woot. (1)

JUNCACEAE
Juncus balticus Willd. (2)
J. interior Wieg var. **arizonicus** (Wieg.) F.J. Herm. (4,5,6)
J. longisytlis Torr. (2)
J. saximontanus A. Nels. (2)

LAMIACEAE
Hedeoma oblongifolium (A. Gray) Heller (4,5)
Mentha arvensis L. (2)
Dracocephalum parviflorum Nutt. (*Moldavica parviflora* (Nutt.) Britton (2,4,5)
Monarda citriodora Cerv. (2)
Prunella vulgaris L. (2)
Teucrium canadensis L. var. **boreale** (Bickn.) Shinners (*T. occidentale* A. Gray) (1)

LILIACEAE
Allium geyeri S. Wats. (2)
Smilacina racemosa (L.) Desf. (2)
S. stellata (L.) Desf. (2)

LINACEAE
Linum kingii S. Wats. (4,5)
L. puberulum (Engelm.) Heller (6)

LORANTHACEAE
Arceuthobium douglasii Engelm. (2)

MALVACEAE
Malva neglecta L. (4,5)
Sidalcea neomexicana A. Gray (2)
Spheralcea incana Torr. (1,4,5)

NYCTAGINACEAE
M. pumila (Standl.) Standl. (3)
M. oblongifolia (A. Gray) Heimerl (*Oxybaphus comatus* (Small) Weatherby) (2)
Tripterocalyx carnea (Greene) L.A. Gal. var. **wootonii** (Standl.) L.A. Gal. (*T. wootonii* Standl.) (5)

ONAGRACEAE
Epilobium ciliatum Raf. ssp. **ciliatum** (*E. adenocaulon* Hausskn.) (2)
Gayophytum diffusum T. & G. ssp. **parviflorum** Lewis & Szweykowski (*G. nuttallii* T. & G.) (2)
Oenothera caespitosa var. **jonesii** Munz (2)
O. c. ssp. **montana** (Nutt.) Munz (6)
O. hookeri T. & G. (4,5)
O. pallida Lindl. (4,5)
O. taraxacoides (Woot. & Standl.) Munz (2)

ORCHIDACEAE
Corallorhiza maculata Raf. (2,4,5)
Malaxis soulei L.O. Williams (2)

OROBANCHACEAE
Orobanche fasciculata Nutt. (3,4,5)

OXALIDACEAE
Oxalis alpina (Rose) R. Knuth (*O. metcalfei* (Small) R. Knuth (2)
O. stricta L. (2)

PINACEAE
Picea pungens Engelm. (2)

PLANTAGINACEAE
Plantago eriopoda Torr. (2)
P. major L. (2)

POACEAE
Agrostis stolonifera L. (*A. alba* L.) (2)
Alopecurus aequalis Sobol. (2)
Aristida orcuttiana Vasey (4,5)
Beckmannia syzigachne (Steud.) Fernald (2)
Bouteloua eriopoda (Torr.) Torr. (6)
Bromus arvensis L. (4,5)
B. carinatus Hook. & Arn. (*B. polyanthus* Scribn.) (4,5)
Deschampsia caespitosa (L.) Beauv. (2)
Elymus lanceolatus (Scribn. & Sm.) Gould ssp. **lanceolatus** phase **dasystachys** (*Agropyron dasystachyum* (Hook.) Scribn. & Sm.) (2)
E. l. ssp. **l.** phase **riparius** (*Agropyron riparium* Scribn. & Sm.) (2)
E. X pseudorepens (Scribn. & Sm.) Barkw. & Dewey (5)
E. repens (L.) Gould (*Agropyron repens* (L.) Beauv.) (2)
Enneapogon desvauxii Beauv. (6)
Eragrostis barrelieri Daveau (4,5)
Erioneuron pilosum (Buckl.) Nash (6)

Festuca idahoensis Elmer (6)
F. ovina L. (4,5)
Hordeum brachyantherum Nevski (2)
H. murinum L. ssp. **leporinum** (Link) Arcangeli (*H. leporinum* Link) (4,5)
Lycurus phleoides H.B.K. (2,4,5,6); Lycurus setosus, maybe conspecific with this taxon, was identified in this study
Muhlenbergia richardsonis (Trin.) Rydb. (2)
M. sinuosa Swallen (2)
Paspalum setaceum Michx. var. **stramineum** (Nash) Banks (*P. stramineum* Nash) (4,5)
Phleum pratense L. (2)
Poa interior Rydb. (2)
P. pratensis L. (2)
Schizachyrium neomexicanum (Nash) Nash (*Andropogon scoparium* Michx. var. *neomexicanus* (Nash) C.L. Hitchc.) (2,4)
Secale cereale L. (4,5)
Stipa nelsonii Scribn. ssp. **dorei** Barkw. & Maze (*S. columbiana* Macoun) (4,5)

POLEMONIACEAE
Collomia linearis Nutt. (2)
Gilia haydenii A. Gray (1)
Gilia ophthalmoides Brand (3)
Ipomopsis macombii (Torr. ex A. Gray) V. Grant (*Gilia macombii* Torr.) (2)
Leptocactylon pungens (Torr.) Nutt. (5)
Phlox longifolia Nutt. (2)

POLYGONACEAE
Eriogonum hieracifolium Benth. (6)
E. polycladon Benth. (4,5)
E. microthecum Nutt. var. **foliosum** (T. & G.) Reveal (*E. simpsonii* Benth.) (4,5)
E. douglasii Greene var. **johnstonii** Munz (*E. sawatchense* Small) (2,4,5)
Rumex altissimus Wood (4,5)

PORTULACACEAE
Portulaca retusa Engelm. (1,5)

PRIMULACEAE
Androsace septentrionalis L. var. **subulifera** A. Gray (6)
A. s. var. **puberulenta** (Rydb.) Knuth (2)

RANUNCULACEAE
Aquilegia chrysantha A. Gray (2)
Delphinium scaposum Greene (4,5)
D. tenuisectum Greene (2)
Myosurus nitidus Eastw. (4,5)
Ranunculus cardiophyllus Hook. (2)
R. cymbalaria Pursh (2)

R. inamoenus Greene (2)
R. macounii Britton (2)
R. sceleratus L. (2)

ROSACEAE
Amelanchier utahensis Koehne ssp. **utahensis** (*A. mormonica* Schneid.) (4,5)
Cercocarpus montanus Raf. var. **paucidentatus** (S. Wats.) F.L. Martin (*C. breviflorus* A. Gray) (1)
C. m. var. **argeneus** (Rydb.) F.L. Martin (6)
Fragaria vesca L. ssp. **bracteata** (Heller) Staudt (*F. bracteata* Heller) (2)
Physocarpus monogynus (Torr.) Coult. (1)
Potentilla ambigens Greene (3)
P. anserina L. (2)
P. concinna Richards. (*P. bicrenata* Rydb.) (2)
P. fruticosa L. (2)
P. norvegica L. (2)
Rosa woodsii Lindl. var. **woodsii** (*R. fendleri* Crepin (2)

RUBIACEAE
Galium boreale L. (2)
G. fendleri A. Gray (2)
Hedyostis rubra (Cav.) A. Gray (6)

SALICACEAE
Populus angustifolia James (2)

SAXIFRAGACEAE
Heuchera parvifolia Nutt. ex T. & G. var. **parvifolia** (6)
Philadelphus microphyllus ssp. **typicus** C.L. Hitchc. (2)

SCROPHULARIACEAE
Besseya arizonica Pennell (2,4,5)
B. plantaginea (James) Rydb. (2)
Castilleja austromontana Greene (2)
C. miniata Dougl. ex Hook. var. **miniata** (*C. confusa* Greene) (5)
C. linariifolia Benth. (4,5)
Gratiola neglecta Torr. (2)
Limosella aquatica L. (2)
Mimulus guttatus DC. (2)
M. suksdorfii A. Gray (4,5)
Orthocarpus luteus Nutt. (2)
Penstemon barbatus (Cav.) Roth ssp. **trichander** (A. Gray) Keck (*P. trichander* (A. Gray) Rydb.) (1,2,4,6)
P. eatoni A. Gray (5)
P. linarioides A. Gray ssp. **linarioides** (2)
P. oliganthus Woot. & Standl. (2)
P. pachyphyllus A. Gray ex Rydb. (5)
Veronica americana (Raf.) Schwein. ex Benth. (2)

SELAGINELLACEAE
Selaginella rupinicola Underwood

SOLANACEAE
Physalis subulata Rydb. (*P. foetens* Poir.; *P. neomexicana* Rydb.) (4,5)
Solanum cornutum Lam. (*S. rostratum* Dunal) (1)

URTICACEAE
Urtica dioica L. var. **gracilis** (Ait.) Taylor & MacBryde (*U. gracilis* Ait.) (2)

VALERIANACEAE
Valeriana capitata Pallas ex Link (2)
V. edulis Nutt. ex T. & G. (2)

VIOLACEAE
Viola nephrophylla Greene (2)

VEGETATION AND WILDLIFE INVENTORY

OF EL MALPAIS NATIONAL MONUMENT

Final Report

Appendix 13

VEGETATION INVENTORY PLANT SPECIES RECORDS DATABASE

APPENDIX 13.

PLANT SPECIES DATABASE FOR INVENTORY SITES.

Refer to plant checklist (Appendix 7) for common names, and plant annotated list (Appendix 8) for additional information on each species.

See Appendix 6 for detailed site information.

FAM. = plant family.

COV. = % canopy cover/species/site.

SITE	FORM	SPECIES	FAM.	COV.
AABA	cactus	Echinocereus trigloch melan	CAC	<1
AABA	cactus	Opuntia polyacantha	CAC	<1
AABA	forb	Arabis fendleri	BRA	<1
AABA	forb	Geranium lentum	GER	<1
AABA	forb	Heterotheca villosa	AST	<1
AABA	forb	Senecio multilobatus	AST	<1
AABA	shrub	Chrysothamnus sp.	AST	<1
AABA	shrub	Holodiscus dumosus	ROS	2
AABA	shrub	Ribes cereum	GRO	<1
AABA	tree	Juniperus scopulorum	CUP	<1
AABA	tree	Populus tremuloides	SAL	1
AABA	tree	Pseudotsuga menziesii	PIN	2
ACOM	cactus	Echinocereus trigloch melan	CAC	<1
ACOM	cactus	Opuntia polyacantha	CAC	<1
ACOM	forb	Arabis sp.	BRA	<1
ACOM	forb	Artemisia sp.	AST	<1
ACOM	forb	Taraxacum officinale	AST	<1
ACOM	forb	Verbascum thapsus	SCR	<1
ACOM	shrub	Fallugia paradoxa	ROS	<1
ACOM	shrub	Forestiera neomexicana	OLE	<1
ACOM	shrub	Holodiscus dumosus	ROS	8
ACOM	shrub	Pericome caudata	AST	<1
ACOM	shrub	Rhus trilobata	ANA	<1
ACOM	shrub	Ribes cereum	GRO	2
ACOM	tree	Juniperus scopulorum	CUP	10
ACOM	tree	Pinus edulis	PIN	<1
ACOM	tree	Pinus ponderosa	PIN	<1
ACOM	tree	Pseudotsuga menziesii	PIN	1
ALBA	cactus	Coryphantha vivipara	CAC	<1
ALBA	cactus	Opuntia sp.	CAC	<1
ALBA	forb	Achillea millefolium lanulosa	AST	<1
ALBA	forb	Androsace septentrionalis glandulosa	PRI	<1
ALBA	forb	Artemisia sp.	AST	<1
ALBA	forb	Astragalus sp.	FAB	<1
ALBA	forb	Balsamorhiza dissecta	AST	<1

ALBA	forb	Castilleja integra	SCR	<1
ALBA	forb	Chaetopappa ericoides	AST	<1
ALBA	forb	Chenopodium sp.	CHE	<1
ALBA	forb	Chenopodium sp.	CHE	<1
ALBA	forb	Chenopodium sp.	CHE	<1
ALBA	forb	Cirsium sp.	AST	<1
ALBA	forb	Cleome serrulata	CAP	<1
ALBA	forb	Corydalis aurea	FUM	<1
ALBA	forb	Cryptantha cinerea	BOR	<1
ALBA	forb	Erigeron divergens	AST	<1
ALBA	forb	Erigeron flagellaris	AST	<1
ALBA	forb	Erysimum capitatum	BRA	<1
ALBA	forb	Glandularia wrightii	VER	<1
ALBA	forb	Grindelia aphanactis	AST	<1
ALBA	forb	Gutierrezia sarothrae	AST	<1
ALBA	forb	Helianthus annuus	AST	<1
ALBA	forb	Heterotheca villosa	AST	<1
ALBA	forb	Hymenopappus filifolius	AST	<1
ALBA	forb	Hymenoxys richardsonii	AST	<1
ALBA	forb	Iris missouriensis	IRI	<1
ALBA	forb	Kochia scoparia	CHE	<1
ALBA	forb	Lactuca serriola	AST	<1
ALBA	forb	Lappula redowskii	BOR	<1
ALBA	forb	Lepidium densiflorum densiflorum	BRA	<1
ALBA	forb	Linum neomexicanum	LIN	<1
ALBA	forb	Lithospermum incisum	BOR	<1
ALBA	forb	Lupinus kingii kingii	FAB	<1
ALBA	forb	Marrubium vulgare	LAM	<1
ALBA	forb	Oenothera sp.	ONA	<1
ALBA	forb	Penstemon sp.	SCR	<1
ALBA	forb	Plantago patagonica	PLA	<1
ALBA	forb	Potentilla subviscosa	ROS	<1
ALBA	forb	Psilostrophe tagetina	AST	<1
ALBA	forb	Senecio multilobatus	AST	<1
ALBA	forb	Sisymbrium sp.	BRA	<1
ALBA	forb	Sophora nuttalliana	FAB	<1
ALBA	forb	Spheralcea digitata	MAL	<1
ALBA	forb	Taraxacum officinale	AST	<1
ALBA	forb	Tragopogon dubius	AST	<1
ALBA	forb	Verbascum thapsus	SCR	<1
ALBA	forb	Vicia americana	FAB	<1
ALBA	grass	Bouteloua gracilis	POA	50
ALBA	grass	Elymus longifolius	POA	<1
ALBA	grass	Schizachyrium scoparium	POA	<1
ALBA	shrub	Chrysothamnus sp.	AST	<1
ALBA	shrub	Forestiera neomexicana	OLE	<1
ALBA	shrub	Ribes cereum	GRO	<1
ALBA	shrub	Tetradymia canescens	AST	<1
ALBA	tree	Juniperus monosperma	CUP	<1
ALBA	tree	Pinus edulis	PIN	<1
ALBA	tree	Pinus ponderosa	PIN	<1
ALBA	tree	Pseudotsuga menziesii	PIN	<1

APCO	cactus	Coryphantha vivipara	CAC	<1
APCO	cactus	Echinocereus trigloch	CAC	<1
APCO	cactus	Echinocereus trigloch melan	CAC	<1
APCO	cactus	Opuntia polyacantha	CAC	<1
APCO	forb	Agastache pallidiflora hybrid	LAM	<1
APCO	forb	Artemisia carruthii	AST	<1
APCO	forb	Castilleja integra	SCR	<1
APCO	forb	Erigeron sp.	AST	<1
APCO	forb	Geranium lentum	GER	<1
APCO	forb	Glandularia wrightii	VER	<1
APCO	forb	Orobanche sp.	ORO	<1
APCO	forb	Senecio multilobatus	AST	<1
APCO	forb	Senecio neomexicanus mutabilis	AST	<1
APCO	forb	Sphaeralcea digitata	MAL	<1
APCO	forb	Talinum confertiflorum	POR	<1
APCO	forb	Tragopogon dubius	AST	<1
APCO	forb	Verbascum thapsus	SCR	<1
APCO	grass	Blepharoneuron tricholepis	POA	5
APCO	grass	Bouteloua gracilis	POA	5
APCO	grass	Elymus longifolius	POA	<1
APCO	grass	Muhlenbergia montana	POA	10
APCO	grass	Oryzopsis micrantha	POA	<1
APCO	shrub	Chrysothamnus sp.	AST	<1
APCO	shrub	Fallugia paradoxa	ROS	<1
APCO	shrub	Forestiera neomexicana	OLE	<1
APCO	shrub	Holodiscus dumosus	ROS	<1
APCO	shrub	Pericome caudata	AST	<1
APCO	shrub	Quercus gambelii	FAG	<1
APCO	shrub	Rhus trilobata	ANA	<1
APCO	shrub	Ribes cereum	GRO	<1
APCO	shrub	Rubus strigosus arizonicus	ROS	<1
APCO	shrub	Yucca baccata	AGA	<1
APCO	tree	Juniperus monosperma	CUP	10
APCO	tree	Pinus edulis	PIN	10
APCO	tree	Pinus ponderosa	PIN	10
APCO	tree	Pseudotsuga menziesii	PIN	<1
APCO	vine	Vitis arizonica	VIT	<1
BACA	forb	Amaranthus blitoides	AMA	<1
BACA	forb	Artemisia carruthii	AST	<1
BACA	forb	Artemisia dracunculus	AST	<1
BACA	forb	Bahia dissecta	AST	<1
BACA	forb	Castilleja integra	SCR	<1
BACA	forb	Chaetopappa ericoides	AST	<1
BACA	forb	Chenopodium leptophyllum	CHE	<1
BACA	forb	Cirsium sp.	AST	<1
BACA	forb	Descurainia obtusa	BRA	<1
BACA	forb	Erigeron flagellaris	AST	<1
BACA	forb	Eriogonum jamesii	PGN	<1
BACA	forb	Glandularia wrightii	VER	<1
BACA	forb	Gutierrezia sarothrae	AST	<1
BACA	forb	Marrubium vulgare	LAM	<1
BACA	forb	Plantago patagonica	PLA	<1

BACA	forb	Salsola iberica	CHE	<1
BACA	forb	Spheralcea digitata	MAL	<1
BACA	forb	Stephanomeria pauciflora	AST	<1
BACA	forb	Verbascum thapsus	SCR	<1
BACA	grass	Bouteloua gracilis	POA	<1
BACA	grass	Elymus longifolius	POA	<1
BACA	grass	Lycurus setosus	POA	<1
BACA	grass	Muhlenbergia montana	POA	<1
BACA	grass	Muhlenbergia torreyi	POA	<1
BACA	grass	Oryzopsis micrantha	POA	<1
BACA	shrub	Fallugia paradoxa	ROS	<1
BACA	shrub	Holodiscus dumosus	ROS	<1
BACA	shrub	Pericome caudata	AST	<1
BACA	shrub	Ribes cereum	GRO	<1
BACA	tree	Pinus edulis	PIN	<1
BACA	vine	Clematis ligusticifolia	RAN	<1
BACR	cactus	Echinocereus trigloch melan	CAC	<1
BACR	cactus	Opuntia polyacantha	CAC	<1
BACR	fern	Pteridium aquilinum	DEN	5
BACR	forb	Agastache pallidiflora hybrid	LAM	<1
BACR	forb	Allium cernuum	LIL	<1
BACR	forb	Apocynum sp.	APO	<1
BACR	forb	Arenaria lanuginosa saxosa	CAR	<1
BACR	forb	Artemisia campestris pacifica	AST	<1
BACR	forb	Asclepias tuberosa terminalis	ASC	<1
BACR	forb	Bahia dissecta	AST	<1
BACR	forb	Brickellia chlorolepis	AST	<1
BACR	forb	Brickellia grandiflora grandiflora	AST	<1
BACR	forb	Chamaesyce revoluta	EUP	<1
BACR	forb	Chenopodium fremontii	CHE	<1
BACR	forb	Cirsium sp.	AST	<1
BACR	forb	Dalea candida	FAB	<1
BACR	forb	Eriogonum jamesii	PGN	<1
BACR	forb	Eupatorium herbaceum	AST	<1
BACR	forb	Euphorbia bilobata	EUP	<1
BACR	forb	Euphorbia lurida	EUP	<1
BACR	forb	Geranium caespitosum	GER	<1
BACR	forb	Gilia pinnatifida	POL	<1
BACR	forb	Hymenoxys argentea	AST	<1
BACR	forb	Ipomopsis aggregata ssp. formosissima	POL	<1
BACR	forb	Lithospermum sp.	BOR	<1
BACR	forb	Lotus wrightii	FAB	<1
BACR	forb	Mentzelia pumila	LOA	<1
BACR	forb	Mirabilis sp.	NYC	<1
BACR	forb	Oenothera caespitosa	ONA	<1
BACR	forb	Penstemon barbatus	SCR	<1
BACR	forb	Phacelia serrata	HYD	<1
BACR	forb	Phaseolus angustissimus latus	FAB	<1
BACR	forb	Pterospora andromeda	ERI	<1
BACR	forb	Senecio multilobatus	AST	<1
BACR	forb	Silene laciniata	CAR	<1
BACR	forb	Thalictrum fendleri	RAN	<1

BACR	forb	Thelypodiopsis linearifolia	BRA	<1
BACR	forb	Verbascum thapsus	SCR	<1
BACR	forb	Viguiera multiflora nevadensis	AST	<1
BACR	grass	Bromus anomalus	POA	<1
BACR	grass	Cyperus fendlerianus	CYP	<1
BACR	grass	Festuca arizonica	POA	<1
BACR	grass	Stipa comata	POA	<1
BACR	shrub	Berberis fendleri	BER	<1
BACR	shrub	Chrysothamnus sp.	AST	<1
BACR	shrub	Fallugia paradoxa	ROS	1
BACR	shrub	Pericome caudata	AST	<1
BACR	shrub	Prunus virginiana	ROS	<1
BACR	shrub	Quercus gambelii	FAG	<1
BACR	shrub	Rosa sp.	ROS	<1
BACR	shrub	Rubus strigosus arizonicus	ROS	<1
BACR	shrub	Yucca baccata	AGA	<1
BACR	tree	Pinus edulis	PIN	5
BACR	tree	Pinus flexilis	PIN	<1
BACR	tree	Pinus ponderosa	PIN	14
BACR	tree	Populus tremuloides	SAL	<1
BACR	tree	Pseudotsuga menziesii	PIN	2
BACR	vine	Parthenocissus inserta	VIT	<1
BAWA	cactus	Echinocereus trigloch melan	CAC	<1
BAWA	cactus	Opuntia polyacantha	CAC	<1
BAWA	forb	Arabis sp.	BRA	<1
BAWA	forb	Artemisia carruthii	AST	<1
BAWA	forb	Bahia dissecta	AST	<1
BAWA	forb	Castilleja integra	SCR	<1
BAWA	forb	Chaetopappa ericoides	AST	<1
BAWA	forb	Erigeron colomexicanus	AST	<1
BAWA	forb	Erigeron flagellaris	AST	<1
BAWA	forb	Geranium lentum	GER	<1
BAWA	forb	Gilia pinnatifida	POL	<1
BAWA	forb	Heterotheca villosa	AST	<1
BAWA	forb	Penstemon barbatus	SCR	<1
BAWA	forb	Potentilla sp.	ROS	<1
BAWA	forb	Pseudocymopterus montanus	API	<1
BAWA	forb	Senecio multilobatus	AST	<1
BAWA	forb	Taraxinum confertiflorum	POR	<1
BAWA	forb	Tragopogon dubius	AST	<1
BAWA	forb	Verbascum thapsus	SCR	<1
BAWA	grass	Bouteloua gracilis	POA	<1
BAWA	grass	Bromus sp.	POA	<1
BAWA	grass	Elymus longifolius	POA	<1
BAWA	grass	Muhlenbergia minutissima	POA	<1
BAWA	grass	Muhlenbergia montana	POA	<1
BAWA	grass	Oryzopsis micrantha	POA	<1
BAWA	shrub	Chrysothamnus parryi attenuatus	AST	<1
BAWA	shrub	Chrysothamnus sp.	AST	<1
BAWA	shrub	Fallugia paradoxa	ROS	<1
BAWA	shrub	Forestiera neomexicana	OLE	<1
BAWA	shrub	Holodiscus dumosus	ROS	5

BAWA	shrub	Pericome caudata	AST	<1
BAWA	shrub	Rhus trilobata	ANA	<1
BAWA	shrub	Ribes cereum	GRO	<1
BAWA	shrub	Yucca baccata	AGA	<1
BAWA	tree	Juniperus monosperma	CUP	5
BAWA	tree	Pinus edulis	PIN	5
BAWA	tree	Pinus ponderosa	PIN	<1
BAWA	tree	Pseudotsuga menziesii	PIN	<1
BHBF	cactus	Coryphantha vivipara	CAC	<1
BHBF	cactus	Echinocereus trigloch melan	CAC	<1
BHBF	cactus	Opuntia macrorhiza	CAC	<1
BHBF	cactus	Opuntia polyacantha	CAC	<1
BHBF	fern	Woodsia plummerae	ASP	<1
BHBF	forb	Arabis sp.	BRA	<1
BHBF	forb	Artemisia carruthii	AST	4
BHBF	forb	Artemisia dracunculus	AST	<1
BHBF	forb	Bahia dissecta	AST	<1
BHBF	forb	Erigeron flagellaris	AST	<1
BHBF	forb	Glandularia wrightii	VER	<1
BHBF	forb	Heterotheca villosa	AST	10
BHBF	forb	Lappula redowskii	BOR	<1
BHBF	forb	Penstemon barbatus	SCR	<1
BHBF	forb	Spheralcea digitata	MAL	<1
BHBF	forb	Thelypodiopsis linearifolia	BRA	<1
BHBF	forb	Tragopogon dubius	AST	<1
BHBF	forb	Verbascum thapsus	SCR	<1
BHBF	grass	Bouteloua gracilis	POA	5
BHBF	grass	Elymus longifolius	POA	<1
BHBF	grass	Muhlenbergia montana	POA	5
BHBF	grass	Schizachyrium scoparium	POA	<1
BHBF	shrub	Chrysothamnus sp.	AST	<1
BHBF	shrub	Fallugia paradoxa	ROS	<1
BHBF	shrub	Forestiera neomexicana	OLE	<1
BHBF	shrub	Quercus gambelii	FAG	<1
BHBF	shrub	Rhus glabra	ANA	<1
BHBF	shrub	Rhus trilobata	ANA	<1
BHBF	shrub	Ribes cereum	GRO	<1
BHBF	shrub	Rubus strigosus arizonicus	ROS	<1
BHBF	tree	Juniperus scopulorum	CUP	<1
BHBF	tree	Pinus ponderosa	PIN	20
BHBF	tree	Populus tremuloides	SAL	8
BHBF	vine	Vitis arizonica	VIT	<1
BIHO	cactus	Echinocereus sp.	CAC	<1
BIHO	cactus	Opuntia macrorhiza	CAC	<1
BIHO	fern	Woodsia plummerae	ASP	<1
BIHO	forb	Arabis sp.	BRA	<1
BIHO	forb	Artemisia carruthii	AST	<1
BIHO	forb	Artemisia frigida	AST	<1
BIHO	forb	Asclepias asperula asperula	ASC	<1
BIHO	forb	Astragalus sp.	FAB	<1
BIHO	forb	Bahia dissecta	AST	<1
BIHO	forb	Castilleja integra	SCR	<1

BIHO	forb	Chaetopappa ericoides	AST	<1
BIHO	forb	Cirsium sp.	AST	<1
BIHO	forb	Cryptantha cinerea	BOR	<1
BIHO	forb	Erigeron colomexicanus	AST	<1
BIHO	forb	Erigeron flagellaris	AST	<1
BIHO	forb	Geranium lentum	GER	<1
BIHO	forb	Glandularia wrightii	VER	<1
BIHO	forb	Gutierrezia sarothrae	AST	<1
BIHO	forb	Heterotheca villosa	AST	<1
BIHO	forb	Hymenoxys richardsonii	AST	<1
BIHO	forb	Lotus wrightii	FAB	<1
BIHO	forb	Lupinus kingii kingii	FAB	<1
BIHO	forb	Plantago patagonica	PLA	<1
BIHO	forb	Potentilla sp.	ROS	<1
BIHO	forb	Pseudocymopterus montanus	API	<1
BIHO	forb	Senecio sp.	AST	<1
BIHO	forb	Sphaeralcea digitata	MAL	<1
BIHO	forb	Stephanomeria pauciflora	AST	<1
BIHO	forb	Talinum confertiflorum	POR	<1
BIHO	forb	Thelypodiopsis linearifolia	BRA	<1
BIHO	forb	Tragopogon dubius	AST	<1
BIHO	grass	Aristida arizonica	POA	<1
BIHO	grass	Aristida purpurea purpurea	POA	<1
BIHO	grass	Blepharoneuron tricholepis	POA	<1
BIHO	grass	Bouteloua gracilis	POA	10
BIHO	grass	Elymus longifolius	POA	<1
BIHO	grass	Koeleria macrantha	POA	<1
BIHO	grass	Muhlenbergia montana	POA	10
BIHO	grass	Schizachyrium scoparium	POA	<1
BIHO	shrub	Fallugia paradoxa	ROS	<1
BIHO	shrub	Forestiera neomexicana	OLE	<1
BIHO	shrub	Mahonia repens	BER	<1
BIHO	shrub	Pericome caudata	AST	<1
BIHO	shrub	Quercus gambelii	FAG	<1
BIHO	shrub	Rhus trilobata	ANA	<1
BIHO	shrub	Ribes cereum	GRO	<1
BIHO	shrub	Rubus strigosus arizonicus	ROS	<1
BIHO	shrub	Tetradymia canescens	AST	<1
BIHO	shrub	Yucca baccata	AGA	<1
BIHO	tree	Juniperus monosperma	CUP	<1
BIHO	tree	Pinus edulis	PIN	<1
BIHO	tree	Pinus ponderosa	PIN	15
BLTT	forb	Androsace septentrionalis glandulosa	PRI	<1
BLTT	forb	Artemisia sp.	AST	<1
BLTT	forb	Astragalus humistratus humistratus	FAB	<1
BLTT	forb	Calliandra humilis	FAB	<1
BLTT	forb	Cryptantha cinerea	BOR	<1
BLTT	forb	Eriogonum alatum alatum	PGN	<1
BLTT	forb	Eriogonum jamesii	PGN	<1
BLTT	forb	Eriogonum racemosum	PGN	<1
BLTT	forb	Eupatorium herbaceum	AST	<1
BLTT	forb	Houstonia wrightii	RUB	<1

BLTT	forb	Ipomopsis aggregata ssp. formosissima	POL	<1
BLTT	forb	Lepidium densiflorum densiflorum	BRA	<1
BLTT	forb	Lotus wrightii	FAB	<1
BLTT	forb	Oenothera caespitosa	ONA	<1
BLTT	forb	Orthocarpus purpureo-albus	SCR	<1
BLTT	forb	Plantago argyrea	PLA	<1
BLTT	forb	Pseudocymopterus montanus	API	<1
BLTT	forb	Solidago sparsiflora	AST	<1
BLTT	forb	Spheralcea digitata	MAL	<1
BLTT	forb	Talinum confertiflorum	POR	<1
BLTT	forb	Thelesperma megapotamicum	AST	<1
BLTT	forb	Viguiera multiflora	AST	<1
BLTT	grass	Blepharoneuron tricholepis	POA	<1
BLTT	grass	Bouteloua curtipendula	POA	<1
BLTT	grass	Elymus longifolius	POA	<1
BLTT	grass	Koeleria macrantha	POA	<1
BLTT	grass	Muhlenbergia montana	POA	<1
BLTT	shrub	Chrysothamnus depressus	AST	<1
BLTT	shrub	Chrysothamnus nauseosus consimilis	AST	<1
BLTT	shrub	Quercus grisea	FAG	<1
BLTT	tree	Juniperus scopulorum	CUP	5
BLTT	tree	Pinus edulis	PIN	5
BLTT	tree	Pinus ponderosa	PIN	5
BRAI	cactus	Echinocereus trigloch melan	CAC	<1
BRAI	fern	Woodsia plummerae	ASP	<1
BRAI	forb	Arabis fendleri	BRA	<1
BRAI	forb	Arabis perennans	BRA	<1
BRAI	forb	Artemisia carruthii	AST	<1
BRAI	forb	Bahia dissecta	AST	<1
BRAI	forb	Chenopodium sp.	CHE	<1
BRAI	forb	Hedeoma nanum	LAM	<1
BRAI	forb	Heterotheca villosa	AST	<1
BRAI	forb	Lotus wrightii	FAB	<1
BRAI	forb	Penstemon barbatus	SCR	<1
BRAI	forb	Potentilla sp.	ROS	<1
BRAI	forb	Senecio multilobatus	AST	<1
BRAI	grass	Bouteloua gracilis	POA	<1
BRAI	grass	Muhlenbergia montana	POA	<1
BRAI	grass	Oryzopsis micrantha	POA	<1
BRAI	shrub	Fallugia paradoxa	ROS	<1
BRAI	shrub	Forestiera neomexicana	OLE	<1
BRAI	shrub	Ribes cereum	GRO	<1
BRAI	shrub	Rubus strigosus arizonicus	ROS	<1
BRAI	tree	Pinus edulis	PIN	<1
BRAI	tree	Pinus ponderosa	PIN	<1
BRAI	tree	Populus tremuloides	SAL	<1
BRAI	vine	Vitis arizonica	VIT	<1
BRWI	cactus	Echinocereus trigloch melan	CAC	<1
BRWI	cactus	Opuntia polyacantha	CAC	<1
BRWI	fern	Cheilanthes feei	ADI	<1
BRWI	fern	Woodsia plummerae	ASP	<1
BRWI	forb	Artemisia sp.	AST	<1

BRWI	forb	Geranium lentum	GER	<1
BRWI	forb	Senecio multilobatus	AST	<1
BRWI	forb	Verbascum thapsus	SCR	<1
BRWI	grass	Bouteloua gracilis	POA	1
BRWI	grass	Muhlenbergia montana	POA	<1
BRWI	grass	Oryzopsis micrantha	POA	<1
BRWI	grass	Poa fendleriana	POA	<1
BRWI	shrub	Holodiscus dumosus	ROS	1
BRWI	shrub	Pericome caudata	AST	<1
BRWI	shrub	Rhus trilobata	ANA	<1
BRWI	shrub	Ribes cereum	GRO	<1
BRWI	tree	Juniperus scopulorum	CUP	<1
BRWI	tree	Pinus edulis	PIN	1
BRWI	tree	Pinus ponderosa	PIN	4
BRWI	tree	Pseudotsuga menziesii	PIN	<1
BSLC	cactus	Echinocereus trigloch melan	CAC	<1
BSLC	cactus	Opuntia polyacantha	CAC	<1
BSLC	fern	Woodsia plummerae	ASP	<1
BSLC	forb	Agastache pallidiflora hybrid	LAM	<1
BSLC	forb	Amaranthus albus	AMA	<1
BSLC	forb	Arabis fendleri fendleri	BRA	<1
BSLC	forb	Arabis fendleri spatifolia	BRA	<1
BSLC	forb	Chenopodium graveolens	CHE	<1
BSLC	forb	Corydalis aurea	FUM	<1
BSLC	forb	Descurainia richardsonii incisa	BRA	<1
BSLC	forb	Glandularia wrightii	VER	<1
BSLC	forb	Heterotheca villosa	AST	<1
BSLC	forb	Lappula redowskii	BOR	<1
BSLC	forb	Linum lewisii	LIN	<1
BSLC	forb	Mimulus floribundus	SCR	<1
BSLC	forb	Mirabilis diffusa	NYC	<1
BSLC	forb	Myosurus cupulatus	RAN	<1
BSLC	forb	Oenothera caespitosa marginata	ONA	<1
BSLC	forb	Verbascum thapsus	SCR	<1
BSLC	grass	Agrostis scabra	POA	<1
BSLC	grass	Bouteloua curtipendula	POA	<1
BSLC	grass	Bouteloua gracilis	POA	2
BSLC	grass	Bromus lanatipes	POA	<1
BSLC	grass	Cyperus aristatus	CYP	<1
BSLC	grass	Eleocharis acicularis	CYP	<1
BSLC	grass	Koeleria macrantha	POA	<1
BSLC	grass	Muhlenbergia minutissima	POA	<1
BSLC	grass	Muhlenbergia pauciflora	POA	<1
BSLC	shrub	Chrysothamnus sp.	AST	<1
BSLC	shrub	Fallugia paradoxa	ROS	<1
BSLC	shrub	Forestiera neomexicana	OLE	<1
BSLC	shrub	Holodiscus dumosus	ROS	<1
BSLC	shrub	Pericome caudata	AST	<1
BSLC	shrub	Rhus trilobata	ANA	<1
BSLC	shrub	Ribes cereum	GRO	<1
BSLC	shrub	Yucca baccata	AGA	<1
BSLC	tree	Juniperus scopulorum	CUP	1

BSLC	tree	Pinus edulis	PIN	1
BSLC	tree	Pinus ponderosa	PIN	3
BWPH	cactus	Echinocereus trigloch melan	CAC	<1
BWPH	cactus	Opuntia polyacantha	CAC	<1
BWPH	forb	Arabis sp.	BRA	<1
BWPH	forb	Artemisia carruthii	AST	<1
BWPH	forb	Erigeron colomexicanus	AST	<1
BWPH	forb	Geranium lentum	GER	<1
BWPH	forb	Glandularia wrightii	VER	<1
BWPH	forb	Heterotheca villosa	AST	<1
BWPH	forb	Penstemon barbatus	SCR	<1
BWPH	forb	Senecio multilobatus	AST	<1
BWPH	forb	Thelypodiopsis linearifolia	BRA	<1
BWPH	forb	Verbascum thapsus	SCR	<1
BWPH	grass	Aristida purpurea purpurea	POA	<1
BWPH	grass	Bouteloua gracilis	POA	5
BWPH	grass	Elymus longifolius	POA	<1
BWPH	grass	Muhlenbergia minutissima	POA	<1
BWPH	grass	Muhlenbergia montana	POA	5
BWPH	grass	Oryzopsis micrantha	POA	<1
BWPH	grass	Schizachyrium scoparium	POA	<1
BWPH	shrub	Chrysothamnus sp.	AST	<1
BWPH	shrub	Fallugia paradoxa	ROS	<1
BWPH	shrub	Forestiera neomexicana	OLE	<1
BWPH	shrub	Holodiscus dumosus	ROS	5
BWPH	shrub	Rhus trilobata	ANA	<1
BWPH	shrub	Ribes cereum	GRO	<1
BWPH	tree	Juniperus monosperma	CUP	<1
BWPH	tree	Juniperus scopulorum	CUP	<1
BWPH	tree	Pinus edulis	PIN	5
BWPH	tree	Pinus ponderosa	PIN	5
BWPH	tree	Pseudotsuga menziesii	PIN	5
CADU	forb	Amaranthus blitoides	AMA	<1
CADU	forb	Chaetopappa ericoides	AST	<1
CADU	forb	Chenopodium capitatum	CHE	2
CADU	forb	Cleome serrulata	CAP	<1
CADU	forb	Erigeron divergens	AST	5
CADU	forb	Glandularia wrightii	VER	3
CADU	forb	Lappula redowskii	BOR	1
CADU	forb	Lepidium ramosissimum	BRA	1
CADU	forb	Lithospermum multiflorum	BOR	<1
CADU	forb	Marrubium vulgare	LAM	<1
CADU	forb	Mentzelia multiflora	LOA	<1
CADU	forb	Phacelia alba	HYD	<1
CADU	forb	Polygonum aviculare	PGN	<1
CADU	forb	Salsola iberica	CHE	5
CADU	forb	Solanum triflorum	SOL	<1
CADU	forb	Spheralcea fendleri	MAL	3
CADU	forb	Verbena bracteata	VER	<1
CADU	grass	Blepharoneuron tricholepis	POA	<1
CADU	grass	Bromus tectorum	POA	5
CAND	forb	Artemisia carruthii	AST	<1

CAND	forb	Astragalus eggelstonii	FAB	<1
CAND	forb	Brickellia brachyphylla	AST	<1
CAND	forb	Cirsium neomexicanum	AST	<1
CAND	forb	Euphorbia lurida	EUP	<1
CAND	forb	Glandularia wrightii	VER	<1
CAND	forb	Heterotheca villosa	AST	<1
CAND	forb	Hymenoxys richardsonii	AST	<1
CAND	forb	Lithospermum incisum	BOR	<1
CAND	forb	Lotus wrightii	FAB	<1
CAND	forb	Lupinus kingii kingii	FAB	<1
CAND	forb	Mirabilis sp.	NYC	<1
CAND	forb	Orobanche uniflora	ORO	<1
CAND	forb	Phacelia serrata	HYD	<1
CAND	grass	Bouteloua gracilis	POA	<1
CAND	grass	Bromus tectorum	POA	<1
CAND	grass	Poa fendleriana	POA	<1
CAND	shrub	Chrysothamnus sp.	AST	<1
CAND	shrub	Fallugia paradoxa	ROS	<1
CAND	shrub	Quercus gambelii	FAG	<1
CAND	shrub	Ribes cereum	GRO	<1
CAND	tree	Juniperus scopulorum	CUP	<1
CAND	tree	Pinus edulis	PIN	<1
CAND	tree	Pinus ponderosa	PIN	<1
CAPO	forb	Amaranthus albus	AMA	<1
CAPO	forb	Coreopsis tinctoria tinctoria	AST	<1
CAPO	forb	Myosurus minimus	RAN	<1
CAPO	forb	Polygonum aviculare	PGN	<1
CAPO	forb	Rorippa microtites	BRA	<1
CAPO	forb	Verbena bracteata	VER	<1
CAPO	forb	Veronica peregrina	SCR	<1
CAPO	grass	Echinochloa muricata microstachya	POA	<1
CAPO	grass	Eleocharis acicularis	CYP	<1
CAPO	grass	Eleocharis macrostachya	CYP	<1
CEBA	cactus	Opuntia polyacantha	CAC	<1
CEBA	cactus	Opuntia sp.	CAC	<1
CEBA	forb	Artemisia sp.	AST	<1
CEBA	forb	Astragalus egglestonii	FAB	<1
CEBA	forb	Bahia dissecta	AST	5
CEBA	forb	Chenopodium sp.	CHE	<1
CEBA	forb	Cirsium sp.	AST	<1
CEBA	forb	Eriogonum alatum	PGN	<1
CEBA	forb	Geranium caespitosum	GER	<1
CEBA	forb	Glandularia wrightii	VER	<1
CEBA	forb	Ipomopsis aggregata ssp. formosissima	POL	<1
CEBA	forb	Lactuca serriola	AST	<1
CEBA	forb	Lithospermum sp.	BOR	<1
CEBA	forb	Lupinus kingii kingii	FAB	<1
CEBA	forb	Mentzelia pumila	LOA	<1
CEBA	forb	Oenothera sp.	ONA	<1
CEBA	forb	Phacelia serrata	HYD	<1
CEBA	forb	Phaseolus angustissimus	FAB	<1
CEBA	forb	Physalis hederifolia cordifolia	SOL	<1

CEBA	forb	Stephanomeria pauciflora	AST	<1
CEBA	forb	Stephanomeria tenuifolia	AST	<1
CEBA	forb	Thelypodiopsis linearifolia	BRA	<1
CEBA	forb	Tragia ramosa	EUP	<1
CEBA	forb	Verbascum thapsus	SCR	<1
CEBA	grass	Aristida sp.	POA	<1
CEBA	grass	Bouteloua gracilis	POA	4
CEBA	grass	Elymus longifolius	POA	<1
CEBA	grass	Muhlenbergia minutissima	POA	<1
CEBA	grass	Muhlenbergia montana	POA	10
CEBA	shrub	Fallugia paradoxa	ROS	2
CEBA	shrub	Pericome caudata	AST	<1
CEBA	shrub	Ribes cereum	GRO	<1
CEBA	shrub	Yucca baccata	AGA	<1
CEBA	tree	Juniperus deppeana	CUP	2
CEBA	tree	Juniperus monosperma	CUP	<1
CEBA	tree	Juniperus scopulorum	CUP	3
CEBA	tree	Pinus edulis	PIN	25
CEBA	tree	Pinus ponderosa	PIN	15
CEBA	tree	Populus tremuloides	SAL	<1
CEEN	cactus	Opuntia imbricata	CAC	<1
CEEN	cactus	Opuntia polyacantha	CAC	<1
CEEN	forb	Arabis sp.	BRA	<1
CEEN	forb	Bahia dissecta	AST	<1
CEEN	forb	Chenopodium graveolens	CHE	<1
CEEN	forb	Chenopodium sp.	CHE	<1
CEEN	forb	Cirsium neomexicanum	AST	<1
CEEN	forb	Descurainia pinnata	BRA	<1
CEEN	forb	Eriogonum jamesii	PGN	<1
CEEN	forb	Erodium cicutarum	GER	<1
CEEN	forb	Gilia sinuata	POL	<1
CEEN	forb	Glandularia wrightii	VER	<1
CEEN	forb	Kochia scoparia	CHE	<1
CEEN	forb	Marrubium vulgare	LAM	<1
CEEN	forb	Mentzelia albicaulis	LOA	<1
CEEN	forb	Spheralcea sp.	MAL	<1
CEEN	forb	Tragia ramosa	EUP	<1
CEEN	forb	Verbascum thapsus	SCR	<1
CEEN	grass	Bouteloua gracilis	POA	3
CEEN	grass	Bromus tectorum	POA	<1
CEEN	grass	Elymus longifolius	POA	<1
CEEN	grass	Poa fendleriana	POA	<1
CEEN	shrub	Fallugia paradoxa	ROS	1
CEEN	shrub	Forestiera neomexicana	OLE	<1
CEEN	shrub	Ribes cereum	GRO	<1
CEEN	shrub	Yucca baccata	AGA	<1
CEEN	tree	Juniperus monosperma	CUP	<1
CEEN	tree	Pinus edulis	PIN	2
CEEN	tree	Pinus ponderosa	PIN	1
CJPA	cactus	Coryphantha vivipara	CAC	<1
CJPA	cactus	Opuntia polyacantha	CAC	<1
CJPA	fern	Cheilanthes fendleri	ADI	<1

CJPA	forb	Achillea millefolium lanulosa	AST	<1
CJPA	forb	Ardrosace septentrionalis glandulosa	PRI	<1
CJPA	forb	Artennaria parvifolia	AST	<1
CJPA	forb	Arabis sp.	BRA	<1
CJPA	forb	Artemisia ludoviciana	AST	<1
CJPA	forb	Artemisia sp.	AST	<1
CJPA	forb	Asclepias asperula asperula	ASC	<1
CJPA	forb	Astragalus sp.	FAB	<1
CJPA	forb	Bahia dissecta	AST	<1
CJPA	forb	Castilleja integra	SCR	<1
CJPA	forb	Chenopodium sp.	CHE	<1
CJPA	forb	Cirsium sp.	AST	<1
CJPA	forb	Erigeron flagellaris	AST	<1
CJPA	forb	Eriogonum jamesii	PGN	<1
CJPA	forb	Eriogonum racemosum	PGN	<1
CJPA	forb	Gilia sinuata	POL	<1
CJPA	forb	Glandularia wrightii	VER	<1
CJPA	forb	Heterotheca villosa	AST	<1
CJPA	forb	Houstonia wrightii	RUB	<1
CJPA	forb	Hymenopappus filifolius	AST	<1
CJPA	forb	Hymenoxys argentea	AST	<1
CJPA	forb	Hymenoxys richardsonii	AST	<1
CJPA	forb	Lithospermum incisum	BOR	<1
CJPA	forb	Lotus wrightii	FAB	<1
CJPA	forb	Microsteris gracilis	POL	<1
CJPA	forb	Penstemon linaroides coloradoensis	SCR	<1
CJPA	forb	Plantago sp.	PLA	<1
CJPA	forb	Psilostrophe tagetina	AST	<1
CJPA	forb	Psoralea sp.	FAB	<1
CJPA	forb	Senecio multilobatus	AST	<1
CJPA	forb	Sphaeralcea digitata	MAL	<1
CJPA	forb	Thlaspi montanum fendleri	BRA	<1
CJPA	forb	Tragia ramosa	EUP	<1
CJPA	forb	Tragopogon dubius	AST	<1
CJPA	forb	Verbascum thapsus	SCR	<1
CJPA	forb	Vicia americana	FAB	<1
CJPA	grass	Aristida sp.	POA	<1
CJPA	grass	Blepharoneuron tricholepis	POA	<1
CJPA	grass	Bromus tectorum	POA	<1
CJPA	shrub	Chrysothamnus sp.	AST	<1
CJPA	shrub	Mahonia repens	BER	<1
CJPA	shrub	Quercus gambelii	FAG	<1
CJPA	shrub	Quercus grisea	FAG	<1
CJPA	shrub	Ribes cereum	GRO	<1
CJPA	shrub	Yucca baccata	AGA	<1
CJPA	tree	Juniperus monosperma	CUP	<1
CJPA	tree	Juniperus scopulorum	CUP	<1
CJPA	tree	Pinus edulis	PIN	<1
CJPA	tree	Pinus ponderosa	PIN	5
CO42	cactus	Coryphantha vivipara	CAC	<1
CO42	forb	Achillea millefolium lanulosa	AST	<1
CO42	forb	Ambrosia artemesiifolia	AST	<1

CO42	forb	Androsace septentrionalis glandulosa	PRI	<1
CO42	forb	Asclepias asperula asperula	ASC	<1
CO42	forb	Aster falcatus commutatus	AST	<1
CO42	forb	Astragalus mollissimus	FAB	<1
CO42	forb	Castilleja integra	SCR	<1
CO42	forb	Chamaesyce serpyllifolia	EUP	<1
CO42	forb	Chenopodium sp.	CHE	<1
CO42	forb	Chenopodium sp.	CHE	<1
CO42	forb	Cirsium wheeleri	AST	<1
CO42	forb	Cleome serrulata	CAP	<1
CO42	forb	Dalea candida oligophylla	FAB	<1
CO42	forb	Delphinium nuttallianum nuttallianum	RAN	<1
CO42	forb	Erigeron formosissimus formosissimus	AST	<1
CO42	forb	Erysimum capitatum	BRA	<1
CO42	forb	Grindelia aphanactis	AST	<1
CO42	forb	Heterotheca villosa	AST	<1
CO42	forb	Houstonia wrightii	RUB	<1
CO42	forb	Hymenopappus filifolius	AST	<1
CO42	forb	Kochia scoparia	CHE	<1
CO42	forb	Lappula redowskii	BOR	<1
CO42	forb	Lepidium densiflorum densiflorum	BRA	<1
CO42	forb	Lithospermum cobrense	BOR	<1
CO42	forb	Lupinus kingii kingii	FAB	<1
CO42	forb	Melilotus officinalis	FAB	<1
CO42	forb	Microsteris gracilis	POL	<1
CO42	forb	Monarda pectinata	LAM	<1
CO42	forb	Oenothera coronopifolia	ONA	<1
CO42	forb	Oenothera laciniata laciniata	ONA	<1
CO42	forb	Orthocarpus purpureo-albus	SCR	<1
CO42	forb	Penstemon linaroides coloradoensis	SCR	<1
CO42	forb	Penstemon virgatus	SCR	<1
CO42	forb	Plantago argyrea	PLA	<1
CO42	forb	Polygonum aviculare	PGN	<1
CO42	forb	Potentilla crinita	ROS	<1
CO42	forb	Potentilla pensylvanica	ROS	<1
CO42	forb	Potentilla subviscosa	ROS	<1
CO42	forb	Pterospora andromeda	ERI	<1
CO42	forb	Ratibida columnifera	AST	<1
CO42	forb	Salvia reflexa	LAM	<1
CO42	forb	Taraxacum officinale	AST	<1
CO42	forb	Thalictrum fendleri	RAN	<1
CO42	forb	Thlaspi montanum	BRA	<1
CO42	forb	Townsendia exscapa	AST	<1
CO42	forb	Tribulus terrestris	ZYG	<1
CO42	forb	Verbascum thapsus	SCR	<1
CO42	forb	Vicia americana minor	FAB	<1
CO42	grass	Andropogon gerardii	POA	<1
CO42	grass	Elymus longifolius	POA	<1
CO42	grass	Elymus smithii	POA	<1
CO42	grass	Munroa squarrosa	POA	<1
DOME	cactus	Echinocereus trigloch melan	CAC	<1
DOME	forb	Arabis fendleri	BRA	<1

DOME	forb	Artemisia carruthii	AST	<1
DOME	grass	Muhlenbergia montana	POA	<1
DOSI	cactus	Opuntia sp.	CAC	<1
DOSI	fern	Dryopteris filix-mas	ASP	<1
DOSI	fern	Woodsia plummerae	ASP	<1
DOSI	forb	Arabis fendleri	BRA	<1
DOSI	forb	Artemisia carruthii	AST	<1
DOSI	forb	Astragalus sp.	FAB	<1
DOSI	forb	Bahia dissecta	AST	<1
DOSI	forb	Chaetopappa ericoides	AST	<1
DOSI	forb	Cryptantha cinerea	BOR	<1
DOSI	forb	Descurainia obtusa	BRA	<1
DOSI	forb	Erigeron flagellaris	AST	<1
DOSI	forb	Eriogonum jamesii	PGN	<1
DOSI	forb	Geranium lentum	GER	<1
DOSI	forb	Glandularia wrightii	VER	<1
DOSI	forb	Gutierrezia sarothrae	AST	<1
DOSI	forb	Heterotheca villosa	AST	<1
DOSI	forb	Plantago patagonica	PLA	<1
DOSI	forb	Senecio multilobatus	AST	<1
DOSI	forb	Sphaeralcea coccinea	MAL	<1
DOSI	forb	Sphaeralcea digitata	MAL	<1
DOSI	forb	Thelypodiopsis linearifolia	BRA	<1
DOSI	grass	Aristida purpurea purpurea	POA	<1
DOSI	grass	Bouteloua gracilis	POA	<1
DOSI	grass	Elymus longifolius	POA	<1
DOSI	grass	Muhlenbergia montana	POA	<1
DOSI	shrub	Fallugia paradoxa	ROS	<1
DOSI	shrub	Holodiscus dumosus	ROS	<1
DOSI	shrub	Pericome caudata	AST	<1
DOSI	shrub	Rhus trilobata	ANA	<1
DOSI	shrub	Ribes cereum	GRO	<1
DOSI	shrub	Tetradymia canescens	AST	<1
DOSI	tree	Pinus edulis	PIN	<1
ELCF	cactus	Coryphantha vivipara	CAC	<1
ELCF	cactus	Echinocereus fendleri	CAC	<1
ELCF	cactus	Echinocereus trigloch	CAC	<1
ELCF	cactus	Echinocereus trigloch melan	CAC	<1
ELCF	cactus	Opuntia imbricata	CAC	<1
ELCF	cactus	Opuntia sp.	CAC	<1
ELCF	forb	Artemisia dracunculus	AST	<1
ELCF	forb	Artemisia frigida	AST	<1
ELCF	forb	Asclepias asperula asperula	ASC	<1
ELCF	forb	Astragalus sp.	FAB	<1
ELCF	forb	Astragalus wootonii wootonii	FAB	<1
ELCF	forb	Chaetopappa ericoides	AST	<1
ELCF	forb	Chenopodium leptophyllum	CHE	<1
ELCF	forb	Chenopodium sp.	CHE	<1
ELCF	forb	Cirsium sp.	AST	<1
ELCF	forb	Coreopsis tinctoria tinctoria	AST	<1
ELCF	forb	Descurainia richardsonii incisa	BRA	<1
ELCF	forb	Erigeron flagellaris	AST	<1

ELCF	forb	Gaillardia pinnatifida	AST	<1
ELCF	forb	Gaura coccinea	ONA	<1
ELCF	forb	Gayophytum ramosissimum	ONA	<1
ELCF	forb	Geranium lentum	GER	<1
ELCF	forb	Glandularia wrightii	VER	<1
ELCF	forb	Lactuca serriola	AST	<1
ELCF	forb	Linum aristatum	LIN	<1
ELCF	forb	Lotus wrightii	FAB	<1
ELCF	forb	Lupinus kingii kingii	FAB	<1
ELCF	forb	Marrubium vulgare	LAM	<1
ELCF	forb	Menodora scabra	OLE	<1
ELCF	forb	Penstemon barbatus	SCR	<1
ELCF	forb	Senecio douglasii longilobus	AST	<1
ELCF	forb	Senecio multilobatus	AST	<1
ELCF	forb	Senecio neomexicanus mutabilis	AST	<1
ELCF	forb	Stephanomeria pauciflora	AST	<1
ELCF	forb	Talinum confertiflorum	POR	<1
ELCF	forb	Thelypodiopsis linearifolia	BRA	<1
ELCF	forb	Tragopogon dubius	AST	<1
ELCF	forb	Tragopogon pratensis	AST	<1
ELCF	grass	Aristida purpurea purpurea	POA	<1
ELCF	grass	Bouteloua gracilis	POA	<1
ELCF	grass	Carex occidentalis	CYP	<1
ELCF	grass	Muhlenbergia montana	POA	10
ELCF	grass	Muhlenbergia torreyi	POA	<1
ELCF	grass	Pleuraphis jamesii	POA	<1
ELCF	grass	Poa fendleriana	POA	<1
ELCF	shrub	Chrysothamnus sp.	AST	<1
ELCF	shrub	Forestiera neomexicana	OLE	<1
ELCF	shrub	Mahonia repens	BER	<1
ELCF	shrub	Ribes cereum	GRO	<1
ELCF	shrub	Tetradymia canescens	AST	<1
ELCF	tree	Juniperus monosperma	CUP	<1
ELCF	tree	Pinus edulis	PIN	<1
ENDC	fern	Woodsia plummerae	ASP	<1
ENDC	forb	Arabis fendleri	BRA	<1
ERHO	cactus	Opuntia macrorhiza	CAC	<1
ERHO	cactus	Opuntia polyacantha	CAC	<1
ERHO	forb	Arabis sp.	BRA	<1
ERHO	forb	Artemisia carruthii	AST	<1
ERHO	forb	Artemisia dracunculus	AST	<1
ERHO	forb	Asclepias asperula asperula	ASC	<1
ERHO	forb	Bahia dissecta	AST	<1
ERHO	forb	Castilleja integra	SCR	<1
ERHO	forb	Chaetopappa ericoides	AST	<1
ERHO	forb	Chamaesyce sp.	EUP	<1
ERHO	forb	Chenopodium dessicatum	CHE	<1
ERHO	forb	Chenopodium graveolens	CHE	<1
ERHO	forb	Cryptantha cinerea	BOR	<1
ERHO	forb	Erigeron flagellaris	AST	<1
ERHO	forb	Gaura coccinea	ONA	<1
ERHO	forb	Geranium lentum	GER	<1

ERHO	forb	Glandularia wrightii	VER	<1
ERHO	forb	Heterotheca villosa	AST	<1
ERHO	forb	Hymenoxys richardsonii	AST	<1
ERHO	forb	Lappula redowskii	BOR	<1
ERHO	forb	Lotus wrightii	FAB	<1
ERHO	forb	Mirabilis sp.	NYC	<1
ERHO	forb	Oenothera sp.	ONA	<1
ERHO	forb	Penstemon barbatus	SCR	<1
ERHO	forb	Plantago patagonica	PLA	<1
ERHO	forb	Potentilla sp.	ROS	<1
ERHO	forb	Sphaeralcea digitata	MAL	<1
ERHO	forb	Talinum confertiflorum	POR	<1
ERHO	forb	Thelypodiopsis linearifolia	BRA	<1
ERHO	grass	Aristida purpurea purpurea	POA	<1
ERHO	grass	Aristida sp.	POA	<1
ERHO	grass	Blepharoneuron tricholepis	POA	10
ERHO	grass	Bouteloua curtipendula	POA	<1
ERHO	grass	Bouteloua gracilis	POA	10
ERHO	grass	Bromus sp.	POA	<1
ERHO	grass	Elymus longifolius	POA	<1
ERHO	grass	Muhlenbergia montana	POA	<1
ERHO	grass	Schizachyrium scoparium	POA	<1
ERHO	shrub	Chrysothamnus sp.	AST	<1
ERHO	shrub	Fallugia paradoxa	ROS	<1
ERHO	shrub	Forestiera neomexicana	OLE	<1
ERHO	shrub	Rhus trilobata	ANA	<1
ERHO	shrub	Ribes cereum	GRO	<1
ERHO	shrub	Yucca baccata	AGA	<1
ERHO	tree	Juniperus monosperma	CUP	<1
ERHO	tree	Pinus ponderosa	PIN	25
FERN	cactus	Opuntia polyacantha	CAC	<1
FERN	fern	Dryopteris filix-mas	ASP	2
FERN	forb	Arabis fendleri	BRA	<1
FERN	forb	Arenaria lanuginosa saxosa	CAR	<1
FERN	forb	Astragalus sp.	FAB	<1
FERN	forb	Baileya dissecta	AST	<1
FERN	forb	Castilleja integra	SCR	<1
FERN	forb	Cryptantha cinerea	BOR	<1
FERN	forb	Erigeron flagellaris	AST	<1
FERN	forb	Eriogonum alatum alatum	PGN	<1
FERN	forb	Glandularia wrightii	VER	<1
FERN	forb	Gutierrezia sarothrae	AST	<1
FERN	forb	Heterotheca villosa	AST	<1
FERN	forb	Lotus wrightii	FAB	5
FERN	forb	Orthocarpus purpureo-albus	SCR	<1
FERN	forb	Penstemon barbatus	SCR	<1
FERN	forb	Psoralea sp.	FAB	<1
FERN	forb	Senecio multilobatus	AST	<1
FERN	forb	Solidago sparsiflora	AST	<1
FERN	forb	Stephanomeria pauciflora	AST	<1
FERN	forb	Taraxacum officinale	AST	1
FERN	forb	Thelesperma megapotamicum	AST	<1

FERN	shrub	Forestiera neomexicana	OLE	<1
FERN	shrub	Mahonia repens	BER	<1
FERN	shrub	Rhus trilobata	ANA	1
FERN	shrub	Ribes cereum	GRO	10
FERN	shrub	Tetradymia canescens	AST	<1
FERN	tree	Juniperus monosperma	CUP	<1
FERN	tree	Juniperus scopulorum	CUP	10
FERN	tree	Pinus edulis	PIN	<1
FERN	tree	Pinus ponderosa	PIN	<1
FOUR	cactus	Echinocereus trigloch melan	CAC	<1
FOUR	cactus	Opuntia polyacantha	CAC	<1
FOUR	fern	Woodsia plummerae	ASP	<1
FOUR	forb	Arabis sp.	BRA	<1
FOUR	forb	Arceuthobium vaginatum cryptopodium	LOR	<1
FOUR	forb	Artemisia sp.	AST	<1
FOUR	forb	Brickellia brachyphylla	AST	<1
FOUR	forb	Chenopodium sp.	CHE	<1
FOUR	forb	Geranium lentum	GER	<1
FOUR	forb	Glandularia wrightii	VER	1
FOUR	forb	Heterotheca villosa	AST	<1
FOUR	grass	Bouteloua curtipendula	POA	<1
FOUR	grass	Bouteloua gracilis	POA	<1
FOUR	grass	Bromus anomalus	POA	<1
FOUR	grass	Koeleria macrantha	POA	<1
FOUR	shrub	Chrysothamnus sp.	AST	<1
FOUR	shrub	Fallugia paradoxa	ROS	<1
FOUR	shrub	Forestiera neomexicana	OLE	<1
FOUR	shrub	Holodiscus dumosus	ROS	<1
FOUR	shrub	Rhus trilobata	ANA	<1
FOUR	shrub	Ribes cereum	GRO	<1
FOUR	shrub	Yucca baccata	AGA	<1
FOUR	tree	Juniperus scopulorum	CUP	3
FOUR	tree	Pinus edulis	PIN	<1
FOUR	tree	Pinus ponderosa	PIN	5
FOUR	tree	Pseudotsuga menziesii	PIN	<1
GICE	fern	Asplenium septentrionale	ASP	<1
GICE	fern	Cheilanthes sp.	ADI	<1
GICE	forb	Oenothera sp.	ONA	<1
GICE	forb	Potentilla pensylvanica	ROS	<1
GICE	grass	Bromus lanatipes	POA	<1
GICE	vine	Vitis arizonica	VIT	<1
HAFE	cactus	Echinocereus trigloch melan	CAC	<1
HAFE	cactus	Opuntia polyacantha	CAC	<1
HAFE	fern	Woodsia plummerae	ASP	<1
HAFE	forb	Amaranthus albus	AMA	<1
HAFE	forb	Arabis fendleri spatifolia	BRA	<1
HAFE	forb	Artemisia carruthii	AST	<1
HAFE	forb	Chamaesyce serpyllifolia	EUP	<1
HAFE	forb	Chenopodium graveolens	CHE	<1
HAFE	forb	Geranium lentum	GER	<1
HAFE	forb	Schistophragma intermedia	SCR	<1
HAFE	forb	Talinum confertiflorum	POR	<1

HAFE	forb	Verbascum thapsus	SCR	<1
HAFE	grass	Bouteloua gracilis	POA	4
HAFE	grass	Bromus lanatipes	POA	<1
HAFE	grass	Carex geophila	CYP	<1
HAFE	grass	Elymus longifolius	POA	<1
HAFE	grass	Muhlenbergia minutissima	POA	<1
HAFE	grass	Oryzopsis micrantha	POA	<1
HAFE	grass	Panicum hirticaule	POA	<1
HAFE	grass	Poa fendleriana	POA	<1
HAFE	shrub	Chrysothamnus parryi attenuatus	AST	<1
HAFE	shrub	Fallugia paradoxa	ROS	1
HAFE	shrub	Forestiera neomexicana	OLE	<1
HAFE	shrub	Holodiscus dumosus	ROS	5
HAFE	shrub	Pericome caudata	AST	<1
HAFE	shrub	Ribes cereum	GRO	2
HAFE	tree	Juniperus scopulorum	CUP	1
HAFE	tree	Pinus edulis	PIN	<1
HAFE	tree	Pinus ponderosa	PIN	1
HAFE	tree	Pseudotsuga menziesii	PIN	10
HIDD	cactus	Coryphantha vivipara	CAC	<1
HIDD	cactus	Echinocereus trigloch melan	CAC	<1
HIDD	cactus	Opuntia polyacantha	CAC	<1
HIDD	fern	Cheilanthes fendleri	ADI	<1
HIDD	forb	Allium cernuum	LIL	<1
HIDD	forb	Anthericum torreyi	LIL	<1
HIDD	forb	Arenaria lanuginosa saxosa	CAR	<1
HIDD	forb	Artemisia ludoviciana	AST	<1
HIDD	forb	Chenopodium fremontii	CHE	<1
HIDD	forb	Commelina dianthifolia longispatha	CMM	<1
HIDD	forb	Commelina erecta angustifolia	CMM	<1
HIDD	forb	Erigeron flagellaris	AST	<1
HIDD	forb	Eriogonum alatum	PGN	<1
HIDD	forb	Eupatorium herbaceum	AST	<1
HIDD	forb	Glandularia wrightii	VER	3
HIDD	forb	Hedeoma drummondii	LAM	<1
HIDD	forb	Helianthella quinquenervis	AST	<1
HIDD	forb	Hymenoxys argentea	AST	<1
HIDD	forb	Hymenoxys richardsonii	AST	4
HIDD	forb	Ipomoea plummerae	CON	<1
HIDD	forb	Ipomopsis aggregata ssp. formosissima	POL	<1
HIDD	forb	Lesquerella rectipes	BRA	<1
HIDD	forb	Linum lewisii	LIN	<1
HIDD	forb	Lithospermum multiflorum	BOR	<1
HIDD	forb	Lotus wrightii	FAB	<1
HIDD	forb	Mirabilis diffusa	NYC	<1
HIDD	forb	Oenothera caespitosa	ONA	<1
HIDD	forb	Penstemon barbatus	SCR	<1
HIDD	forb	Potentilla hippiana diffusa	ROS	<1
HIDD	forb	Pseudocymopterus montanus	API	<1
HIDD	forb	Silene laciniata	CAR	<1
HIDD	forb	Solidago sparsiflora	AST	<1
HIDD	forb	Sphaeralcea fendleri	MAL	<1

HIDD	forb	Talinum confertiflorum	POR	<1
HIDD	forb	Talinum pulchellum	POR	<1
HIDD	forb	Thelypodiopsis linearifolia	BRA	<1
HIDD	forb	Thelypodium wrightii	BRA	<1
HIDD	forb	Thermopsis rhombifolia montana	FAB	<1
HIDD	forb	Thlaspi montanum	BRA	<1
HIDD	grass	Andropogon gerardii	POA	<1
HIDD	grass	Bouteloua curtipendula	POA	<1
HIDD	grass	Bouteloua gracilis	POA	5
HIDD	grass	Cyperus fendlerianus	CYP	<1
HIDD	grass	Koeleria macrantha	POA	<1
HIDD	grass	Lycurus setosus	POA	<1
HIDD	grass	Muhlenbergia montana	POA	<1
HIDD	grass	Panicum bulbosum	POA	<1
HIDD	shrub	Chrysothamnus depressus	AST	<1
HIDD	shrub	Fallugia paradoxa	ROS	<1
HIDD	shrub	Mahonia repens	BER	<1
HIDD	shrub	Quercus X pauciloba	FAG	1
HIDD	shrub	Quercus gambelii	FAG	3
HIDD	shrub	Rhus trilobata	ANA	<1
HIDD	shrub	Ribes cereum	GRO	<1
HIDD	shrub	Tetradymia canescens	AST	<1
HIDD	shrub	Yucca baccata	AGA	<1
HIDD	tree	Juniperus scopulorum	CUP	5
HIDD	tree	Pinus edulis	PIN	10
HIDD	tree	Pinus ponderosa	PIN	15
HIDD	tree	Populus tremuloides	SAL	<1
HIDD	vine	Vitis arizonica	VIT	<1
HOSW	cactus	Echinocereus fendleri	CAC	<1
HOSW	cactus	Opuntia imbricata	CAC	<1
HOSW	cactus	Opuntia macrorhiza	CAC	<1
HOSW	cactus	Opuntia polyacantha	CAC	<1
HOSW	forb	Anthericum torreyi	LIL	<1
HOSW	forb	Arabis sp.	BRA	<1
HOSW	forb	Artemisia carruthii	AST	20
HOSW	forb	Artemisia dracunculus	AST	<1
HOSW	forb	Artemisia frigida	AST	<1
HOSW	forb	Asclepias asperula asperula	ASC	<1
HOSW	forb	Bahia dissecta	AST	<1
HOSW	forb	Castilleja integra	SCR	<1
HOSW	forb	Chaetopappa ericoides	AST	<1
HOSW	forb	Chamaesyce sp.	EUP	<1
HOSW	forb	Chenopodium leptophyllum	CHE	<1
HOSW	forb	Cirsium sp.	AST	<1
HOSW	forb	Cryptantha cinerea	BOR	<1
HOSW	forb	Erigeron colomexicanus	AST	<1
HOSW	forb	Erigeron flagellaris	AST	<1
HOSW	forb	Gaillardia pinnatifida	AST	<1
HOSW	forb	Gaura coccinea	ONA	<1
HOSW	forb	Geranium lentum	GER	<1
HOSW	forb	Glandularia wrightii	VER	<1
HOSW	forb	Gutierrezia sarothrae	AST	<1

HOSW	forb	Heterotheca villosa	AST	<1
HOSW	forb	Hymenoxys richardsonii	AST	<1
HOSW	forb	Lappula redowskii	BOR	<1
HOSW	forb	Penstemon barbatus	SCR	<1
HOSW	forb	Potentilla sp.	ROS	<1
HOSW	forb	Senecio sp.	AST	<1
HOSW	forb	Spheralcea digitata	MAL	<1
HOSW	forb	Stephanomeria sp.	AST	<1
HOSW	forb	Talinum confertiflorum	POR	<1
HOSW	forb	Thelypodiopsis linearifolia	BRA	<1
HOSW	forb	Tragopogon dubius	AST	<1
HOSW	grass	Aristida purpurea purpurea	POA	<1
HOSW	grass	Blepharoneuron tricholepis	POA	<1
HOSW	grass	Bouteloua gracilis	POA	5
HOSW	grass	Elymus longifolius	POA	<1
HOSW	grass	Lycurus setosus	POA	<1
HOSW	grass	Muhlenbergia montana	POA	5
HOSW	grass	Muhlenbergia torreyi	POA	<1
HOSW	grass	Oryzopsis micrantha	POA	<1
HOSW	shrub	Chrysothamnus sp.	AST	<1
HOSW	shrub	Fallugia paradoxa	ROS	<1
HOSW	shrub	Forestiera neomexicana	OLE	<1
HOSW	shrub	Quercus sp.	FAG	<1
HOSW	shrub	Rhus trilobata	ANA	<1
HOSW	shrub	Ribes cereum	GRO	<1
HOSW	shrub	Tetradymia canescens	AST	<1
HOSW	tree	Juniperus monosperma	CUP	<1
HOSW	tree	Pinus ponderosa	PIN	<1
HOYA	cactus	Echinocereus trigloch melan	CAC	<1
HOYA	cactus	Opuntia polyacantha	CAC	<1
HOYA	forb	Acalypha neomexicana	EUP	<1
HOYA	forb	Agastache pallidiflora hybrid	LAM	<1
HOYA	forb	Antennaria parvifolia	AST	<1
HOYA	forb	Arabis sp.	BRA	<1
HOYA	forb	Artemisia carruthii	AST	3
HOYA	forb	Asclepias asperula asperula	ASC	<1
HOYA	forb	Bahia dissecta	AST	<1
HOYA	forb	Cirsium sp.	AST	<1
HOYA	forb	Cryptantha cinerea	BOR	<1
HOYA	forb	Dalea compacta	FAB	<1
HOYA	forb	Dalea leporina	FAB	<1
HOYA	forb	Erigeron flagellaris	AST	<1
HOYA	forb	Eriogonum jamesii	PGN	<1
HOYA	forb	Geranium lentum	GER	<1
HOYA	forb	Glandularia wrightii	VER	<1
HOYA	forb	Heterotheca villosa	AST	5
HOYA	forb	Ipomoea costellata	CON	<1
HOYA	forb	Lotus wrightii	FAB	<1
HOYA	forb	Mommina wrightii	PGL	<1
HOYA	forb	Penstemon barbatus	SCR	<1
HOYA	forb	Salvia subincisa	LAM	<1
HOYA	forb	Spheralcea digitata	MAL	<1

HOYA	forb	Tagetes micrantha	AST	<1
HOYA	forb	Talinum confertiflorum	POR	<1
HOYA	forb	Tragopogon dubius	AST	<1
HOYA	grass	Blepharoneuron tricholepis	POA	2
HOYA	grass	Bouteloua gracilis	POA	10
HOYA	grass	Cyperus aristatus	CYP	<1
HOYA	grass	Elymus longifolius	POA	1
HOYA	grass	Muhlenbergia minutissima	POA	<1
HOYA	grass	Muhlenbergia montana	POA	5
HOYA	grass	Oryzopsis micrantha	POA	<1
HOYA	grass	Schizachyrium scoparium	POA	<1
HOYA	shrub	Fallugia paradoxa	ROS	5
HOYA	shrub	Forestiera neomexicana	OLE	<1
HOYA	shrub	Holodiscus dumosus	ROS	<1
HOYA	shrub	Mahonia repens	BER	<1
HOYA	shrub	Rhus trilobata	ANA	<1
HOYA	shrub	Ribes cereum	GRO	<1
HOYA	shrub	Rubus strigosus arizonicus	ROS	<1
HOYA	tree	Juniperus scopulorum	CUP	<1
HOYA	tree	Pinus edulis	PIN	<1
HOYA	tree	Pinus ponderosa	PIN	40
HOYA	tree	Populus tremuloides	SAL	<1
HOYA	vine	Vitis arizonica	VIT	<1
HOYK	cactus	Echinocereus fendleri	CAC	<1
HOYK	cactus	Opuntia polyacantha	CAC	<1
HOYK	forb	Antennaria parvifolia	AST	<1
HOYK	forb	Arabis fendleri	BRA	<1
HOYK	forb	Artemisia carruthii	AST	<1
HOYK	forb	Artemisia frigida	AST	<1
HOYK	forb	Bahia dissecta	AST	<1
HOYK	forb	Castilleja integra	SCR	<1
HOYK	forb	Chaetopappa ericoides	AST	<1
HOYK	forb	Chenopodium dessicatum	CHE	<1
HOYK	forb	Cirsium neomexicanum	AST	<1
HOYK	forb	Cryptantha cinerea	BOR	<1
HOYK	forb	Erigeron colomexicanus	AST	<1
HOYK	forb	Erigeron divergens	AST	<1
HOYK	forb	Erigeron flagellaris	AST	<1
HOYK	forb	Eriogonum racemosum	PGN	<1
HOYK	forb	Geranium lentum	GER	<1
HOYK	forb	Glandularia wrightii	VER	<1
HOYK	forb	Heterotheca villosa	AST	<1
HOYK	forb	Ipomopsis aggregata ssp. formosissima	POL	<1
HOYK	forb	Lactuca serriola	AST	<1
HOYK	forb	Lappula redowskii	BOR	<1
HOYK	forb	Lotus wrightii	FAB	<1
HOYK	forb	Lupinus kingii kingii	FAB	<1
HOYK	forb	Oenothera caespitosa	ONA	<1
HOYK	forb	Penstemon barbatus	SCR	<1
HOYK	forb	Psoralea tenuiflora bigelovii	FAB	<1
HOYK	forb	Senecio sp.	AST	<1
HOYK	forb	Spheralcea digitata	MAL	<1

HOYK	forb	Talinum confertiflorum	POR	<1
HOYK	forb	Verbascum thapsus	SCR	<1
HOYK	forb	Viguiera multiflora	AST	<1
HOYK	grass	Bouteloua curtipendula	POA	<1
HOYK	grass	Bouteloua gracilis	POA	4
HOYK	grass	Elymus longifolius	POA	<1
HOYK	grass	Muhlenbergia minutissima	POA	<1
HOYK	grass	Muhlenbergia montana	POA	15
HOYK	grass	Schizachyrium scoparium	POA	<1
HOYK	shrub	Fallugia paradoxa	ROS	<1
HOYK	shrub	Forestiera neomexicana	OLE	<1
HOYK	shrub	Rhus glabra	ANA	<1
HOYK	shrub	Rhus trilobata	ANA	<1
HOYK	shrub	Ribes cereum	GRO	<1
HOYK	shrub	Rubus strigosus strigosus	ROS	<1
HOYK	shrub	Yucca baccata	AGA	<1
HOYK	tree	Pinus edulis	PIN	<1
HOYK	tree	Pinus ponderosa	PIN	4
HOYM	cactus	Echinocereus trigloch melan	CAC	<1
HOYM	cactus	Opuntia imbricata	CAC	<1
HOYM	cactus	Opuntia phaeacantha	CAC	<1
HOYM	cactus	Opuntia polyacantha	CAC	<1
HOYM	forb	Artemisia carruthii	AST	<1
HOYM	forb	Glandularia wrightii	VER	<1
HOYM	grass	Bouteloua gracilis	POA	<1
HOYM	shrub	Forestiera neomexicana	OLE	<1
HOYM	shrub	Fraxinus cuspidata	OLE	<1
HOYM	shrub	Quercus X pauciloba	FAG	<1
HOYM	shrub	Rhus trilobata	ANA	<1
HOYM	shrub	Yucca baccata	AGA	<1
HOYM	tree	Juniperus monosperma	CUP	<1
HOYM	tree	Pinus edulis	PIN	<1
HOYM	tree	Pinus ponderosa	PIN	<1
HOYP	cactus	Echinocereus sp.	CAC	<1
HOYP	cactus	Opuntia polyacantha	CAC	<1
HOYP	fern	Woodsia plummerae	ASP	<1
HOYP	forb	Ambrosia sp.	AST	<1
HOYP	forb	Arabis sp.	BRA	<1
HOYP	forb	Asclepias asperula asperula	ASC	<1
HOYP	forb	Astragalus mollissimus	FAB	<1
HOYP	forb	Castilleja integra	SCR	<1
HOYP	forb	Chaetopappa ericoides	AST	<1
HOYP	forb	Cirsium sp.	AST	<1
HOYP	forb	Eriogonum jamesii	PGN	<1
HOYP	forb	Gaillardia pinnatifida	AST	<1
HOYP	forb	Gaura coccinea	ONA	<1
HOYP	forb	Gayophytum ramosissimum	ONA	<1
HOYP	forb	Geranium lentum	GER	<1
HOYP	forb	Glandularia wrightii	VER	<1
HOYP	forb	Heterotheca villosa	AST	2
HOYP	forb	Houstonia wrightii	RUB	<1
HOYP	forb	Infected Arabis	XXX	<1

HOYP	forb	Lappula redowskii	BOR	<1
HOYP	forb	Linum neomexicanum	LIN	<1
HOYP	forb	Lithospermum multiflorum	BOR	<1
HOYP	forb	Lotus wrightii	FAB	<1
HOYP	forb	Oenothera albicaulis	ONA	<1
HOYP	forb	Potentilla pensylvanica	ROS	<1
HOYP	forb	Spheralcea digitata	MAL	<1
HOYP	forb	Tragia ramosa	EUP	<1
HOYP	forb	Verbascum thapsus	SCR	<1
HOYP	grass	Aristida arizonica	POA	<1
HOYP	grass	Aristida purpurea fendleriana	POA	<1
HOYP	grass	Bouteloua gracilis	POA	1
HOYP	grass	Carex occidentalis	CYP	<1
HOYP	grass	Elymus longifolius	POA	<1
HOYP	grass	Lycurus setosus	POA	<1
HOYP	grass	Oryzopsis micrantha	POA	<1
HOYP	grass	Stipa comata	POA	<1
HOYP	grass	Vulpia octoflora	POA	<1
HOYP	shrub	Chrysothamnus sp.	AST	<1
HOYP	shrub	Fallugia paradoxa	ROS	<1
HOYP	shrub	Quercus X pauciloba	FAG	<1
HOYP	shrub	Quercus gambelii	FAG	<1
HOYP	shrub	Quercus grisea	FAG	<1
HOYP	shrub	Rhus trilobata	ANA	<1
HOYP	shrub	Ribes cereum	GRO	<1
HOYP	shrub	Tetradymia canescens	AST	<1
HOYP	shrub	Yucca baccata	AGA	<1
HOYP	tree	Juniperus monosperma	CUP	<1
HOYP	tree	Pinus edulis	PIN	<1
HOYP	tree	Pinus ponderosa	PIN	2
ICEP	cactus	Opuntia polyacantha	CAC	<1
ICEP	fern	Woodsia plummerae	ASP	<1
ICEP	forb	Arabis fendleri	BRA	<1
ICEP	forb	Arenaria lanuginosa saxosa	CAR	<1
ICEP	forb	Asclepias sp.	ASC	<1
ICEP	forb	Astragalus sp.	FAB	<1
ICEP	forb	Castilleja integra	SCR	<1
ICEP	forb	Chaetopappa ericoides	AST	<1
ICEP	forb	Descurainia obtusa brevisiliqua	BRA	<1
ICEP	forb	Erigeron flagellaris	AST	3
ICEP	forb	Eriogonum jamesii	PGN	<1
ICEP	forb	Eriogonum racemosum	PGN	<1
ICEP	forb	Geranium lentum	GER	<1
ICEP	forb	Glandularia wrightii	VER	<1
ICEP	forb	Heterotheca villosa	AST	<1
ICEP	forb	Hymenopappus filifolius	AST	<1
ICEP	forb	Hymenoxys richardsonii	AST	<1
ICEP	forb	Lupinus kingii kingii	FAB	<1
ICEP	forb	Talinum confertiflorum	POR	<1
ICEP	forb	Thelesperma megapotamicum	AST	<1
ICEP	forb	Tragopogon dubius	AST	<1
ICEP	forb	Verbascum thapsus	SCR	<1

ICEP	grass	Carex occidentalis	CYP	<1
ICEP	grass	Elymus trachycaulus	POA	<1
ICEP	shrub	Fallugia paradoxa	ROS	2
ICEP	shrub	Rhus trilobata	ANA	<1
ICEP	shrub	Ribes cereum	GRO	10
ICEP	shrub	Tetradymia canescens	AST	<1
ICEP	shrub	Yucca baccata	AGA	<1
ICEP	tree	Juniperus scopulorum	CUP	4
ICEP	tree	Pinus edulis	PIN	2
ICEP	tree	Pinus ponderosa	PIN	2
ICWA	cactus	Echinocereus trigloch melan	CAC	<1
ICWA	fern	Woodsia plummerae	ASP	<1
ICWA	forb	Arabis fendleri	BRA	<1
ICWA	forb	Artemisia carruthii	AST	<1
ICWA	forb	Descurainia obtusa	BRA	<1
ICWA	forb	Verbascum thapsus	SCR	<1
ICWA	grass	Bromus sp.	POA	<1
ICWA	grass	Muhlenbergia minutissima	POA	<1
ICWA	shrub	Holodiscus dumosus	ROS	1
ICWA	shrub	Ribes cereum	GRO	2
ICWA	tree	Juniperus scopulorum	CUP	<1
INWA	cactus	Echinocereus trigloch melan	CAC	<1
INWA	cactus	Opuntia polyacantha	CAC	<1
INWA	forb	Arabis sp.	BRA	<1
INWA	forb	Artemisia sp.	AST	<1
INWA	forb	Geranium lentum	GER	<1
INWA	forb	Verbascum thapsus	SCR	<1
INWA	grass	Elymus longifolius	POA	<1
INWA	shrub	Chrysothamnus sp.	AST	<1
INWA	shrub	Fallugia paradoxa	ROS	<1
INWA	shrub	Forestiera neomexicana	OLE	<1
INWA	shrub	Holodiscus dumosus	ROS	<1
INWA	shrub	Pericome caudata	AST	<1
INWA	shrub	Rhus trilobata	ANA	<1
INWA	shrub	Ribes cereum	GRO	<1
INWA	tree	Juniperus scopulorum	CUP	3
INWA	tree	Pinus ponderosa	PIN	2
INWA	tree	Populus tremuloides	SAL	<1
INWA	tree	Pseudotsuga menziesii	PIN	3
IRIS	cactus	Opuntia imbricata	CAC	<1
IRIS	cactus	Opuntia polyacantha	CAC	<1
IRIS	forb	Achillea millefolium lanulosa	AST	<1
IRIS	forb	Antennaria parvifolia	AST	<1
IRIS	forb	Arabis sp.	BRA	<1
IRIS	forb	Artemisia frigida	AST	<1
IRIS	forb	Artemisia sp.	AST	<1
IRIS	forb	Astragalus sp.	FAB	<1
IRIS	forb	Bahia dissecta	AST	<1
IRIS	forb	Castilleja integra	SCR	<1
IRIS	forb	Chaetopappa ericoides	AST	<1
IRIS	forb	Chenopodium sp.	CHE	<1
IRIS	forb	Cirsium sp.	AST	<1

IRIS	forb	Convolvulus arvensis	CON	<1
IRIS	forb	Coreopsis tinctoria tinctoria	AST	<1
IRIS	forb	Cryptantha sp.	BOR	<1
IRIS	forb	Erigeron sp.	AST	<1
IRIS	forb	Eriogonum sp.	PGN	<1
IRIS	forb	Frasera speciosa	GEN	<1
IRIS	forb	Geranium sp.	GER	<1
IRIS	forb	Glandularia wrightii	VER	<1
IRIS	forb	Heterotheca villosa	AST	<1
IRIS	forb	Houstonia wrightii	RUB	<1
IRIS	forb	Hymenopappus filifolius	AST	<1
IRIS	forb	Hymenoxys argentea	AST	<1
IRIS	forb	Infected Arabis	XXX	<1
IRIS	forb	Iris missouriensis	IRI	<1
IRIS	forb	Lupinus kingii kingii	FAB	<1
IRIS	forb	Medicago lupinula	FAB	<1
IRIS	forb	Oenothera sp.	ONA	<1
IRIS	forb	Oxalis corniculata	OXA	<1
IRIS	forb	Potentilla pensylvanica	ROS	<1
IRIS	forb	Potentilla sp.	ROS	<1
IRIS	forb	Sophora nuttalliana	FAB	<1
IRIS	forb	Spheralcea digitata	MAL	<1
IRIS	forb	Taraxacum officinale	AST	<1
IRIS	forb	Thalictrum fendleri	RAN	<1
IRIS	forb	Tragia ramosa	EUP	<1
IRIS	forb	Tragopogon dubius	AST	<1
IRIS	forb	Verbascum thapsus	SCR	<1
IRIS	forb	Veronica peregrina	SCR	<1
IRIS	forb	Vicia americana minor	FAB	<1
IRIS	grass	Aristida purpurea purpurea	POA	<1
IRIS	grass	Bouteloua gracilis	POA	<1
IRIS	grass	Carex occidentalis	CYP	<1
IRIS	grass	Elymus longifolius	POA	<1
IRIS	shrub	Chrysothamnus sp.	AST	<1
IRIS	shrub	Fallugia paradoxa	ROS	<1
IRIS	shrub	Forestiera neomexicana	OLE	<1
IRIS	shrub	Mahonia repens	BER	<1
IRIS	shrub	Prunus virginiana	ROS	<1
IRIS	shrub	Quercus gambelii	FAG	1
IRIS	shrub	Quercus grisea	FAG	<1
IRIS	shrub	Rhus trilobata	ANA	<1
IRIS	shrub	Ribes cereum	GRO	<1
IRIS	shrub	Rubus strigosus	ROS	<1
IRIS	shrub	Tetradymia canescens	AST	<1
IRIS	shrub	Yucca baccata	AGA	<1
IRIS	shrub	Yucca baileyi X Y. glauca	AGA	<1
IRIS	tree	Juniperus scopulorum	CUP	<1
IRIS	tree	Pinus ponderosa	PIN	3
IRIS	vine	Clematis ligusticifolia	RAN	<1
JUCA	fern	Woodsia plummerae	ASP	<1
JUCA	forb	Arabis fendleri	BRA	<1
JUCA	forb	Artemisia carruthii	AST	<1

JUCA	forb	Artemisia ludoviciana	AST	<1
JUCA	forb	Bahia dissecta	AST	<1
JUCA	forb	Castilleja integra	SCR	<1
JUCA	forb	Cryptantha cinerea	BOR	<1
JUCA	forb	Cymopterus purpurascens	API	<1
JUCA	forb	Erigeron colomexicanus	AST	<1
JUCA	forb	Eriogonum jamesii	PGN	<1
JUCA	forb	Glandularia wrightii	VER	<1
JUCA	forb	Gutierrezia sarothrae	AST	<1
JUCA	forb	Heterotheca villosa	AST	<1
JUCA	forb	Hymenopappus filifolius	AST	<1
JUCA	forb	Hymenoxys richardsonii	AST	<1
JUCA	forb	Lappula redowskii	BOR	<1
JUCA	forb	Orthocarpus purpureo-albus	SCR	<1
JUCA	forb	Plantago patagonica	PLA	<1
JUCA	forb	Spheralcea coccinea	MAL	<1
JUCA	forb	Spheralcea digitata	MAL	<1
JUCA	forb	Verbascum thapsus	SCR	<1
JUCA	grass	Bouteloua gracilis	POA	<1
JUCA	grass	Elymus longifolius	POA	<1
JUCA	grass	Muhlenbergia montana	POA	<1
JUCA	shrub	Fallugia paradoxa	ROS	<1
JUCA	shrub	Pericome caudata	AST	<1
JUCA	shrub	Rhus trilobata	ANA	<1
JUCA	shrub	Ribes cereum	GRO	<1
JUCA	shrub	Tetradymia canescens	AST	<1
JUCA	tree	Pinus ponderosa	PIN	<1
KIHN	cactus	Echinocereus fendleri	CAC	<1
KIHN	cactus	Opuntia polyacantha	CAC	<1
KIHN	forb	Arabis perennans	BRA	<1
KIHN	forb	Artemisia carruthii	AST	<1
KIHN	forb	Artemisia frigida	AST	<1
KIHN	forb	Asclepias asperula asperula	ASC	<1
KIHN	forb	Bahia dissecta	AST	<1
KIHN	forb	Castilleja integra	SCR	<1
KIHN	forb	Chaetopappa ericoides	AST	<1
KIHN	forb	Chenopodium leptophyllum	CHE	<1
KIHN	forb	Chenopodium sp.	CHE	<1
KIHN	forb	Cirsium sp.	AST	<1
KIHN	forb	Cryptantha cinerea	BOR	<1
KIHN	forb	Erigeron colomexicanus	AST	<1
KIHN	forb	Erigeron flagellaris	AST	<1
KIHN	forb	Eriogonum jamesii	PGN	<1
KIHN	forb	Eriogonum sp.	PGN	<1
KIHN	forb	Gaura hexandra gracilis	ONA	<1
KIHN	forb	Glandularia wrightii	VER	<1
KIHN	forb	Gutierrezia sarothrae	AST	<1
KIHN	forb	Heterotheca villosa	AST	<1
KIHN	forb	Hymenopappus filifolius	AST	<1
KIHN	forb	Hymenoxys richardsonii	AST	<1
KIHN	forb	Lappula redowskii	BOR	<1
KIHN	forb	Linum aristatum	LIN	<1

KIHN	forb	Linum lewisii	LIN	<1
KIHN	forb	Marrubium vulgare	LAM	<1
KIHN	forb	Oenothera sp.	ONA	<1
KIHN	forb	Penstemon barbatus	SCR	<1
KIHN	forb	Plantago patagonica	PLA	<1
KIHN	forb	Spheralcea digitata	MAL	<1
KIHN	forb	Talinum confertiflorum	POR	<1
KIHN	forb	Thelypodiopsis linearifolia	BRA	<1
KIHN	forb	Tragopogon dubius	AST	<1
KIHN	grass	Aristida purpurea purpurea	POA	<1
KIHN	grass	Bouteloua gracilis	POA	<1
KIHN	grass	Dasyochloa pulchella	POA	<1
KIHN	grass	Elymus longifolius	POA	<1
KIHN	grass	Muhlenbergia montana	POA	<1
KIHN	grass	Muhlenbergia torreyi	POA	<1
KIHN	grass	Sporobolus cryptandrus	POA	<1
KIHN	shrub	Chrysothamnus sp.	AST	<1
KIHN	shrub	Mahonia repens	BER	<1
KIHN	shrub	Rhus trilobata	ANA	<1
KIHN	shrub	Ribes cereum	GRO	<1
KIHN	shrub	Tetradymia canescens	AST	<1
KIHN	shrub	Yucca baccata	AGA	<1
KIHN	tree	Juniperus monosperma	CUP	<1
KIHN	tree	Pinus edulis	PIN	<1
KIHN	tree	Pinus ponderosa	PIN	<1
KIHS	cactus	Echinocereus fendleri	CAC	<1
KIHS	cactus	Opuntia polyacantha	CAC	<1
KIHS	forb	Androsace septentrionalis glandulosa	PRI	<1
KIHS	forb	Arabis perennans	BRA	<1
KIHS	forb	Artemisia carruthii	AST	<1
KIHS	forb	Artemisia dracunculus	AST	<1
KIHS	forb	Artemisia frigida	AST	<1
KIHS	forb	Asclepias asperula asperula	ASC	<1
KIHS	forb	Astragalus sp.	FAB	<1
KIHS	forb	Bahia dissecta	AST	<1
KIHS	forb	Castilleja integra	SCR	<1
KIHS	forb	Castilleja sp.	SCR	<1
KIHS	forb	Chaetopappa ericoides	AST	<1
KIHS	forb	Cirsium neomexicanum	AST	<1
KIHS	forb	Cryptantha cinerea	BOR	<1
KIHS	forb	Erigeron colomexicanus	AST	<1
KIHS	forb	Erigeron flagellaris	AST	<1
KIHS	forb	Eriogonum jamesii	PGN	<1
KIHS	forb	Eriogonum racemosum	PGN	<1
KIHS	forb	Gaura coccinea	ONA	<1
KIHS	forb	Glandularia wrightii	VER	<1
KIHS	forb	Gutierrezia sarothrae	AST	<1
KIHS	forb	Heterotheca villosa	AST	<1
KIHS	forb	Hymenopappus filifolius cinereus	AST	<1
KIHS	forb	Hymenoxys richardsonii	AST	<1
KIHS	forb	Lepidium densiflorum	BRA	<1
KIHS	forb	Linum aristatum	LIN	<1

KIHS	forb	Linum lewisii	LIN	<1
KIHS	forb	Lotus wrightii	FAB	<1
KIHS	forb	Lupinus kingii kingii	FAB	<1
KIHS	forb	Oenothera sp.	ONA	<1
KIHS	forb	Plantago patagonica	PLA	<1
KIHS	forb	Spheralcea digitata	MAL	<1
KIHS	forb	Stephanomeria pauciflora	AST	<1
KIHS	forb	Thelypodiopsis linearifolia	BRA	<1
KIHS	forb	Townsendia exscapa	AST	<1
KIHS	forb	Tragopogon dubius	AST	<1
KIHS	forb	Verbascum thapsus	SCR	<1
KIHS	forb	Viguiera multiflora	AST	<1
KIHS	grass	Andropogon gerardii	POA	<1
KIHS	grass	Aristida arizonica	POA	<1
KIHS	grass	Aristida purpurea purpurea	POA	<1
KIHS	grass	Bouteloua gracilis	POA	<1
KIHS	grass	Elymus longifolius	POA	<1
KIHS	grass	Lycurus setosus	POA	<1
KIHS	grass	Muhlenbergia montana	POA	<1
KIHS	grass	Muhlenbergia torreyi	POA	<1
KIHS	grass	Poa fendleriana	POA	<1
KIHS	shrub	Ceratoides lanata	CHE	<1
KIHS	shrub	Chrysothamnus sp.	AST	<1
KIHS	shrub	Chrysothamnus sp.	AST	<1
KIHS	shrub	Fallugia paradoxa	ROS	<1
KIHS	shrub	Forestiera neomexicana	OLE	<1
KIHS	shrub	Mahonia repens	BER	<1
KIHS	shrub	Rhus trilobata	ANA	<1
KIHS	shrub	Ribes cereum	GRO	<1
KIHS	shrub	Tetradymia canescens	AST	<1
KIHS	shrub	Yucca baccata	AGA	<1
KIHS	tree	Juniperus monosperma	CUP	<1
KIHS	tree	Pinus edulis	PIN	<1
KIHS	tree	Pinus ponderosa	PIN	<1
LACR	cactus	Echinocereus trigloch melan	CAC	<1
LACR	cactus	Opuntia polyacantha	CAC	<1
LACR	fern	Woodsia plummerae	ASP	<1
LACR	forb	Anthericum torreyi	LIL	<1
LACR	forb	Artemisia carruthii	AST	<1
LACR	forb	Bahia dissecta	AST	<1
LACR	forb	Brickellia brachyphylla	AST	<1
LACR	forb	Brickellia chlorolepis	AST	<1
LACR	forb	Chenopodium sp.	CHE	<1
LACR	forb	Cryptantha cinerea	BOR	<1
LACR	forb	Descurainia obtusa brevisiliqua	BRA	<1
LACR	forb	Erigeron speciosus	AST	<1
LACR	forb	Eriogonum jamesii	PGN	<1
LACR	forb	Potentilla sp.	ROS	<1
LACR	forb	Psoralea tenuiflora bigelovii	FAB	<1
LACR	forb	Rumex triangulivalvis	PGN	<1
LACR	forb	Talinum confertiflorum	POR	<1
LACR	forb	Tragopogon dubius	AST	<1

LACR	forb	Verbascum thapsus	SCR	<1
LACR	grass	Muhlenbergia minutissima	POA	<1
LACR	shrub	Chrysothamnus sp.	AST	<1
LACR	shrub	Fallugia paradoxa	ROS	<1
LACR	shrub	Forestiera neomexicana	OLE	<1
LACR	shrub	Holodiscus dumosus	ROS	<1
LACR	shrub	Pericome caudata	AST	<1
LACR	shrub	Ribes cereum	GRO	<1
LACR	shrub	Yucca baccata	AGA	<1
LACR	tree	Juniperus scopulorum	CUP	<1
LACR	tree	Pinus edulis	PIN	<1
LACR	tree	Pinus ponderosa	PIN	<1
LACR	tree	Populus tremuloides	SAL	<1
LACR	tree	Pseudotsuga menziesii	PIN	<1
LICO	cactus	Echinocereus trigloch melan	CAC	<1
LICO	cactus	Opuntia polyacantha	CAC	<1
LICO	forb	Arabis sp.	BRA	<1
LICO	forb	Artemisia sp.	AST	<1
LICO	grass	Bouteloua gracilis	POA	2
LICO	grass	Muhlenbergia montana	POA	.2
LICO	grass	Oryzopsis hymenoides	POA	<1
LICO	shrub	Chrysothamnus sp.	AST	<1
LICO	shrub	Fallugia paradoxa	ROS	<1
LICO	shrub	Forestiera neomexicana	OLE	<1
LICO	shrub	Holodiscus dumosus	ROS	1
LICO	shrub	Ribes cereum	GRO	<1
LICO	tree	Juniperus scopulorum	CUP	<1
LICO	tree	Pinus edulis	PIN	<1
LICO	tree	Pseudotsuga menziesii	PIN	<1
LOME	cactus	Coryphantha vivipara	CAC	<1
LOME	cactus	Opuntia polyacantha	CAC	1
LOME	forb	Artemisia campestris pacifica	AST	<1
LOME	forb	Artemisia frigida	AST	<1
LOME	forb	Bahia dissecta	AST	<1
LOME	forb	Cryptantha cinerea	BOR	<1
LOME	forb	Eriogonum alatum	PGN	<1
LOME	forb	Eriogonum annuum	PGN	<1
LOME	forb	Euphorbia lurida	EUP	<1
LOME	forb	Geranium caespitosum	GER	<1
LOME	forb	Glandularia wrightii	VER	5
LOME	forb	Ipomopsis longiflora	POL	<1
LOME	forb	Ipomopsis multiflora	POL	<1
LOME	forb	Macheranthera gracilis	AST	<1
LOME	forb	Mirabilis multiflora	NYC	<1
LOME	forb	Oenothera sp.	ONA	<1
LOME	forb	Penstemon ambiguus laevissimus	SCR	<1
LOME	forb	Phoradendron juniperinum	LOR	<1
LOME	forb	Salvia subincisa	LAM	<1
LOME	forb	Senecio douglasii	AST	<1
LOME	forb	Talinum confertiflorum	POR	<1
LOME	forb	Thelypodiopsis linearifolia	BRA	<1
LOME	forb	Tradescantia occidentalis scopulorum	CMM	<1

LOME	grass	Bouteloua gracilis	POA	4
LOME	grass	Cyperus fendlerianus	CYP	<1
LOME	shrub	Artemisia filifolia	AST	1
LOME	shrub	Chrysothamnus sp.	AST	1
LOME	shrub	Rhus trilobata	ANA	1
LOME	shrub	Yucca baccata	AGA	<1
LOME	tree	Juniperus monosperma	CUP	5
LOME	tree	Pinus edulis	PIN	3
LOME	tree	Pinus ponderosa	PIN	5
LOWO	cactus	Echinocereus sp.	CAC	<1
LOWO	cactus	Echinocereus trigloch melan	CAC	<1
LOWO	cactus	Opuntia sp.	CAC	<1
LOWO	cactus	Opuntia sp.	CAC	<1
LOWO	forb	Arabis sp.	BRA	<1
LOWO	forb	Bahia dissecta	AST	<1
LOWO	forb	Chenopodium sp.	CHE	<1
LOWO	forb	Cirsium sp.	AST	<1
LOWO	forb	Descurainia pinnata	BRA	<1
LOWO	forb	Draba cuneifolia cuneifolia	BRA	<1
LOWO	forb	Eriogonum jamesii	PGN	<1
LOWO	forb	Geranium sp.	GER	<1
LOWO	forb	Gilia sinuata	POL	<1
LOWO	forb	Gutierrezia sarothrae	AST	<1
LOWO	forb	Hieracium fendleri fendleri	AST	<1
LOWO	forb	Lithospermum incisum	BOR	<1
LOWO	forb	Lupinus kingii kingii	FAB	<1
LOWO	forb	Mentzelia sp.	LOA	<1
LOWO	forb	Phacelia sp.	HYD	<1
LOWO	forb	Pseudocymopterus montanus	API	<1
LOWO	forb	Stephanomeria sp.	AST	<1
LOWO	forb	Thermopsis rhombifolia montana	FAB	<1
LOWO	forb	Tragopogon dubius	AST	<1
LOWO	forb	Verbascum thapsus	SCR	<1
LOWO	grass	Bouteloua gracilis	POA	<1
LOWO	grass	Bromus tectorum	POA	<1
LOWO	shrub	Fallugia paradoxa	ROS	1
LOWO	shrub	Pericome caudata	AST	<1
LOWO	shrub	Ribes cereum	GRO	<1
LOWO	tree	Juniperus monosperma	CUP	<1
LOWO	tree	Pinus edulis	PIN	1
LOWO	tree	Pinus ponderosa	PIN	5
LOWO	tree	Populus tremuloides	SAL	<1
LOWO	tree	Pseudotsuga menziesii	PIN	<1
MAR2	cactus	Echinocereus trigloch melan	CAC	<1
MAR2	fern	Dryopteris filix-mas	ASP	<1
MAR2	fern	Woodsia plummerae	ASP	<1
MAR2	forb	Arabis fendleri	BRA	<1
MAR2	forb	Artemisia carruthii	AST	<1
MAR2	forb	Descurainia obtusa brevisiliqua	BRA	<1
MAR2	forb	Frasera speciosa	GEN	<1
MAR2	forb	Thelypodiopsis linearifolia	BRA	<1
MAR2	forb	Verbascum thapsus	SCR	<1

MAR2	shrub	Mahonia repens	BER	<1
MAR2	shrub	Pericome caudata	AST	<1
MAR2	shrub	Quercus gambelii	FAG	<1
MAR2	shrub	Ribes cereum	GRO	10
MAR2	tree	Juniperus scopulorum	CUP	20
MAR2	tree	Pinus ponderosa	PIN	7
MAR2	tree	Pseudotsuga menziesii	PIN	10
MAR3	crypto	Marcantia polymorpha	HEP	<1
MAR3	fern	Dryopteris filix-mas	ASP	1
MAR3	fern	Woodsia plummerae	ASP	<1
MAR3	forb	Brickellia brachyphylla	AST	<1
MAR3	forb	Descurainia obtusa brevisiliqua	BRA	<1
MAR3	forb	Erysimum capitatum	BRA	<1
MAR3	forb	Geranium lentum	GER	2
MAR3	forb	Lotus wrightii	FAB	<1
MAR3	forb	Senecio multilobatus	AST	<1
MAR3	forb	Thelypodiopsis linearifolia	BRA	<1
MAR3	forb	Verbascum thapsus	SCR	<1
MAR3	shrub	Forestiera neomexicana	OLE	<1
MAR3	shrub	Holodiscus dumosus	ROS	30
MAR3	shrub	Pericome caudata	AST	<1
MAR3	shrub	Ribes cereum	GRO	20
MAR3	tree	Juniperus scopulorum	CUP	15
MAR4	cactus	Echinocereus trigloch melan	CAC	<1
MAR4	forb	Descurainia obtusa brevisiliqua	BRA	<1
MAR4	forb	Glandularia wrightii	VER	<1
MAR4	forb	Thelypodiopsis linearifolia	BRA	<1
MAR4	forb	Verbascum thapsus	SCR	<1
MAR4	shrub	Forestiera neomexicana	OLE	<1
MAR4	shrub	Holodiscus dumosus	ROS	30
MAR4	shrub	Pericome caudata	AST	5
MAR4	shrub	Ribes cereum	GRO	5
MAR4	tree	Juniperus scopulorum	CUP	50
MAR5	cactus	Echinocereus fendleri	CAC	<1
MAR5	fern	Woodsia plummerae	ASP	<1
MAR5	forb	Androsace septentrionalis glandulosa	PRI	<1
MAR5	forb	Arabis fendleri	BRA	<1
MAR5	forb	Arenaria lanuginosa saxosa	CAR	<1
MAR5	forb	Artemisia carruthii	AST	<1
MAR5	forb	Cirsium sp.	AST	<1
MAR5	forb	Cryptantha cinerea	BOR	<1
MAR5	forb	Descurainia obtusa brevisiliqua	BRA	<1
MAR5	forb	Frasera speciosa	GEN	<1
MAR5	forb	Geranium caespitosum caespitosum	GER	<1
MAR5	forb	Hieracium fendleri fendleri	AST	<1
MAR5	forb	Linum neomexicanum	LIN	<1
MAR5	forb	Lotus wrightii	FAB	<1
MAR5	forb	Lupinus kingii kingii	FAB	1
MAR5	forb	Thelypodiopsis linearifolia	BRA	<1
MAR5	forb	Verbascum thapsus	SCR	<1
MAR5	shrub	Chrysothamnus sp.	AST	<1
MAR5	shrub	Fallugia paradoxa	ROS	<1

MAR5	shrub	Holodiscus dumosus	ROS	1
MAR5	shrub	Mahonia repens	BER	1
MAR5	shrub	Pericome caudata	AST	<1
MAR5	shrub	Quercus gambelii	FAG	<1
MAR5	shrub	Ribes cereum	GRO	1
MAR5	tree	Juniperus scopulorum	CUP	5
MAR5	tree	Pinus edulis	PIN	<1
MAR5	tree	Pinus ponderosa	PIN	3
MAR5	tree	Pseudotsuga menziesii	PIN	5
MAR6	forb	Artemisia carruthii	AST	1
MAR6	forb	Lotus wrightii	FAB	<1
MAR6	forb	Verbascum thapsus	SCR	<1
MAR6	shrub	Fallugia paradoxa	ROS	2
MAR6	shrub	Pericome caudata	AST	<1
MAR6	shrub	Ribes cereum	GRO	1
MAR6	tree	Juniperus scopulorum	CUP	1
MAR6	tree	Pinus ponderosa	PIN	30
MAR7	fern	Woodsia plummerae	ASP	<1
MAR7	forb	Artemisia carruthii	AST	<1
MAR7	shrub	Holodiscus dumosus	ROS	<1
MAR7	shrub	Pericome caudata	AST	<1
MAR7	shrub	Prunus virginiana	ROS	1
MAR7	shrub	Ribes cereum	GRO	<1
MAR7	tree	Juniperus scopulorum	CUP	5
MAR7	tree	Pseudotsuga menziesii	PIN	10
MARC	cactus	Echinocereus trigloch melan	CAC	<1
MARC	cactus	Opuntia polyacantha	CAC	<1
MARC	fern	Woodsia plummerae	ASP	<1
MARC	forb	Anthericum torreyi	LIL	<1
MARC	forb	Artemisia carruthii	AST	1
MARC	forb	Artemisia dracunculus	AST	<1
MARC	forb	Astragalus egglestonii	FAB	<1
MARC	forb	Astragalus mollissimus mathewsii	FAB	<1
MARC	forb	Bahia dissecta	AST	2
MARC	forb	Chaetopappa ericoides	AST	<1
MARC	forb	Chenopodium graveolens	CHE	<1
MARC	forb	Cirsium sp.	AST	<1
MARC	forb	Cryptantha cinerea	BOR	<1
MARC	forb	Dalea candida oligophylla	FAB	<1
MARC	forb	Dalea exigua or polygonoides	FAB	<1
MARC	forb	Erigeron divergens	AST	<1
MARC	forb	Erigeron flagellaris	AST	<1
MARC	forb	Eriogonum jamesii	PGN	<1
MARC	forb	Erysimum capitatum	BRA	<1
MARC	forb	Euphorbia lurida	EUP	<1
MARC	forb	Frasera speciosa	GEN	<1
MARC	forb	Geranium caespitosum caespitosum	GER	<1
MARC	forb	Geranium lentum	GER	<1
MARC	forb	Glandularia wrightii	VER	<1
MARC	forb	Grindelia aphanactis	AST	<1
MARC	forb	Heterotheca villosa	AST	<1
MARC	forb	Hymenopappus filifolius	AST	<1

MARC	forb	Hymenoxys richardsonii	AST	<1
MARC	forb	Infected Arabis	XXX	<1
MARC	forb	Ipomopsis aggregata ssp. formosissima	POL	<1
MARC	forb	Lappula redowskii	BOR	<1
MARC	forb	Linum neomexicanum	LIN	<1
MARC	forb	Lithospermum multiflorum	BOR	<1
MARC	forb	Lotus wrightii	FAB	<1
MARC	forb	Lupinus kingii kingii	FAB	<1
MARC	forb	Mollugo cerviana	AIZ	<1
MARC	forb	Orthocarpus purpureo-albus	SCR	<1
MARC	forb	Penstemon sp.	SCR	<1
MARC	forb	Pseudocymopterus montanus	API	<1
MARC	forb	Schkuhria multiflora	AST	<1
MARC	forb	Senecio multilobatus	AST	<1
MARC	forb	Senecio neomexicanus mutabilis	AST	<1
MARC	forb	Spheralcea digitata	MAL	<1
MARC	forb	Spheralcea fendleri	MAL	<1
MARC	forb	Thelypodiopsis linearifolia	BRA	<1
MARC	forb	Verbascum thapsus	SCR	<1
MARC	forb	Verbena macdougalii	VER	<1
MARC	grass	Andropogon gerardii gerardii	POA	<1
MARC	grass	Aristida arizonica	POA	<1
MARC	grass	Aristida purpurea fendleriana	POA	<1
MARC	grass	Blepharoneuron tricholepis	POA	<1
MARC	grass	Bouteloua gracilis	POA	5
MARC	grass	Muhlenbergia minutissima	POA	1
MARC	grass	Muhlenbergia pauciflora	POA	<1
MARC	grass	Munroa squarrosa	POA	<1
MARC	grass	Oryzopsis micrantha	POA	<1
MARC	grass	Poa fendleriana	POA	<1
MARC	grass	Schizachyrium scoparium	POA	<1
MARC	shrub	Fallugia paradoxa	ROS	<1
MARC	shrub	Forestiera neomexicana	OLE	<1
MARC	shrub	Holodiscus dumosus	ROS	5
MARC	shrub	Mahonia repens	BER	<1
MARC	shrub	Pericome caudata	AST	<1
MARC	shrub	Quercus gambelii	FAG	<1
MARC	shrub	Rhus trilobata	ANA	1
MARC	shrub	Ribes cereum	GRO	<1
MARC	shrub	Ribes inerme	GRO	2
MARC	shrub	Tetradymia canescens	AST	<1
MARC	shrub	Yucca baccata	AGA	<1
MARC	tree	Juniperus deppeana	CUP	<1
MARC	tree	Juniperus monosperma	CUP	5
MARC	tree	Juniperus scopulorum	CUP	3
MARC	tree	Pinus edulis	PIN	1
MARC	tree	Pinus ponderosa	PIN	15
MCCA	forb	Agastache pallidiflora hybrid	LAM	<1
MCCA	forb	Conyza canadensis	AST	<1
MCCA	forb	Hedeoma nanum	LAM	<1
MCCA	forb	Senecio douglasii	AST	<1
MCCA	forb	Thelypodium wrightii	BRA	<1

MCCA	forb	Viguiera multiflora	AST	<1
MCCA	grass	Bulbostylis capillaris	CYP	<1
MCCA	grass	Muhlenbergia fragilis	POA	<1
MCCA	shrub	Pericome caudata	AST	<1
MCCA	tree	Juniperus monosperma	CUP	<1
MCCA	vine	Clematis ligusticifolia	RAN	<1
MCSW	cactus	Coryphantha vivipara	CAC	<1
MCSW	cactus	Echinocereus trigloch melan	CAC	<1
MCSW	cactus	Opuntia polyacantha	CAC	<1
MCSW	fern	Asplenium septentrionale	ASP	<1
MCSW	forb	Abronia elliptica	NYC	<1
MCSW	forb	Arabis sp.	BRA	<1
MCSW	forb	Artemisia carruthii	AST	<1
MCSW	forb	Bahia dissecta	AST	<1
MCSW	forb	Castilleja integra	SCR	<1
MCSW	forb	Geranium lentum	GER	<1
MCSW	forb	Glandularia wrightii	VER	<1
MCSW	forb	Heterotheca villosa	AST	<1
MCSW	forb	Penstemon barbatus	SCR	<1
MCSW	forb	Potentilla sp.	ROS	<1
MCSW	forb	Senecio multilobatus	AST	<1
MCSW	forb	Tragopogon dubius	AST	<1
MCSW	grass	Aristida purpurea purpurea	POA	<1
MCSW	grass	Blepharoneuron tricholepis	POA	<1
MCSW	grass	Bouteloua curtipendula	POA	<1
MCSW	grass	Bouteloua gracilis	POA	<1
MCSW	grass	Bromus sp.	POA	<1
MCSW	grass	Elymus longifolius	POA	<1
MCSW	grass	Lycurus setosus	POA	<1
MCSW	grass	Muhlenbergia montana	POA	<1
MCSW	grass	Oryzopsis micrantha	POA	<1
MCSW	grass	Panicum capillare brevifolium	POA	<1
MCSW	grass	Schizachyrium scoparium	POA	<1
MCSW	shrub	Chrysothamnus sp.	AST	<1
MCSW	shrub	Fallugia paradoxa	ROS	15
MCSW	shrub	Forestiera neomexicana	OLE	<1
MCSW	shrub	Holodiscus dumosus	ROS	<1
MCSW	shrub	Rhus trilobata	ANA	<1
MCSW	shrub	Ribes cereum	GRO	<1
MCSW	tree	Juniperus monosperma	CUP	<1
MCSW	tree	Pinus edulis	PIN	5
MCSW	tree	Pinus ponderosa	PIN	5
MEBL	cactus	Coryphantha vivipara	CAC	<1
MEBL	cactus	Opuntia macrorhiza	CAC	<1
MEBL	cactus	Opuntia polyacantha	CAC	<1
MEBL	forb	Abronia fragrans	NYC	<1
MEBL	forb	Allium cernuum	LIL	<1
MEBL	forb	Arabis sp.	BRA	<1
MEBL	forb	Arenaria lanuginosa saxosa	CAR	<1
MEBL	forb	Artemisia frigida	AST	<1
MEBL	forb	Astragalus calycosus scaposus	FAB	<1
MEBL	forb	Bahia dissecta	AST	3

MEBL	forb	Brickellia brachyphylla	AST	<1
MEBL	forb	Castilleja integra	SCR	<1
MEBL	forb	Chamaesyce fendleri fendleri	EUP	<1
MEBL	forb	Commelina dianthifolia longispatha	CMM	<1
MEBL	forb	Cryptantha cinerea	BOR	<1
MEBL	forb	Erigeron canus	AST	<1
MEBL	forb	Erigeron divergens	AST	<1
MEBL	forb	Eriogonum alatum alatum	PGN	<1
MEBL	forb	Erysimum capitatum	BRA	<1
MEBL	forb	Gaura coccinea	ONA	<1
MEBL	forb	Geranium caespitosum	GER	<1
MEBL	forb	Glandularia wrightii	VER	5
MEBL	forb	Hedeoma drummondii	LAM	<1
MEBL	forb	Houstonia wrightii	RUB	<1
MEBL	forb	Hymenopappus filifolius cinereus	AST	<1
MEBL	forb	Hymenoxys argentea	AST	<1
MEBL	forb	Hymenoxys richardsonii	AST	<1
MEBL	forb	Ipomoea plummerae	CON	<1
MEBL	forb	Lesquerella rectipes	BRA	<1
MEBL	forb	Linum aristatum	LIN	<1
MEBL	forb	Linum lewisii	LIN	<1
MEBL	forb	Lotus wrightii	FAB	<1
MEBL	forb	Lupinus kingii kingii	FAB	1
MEBL	forb	Mirabilis diffusa	NYC	<1
MEBL	forb	Mirabilis linearis	NYC	<1
MEBL	forb	Mirabilis oxybaphoides	NYC	<1
MEBL	forb	Nama dichotomum	HYD	<1
MEBL	forb	Orthocarpus purpureo-albus	SCR	<1
MEBL	forb	Pseudocymopterus montanus	API	5
MEBL	forb	Sanvitalia abertii	AST	<1
MEBL	forb	Silene laciniata	CAR	<1
MEBL	forb	Sisyrinchium demissum	IRI	<1
MEBL	forb	Spheralcea sp.	MAL	<1
MEBL	forb	Stephanomeria pauciflora	AST	<1
MEBL	forb	Tagetes papposa	AST	<1
MEBL	forb	Talinum pulchellum	POR	<1
MEBL	forb	Tragia ramosa	EUP	<1
MEBL	forb	Tragopogon pratensis	AST	<1
MEBL	grass	Blepharoneuron tricholepis	POA	<1
MEBL	grass	Bouteloua gracilis	POA	10
MEBL	grass	Bromus lanatipes	POA	<1
MEBL	grass	Cyperus fendlerianus	CYP	<1
MEBL	grass	Elymus longifolius	POA	<1
MEBL	grass	Koeleria macrantha	POA	5
MEBL	grass	Muhlenbergia wrightii	POA	<1
MEBL	grass	Stipa comata	POA	<1
MEBL	shrub	Chrysothamnus nauseosus consimilis	AST	<1
MEBL	shrub	Mahonia repens	BER	<1
MEBL	shrub	Quercus gambelii	FAG	<1
MEBL	shrub	Tetradymia canescens	AST	<1
MEBL	shrub	Yucca baccata	AGA	<1
MEBL	tree	Juniperus scopulorum	CUP	10

MEBL	tree	Pinus edulis	PIN	10
MEBL	tree	Pinus ponderosa	PIN	15
MEBL	tree	Populus tremuloides	SAL	<1
MTKI	cactus	Coryphantha vivipara	CAC	<1
MTKI	cactus	Echinocereus fendleri	CAC	<1
MTKI	cactus	Echinocereus trigloch melan	CAC	<1
MTKI	cactus	Opuntia macrorhiza	CAC	<1
MTKI	cactus	Opuntia phaeacantha	CAC	<1
MTKI	cactus	Opuntia polyacantha	CAC	<1
MTKI	fern	Asplenium trichomanes	ASP	<1
MTKI	fern	Cheilanthes fendleri	ADI	<1
MTKI	forb	Agastache pallidiflora hybrid	LAM	<1
MTKI	forb	Arabis sp.	BRA	<1
MTKI	forb	Arenaria fendleri fendleri	CAR	<1
MTKI	forb	Artemisia campestris pacifica	AST	<1
MTKI	forb	Artemisia carruthii	AST	<1
MTKI	forb	Artemisia frigida	AST	<1
MTKI	forb	Asclepias asperula asperula	ASC	<1
MTKI	forb	Bahia dissecta	AST	<1
MTKI	forb	Castilleja integra	SCR	<1
MTKI	forb	Chaetopappa ericoides	AST	<1
MTKI	forb	Chenopodium leptophyllum	CHE	<1
MTKI	forb	Cirsium sp.	AST	<1
MTKI	forb	Cryptantha cinerea	BOR	<1
MTKI	forb	Erigeron colomexicanus	AST	<1
MTKI	forb	Eriogonum alatum alatum	PGN	<1
MTKI	forb	Eriogonum jamesii	PGN	<1
MTKI	forb	Erysimum capitatum	BRA	<1
MTKI	forb	Gaillardia pinnatifida	AST	<1
MTKI	forb	Geranium lentum	GER	<1
MTKI	forb	Glandularia wrightii	VER	<1
MTKI	forb	Gutierrezia sarothrae	AST	<1
MTKI	forb	Heterotheca villosa	AST	<1
MTKI	forb	Hymenopappus filifolius	AST	<1
MTKI	forb	Hymenoxys argentea	AST	<1
MTKI	forb	Hymenoxys richardsonii	AST	<1
MTKI	forb	Lesquerella rectipes	BRA	<1
MTKI	forb	Lotus wrightii	FAB	<1
MTKI	forb	Lupinus kingii kingii	FAB	<1
MTKI	forb	Menodora scabra	OLE	<1
MTKI	forb	Mirabilis multiflora	NYC	<1
MTKI	forb	Orobanche sp.	ORO	<1
MTKI	forb	Penstemon barbatus	SCR	<1
MTKI	forb	Selaginella densa	SEL	<1
MTKI	forb	Senecio multilobatus	AST	<1
MTKI	forb	Spheralcea digitata	MAL	<1
MTKI	forb	Spheralcea fendleri	MAL	<1
MTKI	forb	Talinum confertiflorum	POR	<1
MTKI	forb	Thalictrum fendleri	RAN	<1
MTKI	forb	Thelypodiopsis linearifolia	BRA	<1
MTKI	forb	Thlaspi montanum	BRA	<1
MTKI	forb	Zinnia grandiflora	AST	<1

MTKI	grass	Aristida arizonica	POA	<1
MTKI	grass	Bouteloua gracilis	POA	<1
MTKI	grass	Bouteloua hirsuta	POA	<1
MTKI	grass	Elymus longifolius	POA	<1
MTKI	grass	Festuca arizonica	POA	<1
MTKI	grass	Lycurus setosus	POA	<1
MTKI	grass	Muhlenbergia montana	POA	<1
MTKI	grass	Oryzopsis micrantha	POA	<1
MTKI	grass	Schizachyrium scoparium	POA	<1
MTKI	grass	Stipa sp.	POA	<1
MTKI	shrub	Fallugia paradoxa	ROS	<1
MTKI	shrub	Forestiera neomexicana	OLE	<1
MTKI	shrub	Quercus X pauciloba	FAG	<1
MTKI	shrub	Quercus gambelii	FAG	<1
MTKI	shrub	Rhus trilobata	ANA	<1
MTKI	shrub	Yucca baccata	AGA	<1
MTKI	tree	Juniperus monosperma	CUP	<1
MTKI	tree	Pinus edulis	PIN	<1
MTKI	tree	Pinus ponderosa	PIN	<1
NACO	cactus	Coryphantha vivipara	CAC	<1
NACO	cactus	Echinocereus trigloch	CAC	<1
NACO	cactus	Echinocereus trigloch melan	CAC	<1
NACO	cactus	Opuntia polyacantha	CAC	<1
NACO	fern	Cheilanthes feei	ADI	<1
NACO	forb	Artemisia sp.	AST	<1
NACO	forb	Castilleja integra	SCR	<1
NACO	forb	Chenopodium sp.	CHE	<1
NACO	forb	Erigeron sp.	AST	<1
NACO	forb	Geranium lentum	GER	<1
NACO	forb	Glandularia wrightii	VER	<1
NACO	forb	Lappula redowskii	BOR	<1
NACO	forb	Oenothera caespitosa	ONA	<1
NACO	forb	Oxalis sp.	OXA	<1
NACO	forb	Potentilla pensylvanica	ROS	<1
NACO	forb	Senecio sp.	AST	<1
NACO	forb	Spheralcea digitata	MAL	<1
NACO	forb	Tragia ramosa	EUP	<1
NACO	grass	Blepharoneuron tricholepis	POA	<1
NACO	grass	Bouteloua gracilis	POA	<1
NACO	grass	Carex occidentalis	CYP	<1
NACO	grass	Elymus longifolius	POA	<1
NACO	grass	Muhlenbergia minutissima	POA	<1
NACO	grass	Muhlenbergia montana	POA	<1
NACO	grass	Oryzopsis micrantha	POA	<1
NACO	shrub	Chrysothamnus sp.	AST	<1
NACO	shrub	Fallugia paradoxa	ROS	10
NACO	shrub	Forestiera neomexicana	OLE	<1
NACO	shrub	Holodiscus dumosus	ROS	<1
NACO	shrub	Pericome caudata	AST	<1
NACO	shrub	Rhus trilobata	ANA	5
NACO	shrub	Ribes cereum	GRO	5
NACO	tree	Juniperus monosperma	CUP	10

NACO	tree	Pinus edulis	PIN	10
NACO	tree	Pinus ponderosa	PIN	10
NACO	vine	Vitis arizonica	VIT	<1
NAKI	cactus	Echinocereus trigloch	CAC	<1
NAKI	cactus	Opuntia sp.	CAC	<1
NAKI	forb	Agastache pallidiflora hybrid	LAM	<1
NAKI	forb	Allium cernuum	LIL	<1
NAKI	forb	Artemisia dracunculus	AST	10
NAKI	forb	Artemisia frigida	AST	<1
NAKI	forb	Bahia dissecta	AST	<1
NAKI	forb	Castilleja integra	SCR	<1
NAKI	forb	Chaetopappa ericoides	AST	<1
NAKI	forb	Cirsium sp.	AST	<1
NAKI	forb	Erigeron divergens	AST	<1
NAKI	forb	Eriogonum sp.	PGN	<1
NAKI	forb	Gaura hexandra gracilis	ONA	<1
NAKI	forb	Glandularia wrightii	VER	<1
NAKI	forb	Houstonia wrightii	RUB	<1
NAKI	forb	Hymenopappus filifolius cinereus	AST	<1
NAKI	forb	Lappula redowskii	BOR	<1
NAKI	forb	Linum aristatum	LIN	<1
NAKI	forb	Plantago patagonica	PLA	<1
NAKI	forb	Stephanomeria sp.	AST	<1
NAKI	forb	Talinum confertiflorum	POR	<1
NAKI	forb	Thelypodiopsis linearifolia	BRA	<1
NAKI	forb	Townsendia exscapa	AST	<1
NAKI	forb	Tragopogon dubius	AST	<1
NAKI	grass	Aristida sp.	POA	<1
NAKI	grass	Blepharoneuron tricholepis	POA	<1
NAKI	grass	Bouteloua gracilis	POA	5
NAKI	grass	Elymus longifolius	POA	<1
NAKI	grass	Koeleria macrantha	POA	<1
NAKI	grass	Muhlenbergia montana	POA	<1
NAKI	shrub	Chrysothamnus sp.	AST	<1
NAKI	shrub	Forestiera neomexicana	OLE	<1
NAKI	shrub	Mahonia repens	BER	<1
NAKI	shrub	Quercus gambelii	FAG	<1
NAKI	shrub	Ribes cereum	GRO	<1
NAKI	shrub	Tetradymia canescens	AST	<1
NAKI	shrub	Yucca baccata	AGA	<1
NAKI	tree	Juniperus monosperma	CUP	5
NAKI	tree	Juniperus scopulorum	CUP	<1
NAKI	tree	Pinus edulis	PIN	10
NAKI	tree	Pinus ponderosa	PIN	10
NARR	cactus	Echinocereus trigloch melan	CAC	<1
NARR	cactus	Opuntia imbricata	CAC	<1
NARR	cactus	Opuntia phaeacantha	CAC	<1
NARR	cactus	Opuntia polyacantha	CAC	<1
NARR	fern	Asplenium septentrionale	ASP	<1
NARR	fern	Dryopteris filix-mas	ASP	<1
NARR	fern	Woodsia plummerae	ASP	<1
NARR	forb	Agastache pallidiflora hybrid	LAM	<1

NARR	forb	Arabis fendleri	BRA	<1
NARR	forb	Artemisia carruthii	AST	<1
NARR	forb	Bahia dissecta	AST	<1
NARR	forb	Brickellia brachyphylla	AST	<1
NARR	forb	Castilleja integra	SCR	<1
NARR	forb	Eupatorium herbaceum	AST	<1
NARR	forb	Geranium lentum	GER	<1
NARR	forb	Heterotheca villosa	AST	<1
NARR	forb	Senecio douglasii longilobus	AST	<1
NARR	forb	Senecio multilobatus	AST	<1
NARR	forb	Thelypodium wrightii	BRA	<1
NARR	forb	Verbascum thapsus	SCR	<1
NARR	shrub	Chrysothamnus sp.	AST	<1
NARR	shrub	Fallugia paradoxa	ROS	<1
NARR	shrub	Forestiera neomexicana	OLE	<1
NARR	shrub	Fraxinus cuspidata	OLE	<1
NARR	shrub	Holodiscus dumosus	ROS	<1
NARR	shrub	Pericome caudata	AST	<1
NARR	shrub	Quercus X pauciloba	FAG	<1
NARR	shrub	Rhus trilobata	ANA	<1
NARR	shrub	Yucca baccata	AGA	<1
NARR	tree	Juniperus monosperma	CUP	<1
NARR	tree	Pinus edulis	PIN	<1
NARR	tree	Pinus ponderosa	PIN	<1
NATH	cactus	Echinocereus trigloch	CAC	<1
NATH	cactus	Opuntia sp.	CAC	<1
NATH	forb	Allium cernuum	LIL	<1
NATH	forb	Androsace septentrionalis glandulosa	PRI	<1
NATH	forb	Antennaria parvifolia	AST	<1
NATH	forb	Artemisia dracunculus	AST	<1
NATH	forb	Artemisia frigida	AST	10
NATH	forb	Astragalus humistratus humistratus	FAB	<1
NATH	forb	Castilleja integra	SCR	<1
NATH	forb	Chamaesyce sp.	EUP	<1
NATH	forb	Cirsium sp.	AST	<1
NATH	forb	Cryptantha cinerea	BOR	<1
NATH	forb	Erigeron divergens	AST	<1
NATH	forb	Erigeron flagellaris	AST	<1
NATH	forb	Eriogonum sp.	PGN	<1
NATH	forb	Geranium lentum	GER	<1
NATH	forb	Glandularia wrightii	VER	<1
NATH	forb	Hymenopappus filifolius	AST	<1
NATH	forb	Lappula redowskii	BOR	<1
NATH	forb	Lepidium sp.	BRA	<1
NATH	forb	Lupinus kingii kingii	FAB	<1
NATH	forb	Oenothera albicaulis	ONA	<1
NATH	forb	Orobanche sp.	ORO	<1
NATH	forb	Plantago patagonica	PLA	<1
NATH	forb	Pseudocymopterus montanus	API	<1
NATH	forb	Spheralcea digitata	MAL	<1
NATH	forb	Stephanomeria sp.	AST	<1
NATH	forb	Talinum confertiflorum	POR	<1

NATH	forb	Townsendia exscapa	AST	<1
NATH	forb	Tragopogon dubius	AST	<1
NATH	grass	Aristida sp.	POA	<1
NATH	grass	Blepharoneuron tricholepis	POA	<1
NATH	grass	Bouteloua gracilis	POA	10
NATH	grass	Elymus longifolius	POA	<1
NATH	grass	Muhlenbergia torreyi	POA	<1
NATH	grass	Poa bigelovii	POA	<1
NATH	shrub	Chrysothamnus sp.	AST	<1
NATH	shrub	Fallugia paradoxa	ROS	<1
NATH	shrub	Forestiera neomexicana	OLE	<1
NATH	shrub	Rhus glabra	ANA	<1
NATH	shrub	Rhus trilobata	ANA	<1
NATH	shrub	Ribes cereum	GRO	<1
NATH	shrub	Rubus strigosus arizonicus	ROS	<1
NATH	shrub	Tetradymia canescens	AST	<1
NATH	tree	Juniperus monosperma	CUP	<1
NATH	tree	Pinus edulis	PIN	<1
NATH	tree	Pinus ponderosa	PIN	5
NOMC	fern	Asplenium septentrionale	ASP	<1
NOMC	forb	Mollugo cerviana	AIZ	<1
NOMC	grass	Muhlenbergia brevis	POA	<1
NOPA	forb	Abronia fragrans	NYC	<1
NOPA	forb	Chenopodium leptophyllum	CHE	<1
NOPA	forb	Cuscuta umbellata	CON	<1
NOPA	forb	Erigeron vetensis	AST	<1
NOPA	forb	Eriogonum annuum	PGN	<1
NOPA	forb	Euphorbia lurida	EUP	<1
NOPA	forb	Helianthus petiolaris petiolaris	AST	<1
NOPA	forb	Heterosperma pinnatum	AST	<1
NOPA	forb	Lupinus kingii kingii	FAB	<1
NOPA	forb	Macheranthera gracilis	AST	<1
NOPA	forb	Macheranthera pinnatifida pinnatifida	AST	<1
NOPA	forb	Menodora scabra	OLE	<1
NOPA	forb	Monarda punctata lasiodonta	LAM	<1
NOPA	forb	Pennellia micrantha	BRA	<1
NOPA	forb	Psoralea lanceolata	FAB	<1
NOPA	forb	Rumex triangulivalvis	PGN	<1
NOPA	forb	Silene scouleri scouleri	CAR	<1
NOPA	forb	Vicia americana minor	FAB	<1
NOPA	forb	Zinnia grandiflora	AST	<1
NOPA	grass	Andropogon gerardii paucipilus	POA	<1
NOPA	grass	Bouteloua gracilis	POA	20
NOPA	grass	Elymus trachycaulus	POA	<1
NOPA	grass	Hordeum jubatum	POA	<1
NOPA	grass	Lycurus setosus	POA	<1
NOPA	grass	Muhlenbergia brevis	POA	1
NOPA	grass	Muhlenbergia fragilis	POA	<1
NOPA	grass	Muhlenbergia repens	POA	2
NOPA	grass	Muhlenbergia torreyi	POA	<1
NOPA	grass	Munroa squarrosa	POA	<1
NOPA	grass	Panicum capillare brevifolium	POA	<1

NOPA	grass	Panicum hirticaule	POA	<1
NOPA	grass	Schedonnardus paniculatus	POA	<1
NOPA	grass	Schizachyrium scoparium	POA	<1
NOPA	grass	Setaria viridis	POA	<1
NOPA	shrub	Ceratoides lanata	CHE	<1
NOPA	shrub	Lycium pallidum	SOL	<1
NOSR	cactus	Echinocereus fendleri	CAC	<1
NOSR	cactus	Echinocereus trigloch melan	CAC	<1
NOSR	cactus	Mammillaria heyderi meiacantha	CAC	<1
NOSR	cactus	Mammillaria wrightii	CAC	<1
NOSR	cactus	Opuntia macrorhiza	CAC	<1
NOSR	cactus	Opuntia phaeacantha	CAC	<1
NOSR	forb	Abronia elliptica	NYC	<1
NOSR	forb	Arabis sp.	BRA	<1
NOSR	forb	Artemisia campestris pacifica	AST	<1
NOSR	forb	Artemisia carruthii	AST	<1
NOSR	forb	Artemisia frigida	AST	<1
NOSR	forb	Artemisia ludoviciana	AST	<1
NOSR	forb	Asclepias asperula asperula	ASC	<1
NOSR	forb	Bahia dissecta	AST	<1
NOSR	forb	Castilleja integra	SCR	<1
NOSR	forb	Chaetopappa ericoides	AST	<1
NOSR	forb	Chamaesyce fendleri fendleri	EUP	<1
NOSR	forb	Chenopodium dessicatum	CHE	<1
NOSR	forb	Chenopodium fremontii	CHE	<1
NOSR	forb	Chenopodium leptophyllum	CHE	<1
NOSR	forb	Cirsium sp.	AST	<1
NOSR	forb	Cleome serrulata	CAP	<1
NOSR	forb	Commelina sp.	CMM	<1
NOSR	forb	Cryptantha cinerea	BOR	<1
NOSR	forb	Cryptantha fendleri	BOR	<1
NOSR	forb	Dimorphocarpa wislizenii	BRA	<1
NOSR	forb	Erigeron colomexicanus	AST	<1
NOSR	forb	Erigeron flagellaris	AST	<1
NOSR	forb	Eriogonum alatum alatum	PGN	<1
NOSR	forb	Eriogonum jamesii	PGN	<1
NOSR	forb	Erysimum capitatum	BRA	<1
NOSR	forb	Glandularia wrightii	VER	<1
NOSR	forb	Grindelia aphanactis	AST	<1
NOSR	forb	Gutierrezia sarothrae	AST	<1
NOSR	forb	Heterotheca villosa	AST	5
NOSR	forb	Hymenopappus filifolius	AST	<1
NOSR	forb	Hymenoxys richardsonii	AST	<1
NOSR	forb	Ipomopsis multiflora	POL	<1
NOSR	forb	Lappula redowskii	BOR	<1
NOSR	forb	Lesquerella rectipes	BRA	<1
NOSR	forb	Lotus wrightii	FAB	<1
NOSR	forb	Lupinus kingii kingii	FAB	<1
NOSR	forb	Macheranthera gracilis	AST	<1
NOSR	forb	Mirabilis multiflora	NYC	<1
NOSR	forb	Monarda punctata lasiodonta	LAM	<1
NOSR	forb	Oenothera coronopifolia	ONA	<1

NOSR	forb	Orobanche sp.	ORO	<1
NOSR	forb	Penstemon barbatus	SCR	<1
NOSR	forb	Plantago argyrea	PLA	<1
NOSR	forb	Plantago patogonica	PLA	<1
NOSR	forb	Salsola iberica	CHE	<1
NOSR	forb	Senecio multilobatus	AST	<1
NOSR	forb	Silene laciniata	CAR	<1
NOSR	forb	Silene scouleri scouleri	CAR	<1
NOSR	forb	Spheralcea digitata	MAL	<1
NOSR	forb	Stephanomeria sp.	AST	<1
NOSR	forb	Talinum confertiflorum	POR	<1
NOSR	forb	Thelesperma megapotamicum	AST	<1
NOSR	forb	Thelypodiopsis linearifolia	BRA	<1
NOSR	forb	Townsendia exscapa	AST	<1
NOSR	forb	Tragopogon dubius	AST	<1
NOSR	forb	Zinnia grandiflora	AST	<1
NOSR	grass	Aristida arizonica	POA	1
NOSR	grass	Aristida purpurea longiseta	POA	<1
NOSR	grass	Bouteloua gracilis	POA	10
NOSR	grass	Bouteloua hirsuta	POA	<1
NOSR	grass	Elymus longifolius	POA	<1
NOSR	grass	Koeleria macrantha	POA	<1
NOSR	grass	Lycurus setosus	POA	<1
NOSR	grass	Muhlenbergia montana	POA	<1
NOSR	grass	Schizachyrium scoparium	POA	<1
NOSR	grass	Stipa sp.	POA	<1
NOSR	shrub	Chrysothamnus sp.	AST	<1
NOSR	shrub	Quercus sp.	FAG	<1
NOSR	shrub	Rhus trilobata	ANA	<1
NOSR	shrub	Tetradymia canescens	AST	<1
NOSR	shrub	Yucca baccata	AGA	<1
NOSR	tree	Juniperus monosperma	CUP	15
NOSR	tree	Pinus edulis	PIN	15
NOSR	tree	Pinus ponderosa	PIN	<1
NPMC	cactus	Coryphantha vivipara	CAC	<1
NPMC	cactus	Echinocereus trigloch melan	CAC	<1
NPMC	cactus	Opuntia phaeacantha	CAC	<1
NPMC	cactus	Opuntia polyacantha	CAC	<1
NPMC	fern	Asplenium septentrionale	ASP	<1
NPMC	forb	Agastache pallidiflora hybrid	LAM	<1
NPMC	forb	Artemisia carruthii	AST	<1
NPMC	forb	Bahia dissecta	AST	<1
NPMC	forb	Castilleja integra	SCR	<1
NPMC	forb	Chenopodium leptophyllum	CHE	<1
NPMC	forb	Cryptantha cinerea	BOR	<1
NPMC	forb	Geranium lentum	GER	<1
NPMC	forb	Heterotheca villosa	AST	5
NPMC	grass	Agrostis scabra	POA	<1
NPMC	grass	Blepharoneuron tricholepis	POA	<1
NPMC	grass	Bouteloua gracilis	POA	<1
NPMC	grass	Bromus sp.	POA	<1
NPMC	grass	Lycurus setosus	POA	<1

NPMC	grass	Muhlenbergia minutissima	POA	<1
NPMC	grass	Oryzopsis micrantha	POA	<1
NPMC	grass	Schizachyrium scoparium	POA	<1
NPMC	shrub	Chrysothamnus sp.	AST	<1
NPMC	shrub	Fallugia paradoxa	ROS	5
NPMC	shrub	Forestiera neomexicana	OLE	<1
NPMC	shrub	Fraxinus cuspidata	OLE	<1
NPMC	shrub	Holodiscus dumosus	ROS	<1
NPMC	shrub	Pericome caudata	AST	<1
NPMC	shrub	Rhus trilobata	ANA	<1
NPMC	shrub	Ribes cereum	GRO	<1
NPMC	tree	Juniperus monosperma	CUP	<1
NPMC	tree	Pinus edulis	PIN	10
NPMC	tree	Pinus ponderosa	PIN	10
NPMC	vine	Parthenocissus inserta	VIT	<1
NPMS	cactus	Echinocereus trigloch melan	CAC	<1
NPMS	cactus	Opuntia polyacantha	CAC	<1
NPMS	fern	Asplenium septentrionale	ASP	<1
NPMS	fern	Cheilanthes feei	ADI	<1
NPMS	forb	Agastache pallidoflora hybrid	LAM	<1
NPMS	forb	Arabis sp.	BRA	<1
NPMS	forb	Artemisia carruthii	AST	<1
NPMS	forb	Eriogonum jamesii	PGN	<1
NPMS	forb	Geranium lentum	GER	<1
NPMS	forb	Heterotheca villosa	AST	<1
NPMS	grass	Bouteloua gracilis	POA	<1
NPMS	grass	Elymus longifolius	POA	<1
NPMS	grass	Muhlenbergia minutissima	POA	<1
NPMS	grass	Schizachyrium scoparium	POA	<1
NPMS	shrub	Chrysothamnus parryi attenuatus	AST	<1
NPMS	shrub	Fallugia paradoxa	ROS	1
NPMS	shrub	Forestiera neomexicana	OLE	<1
NPMS	shrub	Holodiscus dumosus	ROS	<1
NPMS	shrub	Rhus trilobata	ANA	<1
NPMS	shrub	Ribes cereum	GRO	<1
NPMS	shrub	Yucca baccata	AGA	<1
NPMS	tree	Juniperus monosperma	CUP	<1
NPMS	tree	Pinus edulis	PIN	<1
NPMS	tree	Pinus ponderosa	PIN	3
NPPO	forb	Amaranthus retroflexus	AMA	<1
NPPO	forb	Convolvulus arvensis	CON	<1
NPPO	forb	Conyza canadensis	AST	<1
NPPO	forb	Polygonum erectum	PGN	<1
NPPO	forb	Portulaca oleracea	POR	<1
NPPO	forb	Rumex triangulivalvis	PGN	<1
NPPO	forb	Suckleya suckleyana	CHE	<1
NPPO	grass	Echinochloa muricata microstachya	POA	<1
NPPO	grass	Eleocharis macrostachya	CYP	<1
NPPO	shrub	Chrysothamnus nauseosus consimilis	AST	<1
NPSS	cactus	Echinocereus trigloch melan	CAC	<1
NPSS	cactus	Mammillaria heyderi meiacantha	CAC	<1
NPSS	cactus	Mammillaria wrightii	CAC	<1

NPSS	cactus	Opuntia macrorhiza	CAC	<1
NPSS	cactus	Opuntia phaeacantha	CAC	<1
NPSS	forb	Artemisia campestris pacifica	AST	<1
NPSS	forb	Artemisia frigida	AST	1
NPSS	forb	Calliandra humilis	FAB	<1
NPSS	forb	Chaetopappa ericoides	AST	<1
NPSS	forb	Eriogonum alatum	PGN	<1
NPSS	forb	Eriogonum jamesii	PGN	<1
NPSS	forb	Gutierrezia sarothrae	AST	<1
NPSS	forb	Heterotheca villosa	AST	<1
NPSS	forb	Hymenopappus filifolius	AST	<1
NPSS	forb	Lesquerella rectipes	BRA	<1
NPSS	forb	Lotus wrightii	FAB	<1
NPSS	forb	Mirabilis multiflora	NYC	<1
NPSS	grass	Aristida arizonica	POA	1
NPSS	grass	Aristida purpurea fendleriana	POA	<1
NPSS	grass	Aristida purpurea purpurea	POA	<1
NPSS	grass	Bouteloua gracilis	POA	6
NPSS	grass	Bouteloua hirsuta	POA	<1
NPSS	grass	Cyperus fendlerianus	CYP	<1
NPSS	grass	Schizachyrium scoparium	POA	<1
NPSS	shrub	Quercus X pauciloba	FAG	1
NPSS	shrub	Rhus trilobata	ANA	<1
NPSS	shrub	Yucca baccata	AGA	<1
NPSS	tree	Juniperus monosperma	CUP	3
NPSS	tree	Pinus edulis	PIN	3
NPSS	tree	Pinus ponderosa	PIN	<1
NSBR	cactus	Echinocereus trigloch melan	CAC	<1
NSBR	fern	Asplenium septentrionale	ASP	<1
NSBR	fern	Woodsia plummerae	ASP	<1
NSBR	forb	Agastache pallidiflora hybrid	LAM	<1
NSBR	forb	Arabis fendleri	BRA	<1
NSBR	forb	Artemisia carruthii	AST	<1
NSBR	forb	Descurainia obtusa brevisiliqua	BRA	<1
NSBR	forb	Erigeron flagellaris	AST	<1
NSBR	forb	Geranium lentum	GER	<1
NSBR	forb	Heterotheca villosa	AST	<1
NSBR	forb	Thelypodiopsis linearifolia	BRA	<1
NSBR	forb	Verbena bracteata	VER	<1
NSBR	shrub	Fallugia paradoxa	ROS	<1
NSBR	shrub	Holodiscus dumosus	ROS	<1
NSBR	shrub	Pericome caudata	AST	<1
NSBR	shrub	Ribes cereum	GRO	<1
NSBR	tree	Juniperus scopulorum	CUP	<1
NSBR	tree	Pinus edulis	PIN	<1
NSBR	tree	Pinus ponderosa	PIN	<1
NSBR	tree	Pseudotsuga menziesii	PIN	<1
NSHO	cactus	Echinocereus trigloch melan	CAC	<1
NSHO	cactus	Opuntia imbricata	CAC	<1
NSHO	cactus	Opuntia phaeacantha	CAC	<1
NSHO	cactus	Opuntia polyacantha	CAC	<1
NSHO	fern	Cheilanthes feei	ADI	<1

NSHO	forb	Acalypha neomexicana	EUP	<1
NSHO	forb	Arabis fendleri	BRA	<1
NSHO	forb	Artemisia carruthii	AST	<1
NSHO	forb	Bahia dissecta	AST	<1
NSHO	forb	Castilleja integra	SCR	<1
NSHO	forb	Chamaesyce sp.	EUP	<1
NSHO	forb	Erigeron divergens	AST	<1
NSHO	forb	Eupatorium herbaceum	AST	<1
NSHO	forb	Glandularia wrightii	VER	<1
NSHO	forb	Heterotheca villosa	AST	<1
NSHO	forb	Senecio multilobatus	AST	<1
NSHO	forb	Spheralcea fendleri	MAL	<1
NSHO	forb	Tragia ramosa	EUP	<1
NSHO	grass	Bouteloua curtipendula	POA	<1
NSHO	grass	Bouteloua gracilis	POA	<1
NSHO	grass	Muhlenbergia minutissima	POA	<1
NSHO	shrub	Fallugia paradoxa	ROS	<1
NSHO	shrub	Forestiera neomexicana	OLE	<1
NSHO	shrub	Fraxinus cuspidata	OLE	<1
NSHO	shrub	Pericome caudata	AST	<1
NSHO	shrub	Rhus trilobata	ANA	<1
NSHO	shrub	Ribes cereum	GRO	<1
NSHO	shrub	Yucca baccata	AGA	<1
NSHO	tree	Juniperus monosperma	CUP	<1
NSHO	tree	Pinus edulis	PIN	<1
NTKI	cactus	Coryphantha vivipara	CAC	<1
NTKI	cactus	Echinocereus trigloch melan	CAC	<1
NTKI	cactus	Opuntia polyacantha	CAC	<1
NTKI	forb	Arabis sp.	BRA	<1
NTKI	forb	Artemisia frigida	AST	10
NTKI	forb	Bahia dissecta	AST	<1
NTKI	forb	Castilleja integra	SCR	<1
NTKI	forb	Chaetopappa ericoides	AST	<1
NTKI	forb	Chamaesyce sp.	EUP	<1
NTKI	forb	Erigeron colomexicanus	AST	<1
NTKI	forb	Erigeron flagellaris	AST	<1
NTKI	forb	Eriogonum jamesii	PGN	<1
NTKI	forb	Erysimum capitatum	BRA	<1
NTKI	forb	Gutierrezia sarothrae	AST	<1
NTKI	forb	Heterotheca villosa	AST	<1
NTKI	forb	Hymenoxys richardsonii	AST	<1
NTKI	forb	Lesquerella rectipes	BRA	<1
NTKI	forb	Lupinus kingii kingii	FAB	<1
NTKI	forb	Mirabilis multiflora	NYC	<1
NTKI	forb	Orobanche sp.	ORO	<1
NTKI	forb	Senecio multilobatus	AST	<1
NTKI	forb	Tragopogon dubius	AST	<1
NTKI	grass	Blepharoneuron tricholepis	POA	<1
NTKI	grass	Bouteloua gracilis	POA	25
NTKI	grass	Elymus longifolius	POA	<1
NTKI	grass	Muhlenbergia montana	POA	<1
NTKI	grass	Oryzopsis micrantha	POA	<1

NTKI	grass	Pleuraphis jamesii	POA	<1
NTKI	shrub	Atriplex canescens	CHE	<1
NTKI	shrub	Chrysothamnus sp.	AST	<1
NTKI	shrub	Forestiera neomexicana	OLE	<1
NTKI	shrub	Quercus gambelii	FAG	<1
NTKI	shrub	Rhus trilobata	ANA	<1
NTKI	shrub	Ribes cereum	GRO	<1
NTKI	shrub	Tetradymia canescens	AST	<1
NTKI	shrub	Yucca baccata	AGA	<1
NTKI	tree	Juniperus monosperma	CUP	<1
NTKI	tree	Juniperus scopulorum	CUP	<1
NTKI	tree	Pinus edulis	PIN	5
NTKI	tree	Pinus ponderosa	PIN	5
OARD	cactus	Opuntia sp.	CAC	<1
OARD	forb	Amaranthus sp.	AMA	<1
OARD	forb	Astragalus brandegei	FAB	<1
OARD	forb	Astragalus humistratus humivagans	FAB	<1
OARD	forb	Astragalus mollissimus mathewsii	FAB	<1
OARD	forb	Castilleja integra	SCR	<1
OARD	forb	Ceanothus fendleri	RHA	<1
OARD	forb	Chenopodium graveolens	CHE	<1
OARD	forb	Chenopodium sp.	CHE	<1
OARD	forb	Cryptantha cinerea	BOR	<1
OARD	forb	Dalea exigua	FAB	<1
OARD	forb	Erigeron flagellaris	AST	<1
OARD	forb	Glandularia wrightii	VER	<1
OARD	forb	Grindelia aphanactis	AST	<1
OARD	forb	Gutierrezia sarothrae	AST	<1
OARD	forb	Hymenopappus filifolius cinereus	AST	<1
OARD	forb	Hymenoxys argentea	AST	<1
OARD	forb	Hymenoxys richardsonii	AST	<1
OARD	forb	Linum aristatum	LIN	<1
OARD	forb	Lithospermum incisum	BOR	<1
OARD	forb	Lithospermum multiflorum	BOR	<1
OARD	forb	Lupinus kingii kingii	FAB	<1
OARD	forb	Mollugo cerviana	AIZ	<1
OARD	forb	Nama dichotomum	HYD	<1
OARD	forb	Oenothera caespitosa marginata	ONA	<1
OARD	forb	Penstemon barbatus torreyi	SCR	<1
OARD	forb	Penstemon linaroides coloradoensis	SCR	<1
OARD	forb	Phoradendron juniperinum	LOR	<1
OARD	forb	Thelypodiopsis linearifolia	BRA	<1
OARD	grass	Aristida arizonica	POA	10
OARD	grass	Aristida purpurea fendleriana	POA	<1
OARD	grass	Bouteloua simplex	POA	<1
OARD	grass	Eragrostis pectinacea	POA	<1
OARD	grass	Muhlenbergia brevis	POA	<1
OARD	grass	Muhlenbergia fragilis	POA	<1
OARD	grass	Muhlenbergia repens	POA	<1
OARD	shrub	Chrysothamnus nauseosus consimilis	AST	<1
OARD	shrub	Chrysothamnus nauseosus nauseosus	AST	<1
OARD	shrub	Forestiera neomexicana	OLE	<1

OARD	shrub	Holodiscus dumosus	ROS	<1
OARD	shrub	Prunus virginiana	ROS	<1
OARD	shrub	Quercus gambelii	FAG	<1
OARD	shrub	Ribes cereum	GRO	<1
OARD	tree	Juniperus deppeana	CUP	<1
OARD	tree	Juniperus scopulorum	CUP	5
OARD	tree	Pinus edulis	PIN	1
OARD	tree	Pinus ponderosa	PIN	15
OARD	tree	Populus tremuloides	SAL	<1
OFSW	cactus	Opuntia macrorhiza	CAC	<1
OFSW	cactus	Opuntia polyacantha	CAC	<1
OFSW	forb	Artemisia carruthii	AST	<1
OFSW	forb	Artemisia dracunculus	AST	<1
OFSW	forb	Artemisia frigida	AST	<1
OFSW	forb	Chaetopappa ericoides	AST	<1
OFSW	forb	Chamaesyce sp.	EUP	<1
OFSW	forb	Chenopodium sp.	CHE	<1
OFSW	forb	Erigeron colomexicanus	AST	<1
OFSW	forb	Eriogonum cernuum	PGN	<1
OFSW	forb	Gutierrezia sarothrae	AST	10
OFSW	forb	Helianthus ciliaris	AST	<1
OFSW	forb	Hymenoxys richardsonii	AST	<1
OFSW	forb	Macheranthera gracilis	AST	<1
OFSW	forb	Malacothrix fendleri	AST	<1
OFSW	forb	Oenothera sp.	ONA	<1
OFSW	forb	Picradeniopsis woodhousei	AST	<1
OFSW	forb	Plantago patagonica	PLA	<1
OFSW	forb	Potentilla sp.	ROS	<1
OFSW	forb	Ratibida columnifera	AST	<1
OFSW	forb	Rorippa sinuata	BRA	<1
OFSW	forb	Solanum triflorum	SOL	<1
OFSW	forb	Spheralcea digitata	MAL	<1
OFSW	grass	Aristida purpurea purpurea	POA	<1
OFSW	grass	Bouteloua gracilis	POA	50
OFSW	grass	Elymus longifolius	POA	<1
OFSW	grass	Hordeum jubatum	POA	<1
OFSW	grass	Lycurus setosus	POA	<1
OFSW	grass	Muhlenbergia torreyi	POA	15
OFSW	grass	Munroa squarrosa	POA	<1
OFSW	shrub	Chrysothamnus sp.	AST	<1
OFSW	shrub	Fallugia paradoxa	ROS	<1
OFSW	shrub	Tetradymia canescens	AST	<1
OFSW	tree	Juniperus monosperma	CUP	<1
OLBA	cactus	Coryphantha vivipara	CAC	<1
OLBA	cactus	Echinocereus fendleri	CAC	<1
OLBA	cactus	Opuntia polyacantha	CAC	<1
OLBA	fern	Woodsia plummerae	ASP	<1
OLBA	forb	Allium cernuum	LIL	<1
OLBA	forb	Androsace septentrionalis glandulosa	PRI	<1
OLBA	forb	Arabis fendleri	BRA	<1
OLBA	forb	Arabis perennans	BRA	<1
OLBA	forb	Artemisia frigida	AST	<1

OLBA	forb	Astragalus humistratus humistratus	FAB	<1
OLBA	forb	Astragalus sp.	FAB	<1
OLBA	forb	Bahia dissecta	AST	<1
OLBA	forb	Castilleja integra	SCR	<1
OLBA	forb	Chaetopappa ericoides	AST	<1
OLBA	forb	Chamaesyce fendleri fendleri	EUP	<1
OLBA	forb	Chenopodium fremontii	CHE	<1
OLBA	forb	Cirsium sp.	AST	<1
OLBA	forb	Cleome serrulata	CAP	<1
OLBA	forb	Cryptantha cinerea	BOR	<1
OLBA	forb	Erigeron colomexicanus	AST	<1
OLBA	forb	Erigeron flagellaris	AST	<1
OLBA	forb	Eriogonum jamesii	PGN	<1
OLBA	forb	Erysimum capitatum	BRA	<1
OLBA	forb	Gaura coccinea	ONA	<1
OLBA	forb	Glandularia wrightii	VER	<1
OLBA	forb	Gutierrezia sarothrae	AST	<1
OLBA	forb	Heterotheca villosa	AST	<1
OLBA	forb	Houstonia wrightii	RUB	<1
OLBA	forb	Hymenopappus filifolius cinereus	AST	<1
OLBA	forb	Hymenopappus flavescens canotomentosus	AST	<1
OLBA	forb	Hymenoxys richardsonii	AST	<1
OLBA	forb	Lappula redowskii	BOR	<1
OLBA	forb	Lepidium densiflorum	BRA	<1
OLBA	forb	Linum aristatum	LIN	<1
OLBA	forb	Lotus wrightii	FAB	<1
OLBA	forb	Lupinus kingii kingii	FAB	<1
OLBA	forb	Marrubium vulgare	LAM	<1
OLBA	forb	Microsteris gracilis	POL	<1
OLBA	forb	Mirabilis linearis	NYC	<1
OLBA	forb	Mirabilis multiflora	NYC	<1
OLBA	forb	Monarda pectinata	LAM	<1
OLBA	forb	Oenothera sp.	ONA	<1
OLBA	forb	Orthocarpus purpureo-albus	SCR	<1
OLBA	forb	Penstemon sp.	SCR	<1
OLBA	forb	Physalis hederifolia	SOL	<1
OLBA	forb	Plantago patagonica	PLA	<1
OLBA	forb	Potentilla crinita	ROS	<1
OLBA	forb	Potentilla pensylvanica	ROS	<1
OLBA	forb	Ratibida columnifera	AST	<1
OLBA	forb	Senecio multilobatus	AST	<1
OLBA	forb	Spheralcea coccinea	MAL	<1
OLBA	forb	Spheralcea digitata	MAL	<1
OLBA	forb	Stachys rothrockii	LAM	<1
OLBA	forb	Stephanomeria sp.	AST	<1
OLBA	forb	Talinum confertiflorum	POR	<1
OLBA	forb	Taraxacum officinale	AST	<1
OLBA	forb	Thelypodiopsis linearifolia	BRA	<1
OLBA	forb	Thlaspi montanum fendleri	BRA	<1
OLBA	forb	Townsendia exscapa	AST	<1
OLBA	forb	Tragopogon dubius	AST	<1
OLBA	forb	Veronica peregrina	SCR	<1

OLBA	grass	Aristida purpurea purpurea	POA	<1
OLBA	grass	Bouteloua gracilis	POA	50
OLBA	grass	Dasyochloa pulchella	POA	<1
OLBA	grass	Elymus longifolius	POA	4
OLBA	grass	Koeleria macrantha	POA	<1
OLBA	grass	Muhlenbergia montana	POA	<1
OLBA	grass	Muhlenbergia torreyi	POA	<1
OLBA	grass	Oryzopsis micrantha	POA	<1
OLBA	grass	Poa bigelovii	POA	<1
OLBA	shrub	Chrysothamnus sp.	AST	<1
OLBA	shrub	Pericome caudata	AST	<1
OLBA	shrub	Rhus trilobata	ANA	<1
OLBA	shrub	Ribes cereum	GRO	<1
OLBA	shrub	Tetradymia canescens	AST	<1
OLBA	shrub	Yucca baileyi X Y. glauca	AGA	<1
OLBA	tree	Juniperus monosperma	CUP	5
OLBA	tree	Pinus edulis	PIN	5
OS01	forb	Astragalus praelongus praelongus	FAB	<1
OS02	forb	Arabis perennans	BRA	<1
OS03	tree	Celtis reticulata	ULM	<1
OS04	forb	Senecio neomexicanus mutabilis	AST	<1
OS05	tree	Salix drummondiana	SAL	<1
OS06	forb	Descurainia richardsonii incisa	BRA	<1
OS07	forb	Sisymbrium altissimum	BRA	<1
OS08	forb	Erigeron colomexicanus	AST	<1
OS09	forb	Penstemon ophianthus	SCR	<1
OS10	forb	Rorippa sinuata	BRA	<1
OS11	forb	Monolepis nuttalliana	CHE	<1
OS12	forb	Gayophytum ramosissimum	ONA	<1
OS13	forb	Melilotus alba	FAB	<1
OS14	forb	Melilotus officinalis	FAB	<1
OS15	forb	Convolvulus equitans	CON	<1
OS16	grass	Bothriochloa laguroides torreyana	POA	<1
OS17	forb	Gaura parviflora	ONA	<1
OS18	forb	Lactuca serriola	AST	<1
OS19	forb	Solanum elaeagnifolium	SOL	<1
OS20	forb	Centaurea repens	AST	<1
OS21	forb	Medicago lupinula	FAB	<1
OS22	forb	Gaura hexandra gracilis	ONA	<1
OS23	forb	Helianthus annuus	AST	<1
OS24	forb	Cirsium vulgare	AST	<1
OS25	forb	Pseudocymopterus montanus	API	<1
OS26	forb	Rumex crispus	PGN	<1
OS27	forb	Tamarix chinensis	TAM	<1
OS28	tree	Juniperus monosperma	CUP	<1
OS29	forb	Typha latifolia	TYP	<1
OS31	tree	Ulmus pumila	ULM	<1
OS32	tree	Populus deltoides wislizenii	SAL	<1
OS33	grass	Phragmites australis	POA	<1
OS34	forb	Senecio douglasii longilobus	AST	<1
OS35	forb	Oenothera albicaulis	ONA	<1
OS36	forb	Polygonum ramosissimum	PGN	<1

OS37	vine	Clematis ligusticifolia	RAN	<1
OS38	forb	Macheranthera australis	AST	<1
OS39	forb	Lupinus argenteus	FAB	<1
OS40	forb	Salsola paulsenii	CHE	<1
OS41	forb	Xanthium strumarium	AST	<1
OS42	shrub	Atriplex canescens	CHE	<1
OS43	shrub	Chrysothamnus nauseosus bigelovii	AST	<1
OS44	shrub	Chrysothamnus viscidiflorus stenophyllus	AST	<1
OS45	forb	Spheralcea digitata	MAL	<1
OS46	forb	Cordylanthus wrightii	SCR	<1
OS47	grass	Elymus canadensis	POA	<1
OS48	forb	Cosmos parviflorus	AST	<1
OS49	forb	Hymenopappus flavescens flavescens	AST	<1
OS50	shrub	Chrysothamnus viscidiflorus stenophyllus	AST	<1
PRWE	cactus	Opuntia polyacantha	CAC	<1
PRWE	fern	Marsillea mollis	MRS	<1
PRWE	forb	Ambrosia sp.	AST	<1
PRWE	forb	Androsace septentrionalis glandulosa	PRI	<1
PRWE	forb	Artemisia frigida	AST	<1
PRWE	forb	Asclepias sp.	ASC	<1
PRWE	forb	Astragalus mollissimus mathewsii	FAB	<1
PRWE	forb	Castilleja integra	SCR	<1
PRWE	forb	Chaetopappa ericoides	AST	<1
PRWE	forb	Chamaesyce fendleri fendleri	EUP	<1
PRWE	forb	Chamaesyce serpyllifolia	EUP	<1
PRWE	forb	Cirsium sp.	AST	<1
PRWE	forb	Cleome serrulata	CAP	<1
PRWE	forb	Corydalis aurea	FUM	<1
PRWE	forb	Cryptantha cinerea	BOR	<1
PRWE	forb	Descurainia pinnata halictorum	BRA	<1
PRWE	forb	Erigeron canus	AST	<1
PRWE	forb	Erigeron divergens	AST	<1
PRWE	forb	Erigeron flagellaris	AST	<1
PRWE	forb	Gaillardia pinnatifida	AST	<1
PRWE	forb	Gayophytum ramosissimum	ONA	<1
PRWE	forb	Geranium lentum	GER	<1
PRWE	forb	Glandularia wrightii	VER	<1
PRWE	forb	Gutierrezia sarothrae	AST	<1
PRWE	forb	Heterotheca villosa	AST	<1
PRWE	forb	Hymenopappus filifolius	AST	<1
PRWE	forb	Lappula redowskii	BOR	<1
PRWE	forb	Linum aristatum	LIN	<1
PRWE	forb	Lupinus kingii kingii	FAB	<1
PRWE	forb	Marrubium vulgare	LAM	<1
PRWE	forb	Microsteris gracilis	POL	<1
PRWE	forb	Mirabilis multiflora	NYC	<1
PRWE	forb	Myosurus minimus	RAN	<1
PRWE	forb	Oenothera albicaulis	ONA	<1
PRWE	forb	Oenothera caespitosa marginata	ONA	<1
PRWE	forb	Orobanche uniflora	ORO	<1
PRWE	forb	Phacelia alba	HYD	<1
PRWE	forb	Phyla cuneifolia	VER	<1

PRWE	forb	Portulaca sp.	POR	<1
PRWE	forb	Potentilla pensylvanica	ROS	<1
PRWE	forb	Rumex triangulivalvis	PGN	<1
PRWE	forb	Senecio multilobatus	AST	<1
PRWE	forb	Solanum triflorum	SOL	<1
PRWE	forb	Spheralcea coccinea	MAL	<1
PRWE	forb	Stachys rothrockii	LAM	<1
PRWE	forb	Suckleya suckleyana	CHE	<1
PRWE	forb	Talinum confertiflorum	POR	<1
PRWE	forb	Tragopogon dubius	AST	<1
PRWE	forb	Verbena bracteata	VER	<1
PRWE	forb	Verbesina encelioides exauriculata	AST	<1
PRWE	forb	Veronica peregrina	SCR	<1
PRWE	grass	Aristida purpurea fendleriana	POA	<1
PRWE	grass	Bouteloua gracilis	POA	<1
PRWE	grass	Elymus longifolius	POA	<1
PRWE	grass	Muhlenbergia torreyi	POA	3
PRWE	grass	Poa bigelovii	POA	<1
PRWE	grass	Poa fendleriana	POA	<1
PRWE	grass	Schedonnardus paniculatus	POA	<1
PRWE	shrub	Chrysothamnus sp.	AST	<1
PRWE	shrub	Fallugia paradoxa	ROS	<1
PRWE	shrub	Forestiera neomexicana	OLE	<1
PRWE	shrub	Rhus trilobata	ANA	<1
PRWE	shrub	Ribes cereum	GRO	<1
PRWE	shrub	Tetradymia canescens	AST	<1
PRWE	shrub	Yucca baileyi X Y. glauca	AGA	<1
PRWE	tree	Juniperus monosperma	CUP	<1
PRWE	tree	Pinus edulis	PIN	<1
PRWE	tree	Pinus ponderosa	PIN	<1
PWPH	grass	Bromus lanatipes	POA	<1
RASN	cactus	Echinocereus trigloch melan	CAC	<1
RASN	cactus	Opuntia polyacantha	CAC	<1
RASN	forb	Artemisia sp.	AST	<1
RASN	forb	Linum neomexicanum	LIN	<1
RASN	forb	Orobanche uniflora	ORO	<1
RASN	forb	Pennellia micrantha	BRA	<1
RASN	grass	Bouteloua gracilis	POA	4
RASN	shrub	Chrysothamnus sp.	AST	<1
RASN	shrub	Fallugia paradoxa	ROS	<1
RASN	shrub	Holodiscus dumosus	ROS	5
RASN	shrub	Rhus trilobata	ANA	<1
RASN	shrub	Ribes cereum	GRO	<1
RASN	tree	Juniperus scopulorum	CUP	10
RASN	tree	Pinus edulis	PIN	1
RASN	tree	Pinus ponderosa	PIN	10
RASN	tree	Populus tremuloides	SAL	1
RASN	tree	Pseudotsuga menziesii	PIN	5
REND	forb	Allium cernuum	LIL	<1
REND	forb	Antennaria parvifolia	AST	<1
REND	forb	Cymopterus purpurascens	API	<1
REND	forb	Erigeron canus	AST	<1

REND	forb	Erigeron divergens	AST	<1
REND	forb	Erigeron flagellaris	AST	<1
REND	forb	Heterotheca villosa	AST	<1
REND	forb	Hieracium fendleri fendleri	AST	<1
REND	forb	Hymenoxys bigelovii	AST	<1
REND	forb	Hymenoxys richardsonii	AST	<1
REND	forb	Infected Arabis	XXX	<1
REND	forb	Linum lewisii	LIN	<1
REND	forb	Lotus wrightii	FAB	<1
REND	forb	Lupinus kingii kingii	FAB	<1
REND	forb	Microsteris gracilis	POL	<1
REND	forb	Orthocarpus purpureo-albus	SCR	<1
REND	forb	Plantago argyrea	PLA	<1
REND	forb	Potentilla hippiana diffusa	ROS	<1
REND	forb	Potentilla subviscosa	ROS	<1
REND	forb	Psoralea tenuiflora bigelovii	FAB	<1
REND	forb	Spheralcea digitata	MAL	<1
REND	forb	Thelypodiopsis linearifolia	BRA	<1
REND	forb	Thermopsis rhombifolia montana	FAB	<1
REND	forb	Thlaspi montanum	BRA	<1
REND	forb	Townsendia exscapa	AST	<1
REND	grass	Bouteloua curtipendula	POA	<1
REND	shrub	Chrysothamnus nauseosus consimilis	AST	<1
REND	shrub	Tetradymia canescens	AST	<1
REND	tree	Juniperus scopulorum	CUP	3
REND	tree	Pinus edulis	PIN	4
REND	tree	Pinus ponderosa	PIN	8
SABL	cactus	Coryphantha vivipara	CAC	<1
SABL	cactus	Echinocereus trigloch melan	CAC	<1
SABL	cactus	Echinocereus trigloch trigloch	CAC	<1
SABL	cactus	Opuntia imbricata	CAC	<1
SABL	cactus	Opuntia macrorhiza	CAC	<1
SABL	cactus	Opuntia polyacantha	CAC	<1
SABL	forb	Abronia fragrans	NYC	<1
SABL	forb	Ambrosia artemesiifolia	AST	<1
SABL	forb	Arabis fendleri fendleri	BRA	<1
SABL	forb	Artemisia campestris pacifica	AST	<1
SABL	forb	Artemisia frigida	AST	<1
SABL	forb	Artemisia ludoviciana	AST	<1
SABL	forb	Astragalus ceramicus ceramicus	FAB	<1
SABL	forb	Castilleja integra	SCR	<1
SABL	forb	Cercocarpus montanus montanus	ROS	<1
SABL	forb	Chamaesaracha coronopus	SOL	<1
SABL	forb	Chamaesyce fendleri chaetocalyx	EUP	<1
SABL	forb	Commelina dianthifolia longispatha	CMM	<1
SABL	forb	Commelina erecta angustifolia	CMM	<1
SABL	forb	Convolvulus arvensis	CON	<1
SABL	forb	Cryptantha cinerea	BOR	<1
SABL	forb	Cryptantha crassisepala elachantha	BOR	<1
SABL	forb	Cymopterus fendleri	API	<1
SABL	forb	Dalea compacta	FAB	<1
SABL	forb	Delphinium virescens wootonii	RAN	<1

SABL	forb	Dimorphocarpa wislizenii	BRA	<1
SABL	forb	Erigeron colomexicanus	AST	<1
SABL	forb	Erigeron divergens	AST	<1
SABL	forb	Erigeron flagellaris	AST	<1
SABL	forb	Eriogonum annuum	PGN	<1
SABL	forb	Eriogonum jamesii	PGN	<1
SABL	forb	Erodium cicutarum	GER	<1
SABL	forb	Eupatorium herbaceum	AST	<1
SABL	forb	Euphorbia lurida	EUP	<1
SABL	forb	Geranium caespitosum	GER	<1
SABL	forb	Helianthus petiolaris petiolaris	AST	<1
SABL	forb	Hymenopappus filifolius cinereus	AST	<1
SABL	forb	Hymenopappus flavescens canotomentosus	AST	<1
SABL	forb	Hymenoxys argentea	AST	<1
SABL	forb	Ipomoea cristulata	CON	<1
SABL	forb	Ipomopsis longiflora	POL	<1
SABL	forb	Ipomopsis multiflora	POL	<1
SABL	forb	Lappula redowskii	BOR	<1
SABL	forb	Lesquerella rectipes	BRA	<1
SABL	forb	Linum aristatum	LIN	<1
SABL	forb	Macheranthera linearis	AST	<1
SABL	forb	Macheranthera tanacetifolia	AST	<1
SABL	forb	Mirabilis glabra	NYC	<1
SABL	forb	Mirabilis multiflora	NYC	1
SABL	forb	Monarda punctata lasiodonta	LAM	<1
SABL	forb	Oenothera albicaulis	ONA	<1
SABL	forb	Orobanche ludoviciana multiflora	ORO	<1
SABL	forb	Orobanche uniflora	ORO	<1
SABL	forb	Penstemon ambiguus laevissimus	SCR	<1
SABL	forb	Physalis hederifolia cordifolia	SOL	<1
SABL	forb	Plantago argyrea	PLA	<1
SABL	forb	Plantago patagonica	PLA	<1
SABL	forb	Portulaca oleracea	POR	<1
SABL	forb	Portulaca parvula	POR	<1
SABL	forb	Psilostrophe tagetina	AST	<1
SABL	forb	Salvia subincisa	LAM	<1
SABL	forb	Sanvitalia abertii	AST	<1
SABL	forb	Schkuhria multiflora	AST	<1
SABL	forb	Senecio multicapitatus	AST	<1
SABL	forb	Senecio multilobatus	AST	<1
SABL	forb	Silene laciniata	CAR	<1
SABL	forb	Solanum jamesii	SOL	<1
SABL	forb	Solidago wrightii adenophora	AST	<1
SABL	forb	Spheralcea fendleri	MAL	<1
SABL	forb	Talinum confertiflorum	POR	<1
SABL	forb	Thalictrum fendleri	RAN	<1
SABL	forb	Thelypodiopsis linearifolia	BRA	<1
SABL	forb	Townsendia incana	AST	<1
SABL	forb	Tradescantia occidentalis scopulorum	CMM	<1
SABL	forb	Verbesina encelioides encelioides	AST	<1
SABL	forb	Vicia americana minor	FAB	<1
SABL	grass	Aristida arizonica	POA	<1

SABL	grass	Aristida purpurea longiseta	POA	<1
SABL	grass	Blepharoneuron tricholepis	POA	<1
SABL	grass	Bouteloua curtipendula	POA	<1
SABL	grass	Bouteloua gracilis	POA	5
SABL	grass	Bouteloua hirsuta	POA	<1
SABL	grass	Cyperus fendlerianus	CYP	<1
SABL	grass	Elymus smithii	POA	<1
SABL	grass	Eragrostis lehmanniana	POA	<1
SABL	grass	Lycurus setosus	POA	<1
SABL	grass	Muhlenbergia dubia	POA	<1
SABL	grass	Muhlenbergia pungens	POA	<1
SABL	grass	Oryzopsis hymenoides	POA	2
SABL	grass	Poa fendleriana	POA	<1
SABL	grass	Schedonnardus paniculatus	POA	<1
SABL	grass	Sporobolus contractus	POA	<1
SABL	grass	Sporobolus cryptandrus	POA	<1
SABL	grass	Stipa comata	POA	<1
SABL	grass	Stipa scribneri	POA	<1
SABL	grass	Vulpia octoflora octoflora	POA	<1
SABL	shrub	Artemisia filifolia	AST	2
SABL	shrub	Atriplex canescens	CHE	<1
SABL	shrub	Fallugia paradoxa	ROS	1
SABL	shrub	Forestiera neomexicana	OLE	<1
SABL	shrub	Fraxinus cuspidata	OLE	<1
SABL	shrub	Lycium pallidum	SOL	<1
SABL	shrub	Rhus trilobata	ANA	<1
SABL	tree	Juniperus monosperma	CUP	10
SABL	tree	Pinus edulis	PIN	5
SABL	tree	Pinus ponderosa	PIN	<1
SEMC	cactus	Echinocereus trigloch melan	CAC	<1
SEMC	cactus	Opuntia polyacantha	CAC	<1
SEMC	fern	Asplenium septentrionale	ASP	<1
SEMC	fern	Dryopteris filix-mas	ASP	<1
SEMC	fern	Woodsia plummerae	ASP	<1
SEMC	forb	Agastache pallidiflora hybrid	LAM	<1
SEMC	forb	Arabis fendleri	BRA	<1
SEMC	forb	Artemisia carruthii	AST	<1
SEMC	forb	Brickellia brachyphylla	AST	<1
SEMC	forb	Castilleja integra	SCR	<1
SEMC	forb	Eriogonum jamesii	PGN	<1
SEMC	forb	Heterotheca villosa	AST	<1
SEMC	forb	Lupinus argenteus	FAB	<1
SEMC	forb	Spheralcea fendleri	MAL	<1
SEMC	grass	Bouteloua gracilis	POA	<1
SEMC	grass	Muhlenbergia minutissima	POA	<1
SEMC	shrub	Chrysothamnus sp.	AST	<1
SEMC	shrub	Fallugia paradoxa	ROS	<1
SEMC	shrub	Forestiera neomexicana	OLE	<1
SEMC	shrub	Holodiscus dumosus	ROS	<1
SEMC	shrub	Pericome caudata	AST	<1
SEMC	shrub	Rhus trilobata	ANA	<1
SEMC	shrub	Ribes cereum	GRO	<1

SEMC	tree	Juniperus monosperma	CUP	<1
SEMC	tree	[illegible]		
TW53	cactus	Coryphantha vivipara	CAC	<1
TW53	forb	Arabis sp.	BRA	<1
TW53	forb	Artemisia dracunculus	AST	<1
TW53	forb	Bahia dissecta	AST	<1
TW53	forb	Cirsium sp.	AST	<1
TW53	forb	Cryptantha cinerea	BOR	<1
TW53	forb	Erigeron flagellaris	AST	<1
TW53	forb	Geranium lentum	GER	<1
TW53	forb	Glandularia wrightii	VER	<1
TW53	forb	Houstonia wrightii	RUB	<1
TW53	forb	Hymenopappus filifolius	AST	<1
TW53	forb	Hymenoxys argentea	AST	<1
TW53	forb	Hymenoxys richardsonii	AST	<1
TW53	forb	Lotus wrightii	FAB	<1
TW53	forb	Lupinus kingii kingii	FAB	<1
TW53	forb	Oenothera sp.	ONA	<1
TW53	forb	Plantago sp.	PLA	<1
TW53	forb	Verbascum thapsus	SCR	<1
TW53	forb	Vicia americana	FAB	<1
TW53	grass	Andropogon gerardii	POA	<1
TW53	grass	Blepharoneuron tricholepis	POA	<1
TW53	grass	Bouteloua gracilis	POA	<1
TW53	grass	Elymus longifolius	POA	<1
TW53	grass	Muhlenbergia montana	POA	10
TW53	shrub	Chrysothamnus sp.	AST	<1
TW53	shrub	Fallugia paradoxa	ROS	<1
TW53	shrub	Forestiera neomexicana	OLE	<1
TW53	shrub	Mahonia haematocarpa	BER	<1
TW53	shrub	Quercus gambelii	FAG	<1
TW53	shrub	Rhus trilobata	ANA	<1
TW53	shrub	Ribes cereum	GRO	<1
TW53	shrub	Tetradymia canescens	AST	<1
TW53	shrub	Yucca baccata	AGA	<1
TW53	tree	Juniperus monosperma	CUP	<1
TW53	tree	Juniperus scopulorum	CUP	<1
TW53	tree	Pinus edulis	PIN	<1
TW53	tree	Pinus ponderosa	PIN	8
TW53	tree	Populus tremuloides	SAL	<1
TWIS	cactus	Echinocereus trigloch melan	CAC	<1
TWIS	cactus	Opuntia polyacantha	CAC	<1
TWIS	fern	Woodsia plummerae	ASP	<1
TWIS	forb	Agastache pallidiflora hybrid	LAM	<1
TWIS	forb	Antennaria parvifolia	AST	<1
TWIS	forb	Anthericum torreyi	LIL	<1
TWIS	forb	Apocynum sp.	APO	<1
TWIS	forb	Arabis fendleri	BRA	<1
TWIS	forb	Artemisia campestris pacifica	AST	<1
TWIS	forb	Artemisia carruthii	AST	<1
TWIS	forb	Astragalus egglestonii	FAB	<1
TWIS	forb	Astragalus humistratus	FAB	<1
TWIS	forb	Bahia dissecta	AST	<1
TWIS	forb	Brickellia brachyphylla	AST	<1

SABL	grass	Aristida purpurea longiseta	POA	<1
SABL	grass	Blepharoneuron tricholepis	POA	<1
SABL	grass	Bouteloua curtipendula	POA	<1
SABL	grass	Bouteloua gracilis	POA	5
SABL	grass	Bouteloua hirsuta	POA	<1
SABL	grass	Cyperus fendlerianus	CYP	<1
SABL	grass	Elymus smithii	POA	<1
SABL	grass	Eragrostis lehmanniana	POA	<1
SABL	grass	Lycurus setosus	POA	<1
SABL	grass	Muhlenbergia dubia	POA	<1
SABL	grass	Muhlenbergia pungens	POA	<1
SABL	grass	Oryzopsis hymenoides	POA	2
SABL	grass	Poa fendleriana	POA	<1
SABL	grass	Schedonnardus paniculatus	POA	<1
SABL	grass	Sporobolus contractus	POA	<1
SABL	grass	Sporobolus cryptandrus	POA	<1
SABL	grass	Stipa comata	POA	<1
SABL	grass	Stipa scribneri	POA	<1
SABL	grass	Vulpia octoflora octoflora	POA	<1
SABL	shrub	Artemisia filifolia	AST	2
SABL	shrub	Atriplex canescens	CHE	<1
SABL	shrub	Fallugia paradoxa	ROS	1
SABL	shrub	Forestiera neomexicana	OLE	<1
SABL	shrub	Fraxinus cuspidata	OLE	<1
SABL	shrub	Lycium pallidum	SOL	<1
SABL	shrub	Rhus trilobata	ANA	<1
SABL	tree	Juniperus monosperma	CUP	10
SABL	tree	Pinus edulis	PIN	5
SABL	tree	Pinus ponderosa	PIN	<1
SEMC	cactus	Echinocereus trigloch melan	CAC	<1
SEMC	cactus	Opuntia polyacantha	CAC	<1
SEMC	fern	Asplenium septentrionale	ASP	<1
SEMC	fern	Dryopteris filix-mas	ASP	<1
SEMC	fern	Woodsia plummerae	ASP	<1
SEMC	forb	Agastache pallidiflora hybrid	LAM	<1
SEMC	forb	Arabis fendleri	BRA	<1
SEMC	forb	Artemisia carruthii	AST	<1
SEMC	forb	Brickellia brachyphylla	AST	<1
SEMC	forb	Castilleja integra	SCR	<1
SEMC	forb	Eriogonum jamesii	PGN	<1
SEMC	forb	Heterotheca villosa	AST	<1
SEMC	forb	Lupinus argenteus	FAB	<1
SEMC	forb	Spheralcea fendleri	MAL	<1
SEMC	grass	Bouteloua gracilis	POA	<1
SEMC	grass	Muhlenbergia minutissima	POA	<1
SEMC	shrub	Chrysothamnus sp.	AST	<1
SEMC	shrub	Fallugia paradoxa	ROS	<1
SEMC	shrub	Forestiera neomexicana	OLE	<1
SEMC	shrub	Holodiscus dumosus	ROS	<1
SEMC	shrub	Pericome caudata	AST	<1
SEMC	shrub	Rhus trilobata	ANA	<1
SEMC	shrub	Ribes cereum	GRO	<1

SEMC	tree	Juniperus monosperma	CUP	<1
SEMC	tree	Pinus edulis	PIN	<1
SEMC	tree	Pinus ponderosa	PIN	<1
SEPT	cactus	Opuntia polyacantha	CAC	<1
SEPT	forb	Abronia fragrans	NYC	<1
SEPT	forb	Ambrosia artemisiifolia	AST	<1
SEPT	forb	Artemisia campestris pacifica	AST	<1
SEPT	forb	Artemisia carruthii	AST	<1
SEPT	forb	Artemisia dracunculus	AST	<1
SEPT	forb	Astragalus mollissimus	FAB	<1
SEPT	forb	Bahia dissecta	AST	<1
SEPT	forb	Castilleja integra	SCR	<1
SEPT	forb	Chamaesyce sp.	EUP	<1
SEPT	forb	Cryptantha cinerea	BOR	<1
SEPT	forb	Dimorphocarpa wislizenii	BRA	<1
SEPT	forb	Draba cuneifolia	BRA	<1
SEPT	forb	Erigeron divergens	AST	<1
SEPT	forb	Eriogonum cernuum	PGN	<1
SEPT	forb	Eriogonum jamesii	PGN	<1
SEPT	forb	Euphorbia lurida	EUP	<1
SEPT	forb	Gaillardia pinnatifida	AST	<1
SEPT	forb	Grindelia aphanactis	AST	<1
SEPT	forb	Gutierrezia sarothrae	AST	<1
SEPT	forb	Hymenopappus flavescens	AST	<1
SEPT	forb	Hymenoxys richardsonii	AST	<1
SEPT	forb	Ipomopsis longiflora	POL	<1
SEPT	forb	Ipomopsis multiflora	POL	<1
SEPT	forb	Lupinus kingii kingii	FAB	<1
SEPT	forb	Macheranthera sp.	AST	<1
SEPT	forb	Monarda punctata	LAM	<1
SEPT	forb	Orthocarpus purpureo-albus	SCR	<1
SEPT	forb	Plantago patagonica	PLA	<1
SEPT	forb	Schkuhria multiflora	AST	<1
SEPT	forb	Senecio multicapitatus	AST	<1
SEPT	forb	Senecio multilobatus	AST	<1
SEPT	forb	Spheralcea digitata	MAL	<1
SEPT	grass	Bouteloua gracilis	POA	<1
SEPT	shrub	Chrysothamnus sp.	AST	<1
SEPT	shrub	Rhus trilobata	ANA	<1
SEPT	shrub	Tetradymia canescens	AST	<1
SEPT	shrub	Yucca baileyi X Y. glauca	AGA	<1
SEPT	tree	Juniperus monosperma	CUP	<1
SEPT	tree	Pinus edulis	PIN	<1
STKI	cactus	Coryphantha vivipara	CAC	<1
STKI	cactus	Opuntia phaeacantha	CAC	<1
STKI	cactus	Opuntia polyacantha	CAC	<1
STKI	forb	Artemisia carruthii	AST	<1
STKI	forb	Bahia dissecta	AST	<1
STKI	forb	Chaetopappa ericoides	AST	<1
STKI	forb	Cryptantha cinerea	BOR	<1
STKI	forb	Eriogonum alatum alatum	PGN	<1
STKI	forb	Eriogonum jamesii	PGN	<1

STKI	forb	Gutierrezia sarothrae	AST	<1
STKI	forb	Hymenoxys richardsonii	AST	<1
STKI	forb	Lesquerella rectipes	BRA	<1
STKI	forb	Lotus wrightii	FAB	<1
STKI	forb	Lupinus kingii kingii	FAB	<1
STKI	forb	Mirabilis multiflora	NYC	<1
STKI	forb	Senecio multilobatus	AST	<1
STKI	forb	Thelypodiopsis linearifolia	BRA	<1
STKI	grass	Aristida purpurea purpurea	POA	<1
STKI	grass	Bouteloua gracilis	POA	10
STKI	grass	Bouteloua hirsuta	POA	<1
STKI	grass	Elymus longifolius	POA	<1
STKI	grass	Muhlenbergia montana	POA	<1
STKI	grass	Schizachyrium scoparium	POA	<1
STKI	shrub	Chrysothamnus sp.	AST	<1
STKI	shrub	Forestiera neomexicana	OLE	<1
STKI	shrub	Quercus gambelii	FAG	<1
STKI	shrub	Yucca baccata	AGA	1
STKI	tree	Juniperus monosperma	CUP	<1
STKI	tree	Pinus edulis	PIN	40
STKI	tree	Pinus ponderosa	PIN	10
SUBR	cactus	Echinocereus trigloch melan	CAC	<1
SUBR	cactus	Opuntia polyacantha	CAC	<1
SUBR	fern	Woodsia plummerae	ASP	<1
SUBR	forb	Arabis fendleri	BRA	<1
SUBR	forb	Artemisia carruthii	AST	<1
SUBR	forb	Erigeron sp.	AST	<1
SUBR	forb	Mirabilis diffusa	NYC	<1
SUBR	forb	Verbascum thapsus	SCR	<1
SUBR	grass	Aristida sp.	POA	<1
SUBR	shrub	Fallugia paradoxa	ROS	<1
SUBR	shrub	Forestiera neomexicana	OLE	<1
SUBR	shrub	Holodiscus dumosus	ROS	<1
SUBR	shrub	Pericome caudata	AST	<1
SUBR	shrub	Ribes cereum	GRO	<1
SUBR	tree	Juniperus scopulorum	CUP	<1
SUBR	tree	Pinus edulis	PIN	<1
SUBR	tree	Pinus ponderosa	PIN	<1
TRIA	cactus	Echinocereus trigloch melan	CAC	<1
TRIA	cactus	Opuntia polyacantha	CAC	<1
TRIA	forb	Arabis fendleri fendleri	BRA	<1
TRIA	forb	Artemisia sp.	AST	<1
TRIA	forb	Penstemon sp.	SCR	<1
TRIA	grass	Muhlenbergia minutissima	POA	<1
TRIA	shrub	Chrysothamnus sp.	AST	<1
TRIA	shrub	Fallugia paradoxa	ROS	<1
TRIA	shrub	Holodiscus dumosus	ROS	1
TRIA	shrub	Pericome caudata	AST	<1
TRIA	shrub	Rhus trilobata	ANA	<1
TRIA	shrub	Ribes cereum	GRO	<1
TRIA	tree	Pinus ponderosa	PIN	3
TRIA	tree	Pseudotsuga menziesii	PIN	2

TW53	cactus	Coryphantha vivipara	CAC	<1
TW53	forb	Arabis sp.	BRA	<1
TW53	forb	Artemisia dracunculus	AST	<1
TW53	forb	Bahia dissecta	AST	<1
TW53	forb	Cirsium sp.	AST	<1
TW53	forb	Cryptantha cinerea	BOR	<1
TW53	forb	Erigeron flagellaris	AST	<1
TW53	forb	Geranium lentum	GER	<1
TW53	forb	Glandularia wrightii	VER	<1
TW53	forb	Houstonia wrightii	RUB	<1
TW53	forb	Hymenopappus filifolius	AST	<1
TW53	forb	Hymenoxys argentea	AST	<1
TW53	forb	Hymenoxys richardsonii	AST	<1
TW53	forb	Lotus wrightii	FAB	<1
TW53	forb	Lupinus kingii kingii	FAB	<1
TW53	forb	Oenothera sp.	ONA	<1
TW53	forb	Plantago sp.	PLA	<1
TW53	forb	Verbascum thapsus	SCR	<1
TW53	forb	Vicia americana	FAB	<1
TW53	grass	Andropogon gerardii	POA	<1
TW53	grass	Blepharoneuron tricholepis	POA	<1
TW53	grass	Bouteloua gracilis	POA	<1
TW53	grass	Elymus longifolius	POA	<1
TW53	grass	Muhlenbergia montana	POA	10
TW53	shrub	Chrysothamnus sp.	AST	<1
TW53	shrub	Fallugia paradoxa	ROS	<1
TW53	shrub	Forestiera neomexicana	OLE	<1
TW53	shrub	Mahonia haematocarpa	BER	<1
TW53	shrub	Quercus gambelii	FAG	<1
TW53	shrub	Rhus trilobata	ANA	<1
TW53	shrub	Ribes cereum	GRO	<1
TW53	shrub	Tetradymia canescens	AST	<1
TW53	shrub	Yucca baccata	AGA	<1
TW53	tree	Juniperus monosperma	CUP	<1
TW53	tree	Juniperus scopulorum	CUP	<1
TW53	tree	Pinus edulis	PIN	<1
TW53	tree	Pinus ponderosa	PIN	8
TW53	tree	Populus tremuloides	SAL	<1
TWIS	cactus	Echinocereus trigloch melan	CAC	<1
TWIS	cactus	Opuntia polyacantha	CAC	<1
TWIS	fern	Woodsia plummerae	ASP	<1
TWIS	forb	Agastache pallidiflora hybrid	LAM	<1
TWIS	forb	Antennaria parvifolia	AST	<1
TWIS	forb	Anthericum torreyi	LIL	<1
TWIS	forb	Apocynum sp.	APO	<1
TWIS	forb	Arabis fendleri	BRA	<1
TWIS	forb	Artemisia campestris pacifica	AST	<1
TWIS	forb	Artemisia carruthii	AST	<1
TWIS	forb	Astragalus egglestonii	FAB	<1
TWIS	forb	Astragalus humistratus	FAB	<1
TWIS	forb	Bahia dissecta	AST	<1
TWIS	forb	Brickellia brachyphylla	AST	<1

TWIS	forb	Castilleja integra	SCR	<1
TWIS	forb	Chaetopappa ericoides	AST	<1
TWIS	forb	Cirsium neomexicanum	AST	<1
TWIS	forb	Cryptantha cinerea	BOR	<1
TWIS	forb	Erigeron divergens	AST	<1
TWIS	forb	Erigeron flagellaris	AST	<1
TWIS	forb	Erigeron formosissimus formosissimus	AST	<1
TWIS	forb	Eriogonum alatum alatum	PGN	<1
TWIS	forb	Eriogonum jamesii	PGN	<1
TWIS	forb	Eupatorium herbaceum	AST	<1
TWIS	forb	Geranium caespitosum	GER	<1
TWIS	forb	Geranium lentum	GER	<1
TWIS	forb	Glandularia wrightii	VER	<1
TWIS	forb	Heterotheca villosa	AST	<1
TWIS	forb	Hieracium fendleri fendleri	AST	<1
TWIS	forb	Hymenoxys richardsonii	AST	<1
TWIS	forb	Ipomopsis aggregata ssp. formosissima	POL	<1
TWIS	forb	Linum neomexicanum	LIN	<1
TWIS	forb	Lotus wrightii	FAB	<1
TWIS	forb	Lupinus kingii kingii	FAB	<1
TWIS	forb	Mirabilis sp.	NYC	<1
TWIS	forb	Oenothera caespitosa	ONA	<1
TWIS	forb	Penstemon barbatus	SCR	<1
TWIS	forb	Phaseolus angustissimus	FAB	<1
TWIS	forb	Plantago patagonica	PLA	<1
TWIS	forb	Pseudocymopterus montanus	API	<1
TWIS	forb	Psoralea tenuiflora bigelovii	FAB	<1
TWIS	forb	Senecio multilobatus	AST	<1
TWIS	forb	Solidago sparsiflora	AST	<1
TWIS	forb	Spheralcea digitata	MAL	<1
TWIS	forb	Spheralcea fendleri	MAL	<1
TWIS	forb	Tragopogon dubius	AST	<1
TWIS	forb	Verbascum thapsus	SCR	<1
TWIS	grass	Bouteloua gracilis	POA	<1
TWIS	shrub	Fallugia paradoxa	ROS	<1
TWIS	shrub	Forestiera neomexicana	OLE	<1
TWIS	shrub	Holodiscus dumosus	ROS	<1
TWIS	shrub	Mahonia repens	BER	<1
TWIS	shrub	Pericome caudata	AST	<1
TWIS	shrub	Prunus virginiana	ROS	<1
TWIS	shrub	Ribes cereum	GRO	<1
TWIS	shrub	Tetradymia canescens	AST	<1
TWIS	shrub	Yucca baccata	AGA	<1
TWIS	tree	Juniperus scopulorum	CUP	<1
TWIS	tree	Pinus edulis	PIN	<1
TWIS	tree	Pinus ponderosa	PIN	<1
TWIS	tree	Populus tremuloides	SAL	<1
TWIS	tree	Pseudotsuga menziesii	PIN	<1
ZABF	cactus	Coryphantha vivipara	CAC	<1
ZABF	cactus	Echinocereus trigloch melan	CAC	<1
ZABF	cactus	Opuntia imbricata	CAC	<1
ZABF	cactus	Opuntia macrorhiza	CAC	<1

ZABF	cactus	Opuntia phaeacantha	CAC	<1
ZABF	cactus	Opuntia polyacantha	CAC	<1
ZABF	fern	Woodsia plummerae	ASP	<1
ZABF	forb	Arabis sp.	BRA	<1
ZABF	forb	Artemisia carruthii	AST	3
ZABF	forb	Bahia dissecta	AST	<1
ZABF	forb	Chenopodium leptophyllum	CHE	<1
ZABF	forb	Chenopodium sp.	CHE	<1
ZABF	forb	Eriogonum racemosum	PGN	<1
ZABF	forb	Glandularia wrightii	VER	<1
ZABF	forb	Heterotheca villosa	AST	2
ZABF	forb	Spheralcea digitata	MAL	<1
ZABF	forb	Talinum confertiflorum	POR	<1
ZABF	forb	Verbascum thapsus	SCR	<1
ZABF	grass	Blepharoneuron tricholepis	POA	<1
ZABF	grass	Bouteloua curtipendula	POA	<1
ZABF	grass	Bouteloua gracilis	POA	1
ZABF	grass	Elymus longifolius	POA	<1
ZABF	grass	Muhlenbergia montana	POA	<1
ZABF	grass	Oryzopsis micrantha	POA	<1
ZABF	grass	Schizachyrium scoparium	POA	<1
ZABF	shrub	Fallugia paradoxa	ROS	<1
ZABF	shrub	Forestiera neomexicana	OLE	<1
ZABF	shrub	Holodiscus dumosus	ROS	<1
ZABF	shrub	Quercus X pauciloba	FAG	<1
ZABF	shrub	Quercus gambelii	FAG	5
ZABF	shrub	Rhus trilobata	ANA	<1
ZABF	shrub	Ribes cereum	GRO	<1
ZABF	tree	Juniperus monosperma	CUP	<1
ZABF	tree	Juniperus scopulorum	CUP	<1
ZABF	tree	Pinus ponderosa	PIN	15
ZABF	vine	Vitis arizonica	VIT	<1
ZAKI	cactus	Coryphantha vivipara	CAC	<1
ZAKI	cactus	Echinocereus fendleri	CAC	<1
ZAKI	cactus	Echinocereus trigloch melan	CAC	<1
ZAKI	cactus	Opuntia imbricata	CAC	5
ZAKI	cactus	Opuntia phaeacantha	CAC	<1
ZAKI	cactus	Opuntia polyacantha	CAC	<1
ZAKI	forb	Artemisia carruthii	AST	<1
ZAKI	forb	Artemisia dracunculus	AST	<1
ZAKI	forb	Astragalus calycosus scaposus	FAB	<1
ZAKI	forb	Bahia dissecta	AST	<1
ZAKI	forb	Castilleja integra	SCR	<1
ZAKI	forb	Chaetopappa ericoides	AST	5
ZAKI	forb	Chamaesyce fendleri chaetocalyx	EUP	<1
ZAKI	forb	Chenopodium sp.	CHE	<1
ZAKI	forb	Cirsium sp.	AST	<1
ZAKI	forb	Cryptantha cinerea	BOR	1
ZAKI	forb	Erigeron sp.	AST	<1
ZAKI	forb	Eriogonum alatum alatum	PGN	<1
ZAKI	forb	Erysimum capitatum	BRA	<1
ZAKI	forb	Glandularia wrightii	VER	<1

ZAKI	forb	Grindelia aphanactis	AST	<1
ZAKI	forb	Gutierrezia sarothrae	AST	<1
ZAKI	forb	Hymenoxys argentea	AST	<1
ZAKI	forb	Lesquerella rectipes	BRA	<1
ZAKI	forb	Linum lewisii	LIN	<1
ZAKI	forb	Macheranthera pinnatifida pinnatifida	AST	<1
ZAKI	forb	Mirabilis multiflora	NYC	<1
ZAKI	forb	Oenothera sp.	ONA	<1
ZAKI	forb	Orobanche ludoviciana multiflora	ORO	<1
ZAKI	forb	Oxalis sp.	OXA	<1
ZAKI	forb	Penstemon barbatus	SCR	<1
ZAKI	forb	Plantago patagonica	PLA	<1
ZAKI	forb	Polygala alba	PGL	<1
ZAKI	forb	Psilostrophe tagetina	AST	1
ZAKI	forb	Spheralcea digitata	MAL	<1
ZAKI	forb	Thelesperma megapotamicum	AST	<1
ZAKI	forb	Zinnia grandiflora	AST	<1
ZAKI	grass	Aristida purpurea purpurea	POA	<1
ZAKI	grass	Bouteloua curtipendula	POA	<1
ZAKI	grass	Bouteloua gracilis	POA	5
ZAKI	grass	Carex filifolia	CYP	<1
ZAKI	grass	Elymus longifolius	POA	<1
ZAKI	grass	Elymus smithii	POA	<1
ZAKI	grass	Lycurus setosus	POA	10
ZAKI	grass	Muhlenbergia montana	POA	<1
ZAKI	grass	Muhlenbergia pauciflora	POA	10
ZAKI	grass	Muhlenbergia torreyi	POA	<1
ZAKI	grass	Oryzopsis hymenoides	POA	<1
ZAKI	grass	Pleuraphis jamesii	POA	<1
ZAKI	grass	Sporobolus cryptandrus	POA	<1
ZAKI	grass	Sporobolus sp.	POA	<1
ZAKI	grass	Stipa comata	POA	<1
ZAKI	grass	Stipa neomexicana	POA	<1
ZAKI	shrub	Atriplex canescens	CHE	5
ZAKI	shrub	Ceratoides lanata	CHE	<1
ZAKI	shrub	Chrysothamnus sp.	AST	5
ZAKI	shrub	Fallugia paradoxa	ROS	<1
ZAKI	shrub	Fraxinus cuspidata	OLE	<1
ZAKI	shrub	Quercus gambelii	FAG	<1
ZAKI	shrub	Rhus trilobata	ANA	<1
ZAKI	shrub	Yucca baileyi X Y. glauca	AGA	<1
ZAKI	tree	Juniperus monosperma	CUP	10
ZAKI	tree	Pinus edulis	PIN	10
ZATF	cactus	Echinocereus fendleri	CAC	<1
ZATF	cactus	Echinocereus trigloch melan	CAC	<1
ZATF	cactus	Opuntia imbricata	CAC	<1
ZATF	cactus	Opuntia phaeacantha	CAC	<1
ZATF	cactus	Opuntia polyacantha	CAC	<1
ZATF	forb	Artemisia carruthii	AST	<1
ZATF	forb	Bahia dissecta	AST	<1
ZATF	forb	Castilleja integra	SCR	<1
ZATF	forb	Chenopodium sp.	CHE	<1

ZATF	forb	Cryptantha cinerea	BOR	<1
ZATF	forb	Erigeron divergens	AST	<1
ZATF	forb	Eriogonum jamesii	PGN	<1
ZATF	forb	Geranium lentum	GER	<1
ZATF	forb	Glandularia wrightii	VER	<1
ZATF	forb	Ipomopsis aggregata ssp. formosissima	POL	<1
ZATF	forb	Lactuca serriola	AST	<1
ZATF	forb	Lappula redowskii	BOR	<1
ZATF	forb	Lotus wrightii	FAB	<1
ZATF	forb	Mirabilis sp.	NYC	<1
ZATF	forb	Orobanche sp.	ORO	<1
ZATF	forb	Senecio sp.	AST	<1
ZATF	forb	Spheralcea digitata	MAL	<1
ZATF	forb	Thelypodiopsis linearifolia	BRA	<1
ZATF	forb	Verbascum thapsus	SCR	<1
ZATF	grass	Blepharoneuron tricholepis	POA	<1
ZATF	grass	Bouteloua curtipendula	POA	<1
ZATF	grass	Bouteloua gracilis	POA	5
ZATF	grass	Elymus longifolius	POA	<1
ZATF	grass	Lycurus setosus	POA	<1
ZATF	grass	Muhlenbergia montana	POA	<1
ZATF	grass	Schizachyrium scoparium	POA	<1
ZATF	shrub	Chrysothamnus sp.	AST	<1
ZATF	shrub	Fallugia paradoxa	ROS	5
ZATF	shrub	Forestiera neomexicana	OLE	<1
ZATF	shrub	Pericome caudata	AST	<1
ZATF	shrub	Quercus gambelii	FAG	5
ZATF	shrub	Rhus trilobata	ANA	<1
ZATF	shrub	Ribes cereum	GRO	<1
ZATF	shrub	Yucca baccata	AGA	<1
ZATF	tree	Juniperus monosperma	CUP	10
ZATF	tree	Pinus edulis	PIN	5
ZATF	tree	Pinus ponderosa	PIN	10
ZATF	vine	Clematis ligusticifolia	RAN	<1
ZATH	cactus	Mammillaria wrightii	CAC	<1
ZATH	cactus	Opuntia phaeacantha	CAC	<1
ZATH	forb	Artemisia carruthii	AST	<1
ZATH	forb	Artemisia dracunculus	AST	<1
ZATH	forb	Chaetopappa ericoides	AST	<1
ZATH	forb	Chenopodium sp.	CHE	<1
ZATH	forb	Convolvulus arvensis	CON	<1
ZATH	forb	Cryptantha cinerea	BOR	4
ZATH	forb	Cryptantha crassisepala elachantha	BOR	<1
ZATH	forb	Erigeron sp.	AST	<1
ZATH	forb	Eriogonum jamesii	PGN	<1
ZATH	forb	Erodium cicutarum	GER	<1
ZATH	forb	Gilia sinuata	POL	<1
ZATH	forb	Glandularia wrightii	VER	<1
ZATH	forb	Gutierrezia sarothrae	AST	<1
ZATH	forb	Kochia scoparia	CHE	<1
ZATH	forb	Lappula redowskii	BOR	<1
ZATH	forb	Linum aristatum	LIN	<1

ZATH	forb	Marrubium vulgare	LAM	<1
ZATH	forb	Mirabilis multiflora	NYC	<1
ZATH	forb	Oenothera sp.	ONA	<1
ZATH	forb	Plantago patagonica	PLA	<1
ZATH	forb	Potentilla sp.	ROS	<1
ZATH	forb	Salsola iberica	CHE	<1
ZATH	forb	Sisymbrium altissimum	BRA	<1
ZATH	forb	Spheralcea digitata	MAL	<1
ZATH	forb	Talinum confertiflorum	POR	<1
ZATH	forb	Taraxacum officinale	AST	<1
ZATH	forb	Tragopogon dubius	AST	<1
ZATH	forb	Verbascum thapsus	SCR	<1
ZATH	forb	Verbena bracteata	VER	<1
ZATH	grass	Aristida havardii	POA	<1
ZATH	grass	Aristida purpurea purpurea	POA	<1
ZATH	grass	Bouteloua gracilis	POA	5
ZATH	grass	Bromus tectorum	POA	<1
ZATH	grass	Carex occidentalis	CYP	<1
ZATH	grass	Chloris verticillata	POA	<1
ZATH	grass	Elymus longifolius	POA	<1
ZATH	grass	Elymus trachycaulus X smithii ?	POA	<1
ZATH	grass	Eragrostis curvula	POA	<1
ZATH	grass	Festuca arizonica	POA	<1
ZATH	grass	Lycurus setosus	POA	<1
ZATH	grass	Muhlenbergia minutissima	POA	<1
ZATH	grass	Muhlenbergia torreyi	POA	<1
ZATH	grass	Poa bigelovii	POA	<1
ZATH	grass	Schedonnardus paniculatus	POA	<1
ZATH	grass	Vulpia octoflora octoflora	POA	<1
ZATH	shrub	Atriplex canescens	CHE	<1
ZATH	shrub	Ceratoides lanata	CHE	<1
ZATH	shrub	Chrysothamnus sp.	AST	5
ZATH	shrub	Fallugia paradoxa	ROS	<1
ZATH	shrub	Lycium pallidum	SOL	<1
ZATH	shrub	Ribes cereum	GRO	<1
ZATH	shrub	Yucca baileyi X Y. glauca	AGA	<1
ZATH	tree	Juniperus monosperma	CUP	5
ZATH	tree	Pinus edulis	PIN	5
ZUNI	cactus	Echinocereus trigloch melan	CAC	<1
ZUNI	cactus	Opuntia polyacantha	CAC	<1
ZUNI	fern	Cheilanthes feei	ADI	<1
ZUNI	fern	Woodsia plummerae	ASP	<1
ZUNI	forb	Artemisia sp.	AST	<1
ZUNI	forb	Geranium lentum	GER	<1
ZUNI	forb	Potentilla pensylvanica	ROS	<1
ZUNI	forb	Thelypodiopsis linearifolia	BRA	<1
ZUNI	forb	Verbascum thapsus	SCR	<1
ZUNI	grass	Elymus longifolius	POA	<1
ZUNI	grass	Muhlenbergia minutissima	POA	<1
ZUNI	grass	Muhlenbergia montana	POA	<1
ZUNI	shrub	Chrysothamnus sp.	AST	<1
ZUNI	shrub	Forestiera neomexicana	OLE	<1

ZUNI	shrub	Holodiscus dumosus	ROS	<1
ZUNI	shrub	Ribes cereum	GRO	<1
ZUNI	shrub	Yucca baccata	AGA	<1
ZUNI	tree	Juniperus scopulorum	CUP	<1
ZUNI	tree	Pinus edulis	PIN	<1
ZUNI	tree	Pseudotsuga menziesii	PIN	<1

VEGETATION AND WILDLIFE INVENTORY

OF EL MALPAIS NATIONAL MONUMENT

Final Report

Appendix 14

VEGETATION INVENTORY OFF-SITE PLANT SPECIES RECORDS

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-1 **Date:** 6 May 1992

Name: *Astragalus praelongus* Sheldon var. *praelongus*

Family: Fabaceae **Field Number:** OFFS-P4

Location and Habitat: NM-117 roadside, appx 3 mi south of I-40

USGS 7.5' quad: Grants SE **Elevation:** 1963 m (6440')

Township: 10 N **Range:** 9 W **Section:** 33 nw 1/4

Latitude: 35° 03' 30" N **Longitude:** 107° 48' 01" W

UTM Zone: 13 **Northing:** 3882900 **Easting:** 244580

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-2 **Date:** 6 May 1992

Name: *Arabis perennans* S. Wats.

Family: Brassicaceae **Field Number:** OFFS-P7

Location and Habitat: NM-117 roadside, appx. 2.3 mi south of Little Narrows

USGS 7.5' quad: Los Pilares **Elevation:** 2103 m (6900')

Township: 8 N **Range:** 10 W **Section:** 23 se 1/4

Latitude: 34° 54' 00" N **Longitude:** 107° 51' 25" W

UTM Zone: 13 **Northing:** 3865500 **Easting:** 238900

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-3 **Date:** 6 May 1992

Name: *Celtis reticulata* Torr.

Family: Ulmaceae **Field Number:** OFFS-P9

Location and Habitat: Near NM-117, on alluvium, appx. 1 mi south of I-40

USGS 7.5' quad: Grants SE **Elevation:** 1945 m (6380')

Township: 10 N **Range:** 9 W **Section:** 22 sw 1/4

Latitude: 35° 04' 47" N **Longitude:** 107° 46' 40" W

UTM Zone: 13 **Northing:** 3884200 **Easting:** 246700

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-4 **Date:** 12 May 1992

Name: *Senecio neomexicanus* A. Gray var. *mutabilis* (Greene) T.M. Barkl.

Family: Asteraceae **Field Number:** OFFS-P12

Location and Habitat: Hoya lava flow, appx 0.5 mi south of Cerro Encierro

USGS 7.5' quad: Ice Caves SE **Elevation:** 2233 m (7325')

Township: 7 N **Range:** 12 W **Section:** 1 nw 1/4

Latitude: 34° 52' 09" N **Longitude:** 108° 03' 13" W

UTM Zone: 12 **Northing:** 3862280 **Easting:** 769350

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-5 **Date:** 13 May 1992

Name: *Salix drummondiana* Barratt ex Hook.

Family: Salicaceae **Field Number:** OFFS-P11

Location and Habitat: Twin Craters flow in small collapse pit

USGS 7.5' quad: Ice Caves **Elevation:** 2336 m (7665')

Township: 9 N **Range:** 12 W **Section:** 35

Latitude: 34° 58' 00" N **Longitude:** 108° 04' 11" W

UTM Zone: 12 **Northing:** 3873060 **Easting:** 767530

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-6 **Date:** 20 May 1992

Name: *Descurainia richardsonii* O.E. Schulz ssp. *incisa* (Engelm.) Detling

Family: Brassicaceae **Field Number:** OFFS-P18

Location and Habitat: NM-53 roadside

USGS 7.5' quad: Ice Caves **Elevation:** 2256 m (7400')

Township: 9 N **Range:** 11 W **Section:** 29

Latitude: 34° 59' 08" **Longitude:** 108° 01' 07"

UTM Zone: 12 **Northing:** 3875300 **Easting:** 772110

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-7 **Date:** 20 May 1992

Name: *Sisymbrium altissimum* L.

Family: Brassicaceae **Field Number:** OFFS-P19

Location and Habitat: NM-53 roadside

USGS 7.5' quad: Ice Caves **Elevation:** 2256 m (7400')

Township: 9 N **Range:** 11 W **Section:** 29

Latitude: 34° 59' 08" **Longitude:** 108° 01' 07"

UTM Zone: 12 **Northing:** 3875300 **Easting:** 772110

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-8 **Date:** 20 May 1992

Name: *Erigeron colomexicanus* A. Nels.

Family: Asteraceae **Field Number:** OFFS-P22

Location and Habitat: NM-53 roadside

USGS 7.5' quad: Ice Caves **Elevation:** 2256 m (7400')

Township: 9 N **Range:** 11 W **Section:** 29

Latitude: 34° 59' 08" **Longitude:** 108° 01' 07"

UTM Zone: 12 **Northing:** 3875300 **Easting:** 772110

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-9 **Date:** 3 June 1992

Name: *Penstemon ophianthus* Pennell

Family: Scrophulariaceae **Field Number:** OFFS-P61

Location and Habitat: along Cibola County Road 42, appx 0.75 mi south of Los Cerros Ranch, on Old Basalt

USGS 7.5' quad: Cerro Hueco **Elevation:** 2289 m (7510')

Township: 8 N **Range:** 13 W **Section:** 25 se 1/4

Latitude: 34° 53' 25" N **Longitude:** 108° 09' 16" W

UTM Zone: 12 **Northing:** 3864340 **Easting:** 760040

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-10 **Date:** 24 June 1992

Name: *Rorippa sinuata* (Nutt.) A.S. Hitchc.

Family: Brassicaceae **Field Number:** OFFS-P43

Location and Habitat: east of Los Cerros Ranch appx 0.4 mi, on Old Basalt, sw corner of Big Hole

USGS 7.5' quad: Cerro Hueco **Elevation:** 2286 m (7500')

Township: 8 N **Range:** 12 W **Section:** 19 sw 1/4

Latitude: 34° 54' 07" N **Longitude:** 108° 08' 35" W

UTM Zone: 12 **Northing:** 3865700 **Easting:** 761040

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-11 **Date:** 24 June 1992

Name: *Monolepis nuttalliana* (Roemer & Schultes) Greene

Family: Chenopodiaceae **Field Number:** OFFS-P46

Location and Habitat: east of Los Cerros Ranch appx 0.4 mi, on Old Basalt, sw corner of Big Hole

USGS 7.5' quad: Cerro Hueco **Elevation:** 2286 m (7500')

Township: 8 N **Range:** 12 W **Section:** 19 sw 1/4

Latitude: 34° 54' 07" N **Longitude:** 108° 08' 35" W

UTM Zone: 12 **Northing:** 3865700 **Easting:** 761040

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-12 **Date:** 24 June 1992

Name: *Gayophytum ramosissimum* Nutt. ex T. & G.

Family: Onagraceae **Field Number:** OFFS-P63

Location and Habitat: east of Los Cerros Ranch appx 0.4 mi, on Old Basalt, sw corner of Big Hole

USGS 7.5' quad: Cerro Hueco **Elevation:** 2286 m (7500')

Township: 8 N **Range:** 12 W **Section:** 19 sw 1/4

Latitude: 34° 54' 07" N **Longitude:** 108° 08' 35" W

UTM Zone: 12 **Northing:** 3865700 **Easting:** 761040

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-13 **Date:** 25 June 1992

Name: *Melilotus alba* Medic.

Family: Fabaceae **Field Number:** 53UP-P9

Location and Habitat: NM-53 roadside, appx 0.5 mi east of Agua Fria

USGS 7.5' quad: Ice Caves **Elevation:** 2268 m (7440')

Township: 9 N **Range:** 11 W **Section:** 20 sw 1/4

Latitude: 34° 59' 20" N **Longitude:** 108° 01' 42" W

UTM Zone: 12 **Northing:** 3875660 **Easting:** 771240

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-14 **Date:** 25 June 1992

Name: *Melilotus officinalis* (L.) Pallas

Family: Fabaceae **Field Number:** 53UP-P10

Location and Habitat: NM-53 roadside, appx 0.5 mi east of Agua Fria

USGS 7.5' quad: Ice Caves **Elevation:** 2268 m (7440')

Township: 9 N **Range:** 11 W **Section:** 20 sw 1/4

Latitude: 34° 59' 20" N **Longitude:** 108° 01' 42" W

UTM Zone: 12 **Northing:** 3875660 **Easting:** 771240

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-15 **Date:** 22 July 1992

Name: *Convolvulus equitans* Benth.

Family: Convolvulaceae **Field Number:** 53MD-P12

Location and Habitat: NM-53 roadside, southeast end of Zuni Mountains

USGS 7.5' quad: Arrosa Ranch **Elevation:** 2085 m (6840')

Township: 9 N **Range:** 10 W **Section:** 32 sw 1/4

Latitude: 34° 57' 36" N **Longitude:** 107° 55' 21" W

UTM Zone: 13 **Northing:** 3872300 **Easting:** 233120

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-16 **Date:** 7 August 1992

Name: *Bothriochloa laguroides* (DC.) Herter ssp. *torreyana* (Steud.) Allred & Gould

Family: Poaceae **Field Number:** 53MD-P1

Location and Habitat: NM-53 roadside, southeast end of Zuni Mountains

USGS 7.5' quad: Arrosa Ranch **Elevation:** 2085 m (6840')

Township: 9 N **Range:** 10 W **Section:** 32 sw 1/4

Latitude: 34° 57' 36" N **Longitude:** 107° 55' 21" W

UTM Zone: 13 **Northing:** 3872300 **Easting:** 233120

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-17 **Date:** 7 August 1992

Name: *Gaura parvifolia* Dougl.

Family: Onagraceae **Field Number:** 53MD-P2

Location and Habitat: NM-53 roadside, southeast end of Zuni Mountains

USGS 7.5' quad: Arrosa Ranch **Elevation:** 2085 m (6840')

Township: 9 N **Range:** 10 W **Section:** 32 sw 1/4

Latitude: 34° 57' 36" N **Longitude:** 107° 55' 21" W

UTM Zone: 13 **Northing:** 3872300 **Easting:** 233120

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-18 **Date:** 7 August 1992

Name: *Lactuca serriola* L.

Family: Asteraceae **Field Number:** 53MD-P3

Location and Habitat: NM-53 roadside, southeast end of Zuni Mountains

USGS 7.5' quad: Arrosa Ranch **Elevation:** 2085 m (6840')

Township: 9 N **Range:** 10 W **Section:** 32 sw 1/4

Latitude: 34° 57' 36" N **Longitude:** 107° 55' 21" W

UTM Zone: 13 **Northing:** 3872300 **Easting:** 233120

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-19 **Date:** 7 August 1992

Name: *Solanum elaeagnifolium* Cav.

Family: Solanaceae **Field Number:** 53MD-P4

Location and Habitat: NM-53 roadside, southeast end of Zuni Mountains

USGS 7.5' quad: Arrosa Ranch **Elevation:** 2085 m (6840')

Township: 9 N **Range:** 10 W **Section:** 32 sw 1/4

Latitude: 34° 57' 36" N **Longitude:** 107° 55' 21" W

UTM Zone: 13 **Northing:** 3872300 **Easting:** 233120

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-20 **Date:** 7 August 1992

Name: *Centaurea repens* L.

Family: Asteraceae **Field Number:** 53MD-P7

Location and Habitat: NM-53 roadside, southeast end of Zuni Mountains

USGS 7.5' quad: Arrosa Ranch **Elevation:** 2085 m (6840')

Township: 9 N **Range:** 10 W **Section:** 32 sw 1/4

Latitude: 34° 57' 36" N **Longitude:** 107° 55' 21" W

UTM Zone: 13 **Northing:** 3872300 **Easting:** 233120

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-21 **Date:** 7 August 1992

Name: *Medicago lupinula* L.

Family: Fabaceae **Field Number:** 53MD-P8

Location and Habitat: NM-53 roadside, southeast end of Zuni Mountains

USGS 7.5' quad: Arrosa Ranch **Elevation:** 2085 m (6840')

Township: 9 N **Range:** 10 W **Section:** 32 sw 1/4

Latitude: 34° 57' 36" N **Longitude:** 107° 55' 21" W

UTM Zone: 13 **Northing:** 3872300 **Easting:** 233120

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-22 **Date:** 7 August 1992

Name: *Gaura hexandra* Ortega ssp. *gracilis* (W. & S.) Raven & Gregory

Family: Onagraceae **Field Number:** 53MD-P9

Location and Habitat: NM-53 roadside, southeast end of Zuni Mountains

USGS 7.5' quad: Arrosa Ranch **Elevation:** 2085 m (6840')

Township: 9 N **Range:** 10 W **Section:** 32 sw 1/4

Latitude: 34° 57' 36" N **Longitude:** 107° 55' 21" W

UTM Zone: 13 **Northing:** 3872300 **Easting:** 233120

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-23 **Date:** 7 August 1992

Name: *Helianthus annuus* L.

Family: Asteraceae **Field Number:** 53UP-P1

Location and Habitat: NM-53 roadside, appx 0.5 mi east of base of cinder hill, in Agua Fria floodplain

USGS 7.5' quad: Paxton Springs **Elevation:** 2291 m (7515')

Township: 9 N **Range:** 12 W **Section:** 24 ne 1/4

Latitude: 35° 00' 05" N **Longitude:** 108° 02' 52" W

UTM Zone: 12 **Northing:** 3877000 **Easting:** 769420

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-24 **Date:** 7 August 1992

Name: *Cirsium vulgare* (Savi) Tenore

Family: Asteraceae **Field Number:** 53UP-P2

Location and Habitat: NM-53 roadside, appx 0.5 mi east of base of cinder hill, in Agua Fria floodplain

USGS 7.5' quad: Paxton Springs **Elevation:** 2291 m (7515')

Township: 9 N **Range:** 12 W **Section:** 24 ne 1/4

Latitude: 35° 00' 05" N **Longitude:** 108° 02' 52" W

UTM Zone: 12 **Northing:** 3877000 **Easting:** 769420

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-25 **Date:** 7 August 1992

Name: *Asclepias subverticillata* (A. Gray) Vail

Family: Asclepiadaceae **Field Number:** 53MD-P5

Location and Habitat: NM-53 roadside, southeast end of Zuni Mountains

USGS 7.5' quad: Arrosa Ranch **Elevation:** 2085 m (6840')

Township: 9 N **Range:** 10 W **Section:** 32 sw 1/4

Latitude: 34° 57' 36" N **Longitude:** 107° 55' 21" W

UTM Zone: 13 **Northing:** 3872300 **Easting:** 233120

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-26 **Date:** 7 August 1992

Name: *Rumex crispus* L.

Family: Polygonaceae **Field Number:** 53UP-P11

Location and Habitat: NM-53 roadside, appx 0.5 mi east of base of cinder hill, in Agua Fria floodplain

USGS 7.5' quad: Paxton Springs **Elevation:** 2291 m (7515')

Township: 9 N **Range:** 12 W **Section:** 24 ne 1/4

Latitude: 35° 00' 05" N **Longitude:** 108° 02' 52" W

UTM Zone: 12 **Northing:** 3875660 **Easting:** 771240

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-27 **Date:** 13 August 1992

Name: *Tamarix chinensis* Lour.

Family: Tamaricaceae **Field Number:** OFFS-P41

Location and Habitat: I-40 roadside near Grants

USGS 7.5' quad: Grants **Elevation:** 1960 m (6430')

Township: 10 N **Range:** 9 W **Section:** 6

Latitude: 35° 07' 30" N **Longitude:** 107° 49' 45" W

UTM Zone: 13 **Northing:** 3890380 **Easting:** 242260

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-28 **Date:** 13 August 1992

Name: *Juniperus monosperma* (Engelm.) Sarg.

Family: Cupressaceae **Field Number:** 53MD-P11

Location and Habitat: NM-53 roadside, southeast end of Zuni Mountains

USGS 7.5' quad: Arrosa Ranch **Elevation:** 2085 m (6840')

Township: 9 N **Range:** 10 W **Section:** 32 sw 1/4

Latitude: 34° 57' 36" N **Longitude:** 107° 55' 21" W

UTM Zone: 13 **Northing:** 3872300 **Easting:** 233120

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-29 **Date:** 13 August 1992

Name: *Typha latifolia* L.

Family: Typhaceae **Field Number:** GALL-P4

Location and Habitat: Gallo Spring, near San Rafael, southwest of Grants

USGS 7.5' quad: San Rafael **Elevation:** 1969 m (6460')

Township: 10 N **Range:** 10 W **Section:** 3 se 1/4

Latitude: 35° 07' 20" N **Longitude:** 107° 52' 29" W

UTM Zone: 13 **Northing:** 3890180 **Easting:** 237980

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-30 **Date:** 13 August 1992

Name: *Sonchus asper* (L.) Hill

Family: Asteraceae **Field Number:** GALL-P1

Location and Habitat: NM-53 roadside, near Gallo Spring

USGS 7.5' quad: San Rafael **Elevation:** 1969 m (6460')

Township: 10 N **Range:** 10 W **Section:** 3 se 1/4

Latitude: 35° 07' 20" N **Longitude:** 107° 52' 29" W

UTM Zone: 13 **Northing:** 3890180 **Easting:** 237980

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-31 **Date:** 13 August 1992

Name: *Ulmus pumila* L.

Family: Ulmaceae **Field Number:** GALL-P6

Location and Habitat: NM-53 roadside, near Gallo Spring

USGS 7.5' quad: San Rafael **Elevation:** 1969 m (6460')

Township: 10 N **Range:** 10 W **Section:** 3 se 1/4

Latitude: 35° 07' 20" N **Longitude:** 107° 52' 29" W

UTM Zone: 13 **Northing:** 3890180 **Easting:** 237980

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-32 **Date:** 13 August 1992

Name: *Populus deltoides* Bartram ex Marshall ssp. *wislizenii* (S. Wats.) Eckenwelder

Family: Salicaceae **Field Number:** GALL-P5

Location and Habitat: NM-53 roadside, near Gallo Spring

USGS 7.5' quad: San Rafael **Elevation:** 1969 m (6460')

Township: 10 N **Range:** 10 W **Section:** 3 se 1/4

Latitude: 35° 07' 20" N **Longitude:** 107° 52' 29" W

UTM Zone: 13 **Northing:** 3890180 **Easting:** 237980

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-33 **Date:** 13 August 1992

Name: *Phragmites australis* (Cav.) Trin. ex Steud.

Family: Poaceae **Field Number:** GALL-P3

Location and Habitat: Gallo Spring, near San Rafael, southwest of Grants

USGS 7.5' quad: San Rafael **Elevation:** 1969 m (6460')

Township: 10 N **Range:** 10 W **Section:** 3 se 1/4

Latitude: 35° 07' 20" N **Longitude:** 107° 52' 29" W

UTM Zone: 13 **Northing:** 3890180 **Easting:** 237980

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-34 **Date:** 18 August 1992

Name: *Senecio douglasii* DC. var. *longilobus* (Benth.) L. Benson

Family: Asteraceae **Field Number:** OFFS-P36

Location and Habitat: along Cibola County Road 42, appx 0.75 mi south of Los Cerros Ranch, on Old Basalt

USGS 7.5' quad: Cerro Hueco **Elevation:** 2289 m (7510')

Township: 8 N **Range:** 13 W **Section:** 25 se 1/4

Latitude: 34° 53' 25" N **Longitude:** 108° 09' 16" W

UTM Zone: 12 **Northing:** 3864340 **Easting:** 760040

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-35 **Date:** 18 August 1992

Name: *Oenothera ablicaulis* Pursh

Family: Onagraceae **Field Number:** OFFS-P54

Location and Habitat: along Cibola County Road 42, appx 0.75 mi south of Los Cerros Ranch, on Old Basalt

USGS 7.5' quad: Cerro Hueco **Elevation:** 2289 m (7510')

Township: 8 N **Range:** 13 W **Section:** 25 se 1/4

Latitude: 34° 53' 25" N **Longitude:** 108° 09' 16" W

UTM Zone: 12 **Northing:** 3864340 **Easting:** 760040

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-36 **Date:** 18 August 1992

Name: *Polygonum ramosissimum* Michx.

Family: Polygonaceae **Field Number:** OFFS-P58

Location and Habitat: along Cibola County Road 42, appx 0.75 mi south of Los Cerros Ranch, on Old Basalt

USGS 7.5' quad: Cerro Hueco **Elevation:** 2289 m (7510')

Township: 8 N **Range:** 13 W **Section:** 25 se 1/4

Latitude: 34° 53' 25" N **Longitude:** 108° 09' 16" W

UTM Zone: 12 **Northing:** 3864340 **Easting:** 760040

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-37 **Date:** 18 August 1992

Name: *Clematis ligusticifolia* Nutt.

Family: Ranunculaceae **Field Number:** OFFS-P59

Location and Habitat: roadside of Cibola County 42, appx 2 mi south of NM-53

USGS 7.5' quad: Ice Caves **Elevation:** 2368 m (7770')

Township: 9 N **Range:** 12 W **Section:** 28

Latitude: 34° 59' 13" N **Longitude:** 108° 06' 23" W

UTM Zone: 12 **Northing:** 3875200 **Easting:** 764130

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-38 **Date:** 18 August 1992

Name: *Macheranthera australis* (Greene) Shinners

Family: Asteraceae **Field Number:** OFFS-P31

Location and Habitat: roadside of Cibola County 42, appx 2 mi south of NM-53

USGS 7.5' quad: Ice Caves **Elevation:** 2368 m (7770')

Township: 9 N **Range:** 12 W **Section:** 28

Latitude: 34° 59' 13" N **Longitude:** 108° 06' 23" W

UTM Zone: 12 **Northing:** 3869550 **Easting:** 759610

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-39 **Date:** 19 August 1992

Name: *Lupinus argenteus* Pursh var. *argenteus*

Family: Fabaceae **Field Number:** OFFS-P50

Location and Habitat: NM-117 roadside, appx 3/4 mi north of south end of McCartys flow

USGS 7.5' quad: Sand Canyon **Elevation:** 2161 m (7090')

Township: 6 N **Range:** 11 W **Section:** 27 ne 1/4

Latitude: 34° 43' 11" N **Longitude:** 107° 58' 50" W

UTM Zone: 13 **Northing:** 3845790 **Easting:** 227010

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-40 **Date:** 19 August 1992

Name: *Salsola paulsenii* Litv.

Family: Chenopodiaceae **Field Number:** OFFS-P78

Location and Habitat: NM-117 roadside, appx 3/4 mi north of south end of McCartys flow

USGS 7.5' quad: Sand Canyom **Elevation:** 2161 m (7090')

Township: 6 N **Range:** 11 W **Section:** 27 ne 1/4

Latitude: 34° 43' 11" N **Longitude:** 107° 58' 50" W

UTM Zone: 13 **Northing:** 3847080 **Easting:** 228360

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-41 **Date:** 10 September 1992

Name: *Xanthium strumarium* L. var. *canadense* (Mill.) T. & G.

Family: Asteraceae **Field Number:** OFFS-P39

Location and Habitat: wash of Cebollita Creek, near NM-117

USGS 7.5' quad: Los Pilares **Elevation:** 2079 m (6820')

Township: 8 N **Range:** 10 W **Section:** 24 nw 1/4

Latitude: 34° 54' 53" N **Longitude:** 107° 50' 52" W

UTM Zone: 13 **Northing:** 3867080 **Easting:** 239780

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-42 **Date:** 10 September 1992

Name: *Atriplex canescens* (Pursh) Nutt.

Family: Chenopodiaceae **Field Number:** OFFS-P45

Location and Habitat: NM-117 roadside, appx 1 mi south of I-40

USGS 7.5' quad: Grants SE **Elevation:** 1951 m (6400')

Township: 10 N **Range:** 9 W **Section:** 21 se 1/4

Latitude: 35° 04' 31" N **Longitude:** 107° 47' 03" W

UTM Zone: 13 **Northing:** 3884800 **Easting:** 246100

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-43 **Date:** 30 September 1992

Name: *Chrysothamnus nauseosus* (Pallas) Britt. ssp. *bigelovii* (A. Gray) H. & C.

Family: Asteraceae **Field Number:** OFFS-P26

Location and Habitat: near south end of Cibola Country road 42, appx 1 mi north of NM-117

USGS 7.5' quad: York Ranch **Elevation:** 2163 m (7095')

Township: 6 N **Range:** 11 W **Section:** 30

Latitude: 34° 43' 04" N **Longitude:** 108° 02' 05" W

UTM Zone: 12 **Northing:** 3845540 **Easting:** 771540

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-44 **Date:** 30 September 1992

Name: *Chrysothamnus viscidiflorus* (Hook.) Nutt. ssp. *stenophyllus* (A. Gray) H. & C.

Family: Asteraceae **Field Number:** OFFS-P29

Location and Habitat: near south end of Cibola Country road 42, appx 1 mi north of NM-117

USGS 7.5' quad: York Ranch **Elevation:** 2163 m (7095')

Township: 6 N **Range:** 11 W **Section:** 30

Latitude: 34° 43' 04" N **Longitude:** 108° 02' 05" W

UTM Zone: 12 **Northing:** 3845540 **Easting:** 771540

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-45 **Date:** 25 August 1993

Name: *Spheralcea digitata* (Greene) Rydb. ssp. *digitata*

Family: Malvaceae **Field Number:** OFFS-P70

Location and Habitat: NM-117 roadside, appx 2 miles north of south end of McCartys flow

USGS 7.5' quad: Sand Canyon **Elevation:** 2195 m (7200')

Township: 6 N **Range:** 11 W **Section:** 23

Latitude: 34° 43' 54" N **Longitude:** 107° 57' 58" W

UTM Zone: 13 **Northing:** 3847080 **Easting:** 228360

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-46 **Date:** 25 August 1993

Name: *Cordylanthus wrightii* A. Gray

Family: Scrophulariaceae **Field Number:** OFFS-P72

Location and Habitat: near NM-117, appx 2 miles north of south end of McCartys flow, on sandy soil in pinon-juniper woodland

USGS 7.5' quad: Sand Canyon **Elevation:** 2195 m (7200')

Township: 6 N **Range:** 11 W **Section:** 23

Latitude: 34° 43' 54" N **Longitude:** 107° 57' 58" W

UTM Zone: 13 **Northing:** 3847080 **Easting:** 228360

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Record

Off-site Record Number: POS-47 **Date:** 25 August 1993

Name: *Elymus canadensis* L.

Family: Poaceae **Field Number:** OFFS-P74

Location and Habitat NM-117 roadside, appx 2 miles north of south end of McCartys flow

USGS 7.5' quad: Sand Canyon **Elevation:** 2195 m (7200')

Township: 6 N **Range:** 11 W **Section:** 23

Latitude: 34° 43' 54" N **Longitude:** 107° 57' 58" W

UTM Zone: 13 **Northing:** 3847080 **Easting:** 228360

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-48 **Date:** 29 September 1993

Name: *Cosmos parviflorus* (Jacq.) H.B.K.

Family: Asteraceae **Field Number:** 53UP-P16

Location and Habitat: NM-53 roadside ditch in cindery soil

USGS 7.5' quad: Paxton Springs **Elevation:** 2365 m (7760')

Township: 9 N **Range:** 12 W **Section:** 23 ne 1/4

Latitude: 35° 00' 06" N **Longitude:** 108° 03' 51" W

UTM Zone: 12 **Northing:** 3877000 **Easting:** 767900

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-49 **Date:** 10 September 1992

Name: *Hymenopappus flavescens* A. Gray *flavescens*

Family: Asteraceae **Field Number:** OFFS-P32

Location and Habitat: NM-117 roadside

USGS 7.5' quad: Los Pilares **Elevation:** 2079 m (6820')

Township: 8 N **Range:** 10 W **Section:** 24 nw 1/4

Latitude: 34° 54' 53" N **Longitude:** 107° 50' 52" W

UTM Zone: 13 **Northing:** 3867080 **Easting:** 239780

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-site Plant Records

Off-site Record Number: POS-50 **Date:** 25 August 1993

Name: *Chrysothamnus viscidiflorus* (Hook.) Nutt. *lanceolatus* (Nutt.) Hall & Clements

Family: Asteraceae **Field Number:** OFFS-P73

Location and Habitat: near NM-117, appx 2 miles north of south end of McCartys flow, on sandy soil in pinon-juniper woodland

USGS 7.5' quad: Sand Canyon **Elevation:** 2195 m (7200')

Township: 6 N **Range:** 11 W **Section:** 23

Latitude: 34° 43' 54" N **Longitude:** 107° 57' 58" W

UTM Zone: 13 **Northing:** 3847080 **Easting:** 228360

VEGETATION AND WILDLIFE INVENTORY

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Appendix 15

THE 36 COMMONEST VASCULAR PLANTS

APPENDIX 15.

THE 36 COMMONEST PLANTS, EL MALPAIS NATIONAL MONUMENT

Based on occurrence at ≥ 25 collection sites; some taxa may be the, or among the, dominant plants at the site. Number of sites follows the family accronym.

SPECIES/FAMILY/NUMBER OF SITE OCCURRENCES

Woodsia plummerae (ASP) 27
Yucca baccata (AGA) 35
Rhus trilobata (ANA) 48
Artemisia carruthii (AST) 44
Bahia dissecta (AST) 41
Chaetopappa ericoides (AST) 29
Chrysothamnus sp. (AST) 45@
Erigeron flagellaris (AST) 29
Heterotheca villosa (AST) 41
Pericome caudata (AST) 35
Senecio multilobatus (AST) 27
Tetradymia canescens (AST) 26
Cryptantha cinerea (BOR) 33
Arabis sp. (BRA) 53#
Thelypodiopsis linearifolia (BRA) 29
Echinocereus triglochidiatus melanacanthus (CAC) 47
Opuntia polyacantha (CAC) 54
Juniperus monosperma (CUP) 45
Juniperus scopulorum (CUP) 38
Lotus wrightii (FAB) 28
Lupinus kingii (FAB) 27
Geranium lentum (GER) 32
Ribes cereum (GRO) 70
Spheralcea digitata (MAL) 33
Forestiera neomexicana (OLE) 48
Eriogonum jamesii (PGN) 28
Pinus edulis (PIN) 63
Pinus ponderosa (PIN) 64
Bouteloua gracilis (POA) 59
Elymus longifolius (POA) 43
Muhlenbergia montana (POA) 36
Fallugia paradoxa (ROS) 55
Holodiscus dumosus (ROS) 36
Castilleja integra (SCR) 39
Verbascum thaspus * (SCR) 39
Glandularia wrightii (VER) 48

@ not including specimens identified to species
including *A. fendleri*, *A. perennans*, and unidentified specimens
* introduced taxon

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Appendix 16

LICHEN SPECIES SUBSTRATE RECORDS

APPENDIX 16.

LIST OF ELMA LICHEN SPECIES AND SUBSTEATES ON WHICH THEY WERE FOUND.

SUBSTRATE CODES:
- L=lava
- S=sandstone
- M=limestone
- T=soil
- W=wood

GENUS	SPECIES	SUBSTRATE
Acarospora	*badiofusca*	S
Acarospora	*chlorophana*	L,S
Acarospora	*fuscata*	L,S
Acarospora	*schleicheri*	L,S
Acarospora	*smaragdula*	S,M
Aspicilia	*alphoplaca*	L,S
Aspicilia	*caesiocinerea*	L,S
Aspicilia	*cf. cinera*	L
Aspicilia	*desertorum*	S
Aspicilia	*quartzitica*	L
Bryoria	*fuscenscens*	W
Buellia	*novomexicana*	L,S
Buellia	*punctata*	W
Buellia	*retrovertens*	L,S
Buellia	*spuria*	L
Caloplaca	*cerina*	W
Caloplaca	*citrina*	L
Caloplaca	*epithallina*	L
Caloplaca	*flavorubescens*	W
Caloplaca	*flavovirescens*	L
Caloplaca	*modesta*	L,S
Caloplaca	sp.aff. *lamprocheila*	M
Caloplaca	*variabilis*	L
Caloplaca	*vitellinula*	S
Candelariella	*aurella*	W
Candelariella	*rosulans*	S,L
Candelariella	*spraguei*	S,L
Candelina	*submexicana*	L
Catapyrenium	*lachneum*	T
Cetraria	*coralligera*	W
Cladonia	*cariosa*	T
Cladonia	*chlorophaea*	T
Cladonia	*pyxidata*	T
Collema	*polycarpon*	L,S
Collema	*texanum*	L
Collema	*thamnodes*	L
Dermatocarpon	*miniatum*	L,S
Dermatocarpon	*moulinsii*	L,S

Dimelaena	*oreina*	L,S
Diploschistes	*actinostomus*	L,S
Diploschistes	*scruposus*	L,S
Flavoparmelia	*baltimorensis*	L,S
Flavoparmelia	*caperata*	L,S
Flavopunctelia	*flaventior*	L,S
Flavopunctelia	*praesignis*	W
Flavopunctelia	*soredica*	W
Glaucomaria	*rupicola*	W
Heppia	*lutosa*	T
Heterodermia	*obscurata*	S
Heterodermia	*pseudospeciosa*	T
Imshaugia	*placorodia*	W
Lasallia	*papulosa*	L,S
Lasallia	*pennsylvanica*	L,S
Lecanora	*agropholis*	L,S
Lecanora	*caesiorubella*	W
Lecanora	*cenisea*	L
Lecanora	*dispersa*	L
Lecanora	*garovaglii*	L
Lecanora	*meridionalis*	W
Lecanora	*nashii*	S
Lecanora	*novomexicana*	L,S
Lecidea	*atrobrunnea*	S
Lecidea	*elabens*	W
Lecidea	*tesselata*	L,S
Lecidella	*carpathica*	S
Lecidella	*euphorea*	W
Lecidella	*stigmatea*	L
Lepraria	*cf. incana*	L,S
Leproloma	*membranacea*	L,S
Leptogium	*denticulatum*	L
Leptogium	*furfuraceum*	W,L
Leptogium	*gelatinosum*	L
Leptogium	*papillosum*	L
Melanelia	*elegantula*	W
Melanelia	*subargentifera*	W
Melanelia	*subolivacea*	W
Melanelia	*substygia*	S
Neofuscelia	*ahtii*	L
Neofuscelia	*occidentalis*	L
Neofuscelia	*subhosseana*	L
Normandina	*pulchella*	L
Ochrolechia	*subisidiata*	W
Pachyospora	*mutabilis*	W
Pannaria	*leucophaea*	L
Pannaria	*praetermissa*	L
Pannaria	*tavaresii*	L
Parmelia	*fraudans*	W
Parmelia	*sulcata*	W
Parmotrema	*reticulatum*	S
Peccania	*arizonica*	T

Peltigera	*rufescens*	S
Pertusaria	*saximontana*	W
Pertusaria	sp. *nov.*	W
Phaeophyscia	*cernohorskyi*	W
Phaeophyscia	*ciliata*	L,S
Phaeophyscia	*hispidula*	L,S
Physcia	*aipolia*	W
Physcia	*biziana*	L,S
Physcia	*caesia*	L,S
Physcia	*callosa*	L,S
Physcia	*dubia*	L,S
Physcia	*mexicana*	W
Physcia	*phaea*	L,S
Physcia	*stellaris*	W
Physciella	*melanchra*	W
Physconia	*detersa*	S
Physconia	*grisea*	T
Physconia	*muscigena*	S
Placynthium	*nigrum*	L
Protoparmeliopsis	*muralis*	S
Psora	*crenata*	T
Psora	*decipeins*	T
Psora	*icterica*	T
Psora	*tuckermanii*	L
Psorula	*rufonigra*	L
Punctelia	*hypoleucites*	L
Punctelia	*rudecta*	S
Punctelia	*semansiana*	L,S
Punctelia	*stricta*	S
Ramalina	*obtusata*	L
Ramalina	*pollinaria*	W,L,S
Rhizocarpon	*disporum*	L,S
Rhizocarpon	*geminatum*	L
Rhizocarpon	*geographicum*	L
Rhizoplaca	*chrysoleuca*	S,L
Rhizoplaca	*melanophthalma*	L
Rinodina	*castanomela*	S
Spilonema	*revertens*	L
Staurothele	*areolata*	L
Staurothele	cf. *fuscocuprea*	S
Staurothele	*drummondii*	S
Staurothele	*elenkinii*	L
Toninia	*tristes*	S
Tuckermannopsis	*fendleri*	W
Tuckermannopsis	*pinastri*	W
Umbilicaria	*vellea*	L,S
Usnea	*subfloridana*	L,S,W
Verrucaria	*calciseda*	M
Xanthoparmelia	*chlorochroa*	T
Xanthoparmelia	*conspersa*	L,S
Xanthoparmelia	*cumberlandia*	L
Xanthoparmelia	*hypopsila*	S

Xanthoparmelia	*lineola*	L,S
Xanthoparmelia	*mexicana*	L,S
Xanthoparmelia	*novomexicana*	L,S
Xanthoparmelia	*plittii*	L,S
Xanthoparmelia	*taractica*	S
Xanthoparmelia	*wyomingica*	L
Xanthoria	*elegans*	L,S
Xanthoria	*fallax*	W,L
Xanthoria	*polycarpa*	W

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Appendix 17

VASCULAR PLANT TAXA FOUND AT ONE SITE

APPENDIX 17.

VASCULAR PLANT TAXA FOUND AT ONE SITE, EL MALPAIS NATIONAL MONUMENT AREA

Alphabetical by family and species
* = introduced taxon

Cymopterus fendleri	(API)	SABL	
Asclepias tuberosa terminalis	(ASC)	BACR	
Asplenium trichomanes	(ASP)	MTKI	
Aster falcatus commutatus	(AST)	CO42	
Centaurea repens *	(AST)	OFFS	NM-53, middle
Chrysothamnus nauseousus bigelovii	(AST)	OFFS	CO-42, lower
C. n. nauseosus	(AST)	OARD	
Cirsium vulgare *	(AST)	OFFS	NM-53, upper
Cosmos parviflorus	(AST)	OFFS	NM-53, upper
Erigeron speciosus	(AST)	LACR	
E. vetensis	(AST)	NOPA	
Helianthella quinquenervis	(AST)	HIDD	
Heterosperma pinnatum	(AST)	NOPA	
Hymenoxys bigelovii	(AST)	REND	
Macheranthera australis	(AST)	OFFS	CO-42, upper
Malacothrix fendleri	(AST)	OFSW	
Picrodeniopsis woodhousei	(AST)	OFSW	
Solidago wrightii adenophora	(AST)	SABL	
Sonchus asper	(AST)	OFFS	Gallo Spring
Stephanomeria tenuifolia	(AST)	CEBA	
Tagetes micrantha	(AST)	HOYA	
Verbesina encelioides encelioides	(AST)	SABL	
V. e. exauriculata	(AST)	PRWE	
Xanthium strumarium	(AST)	OFFS	NM-117
Berberis fendleri	(BER)	BACR	
Mahonia haematocarpa	(BER)	TW53	
Cryptantha fendleri	(BOR)	NOSR	
Lithospermum cobrense	(BOR)	CO42	
Lepidium ramosissimum	(BRA)	CADU	
Rorippa microtites	(BRA)	CAPO	
Echinocereus triglochidiatus t.	(CAC)	SABL	
Mammillaria heyderi meiacantha	(CAC)	NOSR/NPSS	
Arenaria fendleri fendleri	(CAR)	MTKI	
Chenopodium capitatum	(CHE)	CADU	
Monolepis nuttalliana	(CHE)	OFFS	Los Cerros
Salsola paulsenii *	(CHE)	OFFS	lower NM-117
Cuscuta umbellata	(CON)	NOPA	
Ipomoea costellata	(CON)	HOYA	
Ipomoea cristulata	(CON)	SABL	
Bulbostylis capillaris	(CYP)	MCCA	
Carex filifolia	(CYP)	ZAKI	
Carex geophila	(CYP)	HAFE	
Scirpus americanus	(CYP)	OFFS	Gallo Spring
Scirpus pungens	(CYP)	OFFS	Gallo Spring

Pteridium aquilinum	(DEN)	BACR	
Chamaesyce revoluta	(EUP)	BACR	
Euphorbia bilobata	(EUP)	BACR	
Astragalus brandegei	(FAB)	OARD	
Astragalus ceramicus ceramicus	(FAB)	SABL	
Astragalus praelongus praelongus	(FAB)	OFFS	NM-117, upper
Astragalus wootonii wootonii	(FAB)	ELCF	
Dalea leporina	(FAB)	HOYA	
Medicago alba *	(FAB)	OFFS	NM-53, upper
Psoralea lanceolata	(FAB)	NOPA	
Sisyrinchium demissum	(IRI)	MEBL	
Salvia reflexa	(LAM)	CO42	
Mentzelia ablicaulis	(LOA)	CEEN	
Mentzelia multiflora	(LOA)	CADU	
Arceuthobium vaginatum cryptopodium	(LOR)	FOUR	
Marsillea mollis	(MRS)	PRWE	
Mirabilis oxybaphoides	(NYC)	MEBL	
Gaura parviflora	(ONA)	OFFS	NM-53, middle
Oenothera laciniata laciniata	(ONA)	CO42	
Monnina wrightii	(PGL)	HOYA	
Polygala alba	(PGL)	ZAKI	
Polygonum erectum	(PGN)	NPPO	
Polygonum ramosissimum	(PGN)	OFFS	Los Cerros
Rumex crispus *	(PGN)	OFFS	NM-53, upper
Pinus flexilis	(PIN)	BACR	
Andropogon gerardii paucipilus	(POA)	NOPA	
Aristida havardii	(POA)	ZATH	
Bothriochloa laguroides torreyana	(POA)	OFFS	NM-53, middle
Bouteloua simplex	(POA)	OARD	
Chloris verticillata	(POA)	ZATH	
Elymus canadensis	(POA)	OFFS	NM-117
Elymus trachycaulus x smithii	(POA)	ZATH	
Eragrostis curvula *	(POA)	ZATH	
Eragrostis lehmanniana *	(POA)	SABL	
Eragrostis pectinacea	(POA)	OARD	
Muhlenbergia pungens	(POA)	SABL	
Muhlenbergia wrightii	(POA)	MEBL	
Panicum bulbosum	(POA)	HIDD	
Phragmites australis	(POA)	OFFS	Gallo Spring
Sporobolus contractus	(POA)	SABL	
Stipa neomexicana	(POA)	ZAKI	
Stipa scribneri	(POA)	SABL	
Portulaca parvula	(POR)	SABL	
Talinum pulchellum	(POR)	MEBL & HIDD	
Delphinium nuttallianum n.	(RAN)	CO42	
Delphinium virescens wootonii	(RAN)	SABL	
Myosurus cupulatus	(RAN)	BSLC	
Ceanothus fendleri	(RHA)	OARD	
Cercocarpus montanus	(ROS)	SABL	
Rosa sp.	(ROS)	BACR	
Rubus strigosus strigosus	(ROS)	HOYK	
Populus deltoides wislizenii	(SAL)	OFFS	Gallo Spring

Salix drummondiana	(SAL)	OFFS	Twin Craters
Cordylanthus wrightii	(SCR)	OFFS	NM-117
Mimulus floribundus	(SCR)	BSLC	
Penstemon ophianthus	(SCR)	OFFS	Los Cerros
Penstemon virgatus	(SCR)	CO42	
Schistophragma intermedia	(SCR)	HAFE	
Selaginella densa	(SEL)	MTKI	
Chamaesaracha coronopus	(SOL)	SABL	
Solanum elaeagnifolium	(SOL)	OFFS	NM-53, middle
Solanum jamesii	(SOL)	SABL	
Tamarix chinensis *	(TAM)	OFFS	Grants
Typha latifolia	(TYP)	GALL	
Celtis reticulata	(ULM)	OFFS	NM-117, upper
Ulmus pumila *	(ULM)	OFFS	Gallo Spring
Phyla cuneifolia	(VER)	PRWE	
Verbena macdougalii	(VER)	MARC	
Tribulus terrestris *	(ZYG)	CO42	

El Malpais sites with plant taxa found only at the site.
Alphabetical by site; * = introduced taxon

BACR
Asclepias tuberosa terminalis (ASC)
Berberis fendleri (BER)
Pteridium aquilinum (DEN)
Chamaesyce revoluta (EUP)
Euphorbia bilobata (EUP)
Pinus flexilis (PIN)
Rosa sp. (ROS)

BSLC
Myosurus cupulatus (RAN)
Mimulus floribundus (SCR)

CADU
Lepidium ramosissimum (BRA)
Chenopodium capitatum (CHE)
Mentzelia multiflora (LOA)

CAPO
Rorippa microtites (BRA)

CEBA
Stephanomeria tenuifolia (AST)

CEEN
Mentzelia albicaulis (LOA)

ELCF
Astragalus wootonii wootonii (FAB)

FOUR
Arceuthobium vaginatum cryptopodium (LOR)

GALLO SPRING (off-site)
Sonchus asper (AST)
Scirpus americanus (CYP)
Scirpus pungens (CYP)
Phragmites australis (POA)
Populus deltoides wislizenii (SAL)
Typha latifolia (TYP)
Ulmus pumila * (ULM)

HAFE
Carex geophila (CYP)
Schistrophragma intermedia (SCR)

HIDD
Helianthella quinquenervis (AST)

Panicum bulbosus (POA)
Talinum pulchellum (POR) (also at MEBL)

HOYA
Tagetes micrantha (AST)
Ipomoea costellata (CON)
Dalea leporina (FAB)
Monnina wrightii (PGL)

HOYK
Rubus strigosus strigosus (ROS)

LACR
Erigeron speciosus (AST)

MARC
Verbena macdougalii (VER)

MCCA
Bulbostylis capillaris (CYP)

MEBL
Sisyrinchium demissum (IRI)
Mirabilis oxybaphoides (NYC)
Muhlenbergia wrightii (POA)
Talinum pulchellum (POR) (also at HIDD)

MTKI
Asplenium trichomanes (ASP)
Arenaria fendleri fendleri (CAR)
Selaginella densa (SEL)

NOPA
Erigeron vetensis (AST)
Heterosperma pinnatum (AST)
Cuscuta umbellata (CON)
Psoralea lanceolata (FAB)
Andropogon gerardii paucipilus (POA)

NPPO
Polygonum erectum (PGN)

NOSR
Cryptantha fendleri (BOR)
Mammillaria heyderi meiacantha (CAC)

NPSS
Mammillaria heyderi meiacantha (CAC)

OARD
Chrysothamnus nauseosus nauseosus (AST)

Astragalus brandegei (FAB)
Bouteloua simplex (POA)
Eragrostis pectinacea (POA)
Ceanothus fendleri (RHA)

OFSW
Malacothrix fendleri (AST)
Picrodeniopsis woodhousei (AST)

PRWE
Verbesina encelioides exauriculata (AST)
Marsillea mollis (MRS)
Phyla cuneifolia (VER)

REND
Hymenoxys bigelovii (AST)

SABL
Cymopterus fendleri (API)
Solidago wrightii adenophora (AST)
Verbesina encelioides encelioides (AST)
Echinocereus triglochidiatus triglochidiatus (CAC)
Ipomoea cristulata (CON)
Astragalus ceramicus ceramicus (FAB)
Eragrostis lehmanniana * (POA)
Muhlenbergia pungens (POA)
Sporobolus contractus (POA)
Stipa scribneri (POA)
Portulaca parvula (POR)
Delphinium virescens wootonii (RAN)
Cercocarpus montana (ROS)
Chamaesaracha coronopus (SOL)
Solanum jamesii (SOL)

TW53
Mahonia haematocarpa (BER)

TWIN CRATERS FLOW (off-site)
Salix drummondiana (SAL)

ZAKI
Carex filifolia (CYP)
Polygala alba (PGL)
Stipa neomexicana (POA)

ZATH
Aristida havardii (POA)
Chloris verticillata (POA)
Elymus trachycaulus x smithii (POA)
Eragrostis curvula * (POA)

ROADSIDE SITES (all off-site except CO42):

CO42
Aster falcatus commutatus (AST)
Lithospermum cobrense (BOR)
Salvia reflexa (LAM)
Oenothera laciniata lacineata (ONA)
Delphinium nuttallianum nuttallianum (RAN)
Penstemon virgatus (SCR)
Tribulus terrestris * (ZYG)

CO-42, Los Cerros Ranch area
Monolepis nuttalliana (CHE)
Polygonum ramosissimum (PGN)
Penstemon ophianthus (SCR)

CO-42, lower
Chrysothamnus nauseosus bigelovii (AST)

CO-42, upper
Macheranthera australis (AST)

NM-53, middle
Centauria repens * (AST)
Gaura parviflora (ONA)
Bothriochloa laguroides torreyana (POA)
Solanum elaeagnifolium (SOL)

NM-53,upper
Cirsium vulgare * (AST)
Cosmos parviflorus (AST)
Medicago alba * (FAB)
Rumex crispus * (PGN)

NM-117
Xanthium strumarium (AST)
Salsola paulsenii (CHE)
Astragalus praelongus praelongus (FAB)
Elymus canadensis (POA)
Cordylanthus wrightii (SCR)
Celtis reticulata (ULM)

GRANTS
Tamarix chinensis * (TAM)

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MAMMAL SPECIES LIST FOR EL MALPAIS NATIONAL MONUMENT

APPENDIX 18.

LIST OF MAMMAL SPECIES OF EL MALPAIS NATIONAL MONUMENT AREA.

Source Code:
1 = Hooper (1949); El Malpais region
2 = Stolz (1986b); El Morro National Monument
3 = UNM inventory; El Malpais National Monument
4 = Klingel (1992); Cibola County

COMMON NAME	SCIENTIFIC NAME	SOURCE
BATS	Order Chiroptera	
EVENING BATS	Family Vespertilionidae	
Big Brown Bat	***Eptesicus fuscus***	1,2,3,4
California Myotis	***Myotis californicus***	3,4
Cave Myotis	***Myotis velifer***	3
Fringed Myotis	***Myotis thysanodes***	1,2,3,4
Hoary Bat	*Lasiurus cinerius*	1,2,4
Little Brown Myotis	*Myotis lucifugus*	4
Long-eared Myotis	***Myotis evotis***	1,3,4
Long-legged Myotis	*Myotis volans*	1,2,4
Pallid Bat	*Antrozous pallidus*	4
Silver-haired Bat	***Lasconycteris noctivagans***	1,2,3,4
Small-footed Myotis	***Myotis subulatus***	1,2,3,4
Spotted Bat	*Euderma maculatum*	4
Western Big-eared Bat	***Plecotis townsendi***	3
Western Pipistrelle Bat	*Pipistrellus hesperus*	4
Yuma Myotis	*Myotis yumanensis*	4
FREETAIL BATS	Family Molossidae	
Big Freetail Bat	*Tadarida macrotis*	4
Mexican Freetail Bat	***Tadarida brasiliensis***	3,4
INSECT EATERS	Order Insectivora	
SHREWS	Family Soricidae	
Desert Shrew	*Notiosorex crawfordi*	4
Dusky Shrew	*Sorex monticolus*	4
Dwarf Shrew	***Sorex nanus***	3,4
RABBITS AND HARES	Order Lagomorpha	
RABBITS AND HARES	Family Leporidae	
Black-tailed Jackrabbit	***Lepus californicus***	1,2,3,4
Desert Cottontail	***Sylvilagus auduboni***	1,2,3,4
Eastern Cottontail	*Sylvilagus floridanus*	4
Mountain Cottontail	*Sylvilagus nuttallii*	1

RODENTS	Order Rodentia	
SQUIRRELS	Family Sciuridae	
Cliff Chipmunk	***Eutamias dorsalis***	1,2,3,4
Colorado Chipmunk	***Eutamias quadrivittatus***	1,3,4
Red Squirrel	*Tamiasciurus hudsonicus*	4
Rock Squirrel	***Spermophilus variegatus***	1,2,3,4
Spotted Ground Squirrel	*Spermophilus spilosoma*	1,2
Tassel-eared Squirrel	***Sciurus aberti***	2,3,4
Whitetail Prairie Dog	***Cynomys gunnisoni***	1,2,3,4
Whitetail Antelope Squirrel	*Ammospermophilus leucurus*	4
POCKET GOPHERS	Family Geomyidae	
Botta's Pocket Gopher	***Thomomys bottae***	1,2,3,4
Northern Pocket Gopher	*Thomomys talpoides*	4
POCKET MICE & KANGAROO RATS	Family Heteromyidae	
Apache Pocket Mouse	*Perognathus apache*	1
Bannertail Kangaroo Rat	***Dipodomys spectabilis***	1,3,4
Ord's Kangaroo Rat	***Dipodomys ordii***	1,2,3,4
Plains Pocket Mouse	*Perognathus flavescens*	2,4
Rock Pocket Mouse	*Perognathus intermedius*	4
Silky Pocket Mouse	***Perognathus flavus***	1,3,4
NEW WORLD MICE & RATS	*Family Cricetidae*	
Brush Mouse	***Peromyscus boylei***	1,2,3,4
Deer Mouse	***Peromyscus maniculatus***	1,2,3,4
Long-tailed Vole	*Microtus longicaudus*	4
Meadow Vole	*Microtus pennsylvanicus*	4
Mexican Vole	*Microtus mexicanus*	4
Mexican Woodrat	***Neotoma mexicana***	1,2,3,4
Northern Grasshopper Mouse	*Onychomys leucogaster*	1,2,4
Pinyon Mouse	***Peromyscus truei***	1,2,3,4
Rock Mouse	***Peromyscus difficilis***	1,2,3,4
Southern Plains Woodrat	*Neotoma micropus*	4
Stephen's Woodrat	*Neotoma stephensi*	4
Western Harvest Mouse	***Reithrodontomys megalotis***	1,3,4
White-footed Mouse	***Peromyscus leucopus***	3,4
White-throated Woodrat	***Neotoma albigula***	1,2,3,4
PORCUPINES	Family Erethizondorsatum	
Porcupine	***Erethizon dorsatum***	1,2,3,4

CARNIVORES	Order Carnivora	
DOGS	Family Canidae	
Coyote	***Canis latrans***	1,2,3,4
Gray Fox	***Urocyon cinereoargenteus***	1,3,4
Kit Fox	*Vulpes masrotis*	2
BEARS	*Family Ursidae*	
Black Bear	***Ursus americanus***	1,3,4
RACCOONS	*Family Procyonidae*	
Raccoon	*Procyon lotor*	1,2,4
Ringtail	*Bassariscus astutus*	1,4
WEASELS & SKUNKS	Family Mustelidae	
Badger	*Taxidea taxus*	1,2
Hognose Skunk	*Conepatus leuconotus*	1,4
Long-tailed Weasel	*Mustela frenata*	1,4
Short-tailed Weasel	*Mustela erminea*	2
Spotted Skunk	*Spilogale putorius*	2
Striped Skunk	*Mephitis mephitis*	1,2,4
CATS	Family Felidae	
Bobcat	*Lynx rufus*	1,2,4
Mountain Lion	***Felis concolor***	1,2,3,4
HOOFED MAMMALS	Order Artiodactyla	
DEER	Family Cervidae	
Elk	*Cervus canadensis*	2,4
Mule Deer	***Odocoileus hemionus***	1,2,3,4
PRONGHORN	ANTILOCAPRIDAE	
Pronghorn	***Antilocapra americana***	3,4

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BIRD SPECIES LIST FOR EL MALPAIS NATIONAL MONUMENT

APPENDIX 19.

BIRD SPECIES OF EL MALPAIS NATIONAL MONUMENT AREA.

Source Codes:

1: UNM Wildlife Inventory; El Malpais National Monument
2: Klingel (1992); Cibola County

COMMON NAME	FAMILY/ SCIENTIFIC NAME	SOURCE
HERONS	ARDEIDAE	
Great Blue Heron	***Ardea herodias***	1
Green-backed Heron	***Butorides striatus***	1
IBISES	THRESKIORNITHIDAE	
White-faced Ibis	***Plegadis chihi***	1
DUCKS	ANATIDAE	
Green-winged Teal	***Anas crecca***	1
Northern Pintail	***Anas acuta***	1
PLOVERS	CHARADRIIDAE	
Killdeer	***Charadrius vociferus***	1
Mountain Plover	***Charadrius montanus***	1,2
VULTURES	CATHARTIDAE	
Turkey Vulture	***Cathartes aura***	1,2
EAGLES & HAWKS	ACCIPITRIDAE	
Bald Eagle	*Haliaeetus leucocephalus*	2
Cooper's Hawk	***Accipiter cooperii***	1,2
Golden Eagle	***Aquila chrysaetos***	1
Northern Goshawk	***Accipiter gentilis***	1,2
Northern Harrier	***Circus cyaneus***	1
Red-tailed Hawk	***Buteo jamaicensis***	1
Sharp-shinned Hawk	***Accipiter striatus***	1,2
Swainson's Hawk	***Buteo swainsoni***	1
FALCONS	FALCONIDAE	
American Kestrel	***Falco sparverius***	1
American Perigren Falcon	*Falco peregrinus anatum*	2

QUAIL	PHASIANIDAE	
Blue Grouse	*Dendragapus obscurus*	2
Scaled Quail	*Callipepla squamata*	1
Wild Turkey	*Meleagris gallopavo*	1
PIGEONS	COLUMBIDAE	
Band-tailed Pigeon	*Columba fasciata*	1
Mourning Dove	*Zenaida macroura*	1
Rock Dove	*Columba livia*	1
CUCKOOS	CUCULIDAE	
Greater Roadrunner	*Geococcyx californianus*	1,2
OWLS	STRIGIDAE	
Barn Owl	*Tyto alba*	1
Burrowing Owl	*Athene cunicularia*	1
Flammulated Owl	*Otus flammeolus*	2
Great Horned Owl	*Bubo virginianus*	1
Long-eared Owl	*Asio otus*	1,2
Mexican Spotted Owl	*Strix occidentalis lucida*	2
Northern Saw-whet Owl	*Aegolius acadicus*	2
GOATSUCKERS	CAPRIMULGIDAE	
Common Nighthawk	*Chordeiles minor*	1
Common Poorwill	*Phalaenoptilus nuttallii*	1
SWIFTS	APODIDAE	
White-throated Swift	*Aeronautes saxatalis*	1
HUMMINGBIRDS	TROCHILIDAE	
Black-chinned Hummingbird	*Archilochus alexandri*	1
Broad-tailed Hummingbird	*Selasphorus platycercus*	1
Rufous Hummingbird	*Selasphorus rufus*	1
WOODPECKERS	PICIDAE	
Acorn Woodpecker	*Melanerpes formicivorus*	1
Common Flicker	*Colaptes auratus*	1
Downy Woodpecker	*Picoides pubescens*	1
Hairy Woodpecker	*Picoides villosus*	1
Lewis' Woodpecker	*Melanerpes lewis*	1
Three-toed Woodpecker	*Picoides tridactylus*	2
Williamson's Sapsucker	*Sphyrapicus thyroideus*	2
Yellow-bellied Sapsucker	*Sphyrapicus varius*	1

FLYCATCHERS	TYRANNIDAE	
Ash-throated Flycatcher	***Myiarchus cinerascens***	1
Cassin's Kingbird	***Tyrannus vociferans***	1
Cordilleran Flycatcher	***Empidonax occidentalis***	1
Dusky Flycatcher	***Empidonax oberholseri***	1
Olive-sided Flycatcher	*Contopus borealis*	2
Say's Phoebe	***Sayornis saya***	1,2
Willow Flycatcher	*Empidonax traillii extimus*	2
Western Kingbird	***Tyrannus verticalis***	1
Western Wood-Peewee	***Contopus sordidulus***	1
LARKS	ALAUDIDAE	
Horned Lark	***Eremophila alpestris***	1
SWALLOWS	HIRUNDIDIDAE	
Bank Swallow	*Riparia riparia*	2
Cliff Swallow	***Hirundo pyrrhonota***	1
Northern Rough-winged Swallow	***Stelgidopteryx serripennis***	1
Purple Martin	***Progne subis***	1,2
Tree Swallow	***Tachycineta bicolor***	1
Violet-green Swallow	***Tachycineta thalassina***	1
JAYS	CORVIDAE	
American Crow	***Corvus brachyrhynchos***	1,2
Clark's Nutcracker	***Nucifraga columbiana***	1
Common Raven	***Corvus corax***	1
Pinon Jay	***Gymnorhinus cyanocephalus***	1
Scrub Jay	***Aphelocoma coerulescens***	1
Steller's Jay	***Cyanocitta stelleri***	1
CHICKADEES	PARIDAE	
Black-capped Chickadee	***Parus atricapillus***	1,2
Bridled Titmouse	*Parus wollweberi phillipsi*	2
Mountain Chickadee	***Parus gambeli***	1
Plain Titmouse	***Parus inornatus***	1
BUSHTITS	AEGITHALIDAE	
Bushtit	***Psaltriparus minimus***	1,2
CREEPERS	CERTHIIDAE	
Brown Creeper	***Certhia americana***	1,2

NUTHATCHES	SITTIDAE	
Pygmy Nuthatch	***Sitta pygmaea***	1,2
Red-breasted Nuthatch	***Sitta canadensis***	1,2
White-breasted Nuthatch	***Sitta carolinensis***	1,2
WRENS	TROGLODYTIDAE	
Bewick's Wren	***Thryomanes bewickii***	1
Canyon Wren	***Catherpes mexicanus***	1
House Wren	*Troglodytes aedon parkmanii*	2
Rock Wren	***Salpinctes obsoletus***	1
THRUSHES	MUSCICAPIDAE	
American Robin	***Turdus migratorius***	1
Golden-crowned Kinglet	*Regulus satrapa*	2
Hermit Thrush	*Catharus guttatus*	2
Mountain Bluebird	***Sialia currucoides***	1,2
Ruby Crowned Kinglet	***Regulus calendula***	1
Townsend's Solitaire	***Myadestes townsendi***	1,2
Western Bluebird	***Sialia mexicana***	1,2
MIMIC THRUSHES	MIMIDAE	
Brown Thrasher	*Toxostoma rufum longicauda*	2
Gray Catbird	*Dumetella carolinensis*	2
Northern Mockingbird	***Mimus polyglottos***	1
Sage Thrasher	***Oreoscoptes montanus***	1,2
WAXWINGS	BOMBYCILLIDAE	
Cedar Waxwing	***Bombycilla garrulus***	1
SHRIKES	LANIIDAE	
Loggerhead Shrike	***Lanius ludovicianus***	1
Northern Shrike	*Lanius excubitor invictus*	2
VIREOS	VIREONIDAE	
Gray Viereo	*Vireo vicinior*	2
Solitary Vireo	***Vireo solitarius***	1
Warbling Vireo	*Vireo gilvus*	2
WARBLERS & SPARROWS	EMBERIZIDAE	
Black-and-white Warbler	*Mniotilta varia*	2
Black-headed Grosbeak	***Pheucticus melanocephalus***	1,2
Black-throated Gray Warbler	***Dendroica nigrescens***	1,2
Blue Grosbeak	***Guiraca caerulea***	1
Brewer's Blackbird	***Euphagus cyanocephalus***	1

Brewer's Sparrow	***Spizella breweri***	1,2
Brown Towhee	***Pipilo fuscus***	1
Brown-headed Cowbird	***Molothrus ater***	1
Canyon Towhee	*Pipilo fuscus*	2
Cassin's Sparrow	***Aimophila cassinii***	1
Chestnut-sided Warbler	*Dendroica pensylvanica*	2
Chipping Sparrow	***Spizella passerina***	1
Common Yellowthroat	*Geothlypes trichas*	2
Dark-eyed Junco	***Junco hyemalis***	1
Eastern Meadowlark	*Sturnella magna lilianae*	2
Evening Grosbeak	*Coccothraustes vespertinus*	2
Grace's Warbler	***Dendroica graciae***	1
Hepatic Tanager	***Piranga flava***	1
Hooded Warbler	*Wilsonia citrina*	2
Lark Bunting	*Calamospiza melanocorys*	2
Lark Sparrow	***Chondestes grammacus***	1
Mcgillivray's Warbler	*Oporornis tolmiei*	2
Northern Oriole	***Icterus galbula***	1
Olive Warbler	*Peucedramus taeniatus*	2
Orange-crowned Warbler	*Vermivora celata*	2
Painted Redstart	*Myioborus pictus*	2
Pine Grosbeak	*Pinicoloa enucleator montana*	2
Rufous-sided Towhee	***Pipilo erythrophthalmus***	1,2
Sage Sparrow	***Amphispiza belli***	1
Savannah Sparrow	***Passerculus sandwichenis***	1
Scott's Oriole	***Icterus parisorum***	1
Vesper Sparrow	***Pooecetes gramineus***	1
Virginia's Warbler	***Vermivora virginiae***	1,2
Western Meadowlark	***Sternella neglecta***	1,2
Western Tanager	***Piranga ludovician***	1
White-crowned Sparrow	***Zonotrichia leucophrys***	1,2
Wilson's Warbler	***Wilsonia pusilla***	1
Yellow Warbler	***Dendroica petechia***	1
Yellow-rumped Warbler	***Dendroica coronata***	1,2
FINCHES	FRINGILLIDAE	
Cassin's Finch	***Carpodacus cassinii***	1,2
House Finch	***Carpodacus mexicanus***	1
Lesser Goldfinch	***Carduelis psaltria***	1,2
Pine Siskin	***Carduelis pinus***	1
Red Crossbill	***Loxia curvirostra***	1

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Appendix 20

AMPHIBIAN AND REPTILE SPECIES LIST FOR EL MALPAIS NATIONAL MONUMENT

APPENDIX 20.

AMPHIBIANS AND REPTILES OF EL MALPAIS NATIONAL MONUMENT AREA.

Source Code:
1 = Gehlbach (1965); Zuni Mountains
2 = Stolz (1986a); El Morro National Monument
3 = UNM inventory; El Malpais National Monument
4 = C.Painter, NM Game & Fish (pers.comm.,1993); Cibola County

COMMON NAME	SCIENTIFIC NAME	SOURCE
AMPHIBIANS	Class Amphibia	
SALAMANDERS	Order Caudata	
MOLE SALAMANDERS	Family Ambystomatidae	
Tiger Salamander	***Ambystoma tigrinum***	1,2,3,4
FROGS AND TOADS	Order Anura	
SPADEFOOT TOADS	Family Pelobatidae	
Couch's Spadefoot Toad	*Scaphiopus couchii*	4
Plains Spadefoot Toad	*Spea bombifrons*	1,2,4
New Mexico Spadefoot Toad	***Scaphiopus multiplicatus***	1,2,3,4
TRUE TOADS	Family Bufonidae	
Red-spotted Toad	*Bufo punctatus*	1,2,4
Woodhouse's Toad	*Bufo woodhousii*	1,2,4
TREEFROGS	Family Hylidae	
Canyon Treefrog	***Hyla arenicolor***	1,3,4
Chorus Frog	*Pseudacris triseriata*	1,4
TRUE FROGS	Family Ranidae	
Northern Leopard Frog	*Rana pipiens*	1,4
REPTILES	Class Reptilia	
LIZARDS	Suborder Lacertillia	
IGUANIDS	Family Phrynosomatidae	
Collared Lizard	***Crotaphytus collaris***	1,3,4
Eastern Fence Lizard	***Sceloporus undulatus***	1,2,3,4
Lesser Earless Lizard	***Holbrookia maculata***	1,2,3,4
Northern Sagebrush Lizard	*Sceloporus graciosus*	1,2,4
Roundtail Horned Lizard	*Phrynosoma modestum*	4
Short-horned Lizard	***Phrynosoma douglasii***	1,2,3,4

Side-blotched Lizard	*Uta stansburiana*	1,2,4
Tree Lizard	***Urosaurus ornatus***	1,2,3,4
WHIPTAIL LIZARDS	Family Teiidae	
Checkered Whiptail	*Cnemidophorus grahami*	4
Chihuahuan Whiptail	***Cnemidophorus exsanguis***	3,4
Little Striped Whiptail	*Cnemidophorus inornatus*	4
New Mexico Whiptail	*Cnemidophorus neomexicanus*	4
Plateau Striped Whiptail	***Cnemidophorus velox***	1,2,3,4
SKINKS	Family Scincidae	
Great Plains Skink	***Eumeces obsoletus***	1,3,4
Variable Skink	***Eumeces multivirgatus***	1,2,3,4
SNAKES	Suborder Ophidia	
COLUBRID SNAKES	Family Colubridae	
Black-necked Garter Snake	*Thamnophis cyrtopsis*	1,2,4
Coachwhip	*Masticophis flagellum*	1,4
Gopher Snake	***Pituophis melanoleucus***	1,2,3,4
Milk Snake	*Lampropeltis triangulum*	2
Night Snake	*Hysiglena torquata*	1
Mountain Patch-nosed Snake	*Salvadora grahamiae*	1,4
Ringneck Snake	*Diadophis punctatus*	1,2,4
Striped Whipsnake	***Masticophis taeniatus***	1,2,3,4
Wandering Garter Snake	***Thamnophis elegans***	1,2,3,4
VIPERS	Family Viperidae	
Black-tailed Rattlesnake	*Crotalus molossus*	1,4
Western Diamondback	***Crotalus atrox***	1,3,4
Western Rattlesnake	***Crotalus viridis***	1,2,3,4

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Appendix 21

ARTHROPOD SPECIES LIST FOR EL MALPAIS NATIONAL MONUMENT

APPENDIX 21.

ARTHROPOD SPECIES OF EL MALPAIS NATIONAL MONUMENT.

All records are from this inventory project.

Phylum Arthropoda

Subphylum Chelicerata (spiders, scorpions, mites)

Class Arachnida (spiders and scorpions)

Order Araneae (spiders)

Suborder Orthognatha (tarantulas)

Family Therophosidae (tarantulas)

Aphonopelma behlei (Chamberlin)

Suborder Labidognatha (true spiders)

Family Agelenidae (funnel weavers)

Agelenopsis longistylus (Banks)

Family Anyphaenidae

Anyphaena dixiana (Chamberline & Woodbury)

Family Araneidae

unkown genus

Family Clubionidae

unknown genus

Family Corinnidae

Castianeira gertschi Kaston

Family Dictynidae (dictynid spiders)

Cicurina new species, possible ELMA endemic
Dictyna calcarata Banks
Dictyna species 1 unknown
Dictyna species 2 unknown

Family Gnaphosidae (gnaphosid spiders)

Drassyllus mexicanus (Banks)
Herpyllus bulbucus Chamberlin
Herpyllus propinquus (Keyserling)
Herpyllus sp. unkown
Micaria emertoni Gertsch
Micaria imperiosa Gertsch
Zelotes lasalanus Chamberlin
Zelotes species unknown
unknown genus 1
unknown genus 2

Family Linyphiidae (sheet-web weavers)

Lepthyphantes turbatrix (OPC)
Oedothorax species unknown
Origantes rostratus (Emerton)
unknow genus 1
Erigoninae unknown genus 1
Erigoninae unknown genus 2
Erigoninae unknown genus 3

Family Liocranidae

Phrurotimpus species unknown

Family Lycosidae (wolf speiders)

Alopecosa kochii (Keyserling)
Geolycosa species unknown
Pardosa yavapa Chamberlin
Schizocosa mimula
Varacosa gosiuta (Chamberlin)
Lycosa species unknown

Family Mimetidae

Mimetus species unknown

Family Oxyopidae

Hamataliwa species unknown

Family Philodromidae

Ebo species 1 unknown
Ebo species 2 unknown
Philodromus spectabilis Keyserling

Family Pholcidae (cellar spiders)

Pholocphora americana Banks
Psilochorus species unknown

Family Salticidae (jumping spiders)

Habronattus altanus (Gertsch)
Habronattus firgulatus Griswold
Metaphidippus species unknown
Pellenes new species
Phidippus reederi Gertsch & Riechert
Phidippus species unkown
Sassacus papenhoei Peckham & Peckham

Family Tetragnathidae

Tetragnatha species unknown

Family Theridiidae (comb-footed spiders)

Euryopis scriptipes Banks
Latrodectus hesperus C.& I.
Steatoda species unknown

Family Titanoecidae

Titanoeca silvicola (Keyserling)

Family Thomisidae (crab spiders)

Xysticus apachecus Gertsch
Xysticus lassanus Chamberlin

Order Opilones (harvestmen)

Family Sclerosomatidae

Globipes new species
Leiobunum townsendi Weed
Trachyrhinus marmoratus Banks

Order Scorpiones (scorpions)

Family Vaejovidae

Paruroctonus utahensis (Williams)
Vaejovis paysonensis Soleglad

Order Solifugae (sun spiders)

Family Eremobatidae

Eremobates zinni Muma

Order Pseudoscorpiones (pseudoscorpions)

identifications not completed

Order Acari (mites and ticks)

identifications not completed

Subphylum Crustacea

Class Malacostraca

Order Decapoda

identifications not completed

Class Ostracoda

identifications not completed

Subphylum Uniramia

Class Diplopoda (millipedes)

Order Julida

Family Parajulidae

Apacheius guadalupensis Loomis

Order Spirostreptida

Family Spirotstreptidae

Orthoporus ornatus (Girard)

Class Chilopoda (centipedes)

Order Lithobiomorpha

at least 2 unknown species

Order Scolopendramorpha

Family Scolopendridae

Scolopendra viridis (Say)

Class Hexapoda (insects)

Order Collembola (springtails)

Family Bourletiellidae

Bourletiella new species 1, ELMA endemic
Bourletiella new species 2, ELMA endemic

Family Dicrtomidae

Ptenothrix lightfooti Snider, new species, ELMA endemic

Family Entomobryidae

Drepanura californica (Schott)
Entomobrya decemfasciata (Packard)
Entomobrya triangularis Schott
Entomobryoides guthriei Mills
Orchesella alpa Christiansen & Tucker
Seira malpaisensis Snider, new species, ELMA endemic
Seira new species, ELMA endemic

Family Isotomidae

Isotoma (Desoria) nigrifrons Folsom
Isotoma new species A, ELMA endemic

Family Sminthuridae

Sminthurus new species 1, ELMA endemic

Family Tomoceridae

Tomocerus vulgaris (Tullberg)

Order Microcoryphia (jumping bristletails)

Family Machilidae

Mesomachilis hearticus Silvessri

Family Meinertillidae

Machilinus aurdntidcus Schoett

Order Ephemeroptera (mayflies)

identifications not completed

Order Odonata (dragonflies and damseflies)

identifications not completed

Order Dictyoptera (mantids and roaches)

Family Mantidae

Litaneutra minor Scudder
Yersiniops solitarium (Scudder)

Order Orthoptera (grasshoppers and crickets)

Family Acrididae (grasshoppers)

Ageneotettix deorum (Scudder)
Arphia conspersa Scudder
Arphia pseudonietana (Thomas)
Allocara ellioti Thomas
Camnula pellucida Scudder
Circotettix rabula Rehn & Hebard
Cordillacris crenulata (Bruner)
Cordillacris occipitalis (Thomas)
Derotmema haydeni (Thomas)
Dissosteira carolina (Linn.)
Eritettix simplex (Scudder)
Melanopus aridus (Scudder)
Melanoplus bowditchi Scudder
Melanoplus bruneri Scudder
Melanoplus gladstoni Scudder
Melanoplus packardii Scudder
Melanoplus occidentalis (Thomas)
Melanoplus sanguinipes (Fababricius)
Melanoplus splendidus Hebard
Mestobregma plattei (Thomas)
Opeia obscura (Thomas)
Phlibostroma quadrimaculatum (Thomas)
Psoloessa delicatula Scudder
Shistocerca alutacea Scudder
Shotwellia isleta Gurney
Trachyrachis aspera (Scudder)
Trachyrachis coronata (Scudder)
Trachyrachis kiowa Thomas
Trimerotropis campestris McNeil
Trimerotropis cincta (Thomas)
Trimerotropis cyaneipennis Bruner
Trimerotropis fraturcula McNeil
Trimerotropis gracilis (Thomas)

Trimerotropis inconspicua Bruner
Trimerotropis latifasciata Scudder
Trimerotropis modesta Bruner
Trimerotropis pallidipennis (Burmeister)
Trimerotropis new species, ELMA endemic
Xanthippus corallipes Haldeman
Xanthippus montanus (Thomas)

Family Gryllacrididae (camel and Jerusalem crickets)

Ammobaenetes new species, ELMA endemic
Ceuthophilus pallidus Thomas
Ceuthophilus polingi Hubbell
Ceuthophilus testaceus Scudder
Ceuthophilus utahensis Thomas
Ceuthophilus new species, near *arizonensis* Sc., ELMA endemic
Daihinioides hastiferum Rehn
Pristoceuthophilus leptodrilus new sp., Cohn & Hubbell:MS
Stenopelmatus fuscus Haldeman
Stenopelmatus new species
Styracosceles neomexicanus (Scudder)

Family Gryllidae (field, bush, and tree crickets)

Cycloptilium comprehendens Hebard
Gryllus integer
Gryllus veletis
Gryllus new species 1
Gryllus new species 2
Gryllus new species 3, probably ELMA endemic
Hoplosphyrum boreale Scudder
Oecanthus californicus Saussure

Family Romaleidae (lubber grasshoppers)

Phrynotettix tschivanvensis (Haldeman)

Family Tettigoniidae (katydids)

Arethea gracilipes gracilipes Thomas
Capnobotes occidentalis (Thomas)
Eremopedes balli Caudell
Eremopedes scudderi Cockerell

Order Phasmatodea (stick insects)

Family Heteronemiidae

Parabacillus coloradus (Scudder)
Pseudosermyle straminea Scudder

Order Isoptera (termites)

Family Rhinotermitidae

Reticulitermes flavipes (Koller)

Order Psocoptera (psocids)

identifications not completed

Order Thysanoptera (thrips)

identifications not completed

Order Hemiptera (true bugs)

Family Cydnidae

Pangaeus bilineatus (Say)

Family Tingidae

Corythucha morrilli Osborn & Drake

remaining identifications not completed

Order Homoptera (aphids, leafhoppers, cicadas, etc.)

Family Psyllidae

Paratrioza cockerelli (Sulc)

Family Triozidae

Rhinopsylla antennata Crawford

remaining identifications not completed

Order Neuroptera (antlions, lacewings)

identifications not completed

Order Coleoptera (beetles)

Family Carabidae (ground beetles)

Calosoma peregrinator Guerin-Meneville
Harpalus desertus LeConte
Harpalus retractus LeConte
Lebia pulchella Dejean

Pasimachus atronitens Casey
Rhadine longipes Casey
Rhadine umbra Casey
Scaphinotus snowi snowi LeConte
Synuchus dubius LeConte

Family Tenebrionidae (darkling beetles)

Araeoschizus decipiens Horn
Araeoschizus similaris Papp
Asidopsis opaca (Say)
Eleodes carbonarius (Say)
Eleodes dissimilis Blaisdell
Eleodes exticatus (Say)
Eleodes hispilabris Blaisdell
Eleodes hoppingi Blaisdell
Eleodes longicollis LeConte
Eleodes nigrinus LeConte
Eleodes obscurus LeConte
Eleodes sponsus LeConte
Eusattus reticulatus (Say)
Neobaphion planipennis (LeConte)
Parasida lirata (LeConte)
Stenomorpha consurs (Casey)
Steriphanus sp. unknown
Telabis sp. unkown

remaining Coleoptera identifications not completed

Order Lepidoptera (butterflies and moths)

Family Hesperiidae (skippers)

Stinga morrisoni (Edwards)
Hesperia uncas Edwards
Thorybes pylades (Scudder)

Family Lycaenidae (blues and coppers)

Celastrina argiolus (Linn.)
Everes amyntula (Boisduval)
Plebejus melissa (Edwards)

Family Nymphalidae (brush-footed butterflies)

Chlosyne leanira fulvia (Edwards)
Chlosyne acastus (Edwards)
Euptoieta claudia (Cramer)
Phyciodes campestris (Behr)

remaining Lepidoptera identifications not completed

Order Diptera (flies)

Family Agromyzidae

Cerodontha (Cerodontha) dorsalis (Loew)
Amauromyza sp. one undetermined species

Family Asilidae (robber flies)

Efferia costails (Williston)
Efferia incognita Forbes
Efferia rapax (Osten-Sacken)
Efferia willistoni (Hine)
Megaphorus frustrus (Pritchard)

Family Drosophilidae

undetermined spp.

Family Calliphoridae (blow flies)

Calliphora livida Hall
Calliphora coloradensis Hough

Family Chamaemyiidae

Leucopis sp.

Family Chloropidae (frit flies)

Chlorops sp.
Chlorops new sp.
Homaluroides sp. prob. new
Neodiplotoxa pulchripes (Loew)
Neodiplotoxa sp. prob. new
Thaumatomyia pullipes (Coquillett)
Thaumatomyia glabra (Meigen)
Thaumatomyia bistriata (Walker)
Thaumatomyia appropinqua (Adams)
Homaluroides melleus (Loew)
Conioscinella sp.
Nartshukiella sp.
Neoscinella new sp.

Family Culicidae (mosquitoes)

Aedes (Ochlerotatus) sp.
Aedes (Ochlerotatus) nicromaculis (Ludlow)

Family Empididae (dance flies)

Tachypeza sp. near *corticalis* Melander
Platypalpus sp.
Rhamphomyia sp. 1
Rhamphomyia sp. 2
Rhamphomyia sp. 3
Heleodromia sp.

Family Ephydridae

undetermined spp.

Family Heleomyzidae

Pseudoleria sp.
Heleomyza sp.
Schroederella sp.

Family Lauxaniidae

Camptoprosopella inaequalis Shewell
Minettia (Frendelia) sp.

Family Muscidae (muscid flies)

Muscina assimilis (Fallen)
Coenosia sp. 1
Coenosia sp. 2
Helina sp.

Schoenomyza dorsalis (Loew)

Family Mycetophilidae (fungus gnats)

Hesperodes johnsoni Coquillett
Leia sp.
Macrocera sp.
Exechia sp.
Cordyla sp.
Dziedzickia sp.
Mycomya sp.
Mycetophila fungorum group
Mycetophila falcata group

Family Oestridae

Cuterebra fontinella Clark

Family Piophilidae

Mycetalus sp.

Family Sarcophagidae; Sarcophaginae (flesh flies)

2-4 unidentifiable species
Ravinia pusiola (Wulp)
Ravinia lherminieri Robineau-Desvoidy
Boettcheria bisetosa Parker
Ravinia sp.

Family Scatopsidae

several undetermined species

Family Sciaridae

several undetermined species

Family Sepsidae

Sepsis sp.

Family Sphaeroceridae

undetermined spp.

Family Tachinidae (tachinid flies)

Peleteria sp. or spp.
Leucostoma sp.
Meigenielloides cinerea Townsend
Microphthalma disjuncta (Wiedemann)
Microchaetina sp. prob. *valida* Townsend
Paradidyma sp. near *neomexicana* Reinhard
Leskia occidentalis (Coquillet)
Ptilodexia sp. 1
Ptilodexia sp. 2
Phasia sp. or spp.
Dichocera sp
Catharosia sp.

Family Tephritidae (fruit flies)

Eutreta diana (Osten Sacken)
Euaresta stigmatica Coquillett
Euaresta bellula Snow
Neotephritis finalis (Loew)
Tephritis araneosa (Coquillett)
Trupanea nigricornis (Coquillett)
Trupanea actinobola (Loew)
Trupanea vicina (Wulp)
Trupanea radifera (Coquillett)
Neaspilota (Neorellia) sp.

Family Tipulidae (crane flies)

Empedomorpha empedoides (Alexander)

Family Trichoceridae

Trichocera spp. (2 spp.)

remaining Diptera identifications not completed

Order Siphonaptera (fleas)

identifications not completed

Order Hymenoptera (bees, wasps, and ants)

Bees (several families)

Bethylidae species unknown
Agapostemon angelicus
Lasioglossum sisymbrii
Sphecodogastra species unknown
Dialictus species unknown
Sphecodes species unknown
Protandrena sphaeralceae
Triepeolus species unknown
Lithurge apicalis
Bombus fervidus morrisoni
Hylaeus new species
Aphis mellifera

Family Formicidae (ants)

Neivamyrmex nigrescens (Cresson)
Monomorium minimum (Buckley)
Pheidole sp.
Crematogaster punctulata Emery
Crematogaster depilis Wheeler
Crematogaster emeryana Creighton
Crematogaster sp.
Leptothorax nitens Emery
Leptothorax carinatus Cole
Leptothorax sp.
Pogonomyrmex occidentalis (Cresson)
Aphaenogaster huachucana Creighton
Myrmica americana Weber
Myrmica emeryana Forel
Solenopsis molesta (Say)
Dorymyrmex insanus (Buckley)
Tapinoma sessile (Say)
Liometopum luctuosum Wheeler
Liometopum apiculatum Mayr

Forelius pruinosus (Roger)
Myrmecocystus mexicanus Wesmael
Polyergus brevicornis Emery
Acanthomyops latipes (Walsh)
Lasius neoniger Emery
Lasius sitiens Wilson
Lasius sp.
Camponotus vicinus Mayr
Camponotus laevigatus (F. Smith)
Camponotus semitestaceus Emery
Camponotus sayi Emery
Formica densiventris Viereck
Formica subpolita Creighton
Formica podzolica Francoeur
Formica neogagates Emery
Formica pallidefulva nitidiventris Emery
Formica argentea Wheeler
Formica sp.
Formica neorufibarbis Emery
Formica perpilosa Wheeler

Familiy Pompilidae (spider wasps)

Agenilla conflicta Bks.
Ageniella euphorbiae Vier.
Cryptocheilus terminatum terminatum Say
Entypus unifasciatus cressoni Bks.
Evagetes padrinus padrinus Vier.
Hemipepsis toussianti Bks.
Hemipepsis ustulata ustulata Dahl
Pompilus arctus Cress.
Pompilus parvulus Bks.
Pompilus silvivaus Bks.
Priocnemis navajo navajo Bks.

remaining Hynemoptera identifications not completed

VEGETATION AND WILDLIFE INVENTORY

OF EL MALPAIS NATIONAL MONUMENT

Final Report

Appendix 22

WILDLIFE INVENTORY ANIMAL SPECIES RECORDS DATABASE

APPENDIX 22.

EL MALPAIS NATIONAL MOUNUMENT WILDLIFE INVENTORY RECORDS.

Data sorted by GROUP, COMMON NAME, SITE, and DATE. Code is based on scientific name (first 2 letters:genus, second 2 letters: species).

NO. = number of individuals observed. N/A refers to records where individuals were not observed (nests, vocalizations, etc.)

Refer to Appendix 6 for detailed SITE information.

SITE	DATE	GROUP	COMMON NAME	CODE	NO.
BRWI	07/16/91	AMPH	Canyon Treefrog	HYAR	1
HAFE	07/09/91	AMPH	Canyon Treefrog	HYAR	1
PRWE	06/02/92	AMPH	Canyon Treefrog	HYAR	1
SUBR	07/30/91	AMPH	Canyon Treefrog	HYAR	1
SUBR	07/31/91	AMPH	Canyon Treefrog	HYAR	1
NOPA	07/09/92	AMPH	New Mexico Spadefoot Toad	SPMU	N/A
OS33	08/18/93	AMPH	New Mexico Spadefoot Toad	SPMU	1
SABL	08/22/91	AMPH	New Mexico Spadefoot Toad	SPMU	20
SABL	09/19/91	AMPH	New Mexico Spadefoot Toad	SPMU	1
BLTT	09/18/91	AMPH	Tiger Salamander	AMTI	1
BSLC	07/25/91	BIRD	Acorn Woodpecker	MEFO	1
BTKI	07/31/91	BIRD	Acorn Woodpecker	MEFO	1
HOYA	08/14/91	BIRD	Acorn Woodpecker	MEFO	1
LICO	07/16/91	BIRD	Acorn Woodpecker	MEFO	1
MARC	07/01/91	BIRD	Acorn Woodpecker	MEFO	3
ZUNI	07/16/91	BIRD	Acorn Woodpecker	MEFO	1
ZATH	08/26/92	BIRD	American Crow	COBR	2
CO42	07/31/91	BIRD	American Kestrel	FASP	2
HIDD	08/15/91	BIRD	American Kestrel	FASP	1
MCSW	07/07/92	BIRD	American Kestrel	FASP	1
NOPA	07/09/92	BIRD	American Kestrel	FASP	1
NOPA	08/26/91	BIRD	American Kestrel	FASP	2
NPSS	07/12/93	BIRD	American Kestrel	FASP	2
OFSW	07/14/93	BIRD	American Kestrel	FASP	1
PRWE	05/12/92	BIRD	American Kestrel	FASP	2
PRWE	06/02/92	BIRD	American Kestrel	FASP	1
SABL	03/08/93	BIRD	American Kestrel	FASP	2
SABL	08/20/91	BIRD	American Kestrel	FASP	1
ZATF	07/13/93	BIRD	American Kestrel	FASP	1
ZATH	07/12/93	BIRD	American Kestrel	FASP	1
BACR	07/17/91	BIRD	American Robin	TUMI	1
BLTT	07/24/91	BIRD	American Robin	TUMI	2
CJPA	06/04/92	BIRD	American Robin	TUMI	1

CO42	07/12/93	BIRD	American Robin	TUMI	1
ELCA	08/16/91	BIRD	American Robin	TUMI	1
FERN	07/31/91	BIRD	American Robin	TUMI	1
HIDD	08/15/91	BIRD	American Robin	TUMI	2
HOYP	06/02/92	BIRD	American Robin	TUMI	1
MARC	07/01/91	BIRD	American Robin	TUMI	6
MEBL	05/12/92	BIRD	American Robin	TUMI	1
MEBL	06/30/92	BIRD	American Robin	TUMI	1
MEBL	08/14/91	BIRD	American Robin	TUMI	3
MTKI	08/27/91	BIRD	American Robin	TUMI	2
NATH	06/16/92	BIRD	American Robin	TUMI	1
NOSR	07/07/92	BIRD	American Robin	TUMI	2
NPSS	07/12/93	BIRD	American Robin	TUMI	2
NPSS	11/17/92	BIRD	American Robin	TUMI	2
OARD	06/04/92	BIRD	American Robin	TUMI	1
OARD	06/09/92	BIRD	American Robin	TUMI	2
PRWE	06/02/92	BIRD	American Robin	TUMI	1
SABL	11/17/92	BIRD	American Robin	TUMI	1
TWFL	05/12/92	BIRD	American Robin	TUMI	1
ZATF	07/13/93	BIRD	American Robin	TUMI	1
ZATF	07/14/92	BIRD	American Robin	TUMI	1
APCO	06/16/92	BIRD	Ash-throated Flycatcher	MYCI	1
BLTT	07/24/91	BIRD	Ash-throated Flycatcher	MYCI	3
CJPA	06/04/92	BIRD	Ash-throated Flycatcher	MYCI	2
HIDD	08/15/91	BIRD	Ash-throated Flycatcher	MYCI	1
HOYP	06/02/92	BIRD	Ash-throated Flycatcher	MYCI	2
IRIS	06/04/92	BIRD	Ash-throated Flycatcher	MYCI	3
MARC	07/01/91	BIRD	Ash-throated Flycatcher	MYCI	3
MEBL	05/12/92	BIRD	Ash-throated Flycatcher	MYCI	2
MEBL	06/30/92	BIRD	Ash-throated Flycatcher	MYCI	2
NACO	06/16/92	BIRD	Ash-throated Flycatcher	MYCI	1
NAKI	06/16/92	BIRD	Ash-throated Flycatcher	MYCI	1
NOSR	07/07/92	BIRD	Ash-throated Flycatcher	MYCI	2
NPSS	07/12/93	BIRD	Ash-throated Flycatcher	MYCI	3
NTKI	07/07/92	BIRD	Ash-throated Flycatcher	MYCI	1
OARD	05/12/92	BIRD	Ash-throated Flycatcher	MYCI	1
OARD	06/04/92	BIRD	Ash-throated Flycatcher	MYCI	2
OARD	06/09/92	BIRD	Ash-throated Flycatcher	MYCI	1
OARD	07/09/91	BIRD	Ash-throated Flycatcher	MYCI	1
PRWE	05/12/92	BIRD	Ash-throated Flycatcher	MYCI	2
RASN	07/11/91	BIRD	Ash-throated Flycatcher	MYCI	1
STKI	07/07/92	BIRD	Ash-throated Flycatcher	MYCI	1
ZAKI	06/09/92	BIRD	Ash-throated Flycatcher	MYCI	1
ZATF	07/14/92	BIRD	Ash-throated Flycatcher	MYCI	2
ZATH	06/09/92	BIRD	Ash-throated Flycatcher	MYCI	1
ZATH	07/14/92	BIRD	Ash-throated Flycatcher	MYCI	1
CEBA	06/10/92	BIRD	Band-tailed Pigeon	COFA	2
HAFE	07/09/91	BIRD	Band-tailed Pigeon	COFA	1
LICO	07/16/91	BIRD	Band-tailed Pigeon	COFA	2
MARC	06/11/92	BIRD	Band-tailed Pigeon	COFA	2
MARC	07/01/91	BIRD	Band-tailed Pigeon	COFA	4
SABL	08/27/92	BIRD	Band-tailed Pigeon	COFA	4

SABL	08/20/91	BIRD	Barn Owl	TYAL	1
NOSR	07/07/92	BIRD	Bewick's Wren	THBE	1
SABL	09/25/91	BIRD	Bewick's Wren	THBE	1
ACOM	07/16/91	BIRD	Black-capped Chickadee	PAAT	3
BSLC	07/25/91	BIRD	Black-capped Chickadee	PAAT	3
ELCA	08/16/91	BIRD	Black-capped Chickadee	PAAT	1
HAFE	03/17/92	BIRD	Black-capped Chickadee	PAAT	3
HIDD	08/15/91	BIRD	Black-capped Chickadee	PAAT	3
HOYA	08/14/91	BIRD	Black-capped Chickadee	PAAT	2
HOYP	06/02/92	BIRD	Black-capped Chickadee	PAAT	3
MARC	04/13/92	BIRD	Black-capped Chickadee	PAAT	2
MEBL	06/30/92	BIRD	Black-capped Chickadee	PAAT	2
MTKI	07/07/92	BIRD	Black-capped Chickadee	PAAT	3
MTKI	08/27/91	BIRD	Black-capped Chickadee	PAAT	1
NOSR	07/07/92	BIRD	Black-capped Chickadee	PAAT	2
NOSR	08/27/91	BIRD	Black-capped Chickadee	PAAT	2
OARD	06/04/92	BIRD	Black-capped Chickadee	PAAT	2
OARD	07/09/91	BIRD	Black-capped Chickadee	PAAT	3
RASN	03/17/92	BIRD	Black-capped Chickadee	PAAT	2
RASN	04/13/92	BIRD	Black-capped Chickadee	PAAT	3
ZAKI	06/09/92	BIRD	Black-capped Chickadee	PAAT	2
ZATF	07/13/93	BIRD	Black-capped Chickadee	PAAT	3
SABL	08/20/91	BIRD	Black-chinned Hummingbird	ARAL	1
CAND	07/17/91	BIRD	Black-headed Grosbeak	PHME	2
NPSS	08/26/92	BIRD	Black-throated Grey Warbler	DENI	1
NOPA	09/25/91	BIRD	Blue Grosbeak	GUCA	1
NOPA	08/26/91	BIRD	Brewer's Blackbird	EUCY	2
REND	04/13/92	BIRD	Brewer's Sparrow	SPBR	2
REND	04/13/92	BIRD	Brewer's Sparrow	SPBR	1
SABL	09/25/91	BIRD	Brewer's Sparrow	SPBR	3
BLTT	07/24/91	BIRD	Broad-tailed Hummingbird	SEPL	1
CAND	05/12/92	BIRD	Broad-tailed Hummingbird	SEPL	1
CAND	07/17/91	BIRD	Broad-tailed Hummingbird	SEPL	3
CEEN	05/12/92	BIRD	Broad-tailed Hummingbird	SEPL	1
ELCA	08/16/91	BIRD	Broad-tailed Hummingbird	SEPL	2
LICO	07/16/91	BIRD	Broad-tailed Hummingbird	SEPL	1
LOWO	05/12/92	BIRD	Broad-tailed Hummingbird	SEPL	1
MARC	05/13/92	BIRD	Broad-tailed Hummingbird	SEPL	1
MARC	07/01/91	BIRD	Broad-tailed Hummingbird	SEPL	2
MEBL	05/12/92	BIRD	Broad-tailed Hummingbird	SEPL	1
MEBL	06/30/92	BIRD	Broad-tailed Hummingbird	SEPL	1
MTKI	07/07/92	BIRD	Broad-tailed Hummingbird	SEPL	1
NATH	06/16/92	BIRD	Broad-tailed Hummingbird	SEPL	1
NOSR	07/07/92	BIRD	Broad-tailed Hummingbird	SEPL	2
OARD	06/09/92	BIRD	Broad-tailed Hummingbird	SEPL	1
OARD	07/09/91	BIRD	Broad-tailed Hummingbird	SEPL	1
RASN	07/11/91	BIRD	Broad-tailed Hummingbird	SEPL	2
SABL	05/28/92	BIRD	Broad-tailed Hummingbird	SEPL	1
SABL	08/20/91	BIRD	Broad-tailed Hummingbird	SEPL	1
TRIA	07/11/91	BIRD	Broad-tailed Hummingbird	SEPL	1
OARD	06/09/92	BIRD	Brown Creeper	CEAM	1
NOMC	08/21/91	BIRD	Brown Towhee	PIFU	1

SABL	01/11/92	BIRD	Brown Towhee	PIFU	5
CAND	07/17/91	BIRD	Brown-headed Cowbird	MOAT	5
NOPA	08/26/91	BIRD	Brown-headed Cowbird	MOAT	4
OARD	06/04/92	BIRD	Brown-headed Cowbird	MOAT	2
OARD	06/09/92	BIRD	Brown-headed Cowbird	MOAT	1
PRWE	06/02/92	BIRD	Brown-headed Cowbird	MOAT	2
OS25	03/08/93	BIRD	Burrowing Owl	ATCU	1
BACR	07/17/91	BIRD	Canyon Wren	CAME	1
BRAI	07/12/93	BIRD	Canyon Wren	CAME	1
BSLC	06/10/92	BIRD	Canyon Wren	CAME	2
BSLC	07/25/91	BIRD	Canyon Wren	CAME	1
HAFE	07/09/91	BIRD	Canyon Wren	CAME	1
MTKI	07/07/92	BIRD	Canyon Wren	CAME	1
MTKI	08/27/91	BIRD	Canyon Wren	CAME	1
NOSR	08/27/91	BIRD	Canyon Wren	CAME	1
NPMS	07/12/93	BIRD	Canyon Wren	CAME	1
NPSS	07/12/93	BIRD	Canyon Wren	CAME	1
SABL	05/28/92	BIRD	Canyon Wren	CAME	2
SABL	08/20/91	BIRD	Canyon Wren	CAME	1
ALBA	06/04/92	BIRD	Cassin's Kingbird	TYVO	2
BACA	08/16/91	BIRD	Cassin's Kingbird	TYVO	1
BIHO	07/01/92	BIRD	Cassin's Kingbird	TYVO	1
CO42	07/31/91	BIRD	Cassin's Kingbird	TYVO	1
HOSW	07/07/92	BIRD	Cassin's Kingbird	TYVO	1
IRIS	06/04/92	BIRD	Cassin's Kingbird	TYVO	2
NATH	06/16/92	BIRD	Cassin's Kingbird	TYVO	2
NOPA	07/09/92	BIRD	Cassin's Kingbird	TYVO	2
NOPA	08/26/91	BIRD	Cassin's Kingbird	TYVO	2
NOSR	08/27/91	BIRD	Cassin's Kingbird	TYVO	1
NPPO	08/25/93	BIRD	Cassin's Kingbird	TYVO	1
PRWE	06/02/92	BIRD	Cassin's Kingbird	TYVO	2
ZATH	07/14/92	BIRD	Cassin's Kingbird	TYVO	2
SEPT	07/14/93	BIRD	Cassin's Sparrow	AICA	2
NPSS	03/08/93	BIRD	Cedar Waxwing	BOGA	12
BLTT	09/18/91	BIRD	Chipping Sparrow	SPPA	7
ELCA	08/16/91	BIRD	Chipping Sparrow	SPPA	5
MARC	07/01/91	BIRD	Chipping Sparrow	SPPA	2
MARC	07/15/92	BIRD	Chipping Sparrow	SPPA	3
MEBL	06/30/92	BIRD	Chipping Sparrow	SPPA	5
MTKI	07/07/92	BIRD	Chipping Sparrow	SPPA	3
NATH	06/16/92	BIRD	Chipping Sparrow	SPPA	2
NOSR	07/07/92	BIRD	Chipping Sparrow	SPPA	5
OARD	06/04/92	BIRD	Chipping Sparrow	SPPA	5
OARD	06/09/92	BIRD	Chipping Sparrow	SPPA	5
OARD	07/09/91	BIRD	Chipping Sparrow	SPPA	3
SABL	09/25/91	BIRD	Chipping Sparrow	SPPA	9
ZATF	07/14/92	BIRD	Chipping Sparrow	SPPA	4
ZATH	07/14/92	BIRD	Chipping Sparrow	SPPA	2
BACR	07/17/91	BIRD	Clark's Nutcracker	NUCO	2
HIDD	08/15/91	BIRD	Clark's Nutcracker	NUCO	3
MARC	07/01/91	BIRD	Clark's Nutcracker	NUCO	5
NOPA	08/26/91	BIRD	Cliff Swallow	HIPY	2

SABL	08/20/91	BIRD	Cliff Swallow	HIPY	20
SABL	08/27/92	BIRD	Cliff Swallow	HIPY	4
ELCA	08/16/91	BIRD	Common Bushtit	PSMI	4
MEBL	06/30/92	BIRD	Common Bushtit	PSMI	7
MTKI	07/07/92	BIRD	Common Bushtit	PSMI	3
NOSR	07/07/92	BIRD	Common Bushtit	PSMI	6
NTKI	07/07/92	BIRD	Common Bushtit	PSMI	2
RASN	07/11/91	BIRD	Common Bushtit	PSMI	3
APCO	06/16/92	BIRD	Common Flicker	COAU	2
BLTT	07/24/91	BIRD	Common Flicker	COAU	2
CEBA	07/15/92	BIRD	Common Flicker	COAU	2
CEEN	05/12/92	BIRD	Common Flicker	COAU	2
CO42	07/12/93	BIRD	Common Flicker	COAU	1
FERN	07/31/91	BIRD	Common Flicker	COAU	1
MARC	04/13/92	BIRD	Common Flicker	COAU	2
MARC	07/01/91	BIRD	Common Flicker	COAU	11
MARC	07/15/92	BIRD	Common Flicker	COAU	1
MTKI	07/07/92	BIRD	Common Flicker	COAU	2
NOPA	09/25/91	BIRD	Common Flicker	COAU	1
NOSR	07/07/92	BIRD	Common Flicker	COAU	3
NOSR	08/27/91	BIRD	Common Flicker	COAU	1
NPSS	11/17/92	BIRD	Common Flicker	COAU	1
OLBA	07/12/93	BIRD	Common Flicker	COAU	2
PRWE	05/12/92	BIRD	Common Flicker	COAU	2
SEPT	09/25/91	BIRD	Common Flicker	COAU	1
ZATH	06/09/92	BIRD	Common Flicker	COAU	1
ACOM	07/16/91	BIRD	Common Nighthawk	CHMI	3
BLTT	07/24/91	BIRD	Common Nighthawk	CHMI	12
BRWI	07/16/91	BIRD	Common Nighthawk	CHMI	3
BSLC	07/25/91	BIRD	Common Nighthawk	CHMI	4
CJPA	06/04/92	BIRD	Common Nighthawk	CHMI	2
FOUR	07/29/91	BIRD	Common Nighthawk	CHMI	2
HOYA	08/14/91	BIRD	Common Nighthawk	CHMI	4
HOYP	06/02/92	BIRD	Common Nighthawk	CHMI	6
MARC	07/01/91	BIRD	Common Nighthawk	CHMI	10
MEBL	06/30/92	BIRD	Common Nighthawk	CHMI	12
MEBL	08/14/91	BIRD	Common Nighthawk	CHMI	8
NATH	06/16/92	BIRD	Common Nighthawk	CHMI	12
NOSR	07/07/92	BIRD	Common Nighthawk	CHMI	15
NPSS	07/12/93	BIRD	Common Nighthawk	CHMI	5
NPSS	08/18/93	BIRD	Common Nighthawk	CHMI	6
OARD	06/04/92	BIRD	Common Nighthawk	CHMI	5
OARD	06/09/92	BIRD	Common Nighthawk	CHMI	7
OARD	07/09/91	BIRD	Common Nighthawk	CHMI	10
PRWE	06/02/92	BIRD	Common Nighthawk	CHMI	7
RASN	07/11/91	BIRD	Common Nighthawk	CHMI	1
SABL	08/27/92	BIRD	Common Nighthawk	CHMI	2
ZAKI	06/09/92	BIRD	Common Nighthawk	CHMI	2
ZUNI	07/16/91	BIRD	Common Nighthawk	CHMI	5
MARC	07/01/91	BIRD	Common Poorwill	PHNU	2
MCSW	07/07/92	BIRD	Common Poorwill	PHNU	1
MTKI	08/27/91	BIRD	Common Poorwill	PHNU	1

OARD	06/04/92	BIRD	Common Poorwill	PHNU	1
BACR	07/17/91	BIRD	Common Raven	COCO	2
BHBF	07/01/92	BIRD	Common Raven	COCO	1
CAND	05/12/92	BIRD	Common Raven	COCO	2
CJPA	06/04/92	BIRD	Common Raven	COCO	1
HAFE	03/17/92	BIRD	Common Raven	COCO	2
HOSW	07/07/92	BIRD	Common Raven	COCO	1
ICEP	07/31/91	BIRD	Common Raven	COCO	2
LACR	06/11/92	BIRD	Common Raven	COCO	1
LOWO	05/12/92	BIRD	Common Raven	COCO	4
MARC	04/13/92	BIRD	Common Raven	COCO	1
MARC	05/13/92	BIRD	Common Raven	COCO	2
MARC	06/11/92	BIRD	Common Raven	COCO	1
MARC	07/01/91	BIRD	Common Raven	COCO	2
MEBL	06/30/92	BIRD	Common Raven	COCO	3
NOPA	05/28/92	BIRD	Common Raven	COCO	3
NOPA	07/09/92	BIRD	Common Raven	COCO	2
NOPA	08/26/91	BIRD	Common Raven	COCO	2
NOSR	07/07/92	BIRD	Common Raven	COCO	4
NPSS	03/08/93	BIRD	Common Raven	COCO	1
OARD	06/04/92	BIRD	Common Raven	COCO	1
OARD	06/09/92	BIRD	Common Raven	COCO	2
OFSW	07/07/92	BIRD	Common Raven	COCO	2
OFSW	07/14/93	BIRD	Common Raven	COCO	2
PRWE	05/12/92	BIRD	Common Raven	COCO	2
PRWE	06/02/92	BIRD	Common Raven	COCO	1
RASN	07/11/91	BIRD	Common Raven	COCO	1
RASN	07/11/91	BIRD	Common Raven	COCO	3
REND	04/13/92	BIRD	Common Raven	COCO	2
SABL	01/11/92	BIRD	Common Raven	COCO	4
SABL	05/28/92	BIRD	Common Raven	COCO	3
SABL	08/20/91	BIRD	Common Raven	COCO	1
SABL	11/17/92	BIRD	Common Raven	COCO	1
ZATF	07/14/92	BIRD	Common Raven	COCO	1
ZATH	01/11/92	BIRD	Common Raven	COCO	2
ZATH	03/17/92	BIRD	Common Raven	COCO	3
ZATH	06/09/92	BIRD	Common Raven	COCO	1
OARD	05/12/92	BIRD	Cooper's Hawk	ACCO	1
APCO	06/16/92	BIRD	Cordilleran Flycatcher	EMOC	1
BACR	07/17/91	BIRD	Cordilleran Flycatcher	EMOC	3
BRAI	07/12/93	BIRD	Cordilleran Flycatcher	EMOC	1
BRWI	07/16/91	BIRD	Cordilleran Flycatcher	EMOC	2
BSLC	06/10/92	BIRD	Cordilleran Flycatcher	EMOC	2
BSLC	07/15/92	BIRD	Cordilleran Flycatcher	EMOC	1
BSLC	07/25/91	BIRD	Cordilleran Flycatcher	EMOC	2
FERN	07/31/91	BIRD	Cordilleran Flycatcher	EMOC	2
FOUR	07/29/91	BIRD	Cordilleran Flycatcher	EMOC	1
GICE	07/30/91	BIRD	Cordilleran Flycatcher	EMOC	1
HAFE	07/09/91	BIRD	Cordilleran Flycatcher	EMOC	2
HAFE	07/15/92	BIRD	Cordilleran Flycatcher	EMOC	1
INWA	07/10/91	BIRD	Cordilleran Flycatcher	EMOC	2
LACR	06/11/92	BIRD	Cordilleran Flycatcher	EMOC	2

MARC	05/13/92	BIRD	Cordilleran Flycatcher	EMOC	1
MARC	06/11/92	BIRD	Cordilleran Flycatcher	EMOC	1
MARC	07/01/91	BIRD	Cordilleran Flycatcher	EMOC	2
MARC	07/15/92	BIRD	Cordilleran Flycatcher	EMOC	1
MARC3	07/03/91	BIRD	Cordilleran Flycatcher	EMOC	2
MARC4	07/03/91	BIRD	Cordilleran Flycatcher	EMOC	2
MARC5	07/03/91	BIRD	Cordilleran Flycatcher	EMOC	2
NACO	06/16/92	BIRD	Cordilleran Flycatcher	EMOC	1
NSBR	07/31/91	BIRD	Cordilleran Flycatcher	EMOC	1
OARD	06/04/92	BIRD	Cordilleran Flycatcher	EMOC	1
RASN	07/11/91	BIRD	Cordilleran Flycatcher	EMOC	1
STCO	06/16/92	BIRD	Cordilleran Flycatcher	EMOC	1
SUBR	07/30/91	BIRD	Cordilleran Flycatcher	EMOC	2
SUBR	07/31/91	BIRD	Cordilleran Flycatcher	EMOC	1
TRIA	07/11/91	BIRD	Cordilleran Flycatcher	EMOC	2
ZUNI	07/16/91	BIRD	Cordilleran Flycatcher	EMOC	1
BLTT	07/24/91	BIRD	Dark-eyed Junco	JUHY	2
CAND	05/12/92	BIRD	Dark-eyed Junco	JUHY	2
CO42	03/17/92	BIRD	Dark-eyed Junco	JUHY	8
HAFE	07/15/92	BIRD	Dark-eyed Junco	JUHY	2
HOYP	06/02/92	BIRD	Dark-eyed Junco	JUHY	2
LICO	07/16/91	BIRD	Dark-eyed Junco	JUHY	1
MARC	04/13/92	BIRD	Dark-eyed Junco	JUHY	5
MARC	07/01/91	BIRD	Dark-eyed Junco	JUHY	5
NOPA	01/11/92	BIRD	Dark-eyed Junco	JUHY	50
NPSS	11/17/92	BIRD	Dark-eyed Junco	JUHY	3
OARD	05/12/92	BIRD	Dark-eyed Junco	JUHY	2
OARD	06/04/92	BIRD	Dark-eyed Junco	JUHY	4
OARD	06/09/92	BIRD	Dark-eyed Junco	JUHY	4
OARD	07/09/91	BIRD	Dark-eyed Junco	JUHY	3
SABL	01/11/92	BIRD	Dark-eyed Junco	JUHY	45
SABL	03/08/93	BIRD	Dark-eyed Junco	JUHY	4
SABL	11/17/92	BIRD	Dark-eyed Junco	JUHY	2
TWFL	05/12/92	BIRD	Dark-eyed Junco	JUHY	5
ZAKI	06/09/92	BIRD	Dark-eyed Junco	JUHY	1
ZATH	01/11/92	BIRD	Dark-eyed Junco	JUHY	8
FOUR	07/29/91	BIRD	Downy Woodpecker	PIPU	1
ZATF	07/14/92	BIRD	Downy Woodpecker	PIPU	2
BLTT	07/24/91	BIRD	Dusky Flycatcher	EMOB	2
HIDD	08/15/91	BIRD	Dusky Flycatcher	EMOB	1
MEBL	06/30/92	BIRD	Dusky Flycatcher	EMOB	1
NOSR	07/07/92	BIRD	Dusky Flycatcher	EMOB	1
NOSR	08/27/91	BIRD	Dusky Flycatcher	EMOB	1
OARD	06/04/92	BIRD	Dusky Flycatcher	EMOB	1
OARD	06/09/92	BIRD	Dusky Flycatcher	EMOB	1
OARD	07/09/91	BIRD	Dusky Flycatcher	EMOB	2
SABL	08/20/91	BIRD	Dusky Flycatcher	EMOB	1
NOSR	08/26/91	BIRD	Golden Eagle	AQCH	1
TWFL	05/12/92	BIRD	Grace's Warbler	DEGR	1
CAPO	04/19/93	BIRD	Great Blue Heron	ARHE	1
OS59	04/19/93	BIRD	Great Blue Heron	ARHE	1
SUBR	07/30/91	BIRD	Great Horned Owl	BUVI	NA

SUBR	07/31/91	BIRD	Great Horned Owl	BUVI	NA
OS30	07/14/93	BIRD	Greater Roadrunner	GECA	1
NPPO	05/28/92	BIRD	Green-backed Heron	BUST	1
NPPO	08/26/92	BIRD	Green-winged Teal	ANCR	2
PRWE	05/12/92	BIRD	Green-winged Teal	ANCR	2
BHBF	07/01/92	BIRD	Hairy Woodpecker	PIVI	1
HOYA	08/14/91	BIRD	Hairy Woodpecker	PIVI	1
MARC	05/13/92	BIRD	Hairy Woodpecker	PIVI	1
MEBL	06/30/92	BIRD	Hairy Woodpecker	PIVI	1
MEBL	08/14/91	BIRD	Hairy Woodpecker	PIVI	1
MTKI	08/27/91	BIRD	Hairy Woodpecker	PIVI	1
OARD	07/09/91	BIRD	Hairy Woodpecker	PIVI	1
STKI	07/07/92	BIRD	Hairy Woodpecker	PIVI	1
CJPA	06/04/92	BIRD	Hammond's Flycatcher	EMHA	1
ZATF	06/18/92	BIRD	Hammond's Flycatcher	EMHA	1
BSLC	07/25/91	BIRD	Hepatic Tanager	PIFL	1
CEEN	05/12/92	BIRD	Hepatic Tanager	PIFL	2
HOYA	08/14/91	BIRD	Hepatic Tanager	PIFL	1
MEBL	08/14/91	BIRD	Hepatic Tanager	PIFL	1
NAKI	06/16/92	BIRD	Hepatic Tanager	PIFL	1
NATH	06/16/92	BIRD	Hepatic Tanager	PIFL	1
OARD	07/09/91	BIRD	Hepatic Tanager	PIFL	2
SABL	08/20/91	BIRD	Hepatic Tanager	PIFL	1
NOPA	05/28/92	BIRD	Horned Lark	ERAL	8
OFSW	07/07/92	BIRD	Horned Lark	ERAL	2
OFSW	07/14/93	BIRD	Horned Lark	ERAL	5
PRWE	05/12/92	BIRD	Horned Lark	ERAL	5
PRWE	06/02/92	BIRD	Horned Lark	ERAL	5
SABL	09/25/91	BIRD	House Finch	CAMEX	2
NOPA	08/26/91	BIRD	Killdeer	CHVO	2
PRWE	05/12/92	BIRD	Killdeer	CHVO	4
PRWE	06/02/92	BIRD	Killdeer	CHVO	2
CO42	07/31/91	BIRD	Lark Sparrow	CHGR	4
NATH	06/16/92	BIRD	Lark Sparrow	CHGR	1
NOPA	08/26/91	BIRD	Lark Sparrow	CHGR	4
CO42	07/31/91	BIRD	Lesser Goldfinch	CAPS	6
MTKI	07/07/92	BIRD	Lesser Goldfinch	CAPS	2
NOMC	05/28/92	BIRD	Lesser Goldfinch	CAPS	4
NOPA	08/26/91	BIRD	Lesser Goldfinch	CAPS	6
NOSR	08/27/91	BIRD	Lesser Goldfinch	CAPS	6
SABL	08/20/91	BIRD	Lesser Goldfinch	CAPS	4
SABL	08/27/92	BIRD	Lesser Goldfinch	CAPS	4
SABL	09/25/91	BIRD	Lesser Goldfinch	CAPS	6
ZAKI	06/09/92	BIRD	Lesser Goldfinch	CAPS	4
ZATH	07/12/93	BIRD	Lesser Goldfinch	CAPS	2
HOYP	06/02/92	BIRD	Lewis' Woodpecker	MELE	2
NPPO	08/25/93	BIRD	Lewis' Woodpecker	MELE	1
OARD	09/19/91	BIRD	Lewis' Woodpecker	MELE	6
PRWE	06/02/92	BIRD	Lewis' Woodpecker	MELE	2
SABL	08/27/92	BIRD	Lewis' Woodpecker	MELE	5
OS06	09/18/91	BIRD	Loggerhead Shrike	LALU	1
OARD	06/04/92	BIRD	Long-eared Owl	ASOT	1

BACR	07/17/91	BIRD	Mountain Bluebird	SICU	3
HOYP	06/02/92	BIRD	Mountain Bluebird	SICU	2
NOPA	01/11/92	BIRD	Mountain Bluebird	SICU	8
NOPA	05/28/92	BIRD	Mountain Bluebird	SICU	6
NPSS	03/08/93	BIRD	Mountain Bluebird	SICU	5
OARD	06/04/92	BIRD	Mountain Bluebird	SICU	2
PRWE	05/12/92	BIRD	Mountain Bluebird	SICU	2
PRWE	06/02/92	BIRD	Mountain Bluebird	SICU	2
SABL	01/11/92	BIRD	Mountain Bluebird	SICU	3
SABL	03/17/92	BIRD	Mountain Bluebird	SICU	8
SABL	05/28/92	BIRD	Mountain Bluebird	SICU	5
SABL	08/27/92	BIRD	Mountain Bluebird	SICU	2
ZATH	08/26/92	BIRD	Mountain Bluebird	SICU	2
ELCA	08/16/91	BIRD	Mountain Chickadee	PAGA	3
HAFE	07/09/91	BIRD	Mountain Chickadee	PAGA	3
MARC	07/01/91	BIRD	Mountain Chickadee	PAGA	8
NPSS	11/17/92	BIRD	Mountain Chickadee	PAGA	1
OARD	06/09/92	BIRD	Mountain Chickadee	PAGA	1
OARD	07/09/91	BIRD	Mountain Chickadee	PAGA	5
PRWE	05/12/93	BIRD	Mountain Plover	CHMO	8
BLTT	07/12/93	BIRD	Mourning Dove	ZEMA	1
BLTT	07/24/91	BIRD	Mourning Dove	ZEMA	2
CAND	05/12/92	BIRD	Mourning Dove	ZEMA	5
CAND	07/17/91	BIRD	Mourning Dove	ZEMA	3
CO42	07/12/93	BIRD	Mourning Dove	ZEMA	2
CO42	07/31/91	BIRD	Mourning Dove	ZEMA	2
NOPA	07/09/92	BIRD	Mourning Dove	ZEMA	3
NOPA	08/26/91	BIRD	Mourning Dove	ZEMA	2
NPMS	07/12/93	BIRD	Mourning Dove	ZEMA	1
NPPO	08/25/93	BIRD	Mourning Dove	ZEMA	2
NPSS	07/12/93	BIRD	Mourning Dove	ZEMA	1
OLBA	07/12/93	BIRD	Mourning Dove	ZEMA	2
PRWE	05/12/92	BIRD	Mourning Dove	ZEMA	3
RASN	07/15/92	BIRD	Mourning Dove	ZEMA	1
ZATH	07/12/93	BIRD	Mourning Dove	ZEMA	1
ZUNI	07/16/91	BIRD	Mourning Dove	ZEMA	2
OS35	08/16/91	BIRD	Northern Goshawk	ACGE	1
NOPA	09/25/91	BIRD	Northern Harrier	CICY	1
OS19	11/17/92	BIRD	Northern Harrier	CICY	1
ZATH	03/17/92	BIRD	Northern Harrier	CICY	1
HOSW	07/07/92	BIRD	Northern Mockingbird	MIPO	1
NOSR	07/07/92	BIRD	Northern Mockingbird	MIPO	1
OLBA	07/12/93	BIRD	Northern Mockingbird	MIPO	1
ZAKI	06/09/92	BIRD	Northern Mockingbird	MIPO	1
ZATH	07/14/92	BIRD	Northern Mockingbird	MIPO	1
MARC4	07/03/91	BIRD	Northern Oriole	ICGA	1
OS13	07/09/92	BIRD	Northern Oriole	ICGA	1
PRWE	05/12/92	BIRD	Northern Pintail	ANAC	3
BACR	07/17/91	BIRD	Northern Rough-winged Swallow	STSE	4
NOMC	05/28/92	BIRD	Northern Rough-winged Swallow	STSE	3
NOPA	08/26/91	BIRD	Northern Rough-winged Swallow	STSE	2
OFSW	07/14/93	BIRD	Northern Rough-winged Swallow	STSE	3

SABL	05/28/92	BIRD	Northern Rough-winged Swallow	STSE	3
BTKI	07/31/91	BIRD	Pine Siskin	CAPI	4
CEEN	05/12/92	BIRD	Pine Siskin	CAPI	3
HOYP	06/02/92	BIRD	Pine Siskin	CAPI	4
MEBL	05/12/92	BIRD	Pine Siskin	CAPI	2
NSBR	07/31/91	BIRD	Pine Siskin	CAPI	7
BLTT	09/18/91	BIRD	Pinon Jay	GYCY	6
CAND	05/12/92	BIRD	Pinon Jay	GYCY	7
ELCA	08/16/91	BIRD	Pinon Jay	GYCY	5
ERHO	07/07/92	BIRD	Pinon Jay	GYCY	8
HIDD	08/15/91	BIRD	Pinon Jay	GYCY	8
HOYP	06/02/92	BIRD	Pinon Jay	GYCY	9
LOME	08/21/91	BIRD	Pinon Jay	GYCY	4
MEBL	06/30/92	BIRD	Pinon Jay	GYCY	14
MEBL	08/14/91	BIRD	Pinon Jay	GYCY	15
MTKI	07/07/92	BIRD	Pinon Jay	GYCY	5
MTKI	08/27/91	BIRD	Pinon Jay	GYCY	6
NAKI	06/16/92	BIRD	Pinon Jay	GYCY	5
NATH	06/16/92	BIRD	Pinon Jay	GYCY	11
NOMC	08/21/91	BIRD	Pinon Jay	GYCY	3
NOSR	07/07/92	BIRD	Pinon Jay	GYCY	9
NOSR	08/27/91	BIRD	Pinon Jay	GYCY	5
NPMS	07/12/93	BIRD	Pinon Jay	GYCY	5
NPSS	03/08/93	BIRD	Pinon Jay	GYCY	16
NPSS	07/12/93	BIRD	Pinon Jay	GYCY	14
NPSS	08/18/93	BIRD	Pinon Jay	GYCY	2
NPSS	11/17/92	BIRD	Pinon Jay	GYCY	8
NTKI	07/07/92	BIRD	Pinon Jay	GYCY	5
OARD	06/04/92	BIRD	Pinon Jay	GYCY	7
SABL	01/11/92	BIRD	Pinon Jay	GYCY	10
SABL	03/08/93	BIRD	Pinon Jay	GYCY	11
SABL	05/28/92	BIRD	Pinon Jay	GYCY	11
SABL	08/20/91	BIRD	Pinon Jay	GYCY	5
ZABF	07/14/92	BIRD	Pinon Jay	GYCY	3
ZATH	01/11/92	BIRD	Pinon Jay	GYCY	12
SABL	09/25/91	BIRD	Plain Titmouse	PAIN	1
MARC	07/01/91	BIRD	Purple Martin	PRSU	1
BLTT	07/24/91	BIRD	Pygmy Nuthatch	SIPY	1
MEBL	08/14/91	BIRD	Pygmy Nuthatch	SIPY	1
CAND	05/12/92	BIRD	Red Crossbill	LOCU	3
CEBA	07/15/92	BIRD	Red Crossbill	LOCU	2
CEEN	05/12/92	BIRD	Red Crossbill	LOCU	2
JUCA	08/26/92	BIRD	Red Crossbill	LOCU	3
RASN	07/11/91	BIRD	Red Crossbill	LOCU	5
RASN	07/15/92	BIRD	Red Crossbill	LOCU	2
MARC	07/01/91	BIRD	Red-breasted Nuthatch	SICA	2
OARD	07/09/91	BIRD	Red-breasted Nuthatch	SICA	1
ALBA	06/04/92	BIRD	Red-tailed Hawk	BUJA	1
BRAI	07/12/93	BIRD	Red-tailed Hawk	BUJA	1
CJPA	06/04/92	BIRD	Red-tailed Hawk	BUJA	1
CO42	07/31/91	BIRD	Red-tailed Hawk	BUJA	1
ERHO	07/07/92	BIRD	Red-tailed Hawk	BUJA	1

FOUR	07/29/91	BIRD	Red-tailed Hawk	BUJA	1
HAFE	03/17/92	BIRD	Red-tailed Hawk	BUJA	1
HIDD	07/01/92	BIRD	Red-tailed Hawk	BUJA	1
HOYP	06/02/92	BIRD	Red-tailed Hawk	BUJA	6
IRIS	06/04/92	BIRD	Red-tailed Hawk	BUJA	1
LOWO	05/12/92	BIRD	Red-tailed Hawk	BUJA	1
MARC	04/13/92	BIRD	Red-tailed Hawk	BUJA	1
MARC	07/01/91	BIRD	Red-tailed Hawk	BUJA	1
MTKI	08/27/91	BIRD	Red-tailed Hawk	BUJA	1
NOPA	01/11/92	BIRD	Red-tailed Hawk	BUJA	1
NOPA	08/26/91	BIRD	Red-tailed Hawk	BUJA	1
OARD	07/09/91	BIRD	Red-tailed Hawk	BUJA	1
SABL	01/11/92	BIRD	Red-tailed Hawk	BUJA	1
SABL	03/08/93	BIRD	Red-tailed Hawk	BUJA	1
SABL	03/17/92	BIRD	Red-tailed Hawk	BUJA	2
SABL	05/28/92	BIRD	Red-tailed Hawk	BUJA	1
SABL	08/20/91	BIRD	Red-tailed Hawk	BUJA	1
SABL	08/27/92	BIRD	Red-tailed Hawk	BUJA	1
SABL	09/25/91	BIRD	Red-tailed Hawk	BUJA	1
ZAKI	06/09/92	BIRD	Red-tailed Hawk	BUJA	1
ZATF	07/13/93	BIRD	Red-tailed Hawk	BUJA	1
SABL	09/26/91	BIRD	Rock Dove	COLI	2
BACA	08/16/91	BIRD	Rock Wren	SAOB	2
BACR	07/17/91	BIRD	Rock Wren	SAOB	1
BHBF	07/01/92	BIRD	Rock Wren	SAOB	1
BIHO	07/01/92	BIRD	Rock Wren	SAOB	2
BSLC	06/10/92	BIRD	Rock Wren	SAOB	1
BSLC	07/15/92	BIRD	Rock Wren	SAOB	1
CEEN	05/12/92	BIRD	Rock Wren	SAOB	1
ERHO	07/07/92	BIRD	Rock Wren	SAOB	3
HOSW	07/07/92	BIRD	Rock Wren	SAOB	2
HOSW	07/14/93	BIRD	Rock Wren	SAOB	3
HOYP	06/02/92	BIRD	Rock Wren	SAOB	4
MCSW	07/07/92	BIRD	Rock Wren	SAOB	4
MEBL	05/12/92	BIRD	Rock Wren	SAOB	1
MTKI	08/27/91	BIRD	Rock Wren	SAOB	4
NACO	06/16/92	BIRD	Rock Wren	SAOB	4
NATH	06/16/92	BIRD	Rock Wren	SAOB	3
NOMC	08/21/91	BIRD	Rock Wren	SAOB	2
NOSR	07/07/92	BIRD	Rock Wren	SAOB	5
NOSR	08/27/91	BIRD	Rock Wren	SAOB	2
NPMS	07/12/93	BIRD	Rock Wren	SAOB	3
SABL	08/20/91	BIRD	Rock Wren	SAOB	5
SUBR	07/30/91	BIRD	Rock Wren	SAOB	3
SUBR	07/31/91	BIRD	Rock Wren	SAOB	2
ZABF	07/14/92	BIRD	Rock Wren	SAOB	1
ZATF	07/14/92	BIRD	Rock Wren	SAOB	2
ICEP	07/31/91	BIRD	Rock Wren	SAOB	5
MARC	07/01/91	BIRD	Ruby Crowned Kinglet	RECA	4
BLTT	07/24/91	BIRD	Rufous Hummingbird	SERU	2
CAND	05/12/92	BIRD	Rufous Hummingbird	SERU	1
CAND	07/17/91	BIRD	Rufous Hummingbird	SERU	1

ELCA	08/16/91	BIRD	Rufous Hummingbird	SERU	1
GICE	07/30/91	BIRD	Rufous Hummingbird	SERU	1
HIDD	08/15/91	BIRD	Rufous Hummingbird	SERU	1
HOYA	08/14/91	BIRD	Rufous Hummingbird	SERU	1
HOYP	06/02/92	BIRD	Rufous Hummingbird	SERU	1
MARC	05/13/92	BIRD	Rufous Hummingbird	SERU	1
MEBL	06/30/92	BIRD	Rufous Hummingbird	SERU	1
MTKI	08/27/91	BIRD	Rufous Hummingbird	SERU	1
OARD	05/12/92	BIRD	Rufous Hummingbird	SERU	1
OARD	06/04/92	BIRD	Rufous Hummingbird	SERU	1
PRWE	05/12/92	BIRD	Rufous Hummingbird	SERU	1
BSLC	07/25/91	BIRD	Rufous-sided Towhee	PIER	2
NPMS	07/12/93	BIRD	Rufous-sided Towhee	PIER	1
OARD	05/12/92	BIRD	Rufous-sided Towhee	PIER	1
OARD	06/04/92	BIRD	Rufous-sided Towhee	PIER	1
OARD	06/09/92	BIRD	Rufous-sided Towhee	PIER	1
OARD	07/09/91	BIRD	Rufous-sided Towhee	PIER	1
OARD	09/19/91	BIRD	Rufous-sided Towhee	PIER	2
TWFL	05/12/92	BIRD	Rufous-sided Towhee	PIER	1
ZABF	07/14/92	BIRD	Rufous-sided Towhee	PIER	1
ZATF	07/14/92	BIRD	Rufous-sided Towhee	PIER	1
SABL	03/17/92	BIRD	Sage Sparrow	AMBE	1
ELCA	08/16/91	BIRD	Sage Thrasher	ORMO	1
BACA	08/16/91	BIRD	Savannah Sparrow	PASA	1
NOPA	08/26/91	BIRD	Savannah Sparrow	PASA	2
SABL	08/20/91	BIRD	Savannah Sparrow	PASA	3
NOPA	05/28/92	BIRD	Say's Phoebee	SASA	1
NOPA	08/26/91	BIRD	Say's Phoebee	SASA	1
SABL	08/27/92	BIRD	Say's Phoebee	SASA	1
SEPT	07/14/93	BIRD	Say's Phoebee	SASA	1
NOSR	09/26/91	BIRD	Scaled Quail	CASP	5
SABL	03/17/92	BIRD	Scaled Quail	CASP	2
NOPA	07/09/92	BIRD	Scott's Oriole	ICPA	1
SABL	08/20/91	BIRD	Scott's Oriole	ICPA	1
ELCA	08/16/91	BIRD	Scrub Jay	APCO	1
MARC	07/01/91	BIRD	Sharp-shinned Hawk	ACST	1
MEBL	06/30/92	BIRD	Sharp-shinned Hawk	ACST	1
MEBL	08/14/91	BIRD	Sharp-shinned Hawk	ACST	1
NOSR	08/27/91	BIRD	Sharp-shinned Hawk	ACST	1
OARD	07/09/91	BIRD	Sharp-shinned Hawk	ACST	1
PRWE	05/12/92	BIRD	Sharp-shinned Hawk	ACST	1
RASN	07/11/91	BIRD	Sharp-shinned Hawk	ACST	1
SABL	08/20/91	BIRD	Sharp-shinned Hawk	ACST	1
TWFL	05/12/92	BIRD	Sharp-shinned Hawk	ACST	1
MEBL	08/14/91	BIRD	Solitary Vireo	VISO	3
BACR	07/17/91	BIRD	Steller's Jay	CYST	5
BLTT	07/24/91	BIRD	Steller's Jay	CYST	1
BSLC	06/10/92	BIRD	Steller's Jay	CYST	1
IRIS	06/04/92	BIRD	Steller's Jay	CYST	1
LACR	06/11/92	BIRD	Steller's Jay	CYST	2
MARC	07/01/91	BIRD	Steller's Jay	CYST	3
RASN	03/17/92	BIRD	Steller's Jay	CYST	3

RASN	07/11/91	BIRD	Steller's Jay	CYST	2
NOPA	09/25/91	BIRD	Swainson's Hawk	BUSW	1
ELCA	08/16/91	BIRD	Townsend's Solitaire	MYTO	3
LOWO	05/12/92	BIRD	Townsend's Solitaire	MYTO	2
MEBL	08/14/91	BIRD	Townsend's Solitaire	MYTO	3
MTKI	07/07/92	BIRD	Townsend's Solitaire	MYTO	1
NPSS	11/17/92	BIRD	Townsend's Solitaire	MYTO	2
OARD	03/17/92	BIRD	Townsend's Solitaire	MYTO	1
OARD	09/19/91	BIRD	Townsend's Solitaire	MYTO	3
RASN	04/13/92	BIRD	Townsend's Solitaire	MYTO	2
SABL	01/11/92	BIRD	Townsend's Solitaire	MYTO	1
SABL	03/17/92	BIRD	Townsend's Solitaire	MYTO	3
SABL	08/20/91	BIRD	Townsend's Solitaire	MYTO	2
SABL	11/17/92	BIRD	Townsend's Solitaire	MYTO	3
CO42	07/31/91	BIRD	Tree Swallow	TABI	3
SABL	08/20/91	BIRD	Tree Swallow	TABI	2
BACR	07/17/91	BIRD	Turkey Vulture	CAAU	2
BLTT	07/24/91	BIRD	Turkey Vulture	CAAU	3
HAFE	07/09/91	BIRD	Turkey Vulture	CAAU	1
HIDD	08/15/91	BIRD	Turkey Vulture	CAAU	2
LOWO	05/12/92	BIRD	Turkey Vulture	CAAU	2
MARC	07/01/91	BIRD	Turkey Vulture	CAAU	2
NAKI	06/16/92	BIRD	Turkey Vulture	CAAU	2
NATH	06/16/92	BIRD	Turkey Vulture	CAAU	4
NOPA	08/26/91	BIRD	Turkey Vulture	CAAU	2
OFSW	07/14/93	BIRD	Turkey Vulture	CAAU	1
RASN	04/13/92	BIRD	Turkey Vulture	CAAU	1
SABL	05/28/92	BIRD	Turkey Vulture	CAAU	2
ALBA	06/04/92	BIRD	Vesper Sparrow	POGR	3
BACA	08/16/91	BIRD	Vesper Sparrow	POGR	3
CO42	07/31/91	BIRD	Vesper Sparrow	POGR	5
MCSW	07/07/92	BIRD	Vesper Sparrow	POGR	2
NOPA	01/11/92	BIRD	Vesper Sparrow	POGR	30
NOPA	07/09/92	BIRD	Vesper Sparrow	POGR	4
NOPA	08/26/91	BIRD	Vesper Sparrow	POGR	12
NOPA	09/25/91	BIRD	Vesper Sparrow	POGR	12
NOSR	07/07/92	BIRD	Vesper Sparrow	POGR	2
OFSW	07/07/92	BIRD	Vesper Sparrow	POGR	4
OFSW	07/14/93	BIRD	Vesper Sparrow	POGR	2
OLBA	07/12/93	BIRD	Vesper Sparrow	POGR	4
PRWE	06/02/92	BIRD	Vesper Sparrow	POGR	3
REND	04/13/92	BIRD	Vesper Sparrow	POGR	4
SABL	08/20/91	BIRD	Vesper Sparrow	POGR	5
SEPT	09/25/91	BIRD	Vesper Sparrow	POGR	5
ZATH	01/11/92	BIRD	Vesper Sparrow	POGR	10
ZATH	06/09/92	BIRD	Vesper Sparrow	POGR	4
APCO	06/16/92	BIRD	Violet-green Swallow	TATH	5
BACA	08/16/91	BIRD	Violet-green Swallow	TATH	2
BACR	07/17/91	BIRD	Violet-green Swallow	TATH	20
BHBF	07/01/92	BIRD	Violet-green Swallow	TATH	4
BIHO	07/01/92	BIRD	Violet-green Swallow	TATH	2
BLTT	07/24/91	BIRD	Violet-green Swallow	TATH	8

BSLC	07/25/91	BIRD	Violet-green Swallow	TATH	8
CAND	05/12/92	BIRD	Violet-green Swallow	TATH	5
CEBA	07/15/92	BIRD	Violet-green Swallow	TATH	3
CEEN	05/12/92	BIRD	Violet-green Swallow	TATH	8
CJPA	06/04/92	BIRD	Violet-green Swallow	TATH	2
ELCA	08/16/91	BIRD	Violet-green Swallow	TATH	5
FERN	07/31/91	BIRD	Violet-green Swallow	TATH	3
HAFE	07/09/91	BIRD	Violet-green Swallow	TATH	2
HIDD	07/01/92	BIRD	Violet-green Swallow	TATH	3
LACR	06/11/92	BIRD	Violet-green Swallow	TATH	3
LOME	08/21/91	BIRD	Violet-green Swallow	TATH	4
LOWO	05/12/92	BIRD	Violet-green Swallow	TATH	7
MARC	05/13/92	BIRD	Violet-green Swallow	TATH	4
MARC	07/01/91	BIRD	Violet-green Swallow	TATH	6
MEBL	05/12/92	BIRD	Violet-green Swallow	TATH	7
MEBL	06/30/92	BIRD	Violet-green Swallow	TATH	11
MEBL	08/14/91	BIRD	Violet-green Swallow	TATH	8
MTKI	07/07/92	BIRD	Violet-green Swallow	TATH	5
NOPA	08/26/91	BIRD	Violet-green Swallow	TATH	10
NOSR	07/07/92	BIRD	Violet-green Swallow	TATH	8
NTKI	07/07/92	BIRD	Violet-green Swallow	TATH	2
OARD	06/09/92	BIRD	Violet-green Swallow	TATH	8
OARD	07/09/91	BIRD	Violet-green Swallow	TATH	3
PRWE	06/02/92	BIRD	Violet-green Swallow	TATH	6
RASN	07/11/91	BIRD	Violet-green Swallow	TATH	6
SEPT	09/25/91	BIRD	Violet-green Swallow	TATH	4
TWFL	05/12/92	BIRD	Violet-green Swallow	TATH	2
ZAKI	06/09/92	BIRD	Violet-green Swallow	TATH	5
ZATF	07/14/92	BIRD	Violet-green Swallow	TATH	3
ZATH	06/09/92	BIRD	Violet-green Swallow	TATH	6
MARC	05/13/92	BIRD	Virgina's Warbler	VEVI	1
OARD	06/04/92	BIRD	Virgina's Warbler	VEVI	1
ALBA	06/04/92	BIRD	Western Bluebird	SIME	4
BACA	08/16/91	BIRD	Western Bluebird	SIME	4
BHBF	07/01/92	BIRD	Western Bluebird	SIME	2
BIHO	07/01/92	BIRD	Western Bluebird	SIME	2
BLTT	07/24/91	BIRD	Western Bluebird	SIME	3
BRWI	07/16/91	BIRD	Western Bluebird	SIME	5
BSLC	07/25/91	BIRD	Western Bluebird	SIME	2
CEEN	05/12/92	BIRD	Western Bluebird	SIME	2
CJPA	06/04/92	BIRD	Western Bluebird	SIME	2
CO42	03/17/92	BIRD	Western Bluebird	SIME	3
CO42	07/12/93	BIRD	Western Bluebird	SIME	2
CO42	07/31/91	BIRD	Western Bluebird	SIME	5
ELCA	08/16/91	BIRD	Western Bluebird	SIME	2
HIDD	07/01/92	BIRD	Western Bluebird	SIME	3
HIDD	08/15/91	BIRD	Western Bluebird	SIME	4
HOYA	08/14/91	BIRD	Western Bluebird	SIME	2
HOYP	06/02/92	BIRD	Western Bluebird	SIME	2
LICO	07/16/91	BIRD	Western Bluebird	SIME	3
MARC	07/01/91	BIRD	Western Bluebird	SIME	3
MEBL	06/30/92	BIRD	Western Bluebird	SIME	1

MEBL	08/14/91	BIRD	Western Bluebird	SIME	4
MTKI	07/07/92	BIRD	Western Bluebird	SIME	3
MTKI	08/27/91	BIRD	Western Bluebird	SIME	6
NAKI	06/16/92	BIRD	Western Bluebird	SIME	1
NATH	06/16/92	BIRD	Western Bluebird	SIME	2
NOPA	08/26/91	BIRD	Western Bluebird	SIME	3
NOSR	07/07/92	BIRD	Western Bluebird	SIME	2
NPSS	03/08/93	BIRD	Western Bluebird	SIME	3
OARD	06/04/92	BIRD	Western Bluebird	SIME	2
OARD	06/09/92	BIRD	Western Bluebird	SIME	2
OARD	07/09/91	BIRD	Western Bluebird	SIME	3
OLBA	07/12/93	BIRD	Western Bluebird	SIME	1
PRWE	05/12/92	BIRD	Western Bluebird	SIME	1
SABL	01/11/92	BIRD	Western Bluebird	SIME	6
SABL	03/08/93	BIRD	Western Bluebird	SIME	5
SABL	03/17/92	BIRD	Western Bluebird	SIME	7
SABL	08/20/91	BIRD	Western Bluebird	SIME	2
SABL	11/17/92	BIRD	Western Bluebird	SIME	4
SEPT	09/25/91	BIRD	Western Bluebird	SIME	3
STCO	06/16/92	BIRD	Western Bluebird	SIME	2
STKI	07/07/92	BIRD	Western Bluebird	SIME	3
ZATF	07/13/93	BIRD	Western Bluebird	SIME	2
ZATH	01/11/92	BIRD	Western Bluebird	SIME	5
ZATH	03/17/92	BIRD	Western Bluebird	SIME	4
CEEN	05/12/92	BIRD	Western Kingbird	TYVE	1
CO42	07/31/91	BIRD	Western Kingbird	TYVE	2
MEBL	05/12/92	BIRD	Western Kingbird	TYVE	1
PRWE	06/02/92	BIRD	Western Kingbird	TYVE	1
NOPA	08/26/91	BIRD	Western Meadowlark	STNE	3
PRWE	05/12/92	BIRD	Western Meadowlark	STNE	3
BIHO	07/01/92	BIRD	Western Tanager	PILU	3
BLTT	07/24/91	BIRD	Western Tanager	PILU	1
CEBA	07/15/92	BIRD	Western Tanager	PILU	1
MEBL	06/30/92	BIRD	Western Tanager	PILU	1
OARD	06/04/92	BIRD	Western Tanager	PILU	2
OARD	06/09/92	BIRD	Western Tanager	PILU	2
OARD	07/09/91	BIRD	Western Tanager	PILU	2
OARD	08/26/92	BIRD	Western Tanager	PILU	1
ZATF	07/14/92	BIRD	Western Tanager	PILU	1
ZATH	06/09/92	BIRD	Western Tanager	PILU	1
BACR	07/17/91	BIRD	Western Wood-Pewee	COSO	2
BHBF	07/01/92	BIRD	Western Wood-Pewee	COSO	1
BLTT	07/12/93	BIRD	Western Wood-Pewee	COSO	1
BLTT	07/24/91	BIRD	Western Wood-Pewee	COSO	3
BRAI	07/12/93	BIRD	Western Wood-Pewee	COSO	1
BTKI	07/31/91	BIRD	Western Wood-Pewee	COSO	1
CAND	05/12/92	BIRD	Western Wood-Pewee	COSO	1
CJPA	06/04/92	BIRD	Western Wood-Pewee	COSO	1
CO42	07/12/93	BIRD	Western Wood-Pewee	COSO	1
ELCA	08/16/91	BIRD	Western Wood-Pewee	COSO	1
ERHO	07/07/92	BIRD	Western Wood-Pewee	COSO	1
FERN	07/31/91	BIRD	Western Wood-Pewee	COSO	2

HIDD	07/01/92	BIRD	Western Wood-Pewee	COSO	1
HIDD	08/15/91	BIRD	Western Wood-Pewee	COSO	1
HOYA	08/14/91	BIRD	Western Wood-Pewee	COSO	2
HOYP	06/02/92	BIRD	Western Wood-Pewee	COSO	2
IRIS	06/04/92	BIRD	Western Wood-Pewee	COSO	1
MEBL	06/30/92	BIRD	Western Wood-Pewee	COSO	2
MTKI	07/07/92	BIRD	Western Wood-Pewee	COSO	1
NATH	06/16/92	BIRD	Western Wood-Pewee	COSO	1
NOSR	07/07/92	BIRD	Western Wood-Pewee	COSO	3
OARD	06/04/92	BIRD	Western Wood-Pewee	COSO	2
OARD	06/09/92	BIRD	Western Wood-Pewee	COSO	1
TWFL	05/12/92	BIRD	Western Wood-Pewee	COSO	2
ZAKI	06/09/92	BIRD	Western Wood-Pewee	COSO	1
ZATH	06/09/92	BIRD	Western Wood-Pewee	COSO	2
BACR	07/17/91	BIRD	White-breasted Nuthatch	SICAR	2
BLTT	07/24/91	BIRD	White-breasted Nuthatch	SICAR	1
CAND	05/12/92	BIRD	White-breasted Nuthatch	SICAR	1
CO42	03/17/92	BIRD	White-breasted Nuthatch	SICAR	1
HOYA	08/14/91	BIRD	White-breasted Nuthatch	SICAR	1
MEBL	05/12/92	BIRD	White-breasted Nuthatch	SICAR	1
MEBL	06/30/92	BIRD	White-breasted Nuthatch	SICAR	1
MEBL	08/14/91	BIRD	White-breasted Nuthatch	SICAR	1
NOSR	07/07/92	BIRD	White-breasted Nuthatch	SICAR	1
NOSR	08/27/91	BIRD	White-breasted Nuthatch	SICAR	1
NPSS	07/12/93	BIRD	White-breasted Nuthatch	SICAR	1
NPSS	08/18/93	BIRD	White-breasted Nuthatch	SICAR	1
OARD	06/09/92	BIRD	White-breasted Nuthatch	SICAR	1
RASN	03/17/92	BIRD	White-breasted Nuthatch	SICAR	1
ZABF	07/14/92	BIRD	White-breasted Nuthatch	SICAR	1
NOPA	05/28/92	BIRD	White-crowned sparrow	ZOLE	2
OS58	04/19/93	BIRD	White-faced Ibis	PLCH	6
BACR	07/17/91	BIRD	White-throated Swift	AESA	2
LOWO	05/12/92	BIRD	White-throated Swift	AESA	6
MTKI	07/07/92	BIRD	White-throated Swift	AESA	6
MTKI	08/27/91	BIRD	White-throated Swift	AESA	3
SABL	05/28/92	BIRD	White-throated Swift	AESA	7
SABL	08/20/91	BIRD	White-throated Swift	AESA	10
HIDD	07/01/92	BIRD	Wild Turkey	MEGA	1
MEBL	05/12/92	BIRD	Wild Turkey	MEGA	2
MTKI	08/27/91	BIRD	Wild Turkey	MEGA	1
OS12	06/10/92	BIRD	Wild Turkey	MEGA	1
REND	04/13/92	BIRD	Wild Turkey	MEGA	1
REND	06/10/92	BIRD	Wild Turkey	MEGA	1
BACA	08/16/91	BIRD	Wilson's Warbler	WIPU	1
NOSR	08/27/91	BIRD	Yellow Warbler	DEPE	1
OARD	07/09/91	BIRD	Yellow-bellied Sapsucker	SPVA	1
ELCA	08/16/91	BIRD	Yellow-rumped Warbler	DECO	4
OARD	09/19/91	BIRD	Yellow-rumped Warbler	DECO	2
OFSW	07/07/92	MAMM	Bannertail Kangaroo Rat	DISP	N/A
OS57	06/16/93	MAMM	Big Brown Bat	EPFU	3
NOSR	07/07/92	MAMM	Black-tailed Jackrabbit	LECA	1
OS16	08/26/92	MAMM	Black-tailed Jackrabbit	LECA	1

OS20	11/17/92	MAMM	Black-tailed Jackrabbit	LECA	1
OS21	03/08/93	MAMM	Black-tailed Jackrabbit	LECA	2
SEPT	07/14/93	MAMM	Black-tailed Jackrabbit	LECA	1
BACR	07/17/91	MAMM	Botta's Pocket Gopher	THBO	NA
CO42	07/31/91	MAMM	Botta's Pocket Gopher	THBO	NA
ELCA	08/16/91	MAMM	Botta's Pocket Gopher	THBO	NA
MARC	07/01/91	MAMM	Botta's Pocket Gopher	THBO	NA
MEBL	08/14/91	MAMM	Botta's Pocket Gopher	THBO	NA
NOPA	08/26/91	MAMM	Botta's Pocket Gopher	THBO	NA
NOSR	08/27/91	MAMM	Botta's Pocket Gopher	THBO	NA
OARD	07/09/91	MAMM	Botta's Pocket Gopher	THBO	NA
OARD	09/19/91	MAMM	Botta's Pocket Gopher	THBO	NA
OS42	09/25/92	MAMM	Botta's Pocket Gopher	THBO	1
SEPT	09/25/91	MAMM	Botta's Pocket Gopher	THBO	NA
CEBA	07/26/91	MAMM	Brush Mouse	PEBO	1
OARD	07/26/91	MAMM	Brush Mouse	PEBO	2
OS36	09/25/92	MAMM	Brush Mouse	PEBO	1
OS53	06/16/93	MAMM	California Myotis	MYCA	3
OS54	06/16/93	MAMM	Cave Myotis	MYVE	3
BSLC	07/15/92	MAMM	Cliff Chipmunk	EUDO	.1
BSLC	07/25/91	MAMM	Cliff Chipmunk	EUDO	1
CAND	07/17/91	MAMM	Cliff Chipmunk	EUDO	2
LICO	07/16/91	MAMM	Cliff Chipmunk	EUDO	1
MEBL	08/14/91	MAMM	Cliff Chipmunk	EUDO	2
MTKI	08/27/91	MAMM	Cliff Chipmunk	EUDO	3
NOSR	07/07/92	MAMM	Cliff Chipmunk	EUDO	1
OS48	09/25/92	MAMM	Cliff Chipmunk	EUDO	2
APCO	06/16/92	MAMM	Colorado Chipmunk	EUQU	1
BACA	08/16/91	MAMM	Colorado Chipmunk	EUQU	2
BACR	07/17/91	MAMM	Colorado Chipmunk	EUQU	3
BHBF	07/01/92	MAMM	Colorado Chipmunk	EUQU	1
BSLC	07/25/91	MAMM	Colorado Chipmunk	EUQU	1
CAND	07/17/91	MAMM	Colorado Chipmunk	EUQU	12
CJPA	06/04/92	MAMM	Colorado Chipmunk	EUQU	3
ELCA	08/16/91	MAMM	Colorado Chipmunk	EUQU	4
ERHO	07/07/92	MAMM	Colorado Chipmunk	EUQU	2
HIDD	08/15/91	MAMM	Colorado Chipmunk	EUQU	5
HOYA	08/14/91	MAMM	Colorado Chipmunk	EUQU	6
ICEP	07/31/91	MAMM	Colorado Chipmunk	EUQU	2
MARC	07/01/91	MAMM	Colorado Chipmunk	EUQU	2
MARC	07/15/92	MAMM	Colorado Chipmunk	EUQU	1
MEBL	08/14/91	MAMM	Colorado Chipmunk	EUQU	5
MTKI	07/07/92	MAMM	Colorado Chipmunk	EUQU	3
NACO	06/16/92	MAMM	Colorado Chipmunk	EUQU	4
NAKI	06/16/92	MAMM	Colorado Chipmunk	EUQU	1
NATH	06/16/92	MAMM	Colorado Chipmunk	EUQU	3
NOSR	07/07/92	MAMM	Colorado Chipmunk	EUQU	4
NOSR	08/27/91	MAMM	Colorado Chipmunk	EUQU	4
NOSR	08/27/91	MAMM	Colorado Chipmunk	EUQU	4
NPSS	07/12/93	MAMM	Colorado Chipmunk	EUQU	2
NSBR	07/31/91	MAMM	Colorado Chipmunk	EUQU	3
OARD	06/04/92	MAMM	Colorado Chipmunk	EUQU	3

RASN	07/15/92	MAMM	Colorado Chipmunk	EUQU	3
ZABF	07/14/92	MAMM	Colorado Chipmunk	EUQU	2
BLTT	07/12/93	MAMM	Cottontail Rabbit	SYNU	1
CEBA	07/15/92	MAMM	Cottontail Rabbit	SYNU	1
CO42	07/12/93	MAMM	Cottontail Rabbit	SYNU	2
CO42	07/31/91	MAMM	Cottontail Rabbit	SYNU	1
ELCA	08/16/91	MAMM	Cottontail Rabbit	SYNU	2
ICEP	07/31/91	MAMM	Cottontail Rabbit	SYNU	1
MARC3	07/03/91	MAMM	Cottontail Rabbit	SYNU	1
MTKI	07/07/92	MAMM	Cottontail Rabbit	SYAU	2
NACO	06/16/92	MAMM	Cottontail Rabbit	SYAU	1
NAKI	06/16/92	MAMM	Cottontail Rabbit	SYAU	2
NOPA	05/28/92	MAMM	Cottontail Rabbit	SYAU	4
NOPA	08/26/91	MAMM	Cottontail Rabbit	SYAU	2
NOSR	08/27/91	MAMM	Cottontail Rabbit	SYAU	2
NPSS	07/12/93	MAMM	Cottontail Rabbit	SYAU	3
NPSS	08/18/93	MAMM	Cottontail Rabbit	SYAU	1
NTKI	07/07/92	MAMM	Cottontail Rabbit	SYAU	1
OARD	03/17/92	MAMM	Cottontail Rabbit	SYNU	1
OLBA	07/12/93	MAMM	Cottontail Rabbit	SYAU	1
OS49	09/25/92	MAMM	Cottontail Rabbit	SYAU	1
SABL	08/20/91	MAMM	Cottontail Rabbit	SYAU	2
SEPT	09/25/91	MAMM	Cottontail Rabbit	SYAU	1
STKI	07/07/92	MAMM	Cottontail Rabbit	SYAU	1
ZATF	07/13/93	MAMM	Cottontail Rabbit	SYAU	1
BLTT	07/24/91	MAMM	Coyote	CALA	3
CO42	07/31/91	MAMM	Coyote	CALA	1
HOYP	06/02/92	MAMM	Coyote	CALA	1
MCSW	07/07/92	MAMM	Coyote	CALA	1
MEBL	08/14/91	MAMM	Coyote	CALA	2
NOPA	08/26/91	MAMM	Coyote	CALA	2
NOSR	08/27/91	MAMM	Coyote	CALA	1
PRWE	05/12/92	MAMM	Coyote	CALA	1
SEPT	07/14/93	MAMM	Coyote	CALA	1
BACA	09/25/92	MAMM	Deer Mouse	PEMA	5
BLTT	07/25/91	MAMM	Deer Mouse	PEMA	4
BSLC	07/30/91	MAMM	Deer Mouse	PEMA	2
CEBA	07/26/91	MAMM	Deer Mouse	PEMA	2
MARC	07/01/91	MAMM	Deer Mouse	PEMA	4
MEBL	08/15/91	MAMM	Deer Mouse	PEMA	1
NATH	06/16/92	MAMM	Deer Mouse	PEMA	3
NOMC	08/21/91	MAMM	Deer Mouse	PEMA	1
NOSR	08/27/91	MAMM	Deer Mouse	PEMA	2
NPMC	08/27/91	MAMM	Deer Mouse	PEMA	1
NPSS	08/18/93	MAMM	Deer Mouse	PEMA	1
OARD	07/26/91	MAMM	Deer Mouse	PEMA	2
OS38	09/25/92	MAMM	Deer Mouse	PEMA	2
OS47	09/25/92	MAMM	Deer Mouse	PEMA	1
SABL	08/21/91	MAMM	Deer Mouse	PEMA	3
NOMC	07/08/92	MAMM	Deer Mouse	PEMA	1
MARC	09/18/91	MAMM	Dwarf Shrew	SONA	2
OS24	03/08/93	MAMM	Grey Fox	URCI	1

OS56	06/16/93	MAMM	Long-eared Bat	MYVO	4
BACA	09/25/92	MAMM	Mexican Freetail Bat	TABR	19
MARC	07/01/91	MAMM	Mexican Woodrat	NEME	3
OS39	09/25/92	MAMM	Mexican Woodrat	NEME	4
BACA	09/25/92	MAMM	Mexican woodrat	NEME	2
OS14	07/15/92	MAMM	Mountain Lion	FECO	2
BACR	07/17/91	MAMM	Mule Deer	ODHE	1
BLTT	05/12/92	MAMM	Mule Deer	ODHE	6
BLTT	07/24/91	MAMM	Mule Deer	ODHE	1
CJPA	06/04/92	MAMM	Mule Deer	ODHE	1
MCSW	07/07/92	MAMM	Mule Deer	ODHE	1
MEBL	05/12/92	MAMM	Mule Deer	ODHE	3
MEBL	08/14/91	MAMM	Mule Deer	ODHE	2
MTKI	07/07/92	MAMM	Mule Deer	ODHE	2
NOPA	08/26/91	MAMM	Mule Deer	ODHE	1
NOSR	08/27/91	MAMM	Mule Deer	ODHE	2
OARD	07/09/91	MAMM	Mule Deer	ODHE	5
OARD	09/19/91	MAMM	Mule Deer	ODHE	2
OS11	05/12/92	MAMM	Mule Deer	ODHE	6
NOPA	08/18/93	MAMM	Ord's Kangaroo Rat	DIOR	1
NPSS	08/24/93	MAMM	Ord's Kangaroo Rat	DIOR	2
OS17	08/27/92	MAMM	Ord's Kangaroo Rat	DIOR	1
OS29	07/12/93	MAMM	Ord's Kangaroo Rat	DIOR	1
BACA	09/25/92	MAMM	Pinon Mouse	PETR	2
BLTT	07/25/91	MAMM	Pinon Mouse	PETR	3
CEBA	07/26/91	MAMM	Pinon Mouse	PETR	4
HAFE	07/11/91	MAMM	Pinon Mouse	PETR	1
HOYA	08/15/91	MAMM	Pinon Mouse	PETR	1
MEBL	08/15/91	MAMM	Pinon Mouse	PETR	3
NATH	06/16/92	MAMM	Pinon Mouse	PETR	2
NOMC	07/08/92	MAMM	Pinon Mouse	PETR	1
NOMC	08/21/91	MAMM	Pinon Mouse	PETR	2
NOPA	08/26/91	MAMM	Pinon Mouse	PETR	1
NOSR	08/27/91	MAMM	Pinon Mouse	PETR	2
NPMC	08/27/91	MAMM	Pinon Mouse	PETR	2
NPSS	08/18/93	MAMM	Pinon Mouse	PETR	1
OARD	07/26/91	MAMM	Pinon Mouse	PETR	2
OS46	09/25/92	MAMM	Pinon Mouse	PETR	1
OS50	09/25/92	MAMM	Pinon Mouse	PETR	1
RASN	07/11/91	MAMM	Pinon Mouse	PETR	1
SABL	08/21/91	MAMM	Pinon Mouse	PETR	5
MCSW	07/07/92	MAMM	Porcupine	ERDO	1
OS27	07/12/93	MAMM	Porcupine	ERDO	1
OLBA	09/25/92	MAMM	Pronghorn Antelope	ANAM	6
PRWE	05/12/92	MAMM	Pronghorn Antelope	ANAM	3
PRWE	06/02/92	MAMM	Pronghorn Antelope	ANAM	2
BACA	09/25/92	MAMM	Rock Mouse	PETR	5
NOMC	07/08/92	MAMM	Rock Mouse	PETR	2
NOMC	08/21/91	MAMM	Rock Mouse	PETR	2
OARD	07/26/91	MAMM	Rock Mouse	PETR	3
OS37	09/25/92	MAMM	Rock Mouse	PETR	15
OS44	09/25/92	MAMM	Rock Mouse	PETR	1

OS51	09/25/92	MAMM	Rock Mouse	PETR	1
RASN	07/11/91	MAMM	Rock Mouse	PETR	2
SABL	08/21/91	MAMM	Rock Mouse	PETR	3
BACR	07/17/91	MAMM	Rock Squirrel	CIVA	1
BRAI	07/12/93	MAMM	Rock Squirrel	CIVA	2
BSLC	07/15/92	MAMM	Rock Squirrel	CIVA	1
CAND	07/17/91	MAMM	Rock Squirrel	CIVA	2
CJPA	06/04/92	MAMM	Rock Squirrel	CIVA	2
CO42	07/12/93	MAMM	Rock Squirrel	CIVA	1
GICE	07/30/91	MAMM	Rock Squirrel	CIVA	1
ICEP	07/31/91	MAMM	Rock Squirrel	CIVA	2
INWA	07/10/91	MAMM	Rock Squirrel	CIVA	2
MARC	06/11/92	MAMM	Rock Squirrel	CIVA	2
MARC	07/01/91	MAMM	Rock Squirrel	CIVA	1
MARC	07/15/92	MAMM	Rock Squirrel	CIVA	1
MEBL	06/30/92	MAMM	Rock Squirrel	CIVA	2
MEBL	08/14/91	MAMM	Rock Squirrel	CIVA	2
MTKI	08/27/91	MAMM	Rock Squirrel	CIVA	1
NACO	06/16/92	MAMM	Rock Squirrel	CIVA	1
NATH	06/16/92	MAMM	Rock Squirrel	CIVA	1
NPSS	07/12/93	MAMM	Rock Squirrel	CIVA	1
OARD	06/04/92	MAMM	Rock Squirrel	CIVA	1
OS23	03/08/93	MAMM	Rock Squirrel	CIVA	1
STCO	06/16/92	MAMM	Rock Squirrel	CIVA	1
ZABF	07/14/92	MAMM	Rock Squirrel	CIVA	1
ZATF	06/18/92	MAMM	Rock Squirrel	CIVA	1
NOPA	08/18/93	MAMM	Silky Pocket Mouse	PEFL	1
NOPA	08/26/91	MAMM	Silky Pocket Mouse	PEFL	1
NPSS	09/30/92	MAMM	Silky Pocket Mouse	PEFL	1
OLBA	09/30/92	MAMM	Silky Pocket Mouse	PEFL	1
SABL	09/19/91	MAMM	Silky Pocket Mouse	PEFL	1
OS55	06/16/93	MAMM	Silver Haired Bat	LANO	1
CAND	07/17/91	MAMM	Tassel-eared Squirrel	SCAB	1
MTKI	08/27/91	MAMM	Tassel-eared Squirrel	SCAB	1
OARD	06/04/92	MAMM	Tassel-eared Squirrel	SCAB	1
OARD	09/19/91	MAMM	Tassel-eared Squirrel	SCAB	1
BACA	09/25/92	MAMM	Western Big-eared Bat	PLTO	1
OS43	09/25/92	MAMM	Western Harvest Mouse	REME	1
SABL	09/19/91	MAMM	Western Harvest Mouse	REME	1
BACA	09/25/92	MAMM	White-footed Mouse	PELE	1
BLTT	07/25/91	MAMM	White-footed Mouse	PELE	2
NATH	06/16/92	MAMM	White-footed Mouse	PELE	1
NOPA	08/26/91	MAMM	White-footed Mouse	PELE	2
OARD	07/26/91	MAMM	White-footed Mouse	PELE	1
OS41	09/25/92	MAMM	White-footed Mouse	PELE	1
SABL	08/21/91	MAMM	White-footed Mouse	PELE	2
NOPA	08/26/91	MAMM	Whitetail Prairie Dog	CYGU	25
NTKI	07/07/92	MAMM	Whitetail Prairie Dog	CYGU	1
OS01	08/13/91	MAMM	Whitetail Prairie Dog	CYGU	100
OS02	08/26/91	MAMM	Whitetail Prairie Dog	CYGU	25
OS07	09/25/91	MAMM	Whitetail Prairie Dog	CYGU	25
OS09	03/17/92	MAMM	Whitetail Prairie Dog	CYGU	3

OS10	05/12/92	MAMM	Whitetail Prairie Dog	CYGU	150
OS22	03/08/93	MAMM	Whitetail Prairie Dog	CYGU	3
OS26	03/08/93	MAMM	Whitetail Prairie Dog	CYGU	5
PRWE	05/12/92	MAMM	Whitetail Prairie Dog	CYGU	500
PRWE	06/02/92	MAMM	Whitetail Prairie Dog	CYGU	300
ZATH	03/17/92	MAMM	Whitetail Prairie Dog	CYGU	6
OS40	09/25/92	MAMM	Whitethroated Woodrat	NEAL	2
OS45	09/25/92	MAMM	Whitethroated Woodrat	NEAL	3
OS52	09/25/92	MAMM	Whitethroated Woodrat	NEAL	1
BACA	08/16/91	MAMM	Woodrat	NEOT	NA
BRWI	07/16/91	MAMM	Woodrat	NEOT	NA
BSLC	07/25/91	MAMM	Woodrat	NEOT	NA
FOUR	07/29/91	MAMM	Woodrat	NEOT	NA
HAFE	07/09/91	MAMM	Woodrat	NEOT	NA
HIDD	08/15/91	MAMM	Woodrat	NEOT	NA
HOYA	08/14/91	MAMM	Woodrat	NEOT	NA
ICEP	07/31/91	MAMM	Woodrat	NEOT	NA
INWA	07/10/91	MAMM	Woodrat	NEOT	NA
LICO	07/16/91	MAMM	Woodrat	NEOT	NA
MARC	07/01/91	MAMM	Woodrat	NEOT	NA
MARC4	07/03/91	MAMM	Woodrat	NEOT	NA
MARC5	07/03/91	MAMM	Woodrat	NEOT	NA
MTKI	08/27/91	MAMM	Woodrat	NEOT	NA
NOSR	08/27/91	MAMM	Woodrat	NEOT	NA
NSBR	07/31/91	MAMM	Woodrat	NEOT	NA
RASN	07/11/91	MAMM	Woodrat	NEOT	NA
SABL	08/20/91	MAMM	Woodrat	NEOT	NA
SUBR	07/30/91	MAMM	Woodrat	NEOT	NA
TRIA	07/11/91	MAMM	Woodrat	NEOT	NA
ZUNI	07/16/91	MAMM	Woodrat	NEOT	NA
SABL	08/20/91	REPT	Chihuahuan Spotted Whiptail	CNEX	2
ZATH	08/26/92	REPT	Collared Lizard	CRCO	1
ACOM	07/16/91	REPT	Eastern Fence Lizard	SCUN	1
APCO	06/16/92	REPT	Eastern Fence Lizard	SCUN	2
BACA	08/16/91	REPT	Eastern Fence Lizard	SCUN	2
BACR	07/17/91	REPT	Eastern Fence Lizard	SCUN	8
BHBF	07/01/92	REPT	Eastern Fence Lizard	SCUN	2
BIHO	07/01/92	REPT	Eastern Fence Lizard	SCUN	2
BLTT	07/24/91	REPT	Eastern Fence Lizard	SCUN	5
BRAI	07/12/93	REPT	Eastern Fence Lizard	SCUN	2
BRWI	07/16/91	REPT	Eastern Fence Lizard	SCUN	2
BSLC	06/10/92	REPT	Eastern Fence Lizard	SCUN	2
BSLC	07/15/92	REPT	Eastern Fence Lizard	SCUN	2
BSLC	07/25/91	REPT	Eastern Fence Lizard	SCUN	5
BTKI	07/31/91	REPT	Eastern Fence Lizard	SCUN	1
CEEN	05/12/92	REPT	Eastern Fence Lizard	SCUN	4
CJPA	06/04/92	REPT	Eastern Fence Lizard	SCUN	3
CO42	07/31/91	REPT	Eastern Fence Lizard	SCUN	3
ELCA	08/16/91	REPT	Eastern Fence Lizard	SCUN	4
ERHO	07/07/92	REPT	Eastern Fence Lizard	SCUN	5
FERN	07/31/91	REPT	Eastern Fence Lizard	SCUN	3
FOUR	07/29/91	REPT	Eastern Fence Lizard	SCUN	2

HAFE	07/09/91	REPT	Eastern Fence Lizard	SCUN	2
HAFE	07/15/92	REPT	Eastern Fence Lizard	SCUN	1
HIDD	07/01/92	REPT	Eastern Fence Lizard	SCUN	2
HIDD	08/15/91	REPT	Eastern Fence Lizard	SCUN	5
HOSW	07/14/93	REPT	Eastern Fence Lizard	SCUN	2
HOYA	08/14/91	REPT	Eastern Fence Lizard	SCUN	12
HOYP	06/02/92	REPT	Eastern Fence Lizard	SCUN	3
INWA	07/10/91	REPT	Eastern Fence Lizard	SCUN	2
IRIS	06/04/92	REPT	Eastern Fence Lizard	SCUN	2
LOME	08/21/91	REPT	Eastern Fence Lizard	SCUN	2
LOWO	05/12/92	REPT	Eastern Fence Lizard	SCUN	3
MARC	04/13/92	REPT	Eastern Fence Lizard	SCUN	1
MARC	05/13/92	REPT	Eastern Fence Lizard	SCUN	4
MARC	07/01/91	REPT	Eastern Fence Lizard	SCUN	12
MEBL	05/12/92	REPT	Eastern Fence Lizard	SCUN	3
MEBL	08/14/91	REPT	Eastern Fence Lizard	SCUN	4
MTKI	07/07/92	REPT	Eastern Fence Lizard	SCUN	4
MTKI	08/27/91	REPT	Eastern Fence Lizard	SCUN	3
NOMC	08/21/91	REPT	Eastern Fence Lizard	SCUN	4
NOSR	07/07/92	REPT	Eastern Fence Lizard	SCUN	6
NOSR	08/27/91	REPT	Eastern Fence Lizard	SCUN	5
NPMS	07/12/93	REPT	Eastern Fence Lizard	SCUN	4
NSBR	07/31/91	REPT	Eastern Fence Lizard	SCUN	4
RASN	03/17/92	REPT	Eastern Fence Lizard	SCUN	4
RASN	04/13/92	REPT	Eastern Fence Lizard	SCUN	2
RASN	07/11/91	REPT	Eastern Fence Lizard	SCUN	12
RASN	07/15/92	REPT	Eastern Fence Lizard	SCUN	2
SABL	03/17/92	REPT	Eastern Fence Lizard	SCUN	2
SABL	08/20/91	REPT	Eastern Fence Lizard	SCUN	8
STKI	07/07/92	REPT	Eastern Fence Lizard	SCUN	1
SUBR	07/31/91	REPT	Eastern Fence Lizard	SCUN	4
ZABF	07/14/92	REPT	Eastern Fence Lizard	SCUN	2
ZABF	07/14/92	REPT	Eastern Fence Lizard	SCUN	2
ZATF	06/18/92	REPT	Eastern Fence Lizard	SCUN	2
ZATF	07/13/93	REPT	Eastern Fence Lizard	SCUN	2
ZATF	07/14/92	REPT	Eastern Fence Lizard	SCUN	3
ZATH	07/14/92	REPT	Eastern Fence Lizard	SCUN	1
ZUNI	07/16/91	REPT	Eastern Fence Lizard	SCUN	3
NOPA	08/26/91	REPT	Gopher Snake	PIME	1
OS03	08/27/91	REPT	Gopher Snake	PIME	1
OS18	08/27/92	REPT	Gopher Snake	PIME	1
OS32	08/18/93	REPT	Gopher Snake	PIME	1
MARC	05/13/92	REPT	Great Plains Skink	EUOB	2
NOMC	09/19/91	REPT	Great Plains Skink	EUOB	1
OFSW	04/20/93	REPT	Lesser Earless Lizard	HOMA	3
OFSW	07/07/92	REPT	Lesser Earless Lizard	HOMA	1
OFSW	07/14/93	REPT	Lesser Earless Lizard	HOMA	5
SEPT	09/25/91	REPT	Lesser Earless Lizard	HOMA	1
MARC	07/01/91	REPT	Many-lined Skink	EUMU	1
MARC	09/19/91	REPT	Many-lined Skink	EUMU	1
RASN	07/11/91	REPT	Many-lined Skink	EUMU	1
ELCA	08/16/91	REPT	Plateau Striped Whiptail Lizard	CNVE	2

HIDD	08/15/91	REPT	Plateau Striped Whiptail Lizard	CNVE	4
LOWO	05/12/92	REPT	Plateau Striped Whiptail Lizard	CNVE	1
SABL	08/20/91	REPT	Plateau Striped Whiptail Lizard	CNVE	2
ZAKI	06/18/92	REPT	Plateau Striped Whiptail Lizard	CNVE	1
NOPA	09/25/91	REPT	Short-horned Lizard	PHDO	1
ZATF	08/24/93	REPT	Short-horned Lizard	PHDO	1
ZATH	07/16/92	REPT	Short-horned Lizard	PHDO	1
OS05	09/19/91	REPT	Striped Whipsnake	MATA	1
OS15	07/16/92	REPT	Striped Whipsnake	MATA	1
OS34	08/18/93	REPT	Striped Whipsnake	MATA	1
ACOM	07/16/91	REPT	Tree Lizard	UROR	1
APCO	06/16/92	REPT	Tree Lizard	UROR	3
BACR	07/17/91	REPT	Tree Lizard	UROR	2
BRWI	07/16/91	REPT	Tree Lizard	UROR	3
BSLC	06/10/92	REPT	Tree Lizard	UROR	3
BSLC	07/15/92	REPT	Tree Lizard	UROR	2
BSLC	07/25/91	REPT	Tree Lizard	UROR	3
FOUR	07/29/91	REPT	Tree Lizard	UROR	8
GICE	07/30/91	REPT	Tree Lizard	UROR	3
HAFE	07/09/91	REPT	Tree Lizard	UROR	4
HIDD	07/01/92	REPT	Tree Lizard	UROR	2
INWA	07/10/91	REPT	Tree Lizard	UROR	5
LICO	07/16/91	REPT	Tree Lizard	UROR	1
NACO	06/16/92	REPT	Tree Lizard	UROR	1
NACO	06/16/92	REPT	Tree Lizard	UROR	2
NSBR	07/31/91	REPT	Tree Lizard	UROR	2
RASN	07/11/91	REPT	Tree Lizard	UROR	10
STCO	06/16/92	REPT	Tree Lizard	UROR	2
SUBR	07/31/91	REPT	Tree Lizard	UROR	3
TRIA	07/11/91	REPT	Tree Lizard	UROR	2
ZUNI	07/16/91	REPT	Tree Lizard	UROR	2
NPPO	08/25/93	REPT	Wandering Garter Snake	THEL	1
OS08	09/27/91	REPT	Wandering Garter Snake	THEL	1
OS31	08/18/93	REPT	Western Diamondback Rattlesnake	CRAT	1
MARC	07/01/91	REPT	Western Rattlesnake	CRVI	1
OS04	09/26/91	REPT	Western Rattlesnake	CRVI	1
OS28	07/12/93	REPT	Western Rattlesnake	CRVI	1
SABL	08/20/91	REPT	Western Rattlesnake	CRVI	1

VEGETATION AND WILDLIFE INVENTORY

OF EL MALPAIS NATIONAL MONUMENT

Final Report

Appendix 23

WILDLIFE INVENTORY OFF-SITE ANIMAL SPECIES RECORDS

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-1

Group: MAMM

Name: Whitetail prairie dog

Date: 08/13/91 **Observer:** DCL

Descriptive Location: Los Cerros Ranch

USGS Quad. Map Name: Cerro Hueco

Range:12 W **Township:**8 N **Section:**19sw1/4 **Elevation:**7500'

Specific Location (UTM): Zone: 12 North:3865700 **East:**760700

Habitat Description: Pastures around ranch buildings. Grazed blue grama grass, snakeweed, and rabbitbrush.

Comments: Large colony over about 200 ac area, 100-200 animals, many burrows and mounds.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal

Off-Site Record Number: OS-2

Group: MAMM

Common Name: Whitetail prairie dog

Date: 08/26/91 **Observer:** DCL

Descriptive Location: 2 miles north of Sandstone Bluffs Overlook area, on west side of SR 117.

USGS Quad. Map Name: Los Pilares

Range:9 W **Township:**9 N **Section:**29ne1/4 **Elevation:**6620'

Specific Location (UTM): Zone 13 North:3874800 **East:**2343600

Habitat Description: Sandy-loam flat pasture with blue grama, snakeweed, and rabbitbrush. Overgrazed by livestock.

Comments: Small colony, about 25 animals, 5 ha.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-3

Group: REPT

Common Name: Gopher snake

Date: 08/27/91 **Observer:** DCL

Descriptive Location: On SR 117, 3 miles north of Sandstone Bluffs Overlook.

USGS Quad. Map Name: Los Pilares

Range:9 W **Township:**9 N **Section:**20 **Elevation:**6600'

Specific Location (UTM): Zone 13 North:3876100 **East:**243200

Habitat Description: Blue grama grassland, rabbitbrush, snakeweed, dense weeds along roadside.

Comments: One large (4') snake dead on road.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-4

Group: REPT

Common Name: Western rattlesnake

Date: 09/26/91 **Observer:** DCL

Descriptive Location: 2 miles south of Sandstone Bluffs Overlook on SR 117.

USGS Quad. Map Name: Los Pilares

Range:10 W **Township:**8 N **Section:**12se1/4 **Elevation:**6780'

Specific Location (UTM): Zone 13 North:3869300 **East:**240800

Habitat Description: Sandy flat between sandstone cliffs and McCartys lava flow, dense roadside weeds.

Comments: One 4' snake dead on road, color dark greenish-grey, smashed, not collected.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-5

Group: REPT

Common Name: Striped whipsnake

Date: 09/19/91 **Observer:** DCL

Descriptive Location: On SR 117 just north of turn-off to Sandstone Bluffs Overlook

USGS Quad. Map Name: Los Pilares

Range:9 W **Township:**8 N **Section:**5nw1/4 **Elevation:**6725'

Specific Location (UTM): Zone 13 North:3872100 **East:**242500

Habitat Description: Sandy flat area, open blue grama/dropseed grass area, scattered pinon and juniper.

Comments: One snake dead on road, 3.5' long, underside yellow on posterior 1/2, and pink to red on anterior.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-6

Group: BIRD

Common Name: Loggerhead shrike

Date: 09/18/91 **Observer:** DCL

Descriptive Location: Along SR 53, 1 mile east of Zuni/Acoma trailhead.

USGS Quad. Map Name: Arrosa Ranch

Range:10 W **Township:**9 N **Section:**32sw1/4 **Elevation:**6850'

Specific Location (UTM): Zone 13 North:3872500 **East:**233600

Habitat Description: Open sandy flats, blue grama grassland, snakeweed, rabbitbrush.

Comments: One bird roosting on fence post.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-7

Group: MAMM

Common Name: Whitetail prairie dog

Date: 09/25/91 **Observer:** DCL

Descriptive Location: Mouth of Cebollita Creek Canyon along SR 117.

USGS Quad. Map Name: Los Pilares

Range:10 W **Township:**8 N **Section:**24nw1/4 **Elevation:**6820'

Specific Location (UTM): Zone 13 North:3867100 **East:**239300

Habitat Description: Flat sandy-loam area at mouth of canyon, dropseed, grama grassland, overgrazed by livestock.

Comments: Small prairie dog town, about 20 mounds, 50 animals.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-8

Group: REPT

Common Name: Wandering garter snake

Date: 09/27/91 **Observer:** DCL

Descriptive Location: On CR 42 at south base of Cerro Bandera.

USGS Quad. Map Name: Ice Caves

Range:12 W **Township:**9 N **Section:**28ne1/4 **Elevation:**7780'

Specific Location (UTM): Zone 12 North:3875100 **East:**764500

Habitat Description: Ponderosa pine woodland on flat area at base of cinder cone. Small temporary ponds along roadside.

Comments: One snake dead on road, smashed, not collected.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-9

Group: MAMM

Common Name: Whitetail prairie dog

Date: 03/17/92 **Observer:** DCL

Descriptive Location: South of SR 53, 3 miles west of Zuni/Acoma trailhead.

USGS Quad. Map Name: Arrosa Ranch

Range:10 W **Township:**9 N **Section:**32sw1/4 **Elevation:**6853'

Specific Location (UTM): Zone 12 North:3872500 **East:**233600

Habitat Description: Flat open fine loam soil area with snakeweed and blue grama, just north of Twinn Craters lava flow.

Comments: Small colony, 3 animals observed, about 8 mounds.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-10

Group: MAMM

Common Name: Whitetail prairie dog

Date: 05/12/92 **Observer:** DCL

Descriptive Location: Los Cerros Ranch.

USGS Quad. Map Name: Cerro Hueco

Range:12 W **Township:**8 N **Section:**19sw1/4 **Elevation:**7500'

Specific Location (UTM): Zone 12 North:3865700 **East:**760700

Habitat Description: Flat open, grassy pastures near ranch, overgrazed by livestock.

Comments: Large prairie dog town, 100-200 animals, about 100 mounds.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-11

Group: MAMM

Common Name: Mule deer

Date: 05/12/92 **Observer:** DCL

Descriptive Location: Along road to Big Tubes area just east of CR 42, on north side of Cerro Rendija.

USGS Quad. Map Name: Ice Caves

Range:12 W **Township:**9 N **Section:**31se1/4 **Elevation:**7660'

Specific Location (UTM): Zone 12 North:3872200 **East:**761200

Habitat Description: Open pinon/juniper area.

Comments: 6 animals.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-12

Group: BIRD

Common Name: Wild turkey

Date: 06/10/92 **Observer:** DCL

Descriptive Location: Road to Big Tubes area, just east of CR 42, on north side of Cerro Rendija.

USGS Quad. Map Name: Ice Caves

Range:12 W **Township:**9 N **Section:**31se1/4 **Elevation:**7670'

Specific Location (UTM): Zone 12 North:3872200 **East:**761250

Habitat Description: Open pinon/juniper area.

Comments: One bird crossed the road.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-13

Group: BIRD

Common Name: Northern oriole

Date: 07/09/92 **Observer:** DCL

Descriptive Location: The Narrows, along SR 117.

USGS Quad. Map Name: North Pasture

Range:10 W **Township:**7 N **Section:**8 **Elevation:**7080'

Specific Location (UTM): Zone 12 North:3859700 **East:**233400

Habitat Description: Edge of McCartys lava flow, scattered ponderosa pine and ash.

Comments: One male, orange and black.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-14

Group: MAMM

Common Name: Mountain lion

Date: 07/15/92 **Observer:** DCL

Descriptive Location: Dirt road from El Calderon parking area to El Calderon.

USGS Quad. Map Name: Ice Caves

Range:11 W **Township:**9 N **Section:**32 **Elevation:**7380'

Specific Location (UTM): Zone 12 North:77250 **East:**387300

Habitat Description: Open ponderosa pine woodland.

Comments: Fresh tracks of adult and cub in soil on road. A tourist said that he saw the animals, photographed them, and would send photos to the NPS.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-15

Group: REPT

Common Name: Striped Whipsnake

Date:07/16/92 **Observer:** DCL

Descriptive Location: On SR 53, 0.5 miles east of Zuni/Acoma trail head.

USGS Quad. Map Name: Arrosa Ranch

Range:8 N **Township:**10 W **Section:**6n1/2 **Elevation:**6880'

Specific Location (UTM): Zone 13 North:3872400 **East:**232000

Habitat Description: Open grassland with rabbitbrush.

Comments: One live snake crossing the road.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-16

Group: MAMM

Common Name: Black-tailed jackrabbit

Date: 08/26/92 **Observer:** DCL

Descriptive Location: On SR 53, 0.25 miles west of El Calderon.

USGS Quad. Map Name: Ice Caves

Range:11 W **Township:**9 N **Section:**28sw1/4 **Elevation:**7320'

Specific Location (UTM): Zone 12 North:3874200 **East:**773400

Habitat Description: Open ponderosa pine woodland.

Comments: One dead rabbit on road.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-17

Group: MAMM

Common Name: Ord's kangaroo rat

Date: 08/27/92 **Observer:** DCL

Descriptive Location: On SR 117, 0.5 miles south of Southeast Point survey site (SEPT).

USGS Quad. Map Name: Sand Canyon

Range:11 W **Township:**6 N **Section:**27ne1/4 **Elevation:**7130'

Specific Location (UTM): Zone 13 North:3846200 **East:**227300

Habitat Description: Open flat sandy area, rabbitbrush, grass, scattered pinon and juniper.

Comments: One animal dead on road, too badly smashed to collect.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-18

Group: REPT

Common Name: Gopher snake

Date:08/27/92 **Observer:** DCL

Descriptive Location: On SR 117 at North Pasture.

USGS Quad. Map Name: North Pasture

Range:10 W **Township:**7 N **Section:**29nw1/4 **Elevation:**7665'

Specific Location (UTM): Zone 13 North:385200 **East:**233600

Habitat Description: Flat grassland with silty soil

Comments: One snake crossing the road.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-19

Group: BIRD

Common Name: Northern harrier

Date: 11/17/92 **Observer:** DCL

Descriptive Location: Along SR 117, 0.5 miles north of Sandstone Bluffs Overlook.

USGS Quad. Map Name: Los Pilares

Range:9 W **Township:**9 N **Section:**32 **Elevation:**6680'

Specific Location (UTM): Zone 13 North:3872500 **East:**243400

Habitat Description: Flat rabbitbrush, snakeweed, grassland.

Comments: One bird flew across road.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-20

Group: MAMM

Common Name: Black-tailed jackrabbit

Date: 11/17/92 **Observer:** DCL

Descriptive Location: On SR 117 near Acoma/Zuni trailhead.

USGS Quad. Map Name: Los Pilares

Range:10 W **Township:**8 N **Section:**26 **Elevation:**6900'

Specific Location (UTM): Zone 13 North:3863200 **East:**238100

Habitat Description: Flat rabbitbrush grassland, scattered pinon and juniper.

Comments: One rabbit dead on road.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-21

Group: MAMM

Common Name: Black-tailed jackrabbit

Date: 03/08/93 **Observer:** DCL

Descriptive Location: On SR 53, 0.25 miles east of El Calderon.

USGS Quad. Map Name: Arrosa Ranch

Range:11 W **Township:**9 N **Section:**33ne1/4 **Elevation:**7250'

Specific Location (UTM): Zone 12 North:3873900 **East:**226300

Habitat Description: Open ponderosa pine, and pinon/juniper woodland.

Comments: Two rabbits dead on road.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-22

Group: MAMM

Common Name: Whitetail prairie dog

Date: 03/08/93 **Observer:** DCL

Descriptive Location: 2 miles west of Zuni/Acoma trailhead, south of SR 53.

USGS Quad. Map Name: Arrosa Ranch

Range:11 W **Township:**8 N **Section:**3ne1/4 **Elevation:**7120'

Specific Location (UTM): Zone 13 North:3872000 **East:**228000

Habitat Description: Open rabbitbrush grassland on silty soil.

Comments: 3 animals observed, several mounds.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-23

Group: MAMM

Common Name: Rock squirrel

Date: 03/08/93 **Observer:** DCL

Descriptive Location: On SR 53, 0.5 miles west of El Calderon.

USGS Quad. Map Name: Ice Caves

Range:11 W **Township:**9 N **Section:**28sw1/4 **Elevation:**7320'

Specific Location (UTM): Zone 12 North:3874200 **East:**77340

Habitat Description: Open ponderosa pine woodland.

Comments: One squirrel dead on road.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-24

Group: MAMM

Common Name: Grey fox

Date: 03/08/93 **Observer:** DCL

Descriptive Location: On SR 117 at south end of Little Narrows.

USGS Quad. Map Name: Los Pilares

Range:10 W **Township:**8 N **Section:**13ne1/4 **Elevation:**6800'

Specific Location (UTM): Zone 13 North:3868800 **East:**240800

Habitat Description: Rabbitbrush grassland near McCartys lava flow and sandstone cliffs.

Comments: One fox dead on road, photographed.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-25

Group: BIRD

Common Name: Burrowing owl

Date: 03/08/93 **Observer:** DCL

Descriptive Location: 2 miles north of Sandstone Bluffs Overlook along SR 117.

USGS Quad. Map Name: Los Pilares

Range:9 W **Township:**9 N **Section:**29ne1/4 **Elevation:**6620'

Specific Location (UTM): Zone 13 North:3874800 **East:**243950

Habitat Description: Flat rabbitbrush, snakeweed, grassland, area small whitetail prairie dog town, overgrazed by livestock.

Comments: One owl roosting on fence post.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-26

Group: MAMM

Common Name: Whitetail prairie dog

Date: 03/08/93 **Observer:** DCL

Descriptive Location: 2 miles north of Sandstone Bluffs Overlook along SR 117.

USGS Quad. Map Name: Los Pilares

Range:9 W **Township:**9 N **Section:**29ne1/4 **Elevation:**6600'

Specific Location (UTM): Zone 13 North:3874800 **East:**243900

Habitat Description: Flat rabbitbrush, snakeweed, grassland, overgrazed by livestock.

Comments: Small prairie dog colony, 5 animals observed.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-27

Group: MAMM

Common Name: Porcupine

Date: 07/12/93 **Observer:** DCL

Descriptive Location: On SR 117 at the Narrows.

USGS Quad. Map Name: North Pasture

Range:10 W **Township:**7 N **Section:**5ne1/4 **Elevation:**7025'

Specific Location (UTM): Zone 13 North:3861700 **East:**234400

Habitat Description: Scattered ponderosa pine and ash along edge of McCartys lava flow.

Comments: One animal dead on road.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-28

Group: REPT

Common Name: Western Rattlesnake

Date: 07/12/93 **Observer:** DCL

Descriptive Location: On SR 117, 0.25 miles south of the Narrows.

USGS Quad. Map Name: Los Pilares

Range:9 W **Township:**9 N **Section:**20 **Elevation:**6600'

Specific Location (UTM): Zone 13 North:3876200 **East:**243550

Habitat Description: Flat rabbitbrush grassland near sandstone cliffs and McCartys lava flow.

Comments: 3 foot snake crossing road. Light greenish/grey color.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-29

Group: MAMM

Common Name: Ord's kangaroo rat

Date: 07/12/93 **Observer:** DCL

Descriptive Location: On SR 117 at North Pasture.

USGS Quad. Map Name: North Pasture

Range:10 W **Township:**7 N **Section:**29sw1/4 **Elevation:**7070'

Specific Location (UTM): Zone 13 North:3854700 **East:**232900

Habitat Description: Flat grassland and rabbitbrush.

Comments: One rat running across road at night.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-30

Group: BIRD

Common Name: Greater roadrunner

Date: 07/14/93 **Observer:** DCL

Descriptive Location: 2 miles north of Sandstone Bluffs Overlook along SR 117.

USGS Quad. Map Name: Los Pilares

Range:9 W **Township:**9 N **Section:**20 **Elevation:**6600'

Specific Location (UTM): Zone 13 North:3875600 **East:**243800

Habitat Description: Rabbitbrush, snakeweed, grassland. Flat area with silty soil.

Comments: One bird ran across road, perched on fence post.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-31

Group: REPT

Common Name: Western diamondback rattlesnake

Date: 08/18/93 **Observer:** DCL

Descriptive Location: On SR 117, 3 miles north of Sandstone Bluffs Overlook.

USGS Quad. Map Name: Los Pilares

Range:9 W **Township:**9 N **Section:**20 **Elevation:**6600′

Specific Location (UTM): Zone 13 North:3876200 **East:**243550

Habitat Description: Scattered pinon/juniper, rabbitbrush and snakeweed. At base of slope below sandstone cliffs, and near edge of McCartys lava flow.

Comments: One large snake, 5′7′′ dead on road, collected.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-32

Group: REPT

Common Name: Gopher snake

Date: 08/18/93 **Observer:** DCL

Descriptive Location: On SR 117, 2.5 miles north of Sandstone Bluffs overlook.

USGS Quad. Map Name: Los Pilares

Range:9 W **Township:**9 N **Section:**20 **Elevation:**6600′

Specific Location (UTM): Zone 13 North:3875600 **East:**243800

Habitat Description: Scattered pinon/juniper, rabbitbrush and snakeweed, grassland.

Comments: One large snake, 5′3′′ dead on road, collected.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-33

Group: AMPH

Common Name: New Mexico spadefoot toad

Date: 08/18/93 **Observer:** DCL

Descriptive Location: On SR 117 at North Pasture.

USGS Quad. Map Name: North Pasture

Range:10 W **Township:**7 N **Section:**29ne1/4 **Elevation:**7060'

Specific Location (UTM): Zone 13 North:3855600 **East:**323500

Habitat Description: Flat grassland.

Comments: One toad, live on road.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-34

Group: REPT

Common Name: Striped whipsnake

Date: 08/18/93 **Observer:** DCL

Descriptive Location: On SR 117, 0.5 miles north of Sandstone Bluffs Overlook.

USGS Quad. Map Name: Los Pilares

Range:9 W **Township:**9 N **Section:**32 **Elevation:**6680'

Specific Location (UTM): Zone 13 North:3872500 **East:**243400

Habitat Description: Sandy rabbitbrush area near base of sandstone cliffs.

Comments: Dead on road.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-35

Group: BIRD

Common Name: Northern goshawk

Date: 08/16/91 **Observer:** DCL

Descriptive Location: Bonita Canyon, 7 miles north of SR 53, Zuni Mountains.

USGS Quad. Map Name: San Rafael

Range:11 W **Township:**10 N **Section:**34sw1/4 **Elevation:**7630'

Specific Location (UTM): Zone 12 North:3882100 **East:**227100

Habitat Description: Ponderosa pine forest in canyon bottom.

Comments: One bird perched on ponderosa pine, eye stripe distinctive.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-36

Group: MAMM

Common Name: Brush mouse

Date: 09/25/92 **Observer:** DB

Descriptive Location: Research camp, near El Calderon

USGS Quad. Map Name: Arrosa Ranch

Range:11 W **Township:**9 N **Section:**34 **Elevation:**7160'

Specific Location (UTM): Zone 12 North:3872600 **East:**227700

Habitat Description: Ponderosa pine woodland with fine loam soil, adjacent to Twin Craters lava flow.

Comments: Live trapped on Twin Craters lava flow. One animal.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-37

Group: MAMM

Common Name: Rock mouse

Date: 09/25/92 **Observer:** DB

Descriptive Location: Research camp, near El Calderon

USGS Quad. Map Name: Arrosa Ranch

Range:11 W **Township:**9 N **Section:**34 **Elevation:**7160'

Specific Location (UTM): Zone 12 North:3872600 **East:**227700

Habitat Description: Ponderosa pine woodland with fine loam soil, adjacent to Twin Craters lava flow.

Comments: Live trapped on Twin Craters lava flow. 15 animals.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-38

Group: MAMM

Common Name: Deer mouse

Date: 09/25/92 **Observer:** DB

Descriptive Location: Research camp, near El Calderon

USGS Quad. Map Name: Arrosa Ranch

Range:11 W **Township:**9 N **Section:**34 **Elevation:**7160'

Specific Location (UTM): Zone 12 North:3872600 **East:**227700

Habitat Description: Ponderosa pine woodland with fine loam soil, adjacent to Twin Craters lava flow.

Comments: Live trapped on Twin Craters lava flow. Two animals.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-39

Group: MAMM

Common Name: Mexican woodrat

Date: 09/25/92 **Observer:** DB

Descriptive Location: Research camp, near El Calderon

USGS Quad. Map Name: Arrosa Ranch

Range:11 W **Township:**9 N **Section:**34 **Elevation:**7160'

Specific Location (UTM): Zone 12 North:3872600 **East:**227700

Habitat Description: Ponderosa pine woodland with fine loam soil, adjacent to Twin Craters lava flow.

Comments: Live trapped on Twin Craters lava flow. 4 animals

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-40

Group: MAMM

Common Name: Whitethroated woodrat

Date: 09/25/92 **Observer:** DB

Descriptive Location: Research camp, near El Calderon

USGS Quad. Map Name: Arrosa Ranch

Range:11 W **Township:**9 N **Section:**34 **Elevation:**7160'

Specific Location (UTM): Zone 12 North:3872600 **East:**227700

Habitat Description: Ponderosa pine woodland with fine loam soil, adjacent to Twin Craters lava flow.

Comments: Live trapped on Twin Craters lava flow. 2 animals.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-41

Group: MAMM

Common Name: White-footed mouse

Date: 09/25/92 **Observer:** DB

Descriptive Location: Research camp, near El Calderon

USGS Quad. Map Name: Arrosa Ranch

Range:11 W **Township:**9 N **Section:**34 **Elevation:**7160'

Specific Location (UTM): Zone 12 North:3872600 **East:**227700

Habitat Description: Ponderosa pine woodland with fine loam soil, adjacent to Twin Craters lava flow.

Comments: Live trapped on Twin Craters lava flow. One animal.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-42

Group: MAMM

Common Name: Botta's pocket gopher

Date: 09/25/92 **Observer:** DB

Descriptive Location: Research camp, near El Calderon

USGS Quad. Map Name: Arrosa Ranch

Range:11 W **Township:**9 N **Section:**34 **Elevation:**7160'

Specific Location (UTM): Zone 12 North:3872600 **East:**227700

Habitat Description: Ponderosa pine woodland with fine loam soil, adjacent to Twin Craters lava flow.

Comments: Trapped with gopher trap, one animal.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-43

Group: MAMM

Common Name: Western harvest mouse

Date: 09/25/92 **Observer:** DB

Descriptive Location: Research camp, near El Calderon

USGS Quad. Map Name: Arrosa Ranch

Range:11 W **Township:**9 N **Section:**34 **Elevation:**7160'

Specific Location (UTM): Zone 12 North:3872600 **East:**227700

Habitat Description: Ponderosa pine woodland with fine loam soil, adjacent to Twin Craters lava flow.

Comments: Live trapped, one animal.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-44

Group: MAMM

Common Name: Rock mouse

Date: 09/25/92 **Observer:** DB

Descriptive Location: Stock tank 5 miles south of Los Cerros Ranch, along road to Prairie Dog Well.

USGS Quad. Map Name: Cerro Brillante

Range:12 W **Township:**7 N **Section:**18 **Elevation:**7270'

Specific Location (UTM): Zone 12 North:3858200 **East:**761400

Habitat Description: Blue grama grassland with rabbitbrush and snakeweed, scattered pinon and juniper, on Old Flow.

Comments: Live trapped, one animal.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-45

Group: MAMM

Common Name: Whitethroated woodrat

Date: 09/25/92 **Observer:** DB

Descriptive Location: Stock tank 5 miles south of Los Cerros Ranch, along road to Prairie Dog Well.

USGS Quad. Map Name: Cerro Brillante

Range:12 W **Township:**7 N **Section:**18 **Elevation:**7270'

Specific Location (UTM): Zone 12 North:3858200 **East:**761400

Habitat Description: Blue grama grassland with rabbitbrush and snakeweed, scattered pinon and juniper, on Old Flow.

Comments: Live trapped, 3 animals.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-46

Group: MAMM

Common Name: Pinon mouse

Date: 09/25/92 **Observer:** DB

Descriptive Location: Stock tank 5 miles south of Los Cerros Ranch, along road to Prairie Dog Well.

USGS Quad. Map Name: Cerro Brillante

Range:12 W **Township:**7 N **Section:**18 **Elevation:**7270'

Specific Location (UTM): Zone 12 North:3858200 **East:**761400

Habitat Description: Blue grama grassland with rabbitbrush and snakeweed, scattered pinon and juniper, on Old Flow.

Comments: Live trapped, one animal.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-47

Group: MAMM

Common Name: Deer mouse

Date: 09/25/92 **Observer:** DB

Descriptive Location: Stock tank 5 miles south of Los Cerros Ranch, along road to Prairie Dog Well.

USGS Quad. Map Name: Cerro Brillante

Range:12 W **Township:**7 N **Section:**18 **Elevation:**7270'

Specific Location (UTM): Zone 12 North:3858200 **East:**761400

Habitat Description: Blue grama grassland with rabbitbrush and snakeweed, scattered pinon and juniper, on Old Flow.

Comments: Live trapped, one animal.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-48

Group: MAMM

Common Name: Cliff chipmunk

Date: 09/25/92 **Observer:** DB

Descriptive Location: Stock tank 5 miles south of Los Cerros Ranch, along road to Prairie Dog Well.

USGS Quad. Map Name: Cerro Brillante

Range:12 W **Township:**7 N **Section:**18 **Elevation:**7270'

Specific Location (UTM): Zone 12 North:3858200 **East:**761400

Habitat Description: Blue grama grassland with rabbitbrush and snakeweed, scattered pinon and juniper, on Old Flow.

Comments: Two animals shot on nearby Hoya lava flow.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-49

Group: MAMM

Common Name: Cottontail rabbit

Date: 09/25/92 **Observer:** DB

Descriptive Location: Stock tank 5 miles south of Los Cerros Ranch, along road to Prairie Dog Well.

USGS Quad. Map Name: Cerro Brillante

Range:12 W **Township:**7 N **Section:**18 **Elevation:**7270'

Specific Location (UTM): Zone 12 North:3858200 **East:**761400

Habitat Description: Blue grama grassland with rabbitbrush and snakeweed, scattered pinon and juniper, on Old Flow.

Comments: One rabbit shot on nearby Hoya lava flow.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-50

Group: MAMM

Common Name: Pinon mouse

Date: 09/25/92 **Observer:** DB

Descriptive Location: Stock tank 5 miles south of Los Cerros Ranch, along road to Prairie Dog Well.

USGS Quad. Map Name: Cerro Brillante

Range:12 W **Township:**7 N **Section:**18 **Elevation:**7270'

Specific Location (UTM): Zone 12 North:3858200 **East:**761400

Habitat Description: Blue grama grassland with rabbitbrush and snakeweed, scattered pinon and juniper, on Old Flow.

Comments: Live trapped on nearby Hoya lava flow, one animal.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-51

Group: MAMM

Common Name: Rock mouse

Date: 09/25/92 **Observer:** DB

Descriptive Location: Stock tank 5 miles south of Los Cerros Ranch, along road to Prairie Dog Well.

USGS Quad. Map Name: Cerro Brillante

Range:12 W **Township:**7 N **Section:**18 **Elevation:**7270'

Specific Location (UTM): Zone 12 North:3858200 **East:**761400

Habitat Description: Blue grama grassland with rabbitbrush and snakeweed, scattered pinon and juniper, on Old Flow.

Comments: Live trapped on nearby Hoya lava flow, one animal.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-52

Group: MAMM

Common Name: Whitethroated woodrat

Date: 09/25/92 **Observer:** DB

Descriptive Location: Stock tank 5 miles south of Los Cerros Ranch, along road to Prairie Dog Well.

USGS Quad. Map Name: Cerro Brillante

Range:12 W **Township:**7 N **Section:**18 **Elevation:**7270'

Specific Location (UTM): Zone 12 North:3858200 **East:**761400

Habitat Description: Blue grama grassland with rabbitbrush and snakeweed, scattered pinon and juniper, on Old Flow.

Comments: Live trapped on nearby Hoya lava flow, one animal.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-53

Group: MAMM

Common Name: California myotis

Date: 06/13/93 **Observer:** DB

Descriptive Location: Stock tank 5 miles south of Los Cerros Ranch, along road to Prairie Dog Well.

USGS Quad. Map Name: Cerro Brillante

Range:12 W **Township:**7 N **Section:**18 **Elevation:**7270'

Specific Location (UTM): Zone 12 North:3858200 **East:**761400

Habitat Description: Blue grama grassland with rabbitbrush and snakeweed, scattered pinon and juniper, on Old Flow.

Comments: Caught in mist net over stock tank at night, 3 bats.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-54

Group: MAMM

Common Name: Cave myotis

Date: 06/13/93 **Observer:** DB

Descriptive Location: Stock tank 5 miles south of Los Cerros Ranch, along road to Prairie Dog Well.

USGS Quad. Map Name: Cerro Brillante

Range:12 W **Township:**7 N **Section:**18 **Elevation:**7270'

Specific Location (UTM): Zone 12 North:3858200 **East:**761400

Habitat Description: Blue grama grassland with rabbitbrush and snakeweed, scattered pinon and juniper, on Old Flow.

Comments: Caught in mist net over stock tank at night, 3 bats.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-55

Group: MAMM

Common Name: Silver-haired bat

Date: 06/13/93 **Observer:** DB

Descriptive Location: Stock tank 5 miles south of Los Cerros Ranch, along road to Prairie Dog Well.

USGS Quad. Map Name: Cerro Brillante

Range:12 W **Township:**7 N **Section:**18 **Elevation:**7270'

Specific Location (UTM): Zone 12 North:3858200 **East:**761400

Habitat Description: Blue grama grassland with rabbitbrush and snakeweed, scattered pinon and juniper, on Old Flow.

Comments: Caught in mist net over stock tank at night, 1 bat.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-56

Group: MAMM

Common Name: Long-eared myotis

Date: 06/13/93 **Observer:** DB

Descriptive Location: Stock tank 5 miles south of Los Cerros Ranch, along road to Prairie Dog Well.

USGS Quad. Map Name: Cerro Brillante

Range:12 W **Township:**7 N **Section:**18 **Elevation:**7270'

Specific Location (UTM): Zone 12 North:3858200 **East:**761400

Habitat Description: Blue grama grassland with rabbitbrush and snakeweed, scattered pinon and juniper, on Old Flow.

Comments: Caught in mist net over stock tank at night, 4 bats.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-57

Group: MAMM

Common Name: Big brown bat

Date: 06/13/93 **Observer:** DB

Descriptive Location: Stock tank 5 miles south of Los Cerros Ranch, along road to Prairie Dog Well.

USGS Quad. Map Name: Cerro Brillante

Range:12 W **Township:**7 N **Section:**18 **Elevation:**7270'

Specific Location (UTM): Zone 12 North:3858200 **East:**761400

Habitat Description: Blue grama grassland with rabbitbrush and snakeweed, scattered pinon and juniper, on Old Flow.

Comments: Caught in mist net over stock tank at night, 3 bats.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-58

Group: BIRD

Common Name: White-faced ibis

Date: 04/19/93 **Observer:** DB

Descriptive Location: Laguna Americana, 1 mile east of Cerro Americano, along County Road 42.

USGS Quad. Map Name: Cerro Hueco

Range:13 W **Township:**8 N **Section:**12 **Elevation:**7568'

Specific Location (UTM): Zone 12 North:3869100 **East:**760400

Habitat Description: Large playa lake filled with shallow water, muddy shores, and rushes and grasses in water.

Comments: Flock of 6 ibis foraging along shoreline.

EL MALPAIS NATIONAL MONUMENT BIOLOGICAL SURVEY
Off-Site Animal Records

Off-Site Record Number: OS-59

Group: BIRD

Common Name: Great blue heron

Date: 04/19/93 **Observer:** DB

Descriptive Location: Laguna Americana, 1 mile east of Cerro Americano, along County Road 42.

USGS Quad. Map Name: Cerro Hueco

Range:13 W **Township:**8 N **Section:**12 **Elevation:**7568'

Specific Location (UTM): Zone 12 North:3869100 **East:**760400

Habitat Description: Large playa lake filled with shallow water, muddy shores, and rushes and grasses in water.

Comments: One heron foraging along shoreline.

VEGETATION AND WILDLIFE INVENTORY

OF EL MALPAIS NATIONAL MONUMENT

Final Report

Appendix 24

WILDLIFE INVENTORY ANIMAL SPECIES SORTED BY FREQUENCY OF OBSERVATION

APPENDIX 24.

FREQUENCY OF OBSERVATIONS OF ALL ANIMAL SPECIES FROM WILDLIFE INVENTORY.

Summary data from animal records database (Appendix 22). Species sorted in descending order based of frequency of observations.

(.) = N/A in Appendix 22.

SPECIES/:COMMON NAME	NUMBER OF OBSERVATIONS	SUM OF COUNTS
AMPHIBIANS		
Canyon Treefrog	5	5
New Mexico Spadefoot Toad	3	22
Tiger Salamander	1	1
BIRDS		
Western Bluebird	44	132
Common Raven	36	69
Violet-green Swallow	36	198
Cordilleran Flycatcher	30	45
Pinon Jay	29	229
Red-tailed Hawk	26	32
Rock Wren	26	67
Western Wood-Pewee	26	38
Ash-throated Flycatcher	25	41
American Robin	24	38
Common Nighthawk	23	143
Dark-eyed Junco	20	158
Broad-tailed Hummingbird	20	26
Black-capped Chickadee	19	45
Common Flicker	18	38
Vesper Sparrow	18	114
Mourning Dove	16	33
Chipping Sparrow	14	60
Rufous Hummingbird	14	15
White-breasted Nuthatch	15	16
American Kestrel	13	18
Cassin's Kingbird	13	20
Mountain Bluebird	13	50
Canyon Wren	12	14
Townsend's Solitaire	12	26
Turkey Vulture	12	24
Lesser Goldfinch	10	44
Rufous-sided Towhee	10	12

Western Tanager	10	15
Dusky Flycatcher	9	11
Sharp-shinned Hawk	9	9
Hairy Woodpecker	8	8
Hepatic Tanager	8	10
Steller's Jay	8	18
Acorn Woodpecker	6	8
Band-tailed Pigeon	6	15
Common Bushtit	6	25
Mountain Chickadee	6	21
Red Crossbill	6	17
White-throated Swift	6	34
Wild Turkey	6	7
Brown-headed Cowbird	5	14
Horned Lark	5	25
Lewis' Woodpecker	5	16
Northern Mockingbird	5	5
Northern Rough-winged Swallow	5	15
Pine Siskin	5	20
Common Poorwill	4	5
Say's Phoebee	4	4
Western Kingbird	4	5
Brewer's Sparrow	3	6
Clark's Nutcracker	3	10
Cliff Swallow	3	26
Killdeer	3	8
Lark Sparrow	3	9
Northern Harrier	3	3
Savannah Sparrow	3	6
Bewick's Wren	2	2
Brown Towhee	2	6
Downy Woodpecker	2	3
Green-winged Teal	2	4
Great Blue Heron	2	2
Hammond's Flycatcher	2	2
Northern Oriole	2	2
Pygmy Nuthatch	2	2
Red-breasted Nuthatch	2	3
Scaled Quail	2	7
Scott's Oriole	2	2
Tree Swallow	2	5
Virgina's Warbler	2	2
Western Meadowlark	2	6
Yellow-rumped Warbler	2	6
American Crow	1	2
Barn Owl	1	1
Black-chinned Hummingbird	1	1
Black-headed Grosbeak	1	2
Black-throated Grey Warbler	1	1
Blue Grosbeak	1	1
Brewer's Blackbird	1	2
Brown Creeper	1	1

Burrowing Owl	1	1
Cassin's Sparrow	1	2
Cedar Waxwing	1	12
Cooper's Hawk	1	1
Golden Eagle	1	1
Grace's Warbler	1	1
Great Horned Owl	1	.
Greater Roadrunner	1	1
Green-backed Heron	1	1
House Finch	1	2
Loggerhead Shrike	1	1
Long-eared Owl	1	1
Mountain Plover	1	8
Northern Goshawk	1	1
Northern Pintail	1	3
Plain Titmouse	1	1
Purple Martin	1	1
Rock Dove	1	2
Ruby Crowned Kinglet	1	4
Sage Sparrow	1	1
Sage Thrasher	1	1
Scrub Jay	1	1
Solitary Vireo	1	3
Swainson's Hawk	1	1
White-crowned sparrow	1	2
White-faced Ibis	1	6
Wilson's Warbler	1	1
Yellow Warbler	1	1
Yellow-bellied Sapsucker	1	1

MAMMALS

Colorado Chipmunk	27	86
Cottontail Rabbit	23	35
Rock Squirrel	23	31
Woodrat	21	.
Pinon Mouse	18	35
Deer Mouse	16	35
Mule Deer	13	33
Botta's Pocket Gopher	12	1
Whitetail Prairie Dog	12	1143
Coyote	9	13
Rock Mouse	9	34
Cliff Chipmunk	8	13
White-footed Mouse	7	10
Black-tailed Jackrabbit	5	6
Silky Pocket Mouse	5	5
Ord's Kangaroo Rat	4	5
Tassel-eared Squirrel	4	4
Brush Mouse	3	4
Pronghorn Antelope	3	11
Whitethroated Woodrat	3	6

Long-eared Myotis	2	8
Mexican Woodrat	2	7
Silver-haired Bat	2	6
Big Brown Bat	2	4
California Myotis	2	4
Porcupine	2	2
Western Big-eared Bat	2	2
Western Harvest Mouse	2	2
Bannertail Kangaroo Rat	1	.
Grey Fox	1	1
Mexican Freetail Bat	1	19
Cave Myotis	1	3
Dwarf Shrew	1	2
Mexican woodrat	1	2
Mountain Lion	1	2
Fringed Myotis	1	1
Small-footed Myotis	1	1
REPTILES		
Eastern Fence Lizard	58	200
Tree Lizard	21	64
Plateau Striped Whiptail Lizard	5	10
Gopher Snake	4	4
Lesser Earless Lizard	4	10
Western Rattlesnake	4	4
Many-lined Skink	3	3
Short-horned Lizard	3	3
Striped Whipsnake	3	3
Great Plains Skink	2	3
Wandering Garter Snake	2	2
Chihuahuan Spotted Whiptail	1	2
Collared Lizard	1	1
Western Diamondback Rattlesnake	1	1

VEGETATION AND WILDLIFE INVENTORY

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Appendix 25

WILDLIFE INVENTORY ANIMAL SPECIES SORTED BY SUMS OF INDIVIDUAL COUNTS

APPENDIX 25.

SUMS OF TOTAL INDIVIDUAL ANIMALS COUNTED FROM WILDLIFE INVENTORY.

Summary data from animal records database (Appendix 22). Species sorted in descending order based total numbers of individuals counted.

(.) = N/A in Appendix 22.

SPECIES/:COMMON NAME	NUMBER OF OBSERVATIONS	SUM OF COUNTS
AMPHIBIANS		
New Mexico Spadefoot Toad	3	22
Canyon Treefrog	5	5
Tiger Salamander	1	1
BIRDS		
Pinon Jay	29	229
Violet-green Swallow	36	198
Dark-eyed Junco	20	158
Common Nighthawk	23	143
Western Bluebird	44	132
Vesper Sparrow	18	114
Common Raven	36	69
Rock Wren	26	67
Chipping Sparrow	14	60
Mountain Bluebird	13	50
Black-capped Chickadee	19	45
Cordilleran Flycatcher	30	45
Lesser Goldfinch	10	44
Ash-throated Flycatcher	25	41
American Robin	24	38
Common Flicker	18	38
Western Wood-Pewee	26	38
White-throated Swift	6	34
Mourning Dove	16	33
Red-tailed Hawk	26	32
Broad-tailed Hummingbird	20	26
Cliff Swallow	3	26
Townsend's Solitaire	12	26
Common Bushtit	6	25
Horned Lark	5	25
Turkey Vulture	12	24
Mountain Chickadee	6	21
Cassin's Kingbird	13	20

Pine Siskin	5	20
American Kestrel	13	18
Steller's Jay	8	18
Red Crossbill	6	17
Lewis' Woodpecker	5	16
White-breasted Nuthatch	15	16
Band-tailed Pigeon	6	15
Northern Rough-winged Swallow	5	15
Rufous Hummingbird	14	15
Western Tanager	10	15
Brown-headed Cowbird	5	14
Canyon Wren	12	14
Cedar Waxwing	1	12
Rufous-sided Towhee	10	12
Dusky Flycatcher	9	11
Clark's Nutcracker	3	10
Hepatic Tanager	8	10
Lark Sparrow	3	9
Sharp-shinned Hawk	9	9
Acorn Woodpecker	6	8
Hairy Woodpecker	8	8
Killdeer	3	8
Mountain Plover	1	8
Scaled Quail	5	7
Wild Turkey	6	7
Brewer's Sparrow	3	6
Brown Towhee	2	6
Savannah Sparrow	3	6
Western Meadowlark	2	6
White-faced Ibis	1	6
Yellow-rumped Warbler	2	6
Common Poorwill	4	5
Northern Mockingbird	5	5
Tree Swallow	2	5
Western Kingbird	4	5
Green-winged Teal	2	4
Ruby Crowned Kinglet	1	4
Say's Phoebee	4	4
Downy Woodpecker	2	3
Northern Harrier	3	3
Northern Pintail	1	3
Red-breasted Nuthatch	2	3
Solitary Vireo	1	3
American Crow	1	2
Bewick's Wren	2	2
Black-headed Grosbeak	1	2
Brewer's Blackbird	1	2
Cassin's Sparrow	1	2
Great Blue Heron	2	2
Hammond's Flycatcher	2	2
House Finch	1	2

Northern Oriole	2	2
Pygmy Nuthatch	2	2
Rock Dove	1	2
Scott's Oriole	2	2
Virgina's Warbler	2	2
White-crowned sparrow	1	2
Barn Owl	1	1
Black-chinned Hummingbird	1	1
Black-throated Grey Warbler	1	1
Blue Grosbeak	1	1
Brown Creeper	1	1
Burrowing Owl	1	1
Cooper's Hawk	1	1
Golden Eagle	1	1
Grace's Warbler	1	1
Greater Roadrunner	1	1
Green-backed Heron	1	1
Loggerhead Shrike	1	1
Long-eared Owl	1	1
Northern Goshawk	1	1
Plain Titmouse	1	1
Purple Martin	1	1
Sage Sparrow	1	1
Sage Thrasher	1	1
Scrub Jay	1	1
Swainson's Hawk	1	1
Wilson's Warbler	1	1
Yellow Warbler	1	1
Yellow-bellied Sapsucker	1	1
Great Horned Owl	1	.
MAMMALS		
Whitetail Prairie Dog	12	1143
Colorado Chipmunk	27	86
Deer Mouse	16	35
Pinon Mouse	18	35
Rock Mouse	9	34
Mule Deer	13	33
Rock Squirrel	23	31
Desert Cottontail	15	25
Mexican Freetail Bat	1	19
Cliff Chipmunk	8	13
Coyote	9	13
Pronghorn Antelope	3	11
Mountain Cottontail	8	10
White-footed Mouse	7	10
Long-eared Myotis	2	8
Mexican Woodrat	2	7
Black-tailed Jackrabbit	5	6
Silver-haired Bat	2	6
Whitethroated Woodrat	3	6

Ord's Kangaroo Rat	4	5
Silky Pocket Mouse	5	5
Big Brown Bat	2	4
Brush Mouse	3	4
California Myotis	2	4
Tassel-eared Squirrel	4	4
Dwarf Shrew	1	2
Mexican woodrat	1	2
Mountain Lion	1	2
Porcupine	2	2
Western Big-eared Bat	2	2
Western Harvest Mouse	2	2
Botta's Pocket Gopher	12	1
Fringed Myotis	1	1
Grey Fox	1	1
Small-footed Myotis	1	1
Woodrat	21	.
Bannertail Kangaroo Rat	1	.
REPTILES		
Eastern Fence Lizard	58	200
Tree Lizard	21	64
Lesser Earless Lizard	4	10
Plateau Striped Whiptail Lizard	5	10
Gopher Snake	4	4
Western Rattlesnake	4	4
Great Plains Skink	2	3
Many-lined Skink	3	3
Short-horned Lizard	3	3
Striped Whipsnake	3	3
Chihuahuan Spotted Whiptail	1	2
Wandering Garter Snake	2	2
Collared Lizard	1	1
Western Diamondback Rattlesnake	1	1