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**BIOLOGICAL ASSESSMENT
FOR
ENVIRONMENTAL RESTORATION PROGRAM
OPERABLE UNIT 1157
TA-8, 9, 23, 69**

Los Alamos National Laboratory
Los Alamos, New Mexico

Prepared by: Alethea Banar, EM-8
Biological Resource Evaluations Team
Environmental Assessments and Resource Evaluations
Environmental Protection Group, EM-8
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**BIOLOGICAL ASSESSMENT
FOR ENVIRONMENTAL RESTORATION PROGRAM
OPERABLE UNIT 1157, TA-8,9,23, AND 69**

by
Alethea Banar

ABSTRACT

The Los Alamos National Laboratory's (LANL) Biological Resource Evaluation Team (BRET) conducted Level 2 (habitat evaluation) and Level 3 (species-specific) surveys during the summer of 1992 to provide information for a site-characterization plan. The purpose of the surveys was threefold: to determine if species protected by the state or federal government were present before soil sampling took place; to determine if sensitive habitats were present; and to gather baseline data for future studies on plant and wildlife species in Operable Unit (OU) 1157. The information gathered from the field surveys was compared with habitat requirements of potentially-occurring protected species (threatened, endangered, or sensitive) for the purpose of compliance with Federal Endangered Species Act, New Mexico's endangered species laws, and the Floodplain and Wetland Executive Orders 11990 and 11988.

Survey data indicated that potential habitat existed in OU 1157 for several protected species: the northern goshawk, Mexican spotted owl, spotted bat, Jemez Mountains salamander, meadow jumping mouse, wood lily, and helleborine orchid. Although the presence of these species has not been confirmed, mitigation measures are required to ensure no adverse impacts affect these species should they be present in this area.

BRET used the National Wetland Inventory Maps and field checks to record all floodplains and wetlands. Wetland boundary delineation will be conducted prior to site characterization.

Information has been provided to aid in revegetating any area disturbed by site characterization activities. This includes any disturbance caused by off-road vehicular travel.

EXECUTIVE SUMMARY

During the summer months of 1992, field surveys were conducted by the Biological Resource Evaluations Team (BRET) of the Environmental Protection Group (EM-8) for Operable unit (OU) 1157, Technical Areas (TAs) 8, 9, 23 and 69. The Environmental Restoration Program of LANL has proposed to conduct site characterization studies that consist of soil sampling to determine the nature and extent of hazardous waste releases from solid waste management units.

The purpose of BRET's surveys was threefold. The first was to determine the presence or absence, prior to site characterization sampling, of any state or federal threatened, endangered, or sensitive plant or wildlife species or their critical habitat within the OU boundaries. Secondly, surveys were conducted to identify the presence or absence of any sensitive areas, such as

floodplains and wetlands, that are present within the sites to be sampled, as well as the extent of such areas, and their general characteristics. The third purpose was to provide additional plant and wildlife species data that will help define the habitat types within the OU. Data from these surveys will provide further baseline information about the biological components of the sites chosen for site characterization sampling. The data will also aid in determining pre-sampling conditions which can be compared to data collected at the same locations in future similar studies. Furthermore, this information is necessary to support National Environmental Policy Act (NEPA) documentation and possible subsequent determination of a Categorical Exclusion for the site characterization sampling plan.

These surveys were conducted to meet compliance with the Federal Endangered Species Act of 1973; the New Mexico Wildlife Conservation Act (WCA); the New Mexico Endangered Plant Species Act; Federal Executive Order's 11990, "Protection of Wetlands;" 11988, "Floodplain Management;" Federal Regulation 10 CFR 1022; and Department of Energy (DOE) Order 5400.1.

BRET conducted a Level 2 (habitat evaluation) survey after searching an EM-8 database. The database contained the habitat requirements for all state and federally listed threatened, endangered, and sensitive (TES) plant and animal species known to occur within the boundaries of the Laboratory and the surrounding areas. Level 2 surveys were conducted using a combination of line transects and Daubenmire plots. These techniques are designed to gather data on the percent cover, density, and frequency of both understory and overstory components of the plant community.

The habitat information gathered during field surveys was compared with the habitat requirements for each species of concern that was identified in the database search. If habitat requirements were not met for any species of concern, then no further surveys were conducted and the site was considered cleared with no expected impact to state or federally listed species. If habitat requirements were met, site-specific surveys for the species of concern were conducted. The species-specific surveys were conducted in accordance with pre-established survey protocols, which often require certain meteorological or seasonal conditions to complete.

In each location to be sampled, all wetlands and floodplains within the survey area were noted using the National Wetland Inventory Maps followed by field checks. Characteristics of wetlands, floodplains, and riparian areas are noted using criteria outlined in the "Federal Manual For Delineating Jurisdictional Wetlands." However, wetland boundaries were not delineated during these surveys due to the continual fluctuation. Boundary delineation of wetlands, if present, will be conducted just prior to site sampling (based on hydrophytic plants, hydric soils and hydrology). Delineations are valid for two years only and, are therefore, most effective when done at time of sampling.

Databases containing historical information and biological reports of any previous surveys within or near the area to be sampled, were reviewed and summarized within this document to provide background information concerning the site. These summaries provide inventory information that can be used in future ecological risk assessments and pathways analysis.

Most of the canyon systems within OU 1157 are relatively undisturbed. However, locations of varying disturbance on the mesa include: roads, drainages, cleared fields, and LANL facilities.

The terrain of OU 1157 had essentially two types of topographic features: moderately steep to steep canyons and their adjacent mesa tops. The canyon systems include upper Pajarito Canyon and Cañon de Valle. Level 2 surveys were conducted on the north-facing slope of upper Pajarito Canyon and two canyon tributaries of Pajarito Canyon in TA-9. The mesa-top surveys were conducted in disturbed open meadow sites near main facilities, a drainage channel, and a southerly-sloping portion of the mesa top in TAs 8 and 9.

All portions of the OU were primarily within a ponderosa pine community with some mixed conifer. Other overstory species found in this OU were one-seed juniper, Gambel oak, Douglas fir, and white fir. The common midstory species were Gambel oak and Fendler's rose. Willow was recorded as a major midstory species only in the drainage channel transect, and barberry was recorded a major species on the north-facing slope. Understory species varied between transects. The dominant species in the drainage channel were a rush species, bluegrass, and a rose species. Open meadows were dominated by bluegrass, false tarragon, and trailing fleabane. The canyon tributary closest to the main buildings of TA-9 was dominated by mountain muhly, red top, bluegrass, and sedge. The farther canyon tributary was dominated by moss, mountain muhly, and red top. The north-facing slope of Pajarito Canyon was dominated by a carex species, mountain muhly, pussy toes, and western yarrow. Of the last two transects on the mesa top and southerly-sloping mesa top, mountain muhly grass was common in both. Soil crust, desert trumpet and little bluestem were also found on the mesa top. Prairie junegrass was also recorded for the southerly-sloping mesa top.

Database searches indicated that potential species of concern for this OU (based on habitat and/or known occurrences) are the northern goshawk, Mexican spotted owl, peregrine falcon, common black hawk, bald eagle, willow flycatcher, broad-billed hummingbird, Mississippi kite, spotted bat, Say's pond snail, meadow jumping mouse, Jemez Mountains salamander, wood lily, checker lily, helleborine orchid, Sandia alumroot, and Pagosa phlox. As a result of a habitat evaluation of the OU, seven of these species appear to have a moderate to high potential for occurrence in the area: the northern goshawk, Mexican spotted owl, meadow jumping mouse, spotted bat, Jemez Mountains salamander, wood lily, and helleborine orchid. The results of the field habitat evaluation indicates that the habitat elements needed for these species are present.

The northern goshawk occurs in mature ponderosa pine forests. This species has been recorded as nesting near the boundaries of OU 1157, and hunting within the northwest portions of the Laboratory. Presence of the northern goshawk could occur within OU 1157. The following measures must be taken to avoid adverse impact to goshawks:

- Any machine sampling occurring between May and October must be cleared through BRET, EM-8. BRET must be contacted 60 days prior to sampling to evaluate possible nest sites in and around the sample area.
- If any area over one-tenth acre will be disturbed, BRET must be contacted for a presampling site-specific survey.
- Any tree removal (live or snag) must be approved by BRET.

The Mexican spotted owl is found in forested mountains and canyons. Although this species has not been observed in OU 1157, there is potential habitat in this area. Mitigations for the Mexican spotted owl are the same as for the northern goshawk.

Suitable habitat for the spotted bat exists in OU 1157 only in the extreme eastern end of TA-9 in Pajarito Canyon. More suitable sites have been found in Pajarito Canyon in adjacent TA-22 and lower areas of this canyon, and any spotted bats present are expected to be in these areas and not in TA-9. This species is of no concern unless sampling will be conducted in the previously mentioned areas. The spotted bat is found in caves and rock crevices in pinon-juniper, ponderosa, mixed conifer, and riparian areas. Some possible roost sites are present in OU 1157, but open water sources are limited to a narrow flowing stream in Pajarito Canyon. No adverse impact to the spotted bat (if present) should occur as long as small caves and rock crevices are not disturbed and the water sources within the canyon is not altered.

The Jemez Mountains salamander occurs in cool moist and shaded wooded habitats. This species has been found outside OU 1157 on Santa Fe National Forest land and has the potential to occur in OU 1157. If sampling will be conducted on north-facing slopes within OU 1157, a biologist from EM-8 will be present during sampling. If any salamanders are discovered, all ground disturbance activities at that site will cease. Any trees that are cut will be left to enhance habitat. Activity will not be permitted when the soil surface has a high moisture content. All disturbance areas will be revegetated with native plants.

Meadow jumping mouse may be present within stream-side areas of Pajarito Canyon. Mitigation includes the avoidance of excessive vegetation removal around stream areas, and notifying BRET 60 days prior to sampling areas adjacent to the stream so that BRET can evaluate the need for any site-specific surveys. If a survey is required, it must be conducted during the rainy season (optimal time being July), and sampling cannot proceed until the survey is complete.

The wood lily occurs in moist shaded areas. This species has been found in Los Alamos County, but is very rare. If extensive sampling will be conducted within riparian areas the BRET

team must be contacted to conduct a site-specific survey of the area prior to sampling. If heavy equipment or vehicles will be taken off established roads (paved or dirt), personnel from BRET must be notified to conduct a walk through to determine presence or absence of these lilies.

The helleborine orchid is found in damp woods near seeps, springs, streams, and riparian areas. This species has been found in Los Alamos County. If extensive sampling will be conducted within riparian areas contact the BRET team for a site specific survey of the area prior to sampling. If heavy equipment or vehicles will be taken off established roads (paved or dirt), personnel from BRET must be notified to conduct a walk through to determine presence or absence of the orchid.

Surface sampling of this OU should not cause any adverse impacts to any known critical habitat or sensitive areas if conducted in accordance with this document. No significant release of contaminants into the environment is expected to occur during sampling. However, should release of contaminants rise above the predetermined action level, workers must cease operations, shut down the site, and reassess the sampling procedure.

1. INTRODUCTION

This biological assessment was conducted for the site characterization or "sampling phase" of the Environmental Restoration program for OU 1157, TA-8,9,23,69 to determine presence or absence of threatened, endangered, and sensitive (TES) species, and of floodplains and wetlands. It is designed to provide baseline information on the plant and wildlife communities occurring in the sites to be sampled for use in long-term monitoring.

The Environmental Restoration Program proposes to sample sites within OU 1157 for purposes of characterizing particular sites. The sampling will consist of removing soil by means of hand-held auger drills or by using auger-mounted heavy machinery.

The proposed site sampling was evaluated as to its impact on TES species and floodplains and wetlands. This was done in accordance with the 1973 Federal Endangered Species Act, the New Mexico Wildlife Conservation Act (WCA), the New Mexico Endangered Plant Species Act (EPSA), Federal Floodplain/Wetland Executive Orders (EOs) 11990 and 11988, DOE's Order 5400.1 (Environmental Compliance), Federal Regulation 10 CFR 1022, and the National Environmental Policy Act (NEPA)

Section 7 of the Federal Endangered Species Act requires all federal agencies to ensure that its activities or programs will not jeopardize the continued existence of a federally listed threatened or endangered species or its designated critical habitat (if applicable). New Mexico's WCA and EPSA also require federal agencies to ensure that their activities and programs will not jeopardize species that are state protected. Implementation of Section 7, as well as New Mexico's WCA and EPSA, is done within the framework of the National Environmental Policy Act (NEPA).

There are three possible outcomes of a Biological Assessment for threatened and endangered species:

1. There are no threatened or endangered species utilizing habitat within the proposed project area;
2. There are threatened or endangered species utilizing habitat within the proposed project area, but there are no expected adverse impacts to the species; or
3. There are threatened or endangered species utilizing habitat within the proposed project area and adverse impacts to the species are expected to occur as a result of the proposed project.

If the biological evaluation indicates that the proposed project is expected to jeopardize a listed species, consultation with the appropriate state and/or federal agency is initiated. Formal consultation efforts could result in modifications, alternatives, or complete abandonment of the proposed project, in order to avoid potential adverse impacts to protected species.

Two Executive Orders provide protection for floodplains and wetlands. Executive Order 11988, "Floodplain Management," calls for protection of floodplains and mandates that potential effects of any federally funded action in a floodplain be evaluated for impact to the environment and potential health and safety problems arising from any construction on the floodplain. Executive Order 11990, "Protection of Wetlands," requires all federally funded agencies to issue or amend procedures to ensure wetlands be protected from loss and/or degradation.

Code of Federal Regulations 10 CFR 1022 outlines the procedures for DOE compliance with the executive orders and provides the means for public review of floodplain and wetland impacts. The CFR requires that all DOE actions will be assessed for impacts to floodplains and wetlands. This CFR does not include a specific minimum size. Public review of potential impacts is provided through NEPA documentation or Federal Register Notification. If floodplains or wetlands could potentially be impacted, a floodplain and wetland assessment must be conducted to determine if the impacts would be considered adverse.

Additionally, under Section 404 of the Clean Water Act, the degradation of wetlands and floodplains are also controlled by limiting the discharge of fill into these sensitive areas. The Corp. of Engineers (COE) oversees fill discharge limits and issues two types of permits depending on the size of the floodplain or wetland to be impacted. Nationwide permits apply to areas where the impact is less than 10 acres. If the impact is greater than 10 acres, individual permits must be issued on a case by case basis before activities can be initiated.

In addition to the previously discussed regulations, DOE Order 5400.1 requires an environmental survey (a "pre-operational" survey) prior to the start-up of a new site, facility, or process, which has the potential for adverse environmental impact. The survey should begin no less than one year, and preferably two years, before the proposed project start-up date to evaluate

the biotic communities under varied seasonal changes. This baseline data supports the "Environmental Setting" portion of the work plans for site investigation and are also an important aspect for the evaluation of environmental impacts of corrective measures.

2. PROJECT DESCRIPTION

2.1 Background

Research activities conducted at Los Alamos National Laboratory (LANL) since its inception, have resulted in the formation of a large number of Solid Waste Management Units (SWMUs). SWMUs at LANL are defined as "any discernible unit which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous waste" (LANL, 1990). These SWMUs are located at various technical areas throughout the 43 square-mile (69 square km) facility and consist of various contaminants released from Laboratory facilities.

The U.S. Environmental Protection Agency (EPA) is the regulatory authority that is in charge of SWMUs and derives its authority through the Resource Conservation and Recovery Act (RCRA). In accordance with the requirements of RCRA, LANL must develop corrective actions for all released hazardous waste material (SWMUs) into the environment.

The Environmental Restoration (ER) Group (EM-13) is the responsible party for the development and implementation of corrective actions for SWMUs at LANL. The corrective action process is divided into four phases: 1) Site assessment, 2) Site characterization, 3) Development of proposed corrective actions, and 4) Selecting and performing corrective actions (LANL, 1990).

This Biological Assessment has been prepared for use with the site characterization phase. Biological Assessments for other phases may be required.

2.2 SWMUs and Proposed Sampling

SWMUs are located throughout TAs in OU 1157 and are associated with the following:

TA-8

- Firing Site
 - Inactive Septic Tanks
 - Drains and Sumps
 - Drains and Outfalls
 - Waste and Waste Container Storage
 - Material Disposal Area Q
 - Silver Recovery Resin Bin
 - Transformer Storage Area
 - Decommissioned Underground Storage Tanks
- #### TA-9 (includes former TA-23)
- Old Anchor East Firing Sites

- Old Anchor East Burn Pit
- Old Anchor East Decommissioned Sumps
- Active HE Sumps
- Septic Systems (active and decommissioned)
- Inactive Sump
- Oxidation Pond
- Lagoon and Sand Filter
- Waste Shelters and Storage Areas
- Waste Pit
- Material Disposal Area M
- Firing Site
- Industrial Waste Manhole
- Decommissioned Underground Storage Tank
- TA-69
- Two Mile Mesa Incinerator
- Septic Systems

Sampling of the SWMUs and sites down gradient from the SWMUs, will be conducted to determine the type, quantity, and extent of any environmental contamination. The sampling will also target drainages leading to Pajarito Canyon and the springs in the canyon. Surface and subsurface soils will be sampled. Sampling will vary from surface samples of no greater than 12 inches to core drilling to depths of 6.. These samples will be collected using hand methods of spade and scoop and thin wall tube sampler, to sampling equipment using eight inch diameter hollow-stem augers.

No significant release of contaminants into the environment is expected to occur during sampling. However, should release of contaminants rise above the predetermined action levels, workers must cease operations, shut down the site, and reassess the sampling.

3. ENVIRONMENTAL SETTING

3.1 General Setting

OU 1157 lies within the boundaries of LANL in Los Alamos, New Mexico. The Laboratory is located in north-central New Mexico approximately 160 km (100 miles) by road north of Albuquerque and 72 km (45 miles) by road northwest of Santa Fe (Fig. 1).

Los Alamos National Laboratory is located on the Pajarito Plateau on the east-central edge of the Jemez mountains. These mountains are formed by a complex pile of volcanic rocks along the northwest margin of the Rio Grande rift in north-central New Mexico. The plateau, which forms an apron of volcanic sedimentary rocks along the eastern flank of the mountains, is aligned approximately north-south and is about 32 to 40 km (20 to 25 miles) in length and 8 to 16 km (5 to 10 miles) wide. The plateau slopes gently eastward from an elevation of about 2286 m (7500 ft) near the mountains toward the Rio Grande where it terminates at an elevation of about 1889 m (6200 ft) in steep slopes formed by the down-cutting of the Rio

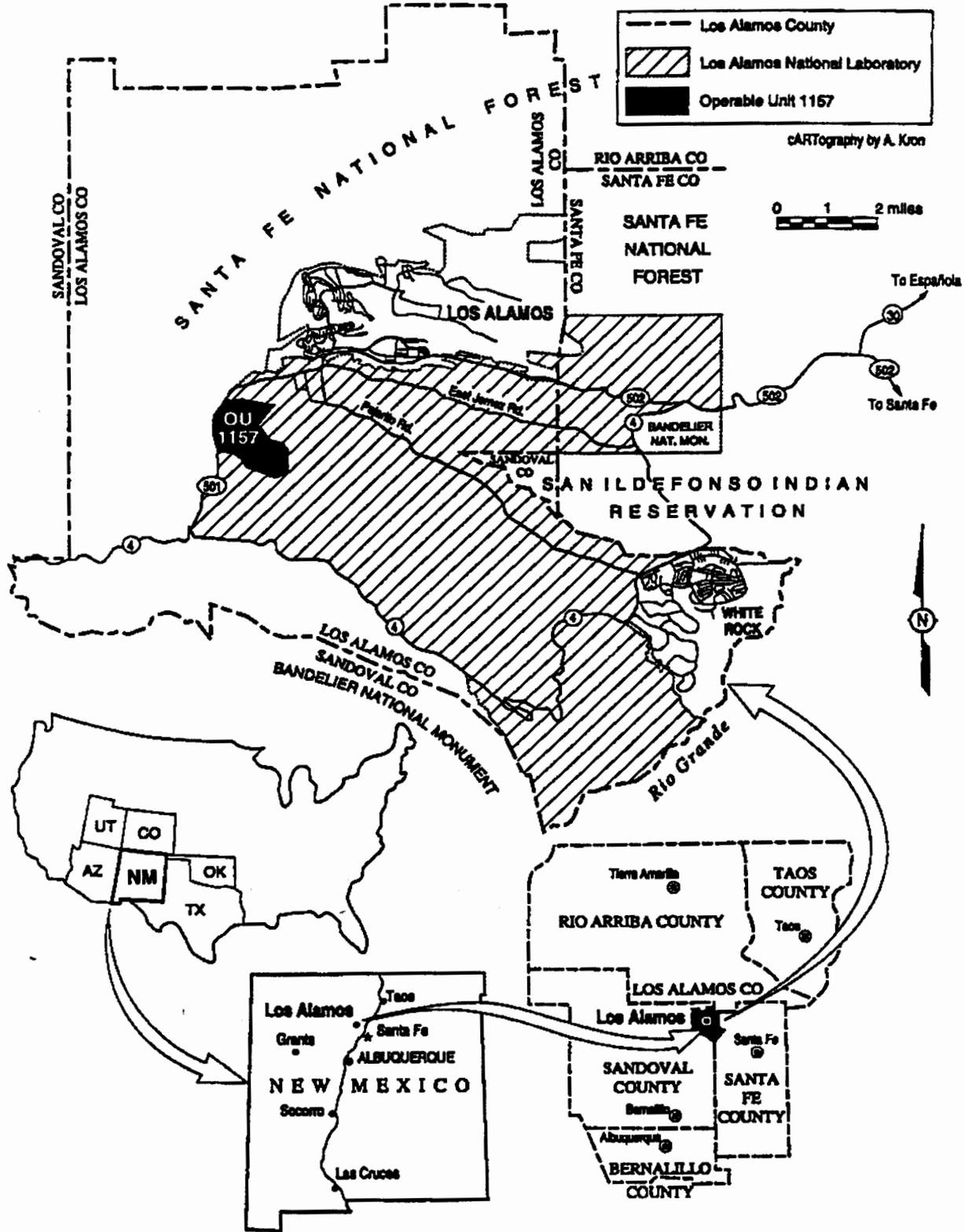


Fig. 1. Location of Los Alamos National Laboratory.

Grande River which lies at 1647 m (5400 ft). The plateau has been dissected into a number of narrow mesas by southeast-trending intermittent streams.

The apron-like plateau at the base of the mountains extends into finger-like mesas separated by deep canyons. Geological substrate Bandelier Tuff was deposited from volcanic eruptions in the Jemez Mountains about 1.1 to 1.4 million years ago (LANL 1988). The tuffs overlap other volcanics which are underlain by the conglomerate of the Puye Formation (LANL 1988). This conglomerate intermixes with Chino Mesa basalts along the Rio Grande River.

The area is characterized by a semiarid, temperate mountain climate with summer temperatures typically ranging from 10 to 22C (50F to 70F and 80F) during a 24 hr period (Bowen 1990). Winter temperatures generally range from -6 to -11C (the teen's to about 50F) during a 24 hr period. The annual precipitation in the vicinity of Los Alamos ranges from 32 to 46 cm (13 to 18 inches) with much of it occurring during summer rain showers in July and August.

Meteorological conditions during the 1992 field season are summarized in Figure 2.

3.2 Description of OU 1157

OU 1157 is located in the north western section of the Laboratory. The areas surveyed by BRET are bounded on the north by Two Mile Canyon and on the south by Cañon de Valle. This OU extends south and east on the western Laboratory boundary (IT Corp., 1990) (Fig. 3). The unit is located in Township 19 North, Range 6 East, Sections 19,20,29 and 30. This is an approximation only for this section and may include portions of additional sections. UTM Coordinates for the area are:

Zone	Easting	Northing
NW	3,970,000	378,000
SW	3,968,600	377,800
NE	3,968,700	380,000
SE	3,968,000	380,000

The OU encompasses portions of upper Pajarito Canyon, Two Mile Canyon and Cañon de Valle. The entire OU ranges in elevation from approximately 2395 m (7300 ft)asl at the western edge to about 2559 m (7800 ft) asl at the eastern edge. The topography is varied ranging from moderate to steep canyon walls to gently sloping mesa tops.

The geology of the study area is along the eastern edge of the Pajarito Plateau. OU 1157 is underlain by welded Bandelier Tuff with Tesuque and Puye formations (Ferenbaugh 1982). Soil compositions in the area consist of Carjo loam, fine and clayey-skeletal Typic Eutroboralfs, Frijoles and Tocal very fine sandy loam, Seaby loam, and rock outcrop (Nyhan *et al.*, 1978). The potentiometric surface of the main aquifer in the Los Alamos area lies about 6200 to 6400 feet asl over the entire OU area. Over 1000 feet of unsaturated tuff

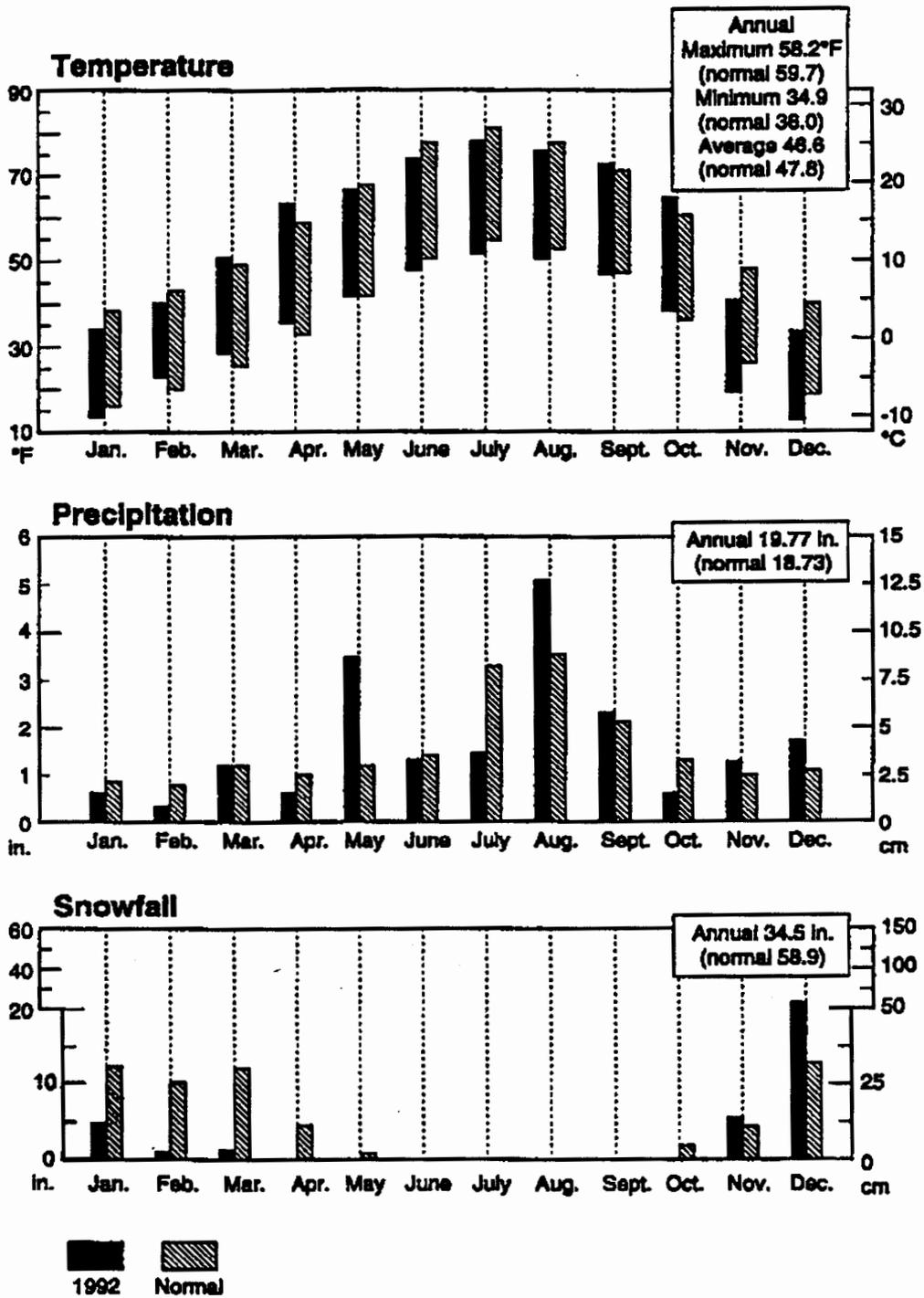


Fig. 2. Meteorological conditions for 1992 at Los Alamos, NM (elevation 7425 ft.).

SANTA FE NATIONAL FOREST

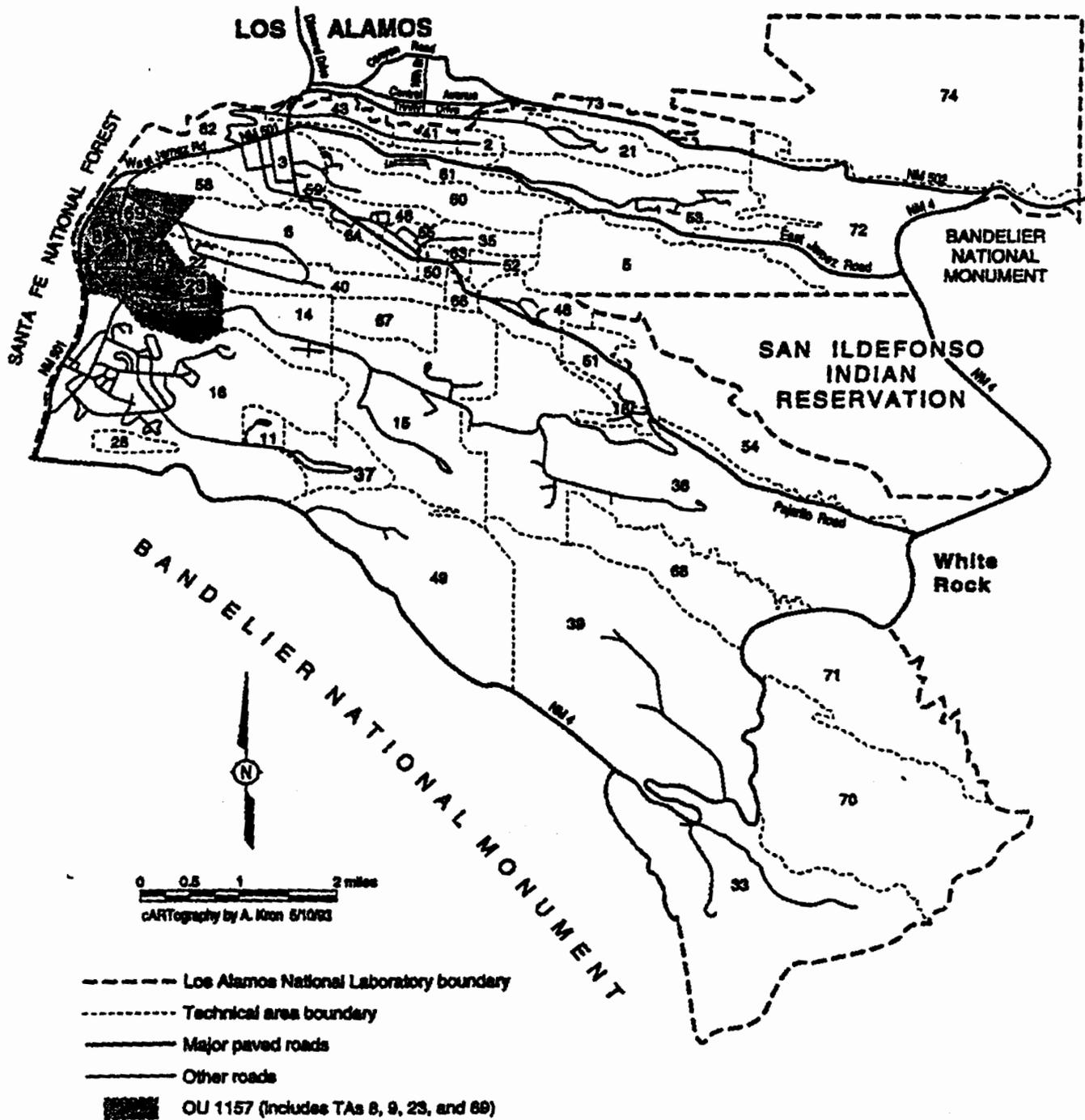


Fig. 3. Location of Operable Unit 1157.

and volcanic rock separate the surface from the underlying aquifer (IT, 1987a). Pajarito canyon acts as a drainage for the flanks of the Jemez Mountain. Spring and summer thunderstorms recharge a thin perched aquifer confined to the alluvium in the canyon.

3.3 Historical Background

The Pajarito Plateau has been in use since the late 1100's when the Pueblo Indians settled in the area and began agriculture on the mesas and canyon bottoms (Foxy & Tierney 1984). Large pueblo settlements were in place in the late 1300's. With the arrival of the Spanish, grazing animals such as sheep, goats, cows, and horses were introduced. Sheep was the major domestic livestock until the late 1800's when cattle became more profitable. It is believed that Pajarito Canyon was used as a source of water by San Ildefonso for sheep and later possibly for cattle from nearby ranches. In 1897, H. S. Buckman bought logging and timber rights to the Ramon Vigil Grant which is just east and south of the present day OU 1157. Areas adjacent to the Grant were also logged when the land was sold to the Ramon Land and Lumber Company in 1906; logging continued into the 1940's.

After the Homestead Act of 1862, the plateau west and north of the Ramon Vigil Grant became homesteads for summer grazing areas and agriculture. In 1906, Martha Brooks made application for official homestead for 150 acres of land in Township 19 N, Range 6 E, Section 14 (Homestead Entry serial #019452-1197034, US Land Office, Santa Fe, NM). The present day OU 1157 encompasses Martha Brooks Anchor Ranch. According to testimony by Brooks and other witnesses, only 80-82 acres could be cultivated, the rest being too rough and rocky, with only a few small pine and pinon trees. The Anchor Ranch consisted of a frame house and one half mile of wire fencing on the west side of the claim. Crops of beans, rye, oats, and corn were planted from 1913 to 1918.

Much of the homesteading areas were later taken over by the Manhattan Project. Homesteads including the Anchor Ranch were acquired by condemnation or purchase.

4. PREVIOUS STUDIES

Prior to the 1992 surveys, several site-specific studies had been completed within or immediately adjacent to OU 1157. These studies, gathered at sites of proposed Laboratory activities, include information on threatened and endangered species, vegetation, wildlife baseline and inventory data.

Much of the species information in this section is extrapolated for use as a general description of the biological make-up of the project area. The most recent vegetation surveys conducted as part of this biological assessment of the biological community were necessary to

determine more complete and accurate plant and wildlife species information for the proposed sampling sites.

4.1 Previous Vegetation Studies

A few vegetation analyses and surveys have been conducted within portions of the canyons and mesa tops of OU 1157, and in surrounding areas. The surveys are noted on Table 1. These studies include previous floristic surveys of the Los Alamos National Laboratory, a study conducted on outfalls throughout the Laboratory, and observational data. All of these studies and surveys were conducted prior to 1993. A complete checklist of plant species identified during these surveys in addition to the most recent field surveys is given in Appendix A.

Table 1: Documents/Surveys Previously Completed Containing Information on Plant Species Within or Near OU 1157.

<u>PROJECT</u>	<u>DATE</u>	<u>AUTHORS</u>
Wood lily survey	1979	Kosiewicz
	1984	Foxx and Hoard
Biological Survey 77-008	1977-78	Foxx and Tierney
Flora of Los Alamos Lab	1980	Foxx and Tierney
Flora of Los Alamos Lab	1984	Foxx and Tierney
Flora of Los Alamos Lab	1985	Foxx and Tierney
Memo Report HSE8-85-842	1985	Foxx and Tierney
CAD/CAM Cable Line Outfall Study	1992	Edeskuty, Foxx, and Raymer

The survey of NPDES outfalls included several outfalls within OU 1157 (Table 2). All the outfalls surveyed drained various effluent into Pajarito Canyon and its water course. Length of flow was not always determined because not all outfalls were flowing at the time of the survey. In addition, according to personnel at the site, outfall 04A-155 in TA-9 no longer discharges. Of eight outfalls surveyed in OU 1157, 06A-075 can be considered jurisdictional wetlands from hydrophytic vegetation such as cattail stands.

Table 2: NPDES Outfalls Surveyed in OU 1157

TA #	NPDES ID #	Near Build	Type Effluent	Flow Length	Canyon Water Course Enters
8	04A-115	70	non-contact cooling water	(not flowing at time of survey)	Pajarito
8	06A-074	22	Photo waste	500-1000 ft.	Pajarito
8	06A-075	21	Photo waste	200-500 ft.	Pajarito
9	04A-155	55	non-contact cooling water	(not flowing at time of survey)	Pajarito
9	05A-066	40	HE discharge	51-100 ft.	Pajarito
9	05A-067	44	HE discharge	(not flowing at time of survey)	Pajarito
9	05A-068	48	HE discharge	(not flowing at time of survey)	Pajarito
9	SSS-02S	N/A	Oxid. Pd.	25 ft. & enters water course	Pajarito

4.2 Wildlife

Several surveys and observational data describing the fauna within portions of the canyons and mesa tops within or adjacent to the OU and surrounding areas are given in Table 3. These studies are discussed below with species lists provided in Appendix B

Table 3: Documents/Surveys Previously Completed Containing Information on Wildlife Species Within or Near OU 1157.

<u>PROJECT</u>	<u>DATE</u>	<u>AUTHORS</u>
Movements of Mule Deer on the Los Alamos National Environmental Research Park	1979	Eberhardt and White
Biotelemetry Studies on Elk	1981	White
Jemez Salamander Surveys	1985	Schmitt <i>et al.</i>
Seismic Trench Study	1991	Edeskuty and Bennett

Table 3: Documents/Surveys Previously Completed Containing Information on Wildlife Species Within or Near OU 1157, cont.

<u>PROJECT</u>	<u>DATE</u>	<u>AUTHORS</u>
The Ants of Los Alamos County (Hymenoptera: Formicidae)	1986	Mackay, <i>et al.</i>
Atlas of Breeding Birds of Los Alamos County	1991	Travis
Outfall Study	1992	Edeskuty, Foxx, and Raymer
Species Diversity and Composition of Small Mammals along an Elevational Gradient in the LASL Environs	(Unpubl.)	Miera & Eberhardt

4.2.1 Insects

No insect studies have been completed within OU 1157. However, one insect study conducted on the Laboratory could have limited application to this OU because of similarity of habitats. MacKay *et al.* (1986) collected ants during the summer of 1986 in Los Alamos County. He also supplied data from previously conducted studies. Appendix B lists those species potentially or actually (confirmed) in the area and in habitats similar to what is found in OU 1157.

4.2.2 Mollusks

No extensive or formal field surveys have been conducted for mollusks in this OU.

4.2.3 Reptiles and Amphibians

No extensive or formal field surveys have been conducted for reptiles and amphibians within OU 1157.

4.2.4 Birds

A list of bird species potentially and actually (confirmed) occurring within or near OU 1157 was extracted from the "Atlas of breeding birds of Los Alamos County, New Mexico" (Travis 1992). Species recorded on general observation sheets also provided species observed in the area. Appendix B lists actually- and potentially-occurring bird species in the vicinity of OU 1157.

4.2.5 Fish

There are no suitable fish habitats located within OU 1157, therefore no fish species are expected to occur in this unit.

4.2.6 Mammals

4.2.6.1 Small Mammals. Appendix B lists those species captured or observed in the study sites and species visually observed or captured in related studies. Species listed in the Outfall study and Miera's survey were included because of similar habitat types. Data from these surveys can be extrapolated to habitat types in this OU.

4.2.6.2 Large Mammals. Eberhardt and White (1979) conducted a study entitled "Movements of mule deer on the Los Alamos National Environments Research Park," on LANL land from 1975-1978. They captured 36 deer, marked 11 with radio-collars and marked 24 with visual markings (ear tags, streamers, and neck collars). Deer homes ranges tended to be elongated following the mesa and canyons of LANL. Average home range size was 5.0- 13.7 km². Because deer do not make large seasonal migrations they are considered a resident population. Eberhardt and White found mule deer do not seem to avoid areas of high human activity but their movements are affected by the Laboratory's 2.6 m-high security fences.

Gary White conducted a biotelemetry study on elk from 1978 to 1980 (White 1981). He radio-collared 30 elk and found that in general elk use Cerro del Medio (Baca Land) for calving and nursing areas and areas in early successional stages. In general, the radio-collared elk did not tend to use areas at LANL with high human activity. Figure 4 shows the general use of Laboratory land by deer and elk.

4.3 Threatened, Endangered and Sensitive Species

4.3.1 Vegetation

The state-endangered wood lily (*Lilium philadelphicum*) has been found in Los Alamos County several times. This species has been recorded near the OU 1157 area in observational data by Kosiewicz in 1979 and in a general survey by Foxx and Hoard (1984). The wood lily has generally been recorded as occurring in upper Pajarito Canyon in ponderosa to mixed-conifer areas.

4.3.2 Wildlife

Jemez Mountains salamander: The Jemez Mountains salamander (*Plethodon neomexicanus*) has been found in Los Alamos County in two separate surveys (see Appendix C for references). Schmitt, *et al.* in 1985, and Edeskuty and Bennett in 1991, located the species in the general map location of upper Pajarito Canyon.

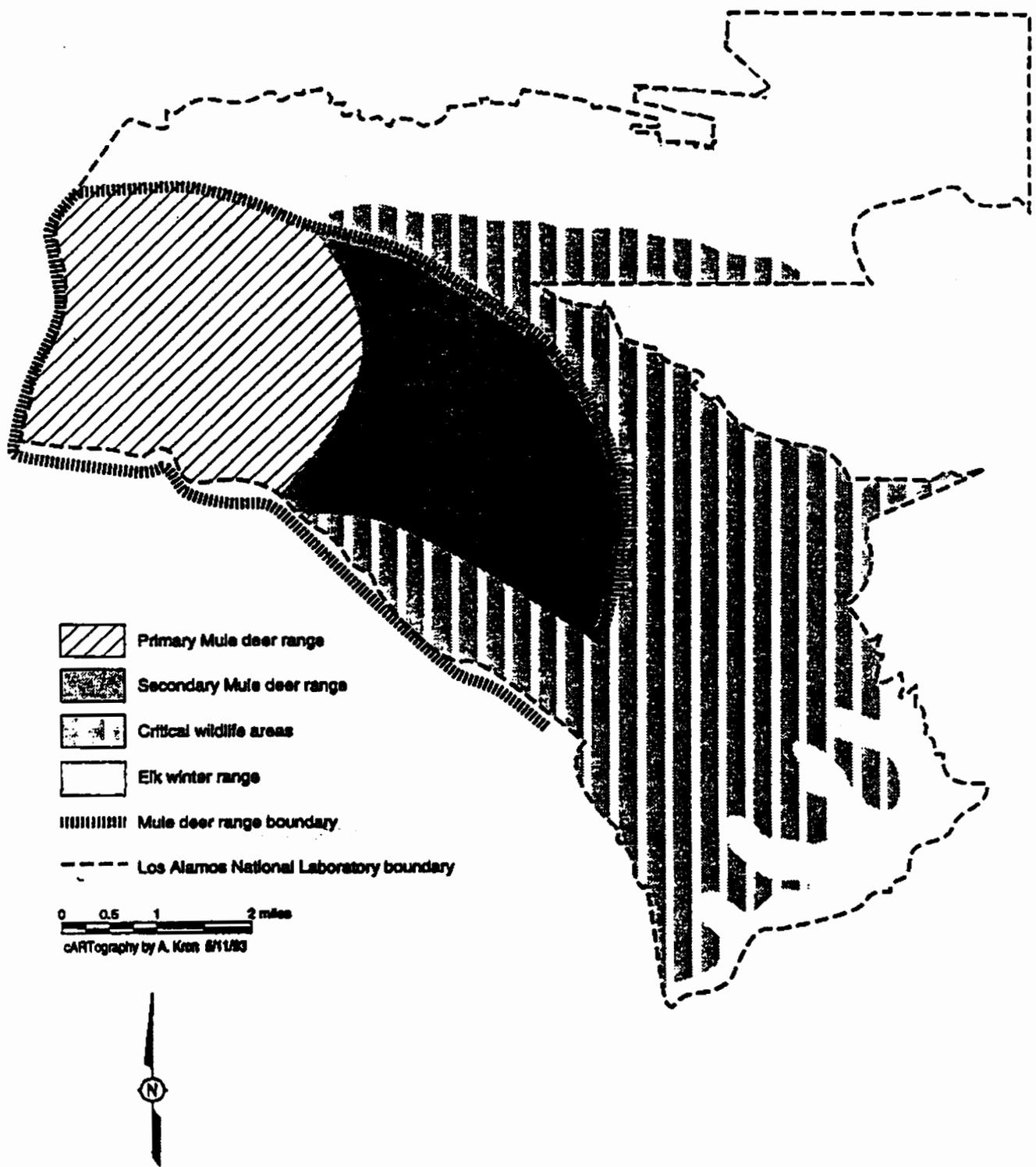


Fig. 4. Wintering deer and elk patterns on Los Alamos National Laboratory land.

The survey conducted by Edeskuty and Bennett was conducted in an area just outside OU 1157 using a Time-Constrained Search (TCS) as described by US Forest Service's protocol 'A'. This species was found in the area just to the west of OU 1157. Schmitt *et al.* found the salamander in various locations in the Jemez Mountains in Los Alamos County. This species was found to occur in areas characterized by conifers, with cool, moist, and shaded habitats. All areas where the salamander occurs are considered key habitat.

4.4 Previous Wetland Studies

The Environmental Protection Agency (EPA) required a determination of all wetlands within the watershed of lands owned by the DOE/LANL for the LANL/DOE Resource and Conservation Recovery Act (RCRA) and Hazardous and Solid Waste Act (HSWA) part B permit. Consequently, a project to map and characterize those wetlands was undertaken in 1990. The wetlands mapping was done by the USFWS in accordance with the National Wetlands Inventory (NWI). The national inventory of wetlands includes all wetlands and deep water habitats throughout the United States, including rivers, lakes, streams, marshes, bogs and ponds. In cooperation with other federal and states agencies, private organizations and individuals the, USFWS developed a wetland definition for conducting an inventory of the nation's wetlands. This definition was published in the "Classification of Wetlands and Deep Water Habitats of the United States" (Cowardin, *et al.* 1979). In the NWI, wetlands are defined as "lands transitional between aquatic and terrestrial systems where the water table is usually at or near the surface, or the land is covered by shallow water." In addition, the definition requires that the land support predominantly hydrophytes and the substrate is drained hydric soils (Dunke, *et al.* 1989).

The NWI maps are broad in scope and are meant to only provide guidance but not proprietary jurisdiction. The method for classification is a hierarchical system and is solely based on aerial photography (Fig. 5). The NWI aerial maps typically reflect conditions during the specific year and season they were taken. Small wetlands and those wetlands in deep steep canyons may not have been detected using this method. A detailed on-the-ground and historical analysis of single sites is being undertaken for each OU.

4.5 Previous Floodplains Studies

Under existing permit requirements, the EPA stipulates that facilities regulated by RCRA must delineate all 100 year floodplain elevations within their boundaries. McLin (1992) did floodplain computational mapping using the COE's computer-based Flood Hydrograph Package (HEC-1) and HEC-2 (McLin 1992). HEC-1 generates storm hydrographs at selected channel locations within each ungaged watershed, HEC-2 defines the floodplains (Fig. 6). He used the approach to define the hydrograph peaks for 100 year, 6-hour design storm event for Los Alamos.

Total basin areas for each canyon at the east LANL boundary were 3.28 square miles for Two Mile Canyon, 11.36 square miles for Pajarito Canyon, and 4.28 square miles for Cañon de Valle. The total runoff volumes (acre-feet) calculated for 6-hour storm events were 149, 498, and 141 respectively.

5. METHODOLOGY

Three levels of surveys were conducted within this OU. The primary purpose of these surveys was to determine the presence or absence of species of concern or of sensitive habitats that could be impacted by the site characterization sampling.

5.1 Level 1 (Reconnaissance Surveys)

The Level 1 (reconnaissance) survey is the initial survey conducted to determine placement location of line transects, the extent of potential impact, the presence or absence of water or floodplains, and the presence or absence of disturbance.

After the initial field reconnaissance, the TES species database developed by BRET was searched. The database contains the latest information concerning individual threatened and endangered species occurring in Los Alamos and the surrounding counties. The information is supplied through the New Mexico Department of Game and Fish, New Mexico Energy and Minerals and Natural Resources Department, New Mexico Plants Protection Advisory Committee (1984), and the USFWS (50 CFR 17.11 and 17.12, 1989). BRET obtained a listing of potential species that could occur in the area by inputting habitat characteristics noted during the reconnaissance survey. The habitat match generated a listing of potential state and federal TES species which could occur within the OU (see Appendix C).

5.2 Level 2 Surveys (Habitat Evaluation)

The Level 1 survey found that portions of the canyon walls and canyon bottoms were relatively undisturbed, and therefore potential habitat for threatened and endangered species. Based on these results, BRET conducted a Level 2 (habitat evaluation) survey.

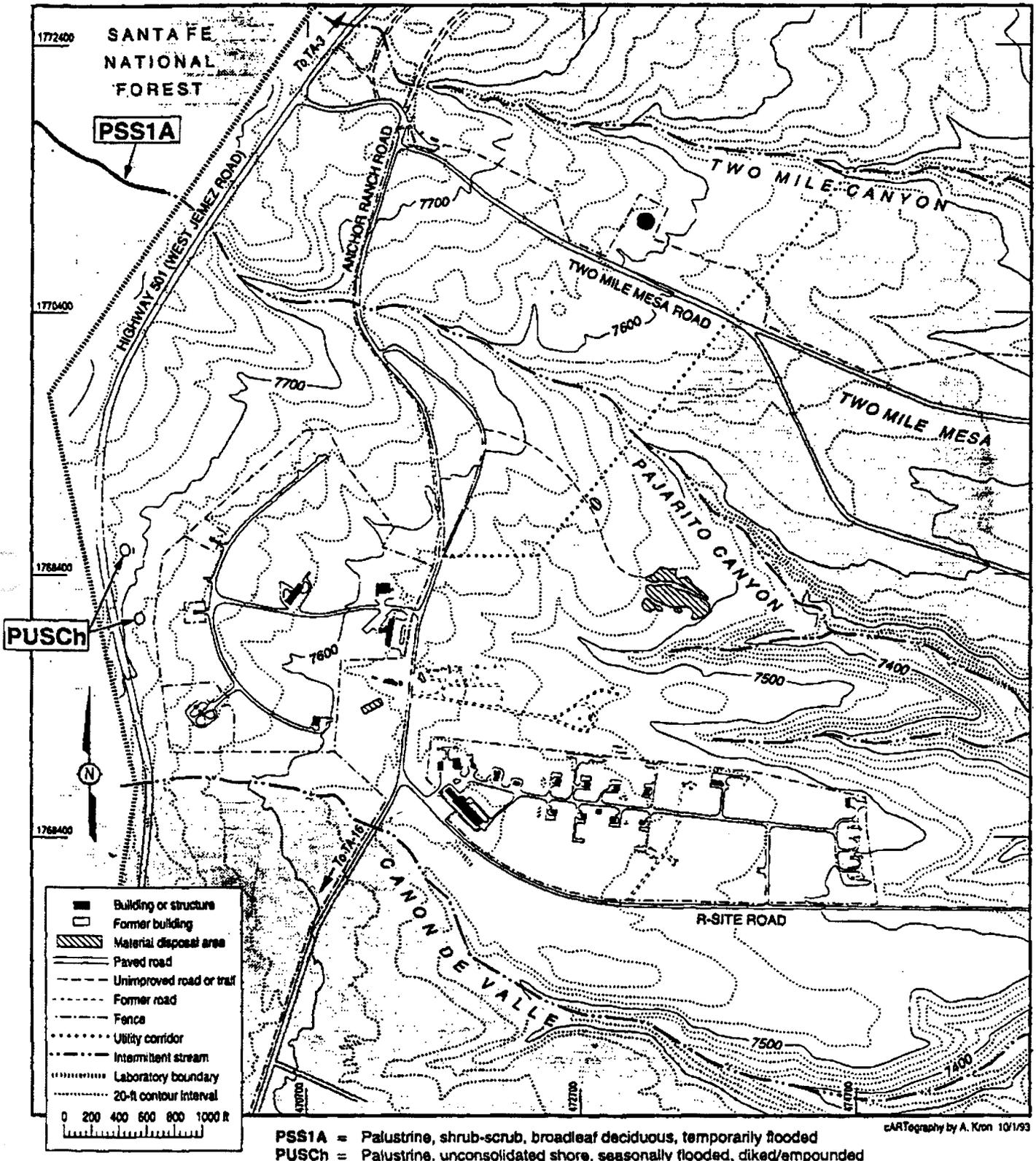
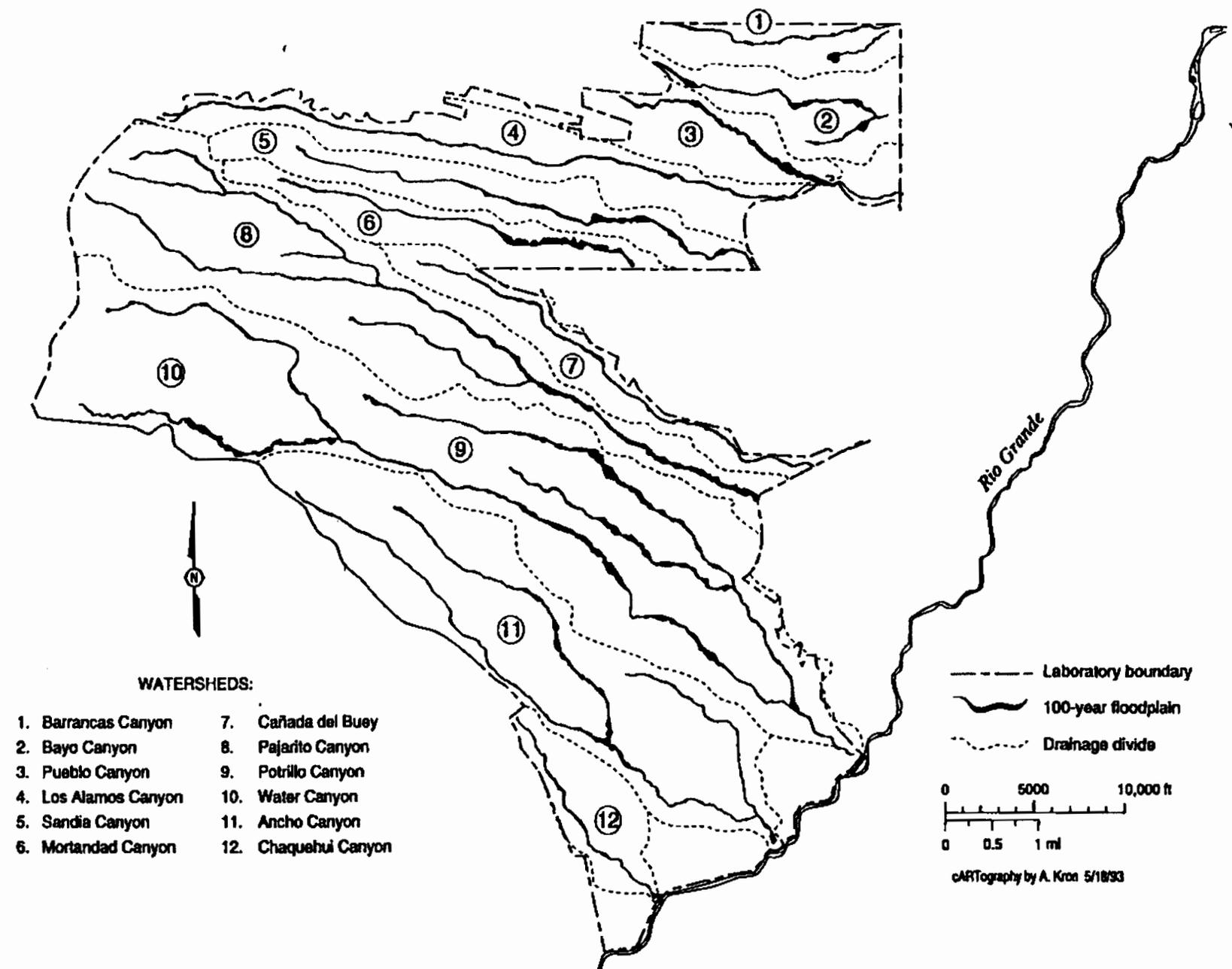


Fig. 5. National wetland inventory map for OU 1157.



WATERSHEDS:

- | | |
|----------------------|----------------------|
| 1. Barrancas Canyon | 7. Cañada del Buey |
| 2. Bayo Canyon | 8. Pajarito Canyon |
| 3. Pueblo Canyon | 9. Potrillo Canyon |
| 4. Los Alamos Canyon | 10. Water Canyon |
| 5. Sandia Canyon | 11. Ancho Canyon |
| 6. Mortandad Canyon | 12. Chaquehui Canyon |

Fig. 6. 100-year floodplain map for Los Alamos National Laboratory.

After the TES database search generated a list of species of concern, BRET undertook the Level 2 survey which quantitatively measures habitat, documents habitat parameters, and determines if habitat parameters for any known sensitive species are present. The habitat evaluation can also be used for environmental settings to run habitat evaluation procedures and to provide baseline information on the biotic communities. Once data from the vegetation transects were collected, BRET used a hierarchical classification system to summarize species information into "mapping units" using . These mapping units provided baseline information with which to map vegetation on to Geographic Information Systems such as ARC-INFO. Study areas were classified using Brown, *et al.*, (1982) and USFS Habitat Types (Moir and Ludwig 1979). Descriptions are based on the following system: Vegetation Type, Formation Type, Climatic (Thermal) Zone, Biotic Community, Series, Habitat Type, and Phase. (See also Appendix D.) Definitions for each classification are as follows:

Vegetation Type: Refers to vegetation established under an existing climate and includes one of two types: Upland and Wetland.

Formation Type: Refers to the formations that are vegetative responses to various environmental factors, primarily available soil moisture, and include the following:

Upland	Wetland
Tundra	Wet Tundra
Forest and Woodland	Forest
Scrubland	Swamp-scrub
Grassland	Marshland
Desertland	Strand
Non-vascular	Submergent

Climatic Zone: Refers to one of the four world climatic zones where minimum temperature is the primary determining factor in separation of formation types. These include Arctic-Boreal, Cold Temperate, Warm Temperate, and Tropical-Subtropical.

Biotic Community: Refers to a unit characterized by a distinct evolutionary history within a formation, and centered in a biogeographical region that has a particular precipitation pattern or climatic regime.

Series: Refers to principal plant-animal communities within each biotic community. These are based on distinct climax plant dominantes.

Habitat Type: Based on the occurrence of a particular dominate species that is local or regional in distribution.

Phase: Based on detailed data collection in determining co-dominates, understory species, and other species information.

BRET used standard ecological techniques in the habitat evaluation to measure cover, density, and frequency of the vegetative component, and to calculate importance indexes for each species in the overstory and understory components. The importance indexes given in the tables for tree and shrub species were calculated by averaging the relative cover, density, and frequency of each species encountered in the line transects. To obtain the importance index for understory species, only the relative cover and frequency were averaged.

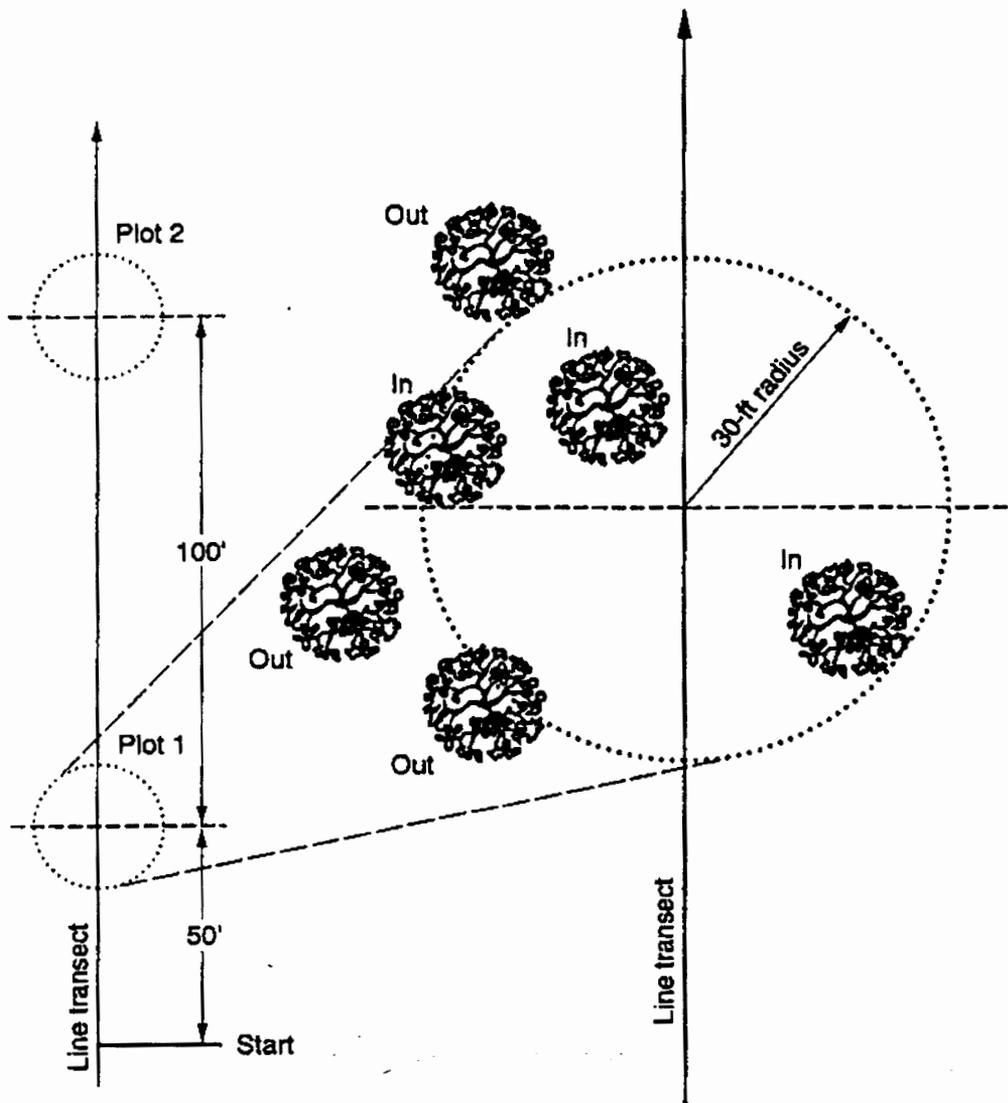
5.2.1 Overstory Evaluation

BRET used circular plot and line intercept techniques to measure the overstory components of the forest, woodland, and riparian communities.

Circular plots were used primarily in multi-stemmed pinon-juniper woodlands and along some riparian zones. The line intercept method was used primarily in taller, single-stemmed overstory habitats, such as ponderosa pine communities and riparian zones.

The total length of each transect was determined based on a "species area curve" or until a maximum of 700 ft is reached. The species area curve was calculated by comparing the total number of individual plant species recorded along a transect by the total number of plots along the same transect. The total length of the transect was considered adequate when the species area curve becomes relatively level, that is, when no new species were encountered in the transect. Based on previous experience, BRET established 700 ft as a transect length adequate for their surveys.

5.2.1.1 Circular Plots. Measurement of the overstory components within riparian zones and woodlands was done using the circular plot technique. BRET placed a transect line within the habitat to be evaluated (maximum 700 ft). Circular plots were established every 100 ft along the transect (Fig. 7) starting at the first 50 ft mark. BRET measured the basal diameter of all multi-stemmed species (i.e., pinon pine and juniper) within a 30 ft radius of the center point (that is, the transect line). All single-stemmed trees (i.e., ponderosa pine) were measured at diameter at breast height (DBH). BRET determined the amount of cover of each species by dividing the circle into four equal subplots, then estimated the individual species' cover within each of the subplots.



Tree boles and shrub stems should be counted in when 50% or greater of the bole or stem is in the plot.

Fig. 7. Circular plot method diagram for trees and shrubs.

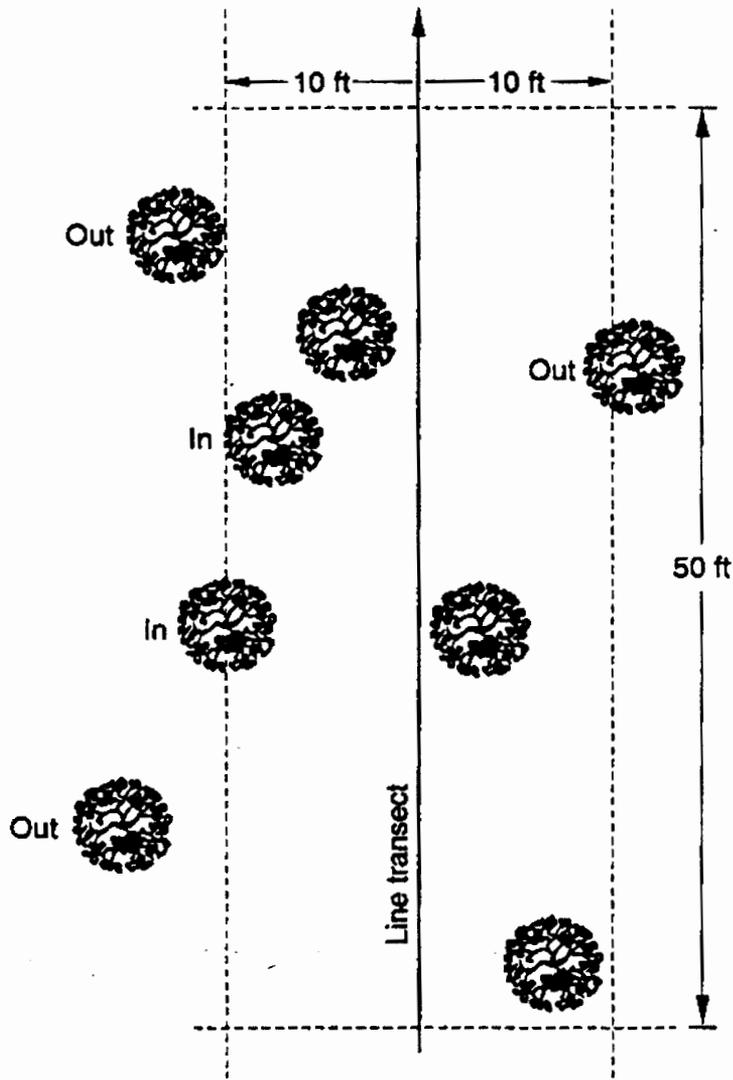
5.2.1.2 Line Intercept

BRET used the line intercept method to measure the single-stemmed overstory components within some riparian zones and most taller woodlands (i.e., ponderosa pine, mixed-conifer). For this method BRET placed a transect line totaling 700 ft within the habitat to be evaluated. For statistical purposes, the line was divided into 50 ft sections, thus creating 12 separate divisions in each 700 ft transect. Within each 50 ft section, BRET recorded the DBH of all trees and shrubs within 10 ft either side of the transect line and equal to or greater than 3 ft in height were recorded (Fig. 8). BRET estimated canopy cover by measuring the length of the cover of any species intersecting the transect line. This canopy cover was measured from the point at which an individual of each particular species first overhung the transect line to the point where that species terminated coverage along the line (Fig. 9). Canopy cover was measured separately for each species. If cover overlapped, that is, there were more than one individual of the same species included in that cover, canopy was measured as continuous as long the canopy cover of that particular species had no breaks in the cover intersecting the line. If the canopy extended into the next 50 ft section, the measurement was counted separately in the two sections.

5.2.2 Understory

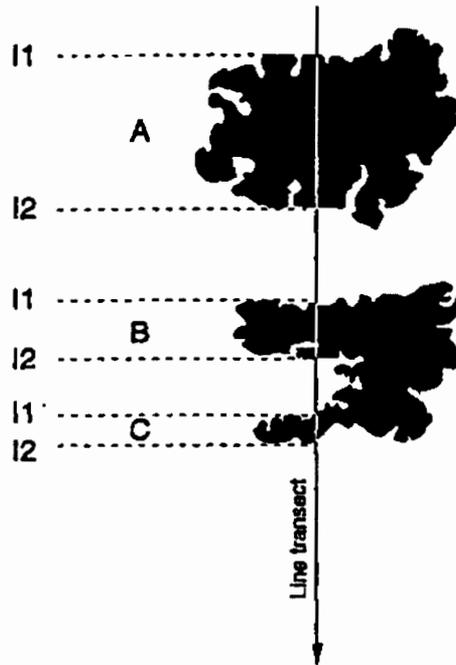
The quadrat method was used with a Daubenmire plot of 20 x 50 cm (Daubenmire 1959) to measure the cryptogamic and herbaceous layer, the percent bare soil, litter, and woody species less than 3 ft tall. Visual estimates of foliar cover were used to determine percent cover and species composition. Quadrats were placed every 10 ft along the same 700 ft transect line established for overstory evaluation (Fig. 10).

BRET used Martin and Hutchins (1980), Foxx and Hoard (1984), and Foxx and Tierney (1985) for plant identification. When necessary, voucher specimens were collected and archived in the EM-8 Herbarium. Any specimens with questionable identifications were taken to the University of New Mexico Herbarium for confirmation.

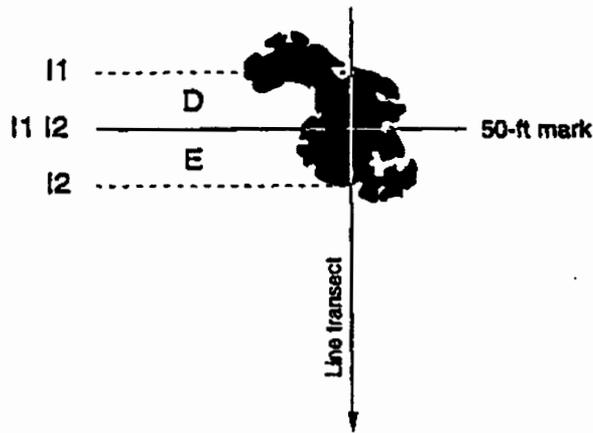


Tree boles or stems should be counted in when 50% or greater of the bole or stem is in the plot

Fig. 8. Line transect method of tree bole measurements and stem counts.



View from above the line showing a transect with tree and shrub intercepts indicated.
 I1 = beginning intercept
 I2 = ending



When the intercept crosses the 50-ft mark, intercepts should be read separately, with a new intercept beginning at the 50-ft mark.

Fig. 9. Reading foliar intercepts.

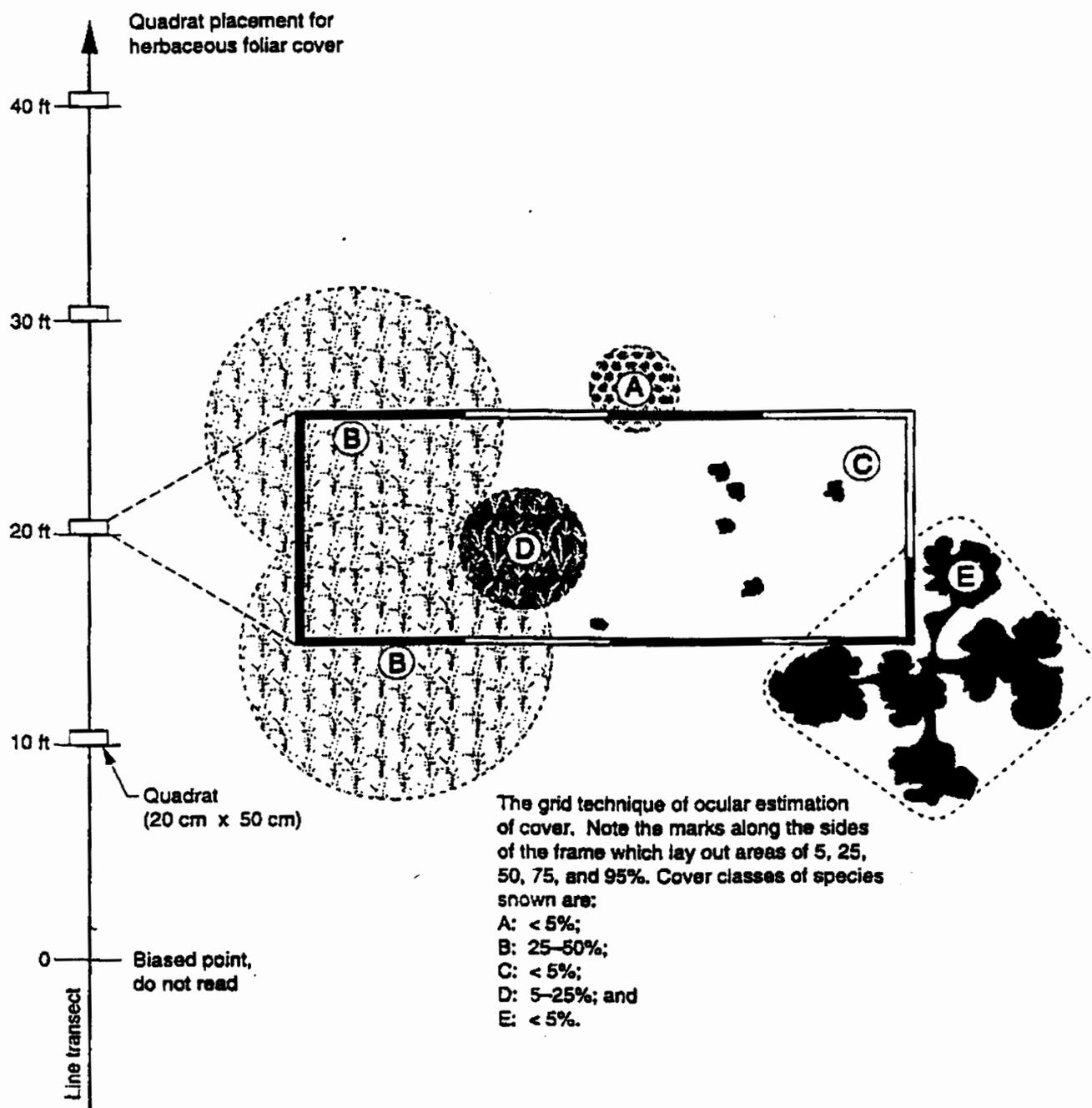


Fig. 10. Location of quadrats for understory transects of herbaceous foliar cover, and the grid technique of ocular estimation of cover (from Daubermire 1973).

5.3 Level 3 (Species Specific Surveys)

Based on the results of the Level 1 and Level 2 surveys and consultation with experts, BRET concluded that Level 3 surveys were necessary to determine the presence or absence of wildlife species. BRET conducted three formal Level 3 surveys for specific species.

5.3.1 Vegetation

BRET conducted numerous vegetation surveys, although no species specific surveys were undertaken for vegetation.

5.3.2 Wildlife

5.3.2.1 Small Mammals. BRET conducted small mammal live-trapping sessions in OU 1157 for Pajarito Canyon. Capture/marked recapture methods were used in order to obtain a species list for this area in conjunction with the meadow jumping mouse survey. In upper Pajarito Canyon, BRET established a trapping grid consisting of 210 traps set out in two lines of 50 m each along both sides of the stream in the bottom of the canyon. Trap stations were spaced 10 m apart and three traps were placed at each station. Morrison (1990) recommends a two- to four-times trap density in order to capture meadow jumping mice. All studies used ventilated aluminum 9x3x12 Sherman live traps baited with oats or peanut butter. For nocturnal trapping, traps were baited in late afternoon and set on a level surface under cover for protection from exposure to heat and precipitation. Traps were left open all night to capture animals then checked immediately the next morning. Captured animals were weighed and measured in a cloth or plastic bag, identified, tagged with fingerling-sized metal ear tags, photographed, then released at the site of capture. The grid was run for only one week at any given time. When necessary, voucher specimens of small mammals were taken for identification purposes

In addition, four traps for medium-sized mammals were placed along the small mammal trapping lines. Havahart live traps, one 1050(3A), two 1045(3), and one 1025(1), were baited with sardines or strawberries, and left open for one to two nights. Trapping was conducted for four nights. Any species captured was identified, determined as to age and sex, and then released.

5.3.2.2 Large Mammals. No specific large mammal surveys were conducted in OU 1157. However, while doing other field work, the team recorded any observations of animals, their tracks or scat.

5.3.3 Birds

No systematic surveys were conducted for non TES birds within OU 1157 during the 1992 field season. However, BRET recorded any observations made while doing other field work. Identifications were made using Peterson's guide to Western Birds (1990).

5.3.4 Amphibians and Reptiles

BRET undertook no systematic surveys of amphibians or reptiles within the OU. However, BRET recorded any observations made while doing other field work. If possible, with the exception of rattlesnakes, the animals were captured by hand and identified, photographed, weighed, measured, and then released. All identifications were made using Stebbins (1985).

5.3.4 Snails and Bivalves

BRET conducted no systematic surveys snails or bivalves within the OU.

5.3.6 Insects

Ground dwelling: BRET conducted no formal survey for ground-dwelling terrestrial insects within the OU prior to 1991. However, all observations were recorded.

Aquatic: BRET conducted no surveys for aquatic insects in OU 1157.

5.3.7 Fish

No formal fish surveys were conducted within this OU.

5.3.8 Threatened, Endangered, and Sensitive Species

Northern Goshawk: An inventory for this species was conducted in the summer of 1993 by Colorado State University personnel. The study took place from May to July to coincide with the incubation, nesting, and fledgling-dependency stages of the goshawk nesting season (Kennedy 1991). The inventory was conducted along canyon edges and all main and side drainages of upper Pajarito Canyon and Canyon de Valle. Transects were based on the method recommended by Kennedy and Stahlecker (1993) with a difference of 150 m and 200 m between calling stations. Distances were measured by pacing. At each station, a broadcast of the goshawk alarm call taped from commercial recordings was played.

Any vocal or aggressive response from an accipiter would lead to an intensive nest search in the response area (Reynolds 1982). The search area would cover approximately 2500 m² (radius=800 m) and varying in shape according to terrain and vegetation (Sinton & Kennedy 1993). Each tree in the immediate area would be scanned with binoculars for an active nest until the nest was located. If no nest was found, additional calling would have been conducted (Sinton & Kennedy 1993).

Spotted Bat: A contract group, 3D/Environmental Services, Inc., conducted a survey for bats with emphasis on the spotted bat in the Los Alamos National Environmental Research Park.

(1992). They conducted two nights of mist netting in OU 1157 at a permanent pond located in TA-8 near the West Jemez Road.

Bat surveys were conducted using mist nets. This method is not specific to spotted bats, and therefore the mist-netting sessions collected general inventory data on bat species of the LANL area. Nets were set up and opened from dusk until between 2 a.m. and dawn. Nets were closely monitored and checked every few minutes to determine if any bats were caught. When a bat was caught in the net, it was carefully removed by holding it gently and pulling the net stands away from its body and wings. Data recorded included the species, sex, age, reproductive status, forearm length, direction of flight, and time of capture. Photographs were taken of some specimens for identification. The animal was then released. Only rabies-immunized researchers handled the bats. Identifications were made using Whitaker (1980) and Burt and Grossenheider (1976).

Meadow Jumping Mouse. A survey for this species was conducted along with the small mammal survey in upper Pajarito Canyon. The same procedure was followed for small mammal capture with two additional traps at every station to increase the density by two- to four-times (Morrison 1990). The meadow jumping mouse is not attracted to bait and therefore the number of traps should be increased to increase the chances of capture when live trapping is conducted.

5.4 Floodplain and Wetland Assessment Techniques

Wetlands: The Federal Manual for Identifying and Delineating Wetlands has three mandatory technical criteria for wetland identification: 1) hydrophytic vegetation, 2) hydric soils and 3) hydrology.

An area is considered to have wetland hydrology when, during the growing season, there is: 1) permanent or periodic inundation or soil saturation for a significant period (usually a week or more), 2) a water table less than .5 to 1.5 feet from the surface for one week or more ; or an area is inundated through ponding or flooding for one week or more. Various information can be used to determine direct or indirect evidence of inundation or soils saturation including field observations, recorded data, aerial photographs and field indicators.

Hydric soils are formed when prolonged inundation caused anaerobic soil conditions. This changes the iron oxides and manganese oxides affecting solubility, movement, and aggregation of the oxides. This becomes reflected on soil color and physical characteristics. These changes in color and physical characteristics indicate inundation, and are used as a field indicator of wetlands. Soil pits at least 18 inches in depth can be dug to determine the field indicators of soil saturation, soil color, mottling, gleying, and aquic or paraquic moisture regimes. Soil color is determined with a Munsell soil color chart.

The third key parameter in determining wetland status is the presence of hydrophytic vegetation. Such plants are adapted to inundation or periodic saturation, and can withstand

anaerobic soil conditions. Vegetation can be classified in five different categories: obligate wetland (OBL), facultative wetland (FACW), facultative (FAC), and obligate upland (UPL). Hydrophytic vegetation is indicated when under normal circumstance: 1) more than 50% of the composition of the dominate species forming all strata (trees, shrubs, herbs) are obligate wetland, facultative wetland and/or facultative species; 2) a frequency analysis of all species within the community yields a prevalence index of less than 3 (where OBL=1, FACW=2, FAC=3, FACU=4 and UPL=5) (National List of Plant Species That Occur in Wetlands: Southwest (Region 7). Hydric vegetation was noted during the habitat evaluations as part of the Level 2 surveys.

Floodplains: Floodplains are identified as "lowlands adjoining inland and coastal water and relatively flat areas." The base floodplain is defined as the 100-year (1.0%) floodplain. The critical action floodplain is defined as the 500 year (0.2%) floodplain. Floodplains are protected from disturbance under EO 19900. Floodplain maps indicate the base floodplain or 100 year floodplain (McLin 1992).

6. RESULTS

6.1 Level 1 (Reconnaissance Survey)

BRET conducted Reconnaissance surveys for Pajarito Canyon and Pajarito Mesa to determine potential habitats, identify sampling locations, and to determine access to conduct field surveys. All sampling locations were readily accessible, either by vehicle or a relatively brief walk.

To determine whether any TES plant and animal species potentially exist within the project area, we reviewed the TES database containing information on previously documented occurrences and existing habitat. Appendix C provides a printout of the actual database.

Based on the Level 1 surveys, the following plant communities were defined (Table 4) and used for search criteria:

- Ponderosa-piñon
- Ponderosa pine
- Mixed-conifer
- Wetlands
- Riparian

Although these community delineations may differ from habitats discussed in the following sections, they include all habitat types identified in this document.

TABLE 4: Threatened, Endangered, and Sensitive Species List.

Plants

State Endangered

Wood lily	<i>Lilium philadelphicum var. andium</i>
Helleborine orchid	<i>Epipactis gigantea</i>

State Sensitive

Checker lily	<i>Fritillaria atropurpurea</i>
Sandia alumroot	<i>Heuchera pulchella</i>
Pagosa phlox	<i>Phlox caryophylla</i>

Wildlife

Federally Endangered

Peregrine falcon	<i>Falco peregrinus</i>
Bald eagle	<i>Haliaeetus leucocephalus</i>

Federally Threatened

Mexican spotted owl	<i>Strix occidentalis lucida</i>
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Federal Candidate

Northern goshawk	<i>Accipiter gentilis</i>
Willow flycatcher	<i>Empidonax traillii</i>
Meadow jumping mouse	<i>Zapus hudsonius</i>
Spotted bat	<i>Euderma maculatum</i>

State Endangered

Meadow jumping mouse	<i>Zapus hudsonius</i>
Spotted bat	<i>Euderma maculatum</i>
Jemez Mountain salamander	<i>Plethodon neomexicanus</i>
Say's pond snail	<i>Lymnaea captera</i>
Broad-billed hummingbird	<i>Cynanthus latirostris</i>
Mississippi kite	<i>Ictinia mississippiensis</i>
Common black hawk	<i>Buteogallus anthracinus</i>

6.1.1 Vegetation

Federally Listed Species: There were no Federal endangered, threatened or candidate plant species listed as potentially occurring in the OU.

State Listed Species: There were two plant species listed as state threatened or endangered (Foxy and Hoard, 1984).

Endangered

Wood lily	<i>Lilium philadelphicum var. andium</i>
Helleborine orchid	<i>Epipactis gigantea</i>

Sensitive Species

Under the Federal Endangered Species Act and state statutes, only those species that are listed, or are candidates for listing, are protected. New Mexico has listed species occurring within the state that are considered rare because of restricted distribution or low numerical density. Since these plants are considered rare, these species are sensitive to long-term or cumulative land use impacts and are vulnerable to biological or climatic events that could eventually threaten them. These species are monitored by the state to determine if they should be elevated to endangered status. The following species are listed as State Sensitive:

Checker lily	<i>Fritillaria atropurpurea</i>
Sandia alumroot	<i>Heuchera pulchella</i>
Pagosa phlox	<i>Phlox caryophylla</i>

6.1.2 Wildlife

Federally Listed Species: There were two federally endangered species, one federally threatened, and two candidate species that meet the search criteria (U. S. Fish and Wildlife Service 1991):

Endangered	
Peregrine falcon	<i>Falco peregrinus</i>
Bald eagle	<i>Haliaeetus leucocephalus</i>

Threatened	
Mexican spotted owl	<i>Strix occidentalis lucida</i>

Candidate	
Northern Goshawk	<i>Accipiter gentilis</i>
Willow flycatcher	<i>Empidonax traillii</i>
Meadow jumping mouse	<i>Zapus hudsonius</i>
Spotted bat	<i>Euderma maculatum</i>

State Listed Species: Species listed as endangered or threatened in the State of New Mexico that met the search criteria are as follows (New Mexico Department of Game and Fish 1988):

Endangered	
Meadow Jumping Mouse	<i>Zapus hudsonius</i>
Spotted Bat	<i>Euderma maculatum</i>
Jemez Mountains salamander	<i>Plethodon neomexicanus</i>
Say's Pond Snail	<i>Lymnaea captera</i>
Broad-billed hummingbird	<i>Cynanthus latirostris</i>

Mississippi kite
Common black hawk

Ictinia mississippiensis
Buteogallus anthracinus

The Migratory Bird Treaty Act (16 USC 703-711) provides federal protection for all wild birds except resident game birds, English sparrows, starlings, and feral pigeons. The Bald Eagle Protection Act further protects eagles, including the golden eagle. These species are protected from being collected, maimed, and from having nests disturbed.

6.2 Level 2 (Habitat Evaluation) Surveys

BRET established vegetation transects in Pajarito Canyon and on Pajarito Mesa to evaluate the understory and overstory components of the following general habitats and locations:

Location	Habitat
Pajarito Mesa	Drainage Channel Open Meadows Southerly-facing Area
Pajarito Canyon	Canyon Tributary Bottoms North-facing Slope

In general, OU 1157 is located in the Rocky Mountain Montane Conifer Forest Community. More specifically, much of the vegetation within the unit is characterized as being in the Ponderosa Pine Series with varying vegetation complexes found throughout. This unit is comprised primarily of two canyon systems and a mesa. Pajarito Canyon, Pajarito Mesa, and Cañon de Valle are the major systems found in the unit. Line intercept and circular plot transects were established within two of these systems (Pajarito Canyon and Pajarito Mesa) to evaluate the overstory component. A further breakdown and discussion of vegetation is given below (see Appendix E for raw data summaries).

6.3.1 Overstory

Following a reconnaissance survey of OU 1157, general habitats displaying vegetational differences were selected for placement of vegetation transects. Drainage channel, open meadows, mesa tops, canyon tributaries, and north-facing slope were each identified as having, to some degree, a vegetatively different species composition. Each site selected for transect placement appeared to be representative of the overall habitat of OU 1157. Specific site characteristics (dominant species, relative density, cover, etc.) are discussed and comparisons made when possible.

These locations are relative to one-another within the OU. and do not necessarily represent the entire length of the canyon systems.

6.3.1.1 Pajarito Mesa Top. Within the TA-9 area, a transect was conducted on the mesa top between the finger canyons surveyed. Species recorded for the area were ponderosa pine, Douglas fir and one-seed juniper (Table 5). As in previous transects, ponderosa had the greater values for relative cover and frequency (98.01% and 98.4% respectively). There was no recorded cover for one-seed juniper; however this species occurred with more frequency than Douglas fir. Values for juniper and fir were all under 10%.

6.3.1.2 Drainage Channel on Pajarito Mesa. Typically, drainage channels are more densely vegetated than other terrain aspects due to their higher moisture content. Ponderosa pine and one-seed juniper are the dominant overstory species along the drainage channel behind Bldg. 70 in TA-8 (Table 5). Ponderosa pine has higher values for relative frequency, cover and density (53.85%, 83.47% and 94.23% respectively). Juniper occurs with a frequency close to that of ponderosa (46.15) however ponderosa has the higher importance index value of the two (77.18).

6.3.1.3 Open Meadows on Pajarito Mesa. The surveys of open meadows were both conducted in disturbed areas. The transect in TA-8 was located behind building 70 and the transect in TA-9 was located near a sewage lagoon. No overstory was recorded for the meadow in TA-8 however one one-seeded juniper seedling was observed in the area. Near the sewage lagoon, ponderosa pine and one-seeded juniper were the dominant overstory species (Table 5). One-seeded juniper had a higher relative cover than ponderosa (80% and 20% respectively). Ponderosa had the higher values for relative frequency and density (75% and 66.67%). Both species had close importance index values however ponderosa pine had the higher of the two (53.89%).

6.3.1.4 North-facing Slope of Pajarito Canyon. The north-facing slope of Pajarito Canyon was dominated by ponderosa pine with Gambel oak as a co-dominant. Pine occurred with 41.67% relative frequency and 85.07% relative cover (Table 5). Gamble oak had the second highest values (33.33% and 12.65% respectively). Douglas fir occurred in the transect with a 16.67% frequency. This was the only other species that occurred more than 10% in value in the transect but had a less than 10% value for the importance index. Ponderosa pine had the greatest value for the importance index (68.69%).

6.3.1.5 South-facing Area of Pajarito Mesa. A transect was conducted on a sloping portion of Pajarito Mesa north and west of the finger canyons. Only two overstory species, ponderosa pine and white fir, are recorded here (Table 5). No cover was recorded for white fir and all other values for this species were under 10% (relative frequency 0.72% and relative density 0.73%). Ponderosa pine occurs with 99.28% relative frequency and an importance index value of 99.52.

6.3.1.6 Canyons Tributaries of Pajarito Canyon. Two surveys were conducted in TA-9 in canyon tributaries of upper Pajarito Canyon. The first transect was located in a tributary just north of the building complex in TA-9. Ponderosa pine, Douglas fir and one-seed juniper comprise the overstory layer (Table 5). Ponderosa was the only species with recorded cover. All other values; relative frequency, density, and importance index, were greater than 90%. Douglas fir and one-seed juniper occurred under 5% of the time.

**TABLE 5: Overstory Vegetation Characteristics of the Tree Canopy Layer
Species Recorded in Operable Unit 1157.**

SPECIES	TRANSECT			
	Drainage Channel (a)	Open Meadow 1 (a)	Open Meadow 2 (a)	Southerly- facing Area (a)
Ponderosa pine				
Average DBH	5.69	-	-	-
Relative Cover	83.47	-	20.00	100.00
Relative Density	94.23	-	66.76	99.27
Relative Frequency	53.85	-	75.00	99.28
Importance Index	77.18	-	53.89	99.52
One-seed juniper				
Average DBH	2.20	-	-	-
Relative Cover	16.53	-	80.00	-
Relative Density	5.77	-	33.33	-
Relative Frequency	46.15	-	25.00	-
Importance Index	22.82	-	46.11	-
Douglas fir				
Average DBH	-	-	-	-
Relative Cover	-	-	-	-
Relative Density	-	-	-	-
Relative Frequency	-	-	-	-
Importance Index	-	-	-	-
White fir				
Average DBH	-	-	-	-
Relative Cover	-	-	-	0.00
Relative Density	-	-	-	0.73
Relative Frequency	-	-	-	0.72
Importance Index	-	-	-	0.48
Gambel oak				
Average DBH	-	-	-	-
Relative Cover	-	-	-	-
Relative Density	-	-	-	-
Relative Frequency	-	-	-	-
Importance Index	-	-	-	-

A dash (-) indicates the species was not recorded at this site.

a = Pajarito Mesa b = Pajarito Canyon

TABLE 5 cont.

SPECIES	TRANSECT			
	Mesa Top (a)	Finger Canyon 1 (b)	Finger Canyon 2 (b)	North- facing Slope (b)
Ponderosa pine				
Average DBH			16.33	9.71
Relative Cover	98.01	100.00	61.17	85.07
Relative Density	98.37	96.55	94.12	79.34
Relative Frequency	98.40	96.59	44.44	41.67
Importance Index	98.26	97.71	66.58	68.69
One-seed juniper				
Average DBH			-	0.10
Relative Cover	0.00	0.00	-	0.00
Relative Density	1.09	1.38	-	1.33
Relative Frequency	1.07	1.38	-	41.67
Importance Index	0.72	0.92	-	1.83
Douglas fir				
Average DBH	4.35		18.17	0.35
Relative Cover	83.94	0.00	25.89	0.66
Relative Density	80.56	2.07	2.94	7.33
Relative Frequency	80.56	2.03	33.33	16.67
Importance Index	81.68	1.37	20.72	8.22
White fir				
Average DBH	-	-	2.10	3.83
Relative Cover	-	-	12.94	1.61
Relative Density	-	-	2.94	2.00
Relative Frequency	-	-	22.22	4.17
Importance Index	-	-	12.70	2.59
Gambel oak				
Average DBH	-	-	-	4.75
Relative Cover	-	-	-	12.65
Relative Density	-	-	-	10.00
Relative Frequency	-	-	-	33.33
Importance Index	-	-	-	18.66

A dash (-) indicates the species was not recorded at this site.
a= Pajarito Mesa b= Pajarito Canyon

The second transect was located in another canyon tributary to the north of the first. Ponderosa pine, Douglas fir and white fir were the dominant overstory species (see Table 4). Of the three species, ponderosa once again had the highest values with over 50% for relative cover and density (61.17% and 94.12% respectively). White fir and Douglas fir had under 35% for all values including importance index (12.70% and 20.72%). Ponderosa pine showed the highest importance index value of 66.58%.

6.3.2 Shrubs

When conducting line intercepts and circular plots to determine overstory content, BRET separated woody species into trees and shrubs for purposes of analysis. There were also cases of overlap between measuring the shrub layer and measuring the understory layer when woody species were less than three feet in height.

6.3.2.1 Pajarito Mesa Top. There were no recorded shrub species for the mesa top (Table 6). This area was heavily dominated by ponderosa pine.

6.3.2.2 Drainage Channel on Pajarito Mesa. Seven species were recorded for the drainage channel area. Gambel oak, the major shrub species, occurred with 20.69% relative frequency and was recorded with 38.83% cover (Table 6). Oak also had the highest importance index value of (38.06%). Willow had the next highest cover (38.28%) but did not occur as frequently in the transect as Fendler's rose. These two species were ranked with importance index values of 19.66% and 15.09% respectively. Other species found in the transect were wild rose, chokecherry, whitestem gooseberry and New Mexico locust.

6.3.2.3 Open Meadows on Pajarito Mesa. Of the two transects conducted in open meadows, shrub species were only recorded in the transect near the sewage lagoon (Table 6). Gambel oak was the only shrub recorded here.

6.3.2.4 North-facing slope of Pajarito Canyon

There were three shrub species recorded for the north-facing slope (Table 6). Gambel oak occurred with the greatest relative frequency, density, and cover (72.16%, 59.38%, and 99.37% respectively). Fendler's barberry occurred with the second highest frequency (20.29%) but had less than 10% relative cover. The only other species recorded in this transect was cliffbush.

6.3.2.5 South-facing Area of Pajarito Mesa

Only one shrub species, Gambel oak, was recorded for the transect conducted on a south sloping area of Pajarito Mesa (Table 6).

6.3.2.6 Canyons Tributaries of Pajarito Canyon

Gambel oak was recorded as the dominant species in both transects (Table 6). The area closest to the TA-9 buildings showed that oak occurred with 92.48% relative frequency and was the only species recorded with cover. Fendler's rose and an unidentified species, *malus*, had relative frequency and importance index values of less than 10%. In the second canyon tributary

TABLE 6: Overstory Vegetation Characteristics of the Shrub Canopy Layer Species Recorded in Operable Unit 1157.

SPECIES	TRANSECT			
	Drainage Channel (a)	Open Meadow 1 (a)	Open Meadow 2 (a)	Southerly-facing Area (a)
Gambel oak				
Average DBH	676.92	4.36	-	56.01
Relative Cover	38.83	100.00	-	100.00
Relative Density	54.66	100.00	-	100.00
Relative Frequency	20.69	100.00	-	100.00
Importance Index	38.06	100.00	-	100.00
Willow				
Stems per Acre	128.21	-	-	-
Relative Cover	38.28	-	-	-
Relative Density	10.35	-	-	-
Relative Frequency	10.34	-	-	-
Importance Index	19.66	-	-	-
Fendler barberry				
Stems per Acre	-	-	-	-
Relative Cover	-	-	-	-
Relative Density	-	-	-	-
Relative Frequency	-	-	-	-
Importance Index	-	-	-	-
Fendler's rose				
Stems per Acre	292.31	-	-	-
Relative Cover	4.42	-	-	-
Relative Density	23.60	-	-	-
Relative Frequency	17.24	-	-	-
Importance Index	15.09	-	-	-
Chokecherry				
Stems per Acre	-	-	-	-
Relative Cover	-	-	-	-
Relative Density	-	-	-	-
Relative Frequency	-	-	-	-
Importance Index	-	-	-	-
Cliffbush				
Stems per Acre	-	-	-	-
Relative Cover	-	-	-	-
Relative Density	-	-	-	-
Relative Frequency	-	-	-	-
Importance Index	-	-	-	-

A dash (-) indicates the species was not recorded at this site.
a= Pajarito Mesa b= Pajarito Canyon

TABLE 6 cont.

SPECIES	TRANSECT			
	Mesa Top (a)	Finger Canyon 1 (b)	Finger Canyon 2 (b)	North- facing Slope (b)
Gambel oak				
Average DBH	-	115.12	225.64	496.58
Relative Cover	-	100.00	64.58	99.37
Relative Density	-	92.50	52.63	59.38
Relative Frequency	-	92.48	43.75	72.73
Importance Index	-	94.99	53.65	77.16
Willow				
Stems per Acre	-	-	-	-
Relative Cover	-	-	-	-
Relative Density	-	-	-	-
Relative Frequency	-	-	-	-
Importance Index	-	-	-	-
Fendler barberry				
Stems per Acre	-	-	67.69	313.63
Relative Cover	-	-	10.12	0.63
Relative Density	-	-	15.79	37.50
Relative Frequency	-	-	18.75	22.73
Importance Index	-	-	14.89	20.29
Fendler's rose				
Stems per Acre	-	-	-	-
Relative Cover	-	-	-	-
Relative Density	-	-	-	-
Relative Frequency	-	-	-	-
Importance Index	-	-	-	-
Chokecherry				
Stems per Acre	-	-	123.08	-
Relative Cover	-	-	15.18	-
Relative Density	-	-	28.71	-
Relative Frequency	-	-	18.75	-
Importance Index	-	-	20.88	-
Cliffbush				
Stems per Acre	-	-	12.31	-
Relative Cover	-	-	10.12	-
Relative Density	-	-	2.87	-
Relative Frequency	-	-	18.75	-
Importance Index	-	-	10.58	-

A dash (-) indicates the species was not recorded at this site.
a = Pajarito Mesa b = Pajarito Canyon

surveyed oak occurred in the transect with relative frequency 43.75%, and had an importance index value of 53.65%. Barberry, chokecherry and cliffbush values were all recorded as less than 20%.

6.3.3 Understory

6.3.3.1 Drainage Channel on Pajarito Mesa. In the drainage channel behind Bldg. 70 of TA-8, a rush species had the greatest relative cover and frequency (40.53% and 16.67% respectively)(Table 7). More common species with relative frequency of more than 10% were bluegrass (15.38%) and a rose species (11.54%). The rose species had less than 10% relative cover and bluegrass had the second highest relative cover value 13.12%. The rush species had the greater overall importance index value.

Some additional species found in the drainage channel included bromegrass, red top grass, mountain muhly, sedge, bottlebrush squirreltail, Fendler meadowrue, poison ivy, Canada violet, geranium, puccoon, Townsend's aster, white sweet clover, false tarragon, wormwood, dock, oak, stinging nettle, mullein, cattail, willow, barely and sunflower.

6.3.3.2 Pajarito Mesa Top. Mountain muhly grass and soil crust had the higher values in this transect (Table 8). Soil crust had the higher relative cover value of 63.95%. However, mountain muhly grass occurred more frequently, 50.00%. Soil crust had the higher importance index value. Only two other species were recorded for the mesa top transect. Desert trumpet and little bluestem had less than 10% relative cover and 12.50% relative frequency.

6.3.3.3 Open Meadows on Pajarito Mesa. The two meadow transect conducted in OU 1157 have similar dominant understory species. In TA-8, bluegrass had greater than 50% relative cover and occurred the most frequently (30.67%)(See Table 7). False tarragon had the second highest values overall for relative cover and frequency (7.39% and 14.29% respectively). All other species were recorded as less than 10% values in this area.

In TA-9, bluegrass again had the highest relative cover and frequency values (30.38% and 17.68%)(See Table 7). Trailing fleabane, which was recorded in TA-8, had the second highest values for relative cover, 24.93%, and relative frequency, 13.41%. Even though false tarragon was recorded with values of less than 10%, this species did have the third highest values for this transect.

Other species found in TA-8 and 9 were wormwood, Canada wildrye, yellow salsify, globe mallow, aster, barley, spreading fleabane, desert trumpet, gumweed, chrysanthemum, nodding brome, horseweed, yellow flax, golden-eye, larkspur, blazing star, foxtail barley, wheatgrass, bottlebrush squirreltail, rush, buffalo grass, sedge, red top, sand dropseed, vervain, pingue, chicory, leafy golden aster, pussytoes, white sweet clover, cinquefoil, prairie sunflower, white stemless primrose, woolly Indian-wheat, American vetch, coneflower, yellow sweet clover, James geranium and moss.

TABLE 7: Understory Vegetation Characteristics of Plants Species Recorded in Operable Unit 1157.

SPECIES	TRANSECT			
	Drainage Channel (a)	Open Meadow 1 (a)	Open Meadow 2 (a)	Southerly-facing Area (a)
Rush				
Relative Cover	40.53	-	-	-
Relative Frequency	16.67	-	-	-
Importance Index	28.60	-	-	-
Bluegrass				
Relative Cover	13.12	-	30.38	-
Relative Frequency	15.38	-	17.62	-
Importance Index	14.25	-	24.00	-
Mutton grass				
Relative Cover	-	56.58	-	-
Relative Frequency	-	30.67	-	-
Importance Index	-	43.62	-	-
False tarragon				
Relative Cover	-	7.39	-	-
Relative Frequency	-	14.29	-	-
Importance Index	-	10.84	-	-
Trailing fleabane				
Relative Cover	-	-	24.93	-
Relative Frequency	-	-	13.41	-
Importance Index	-	-	19.17	-
Mountain muhly				
Relative Cover	-	-	-	36.17
Relative Frequency	-	-	-	57.50
Importance Index	-	-	-	46.84
Junegrass				
Relative Cover	-	-	-	44.68
Relative Frequency	-	-	-	10.00
Importance Index	-	-	-	27.34
Sedge				
Relative Cover	-	-	-	10.64
Relative Frequency	-	-	-	20.00
Importance Index	-	-	-	15.32
Soil crust				
Relative Cover	-	-	-	-
Relative Frequency	-	-	-	-
Importance Index	-	-	-	-

A dash (-) indicates the species was not recorded at this site.

a= Pajarito Mesa

b= Pajarito Canyon

TABLE 7 cont.

SPECIES	TRANSECT			
	Drainage Channel (a)	Open Meadow 1 (a)	Open Meadow 2 (a)	Southerly-facing Area (a)
Bottlebrush squirreltail				
Relative Cover	-	-	-	-
Relative Frequency	-	-	-	-
Importance Index	-	-	-	-
Red top				
Relative Cover	-	-	10.76	-
Relative Frequency	-	-	13.85	-
Importance Index	-	-	12.30	-
Moss				
Relative Cover	-	-	49.72	-
Relative Frequency	-	-	23.08	-
Importance Index	-	-	36.40	-
Yarrow				
Relative Cover	-	-	-	-
Relative Frequency	-	-	-	-
Importance Index	-	-	-	-
Pussy toes				
Relative Cover	-	-	-	-
Relative Frequency	-	-	-	-
Importance Index	-	-	-	-

A dash (-) indicates the species was not recorded at this site.

a= Pajarito Mesa

b= Pajarito Canyon

6.3.3.4 North-facing Slope of Pajarito Canyon. Carex grass was the dominant species in this transect. It occurred with a 23.38% relative frequency and a 27.77% relative cover (Table 8). Pussy toes and mountain muhly occurred greater than 10% in the transect for all values. Western yarrow had a relative frequency of 14.29% but has a relative cover value under 10%.

Other species recorded for this transect include bottlebrush squirreltail, brome grass, James geranium, dandelion, American vetch, Fendler meadowrue, mutton grass, western dog violet, barberry, potentilla, Bigelow groundsel, little bluestem, wild strawberry, pingue, tobacco root, and Rocky Mountain clematis.

6.3.3.6 South-facing Area of Pajarito Mesa. Prairie junegrass and mountain muhly had the higher values for this transect (Table 8). Mountain muhly occurred more frequently than junegrass (57.50% and 10.00% respectively). However, junegrass had the higher relative cover, 36.17%. A third species, sedge, was recorded with greater than 10% relative frequency. Mountain

muhly had the highest importance index value, 46.84%. Other species found in this transect were little bluestem and moss.

6.2.3.5 Canyons Tributaries of Pajarito Canyon. Of the two transects conducted in canyon tributaries, the one closest to the main buildings of TA-9 was dominated by mountain muhly grass for cover and frequency (22.57% and 13.58%)(Table 8). Red top, bluegrass and sedge had the next highest values for cover (13.66%, 13.66%, and 12.33%) however the red top and bluegrass occurred with less than 10% frequency. Sedge was recorded with the second highest relative frequency of all species in the transect (12.35%) and bottlebrush squirreltail followed with a relative frequency of 11.11%. All other species occurred with less than 10% cover and frequency.

The second transect conducted in a canyon tributary recorded moss for the highest relative cover value and importance index value (49.72% and 36.40% respectively)(Table 8). Mountain muhly grass occurred with more relative frequency in this area, 26.15%, and had the second highest relative cover value, 21.52%. The only other species in this transect with values greater than 10% was red top.

Other species found in these two transects are junegrass, little bluestem, barley, brome grass, thistle, desert trumpet, pingue, nodding onion, false tarragon, pussytoes, yarrow, rush, Fendler barberry and strawberry.

TABLE 8: Understory Vegetation Characteristics of Plants Species Recorded in Operable Unit 1157.

SPECIES	TRANSECT			
	Mesa Top (a)	Finger Canyon 1 (b)	Finger Canyon 2 (b)	North-facing Slope (b)
Rush				
Relative Cover	-	-	-	-
Relative Frequency	-	-	-	-
Importance Index	-	-	-	-
Bluegrass				
Relative Cover	-	13.66	-	-
Relative Frequency	-	7.41	-	-
Importance Index	-	10.54	-	-
Mutton grass				
Relative Cover	-	-	-	-
Relative Frequency	-	-	-	-
Importance Index	-	-	-	-
False tarragon				
Relative Cover	-	-	-	-
Relative Frequency	-	-	-	-
Importance Index	-	-	-	-
Rush				
Trailing fleabane				
Relative Cover	-	-	-	-
Relative Frequency	-	-	-	-
Importance Index	-	-	-	-
Mountain muhly				
Relative Cover	29.07	22.57	21.52	18.11
Relative Frequency	50.00	13.58	26.15	12.99
Importance Index	39.53	18.08	23.84	15.55
Junegrass				
Relative Cover	-	-	-	-
Relative Frequency	-	-	-	-
Importance Index	-	-	-	-
Sedge				
Relative Cover	-	12.33	-	27.77
Relative Frequency	-	12.35	-	23.38
Importance Index	-	12.34	-	25.57
Soil crust				
Relative Cover	63.95	-	-	-
Relative Frequency	25.00	-	-	-
Importance Index	44.48	-	-	-

TABLE 8, cont.

SPECIES	TRANSECT			
	Mesa Top (a)	Finger Canyon 1 (b)	Finger Canyon 2 (b)	North- facing Slope (b)
Bottlebrush squireltail				
Relative Cover	-	9.57	-	-
Relative Frequency	-	11.11	-	-
Importance Index	-	10.34	-	-
Red top				
Relative Cover	-	-	-	-
Relative Frequency	-	-	-	-
Importance Index	-	-	-	-
Moss				
Relative Cover	-	-	-	-
Relative Frequency	-	-	-	-
Importance Index	-	-	-	-
Yarrow				
Relative Cover	-	-	-	6.67
Relative Frequency	-	-	-	14.29
Importance Index	-	-	-	10.48
Pussy toes				
Relative Cover	-	-	-	13.88
Relative Frequency	-	-	-	14.29
Importance Index	-	-	-	14.08

A dash (-) indicates the species was not recorded at this site.

a= Pajarito Mesa b= Pajarito Canyon

6.3 Level 3 (Species Specific) Surveys

6.3.1 Vegetation

BRET conducted no species specific surveys for vegetation. However, while conducting the vegetation transects for Level 2 surveys, no TES plant species were found.

6.3.2 Wildlife

6.3.2.2 Small Mammals. During the 1992 field season, seven species of small mammals were captured: long-tailed vole (*Microtus longicaudus*), montane vole (*Microtus montanus*), brush mouse (*Peromyscus boylii*), white-footed mouse (*Peromyscus leucopus*), deer mouse (*Peromyscus maniculatus*), least chipmunk (*Eutamias minimus*), and Colorado chipmunk (*Eutamias quadrivittatus*). Only one capture was made in the medium size mammal traps: rock squirrel (*Spermophilus variegatus*). Further analysis has not been completed.

6.3.3 Threatened, Endangered, and Sensitive Species

Northern goshawk: During the northern goshawk inventory (Sinton & Kennedy 1993) no goshawks were observed in the OU. A minimum of one more year of inventory needs to be conducted to minimize the number of unsuccessful territories missed during a survey. Other raptors were seen in the area. In upper Pajarito Canyon, a great horned owl nest was found with pellets. An unidentified raptor nest about Cooper's hawk size was also found. In Canyon de Valle, a great horned owl was sighted just outside the eastern edge of OU 1157.

Spotted bat: At the pond in TA-8, 44 bats from 10 species were captured in three nights of mist netting. No spotted bats were captured in this OU or on Laboratory land. However, this is not evidence that this species does not exist on Laboratory lands. Due to limited sampling efforts, a more complete survey should be conducted (3D Environmental Services, 1992)

Meadow jumping mouse: Of the one survey conducted for this species, no meadow jumping mice were found. This survey was not conducted during the optimal trapping time, the rainy season (July), which we feel contributed to failure to find this species in upper Pajarito Canyon. Failure to capture this species is not evidence that it does not exist in the area.

6.4 Identification of Wetlands

Both floodplains and wetlands were located within OU 1148. Wetlands were restricted to upper Pajarito Canyon and permanent ponds near West Jemez Road. Both Pajarito Canyon and Cañon de Valle bottoms should be considered floodplains.

Three factors can be examined to declare an area a wetland: hydrology, hydric soils, and hydrophytic plants. BRET examined only hydrology and hydrophytic plants for OU 1157 to determine riparian areas.

Pajarito appears to be interrupted or has near perennial reaches as a result of springs, seeps and rain runoff. Recorded (historical) data, aerial photographs and field observations indicate a wetland hydrology. Historical records back to 1914 list upper Pajarito as having a running spring. The NWI identified two wetland types within Pajarito Canyon; however, only one of these is listed as occurring in OU 1157 (see Figure 5). USFWS identified the permanent ponds at TA-8 near West Jemez Road as palustrine diked or impounded wetlands (US Fish & Wildlife 1985). Plant species associated with hydrology found in the pond areas include cattails, rushes, and willow. The second wetland type identified by NWI ends just outside the western boundary of OU 1157 in Pajarito Canyon. NWI mapping is based on aerial photography, and therefore, small wetlands in steep or deep canyons may not have been detected using this method. Hydric vegetation in association with its three springs located inside the OU boundary (Fig. 11), was

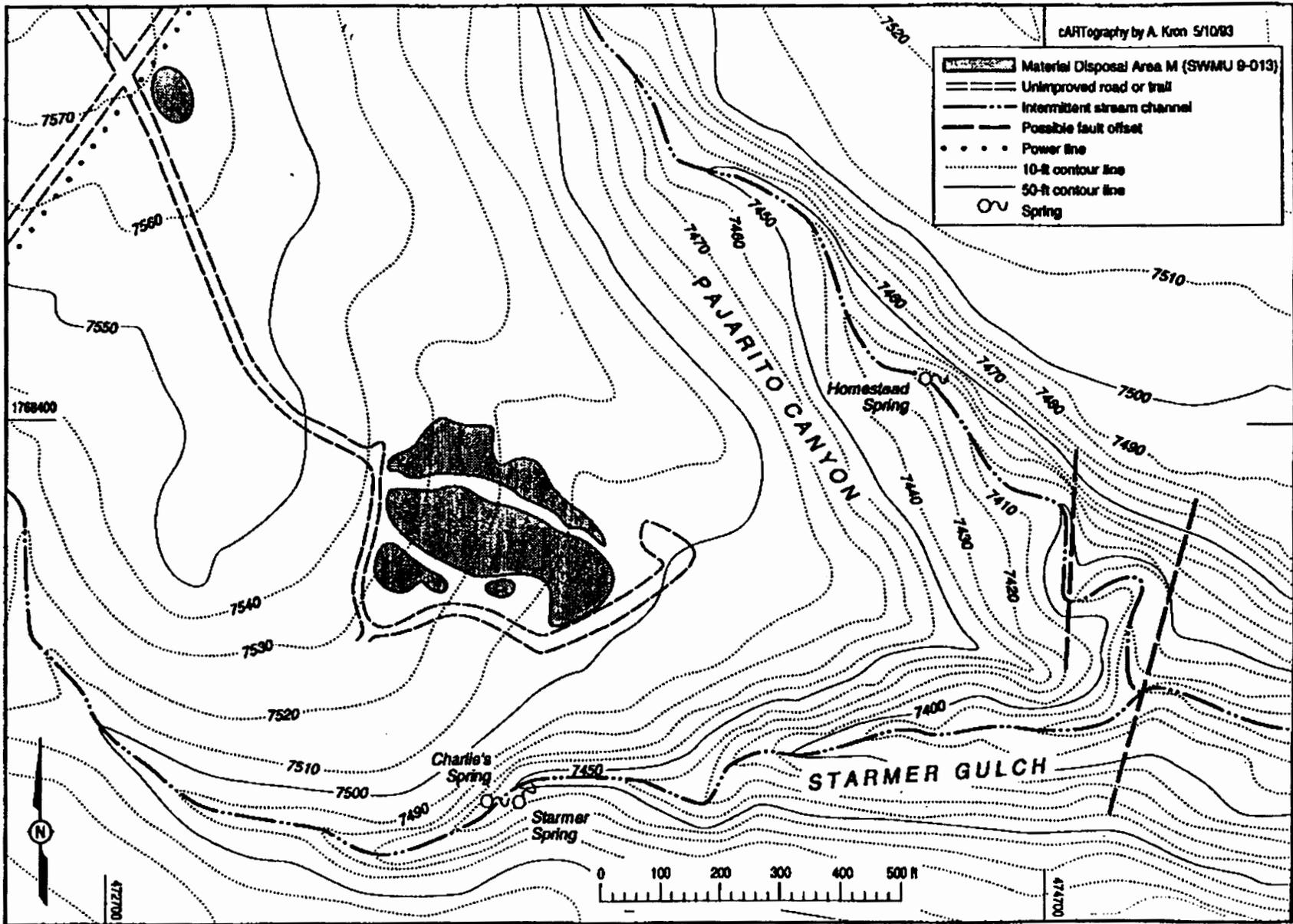


Fig. 11. Location of springs in Upper Pajarito Canyon.

found along the bottom of Pajarito Canyon. The springs are believed to part of a shallow perched zone discharging from under Pajarito Mesa.

Any stream flow in Cañon de Valle is the result of intermittent runoff. No hydric soils or hydrophytic vegetation surveys were conducted in this canyon. Field observations, however, indicated that during heavy rains, runoff could be quite heavy. The NWI maps do not indicate any areas that meet the wetland criteria from the aerial mapping protocol. A previous study conducted by McLin (1992) has identified Cañon de Valle as a floodplain (see Figure 6).

7. DISCUSSION

7.1 Level 2 Survey (Habitat Evaluation)

The classification breakdown for both Upland and Wetland Vegetation Types for the Pajarito Plateau is given in Appendix D. This listing includes known and potential habitat types and phases based on Brown, *et al.* (1982), Moir and Ludwig (1979), and USFS (ND). No attempt was made to develop new habitat types for this area. If a study area did not fit within one of the designated habitat types previously defined for northern New Mexico, the habitat type was considered "potential" and further studies are necessary to make a complete and accurate determination.

The vegetation surveys indicated there is primarily one vegetation community present within or adjacent to OU 1157: the Rocky Mountain Montane Conifer Forest. This community can be further separated into series, and more specifically, habitat types.

Based on the species composition of the transects and their locations within the OU, it could be seen that differences in species dominance were associated with the various topographic differences. The following are descriptions of the vegetation community and its phase or habitat type.

7.1.1 Rocky Mountain Montane Conifer Forest. This community consisted of primarily one vegetation series, ponderosa pine. Of the habitat types in the Ponderosa Pine Series, six were present in the OU. The mesa top is in a climax stage of ponderosa pine habitat type. Open meadows on the mesa are highly disturbed but are in the Ponderosa Series in a *Poa* habitat type. Ponderosa pine/Gambel oak is found on the southerly-sloping area and in the *Juncus* phase in the drainage channel. In the canyon tributaries, there are *Juniperus* and *Muhlenbergia montana* habitat types. The *Muhlenbergia* habitat type continues on the north-facing slope.

7.2 Level 3 (Species Specific) Survey

Habitat information collected from the Level 1 and Level 2 field surveys was compared to the habitat information in the database for each sensitive species, the threats to the taxon, and previous data. Based on that information, species were either dismissed from further consideration or Level 3 (species specific) surveys were conducted to confirm the presence/absence of the species within that habitat.

7.2.1 Species Dismissed From Further Consideration

Based on the information gained from the Level 1 and Level 2 field surveys and previous data, the following species have been ruled out as being present in this OU, or are not expected to be impacted by the proposed project:

7.2.1.1 Vegetation. None the following species have been previously recorded for OU 1157. Due to the low potential for occurrence within this site, the following species are being dismissed from further consideration:

Sandia alumroot (*Heuchera pulchella*) has been found previously in Bernalillo, Sandoval, San Miguel, Sierra, Socorro and Torrance Counties but not in Los Alamos County. This species is a cliff-loving plant that occurs in mixed conifer at a minimum elevation of 8000 feet. The highest elevation in OU 1157 is 7800 feet. This species was not observed during Level 1 and 2 surveys and is not expected to be present in OU 1157.

Checker lily (*Fritillaria atropurpurea*) can be found in mixed conifer habitat. This species has not been found in the area of OU 1157 although it has been observed in Los Alamos County in the past. This species was not observed during Level 1 and 2 surveys and is not expected to be present in OU 1157.

Pagosa phlox (*Phlox caryophylla*) is found in ponderosa-piñon habitat on open slopes of open woods in mountains. The highest elevation this species is know to occur at is 7500 feet. This species has never been found in Los Alamos County and was not observed during Level 2 surveys. This species is not expected to be present in OU 1157

7.2.1.2 Wildlife. Say's pond snail (*Lymnaea captera*) is known to occur only in the Cerro la Jara area of the Jemez Mountains in Sandoval County which is the key habitat area in the state. The Say's pond snail is found in vegetated ditches, marches, streams, and ponds that are seasonally dry or in areas of perennial water. It is not expected to occur in Los Alamos (Taylor 1985).

Willow flycatcher (*Empidonax traillii*) breeds through central New Mexico and are seen statewide only in spring and autumn migrations. In breeding season, they are confined to riparian woodlands dominated by cottonwoods. OU 1157 does not have the cottonwood habitat necessary for this species.

Broad-billed hummingbird (*Cyanthus latirostris*) is found in riparian woodlands often characterized by cottonwood, sycamore, or white oak and breed primarily in the southern part of the state of New Mexico. They have been identified in the riparian woodlands of Bandelier National Monument and occasionally occur near Los Alamos as vagrants. The riparian areas in OU 1157 do not fulfill this species habitat requirements for a riparian woodland.

Mississippi kite (*Ictinia mississippiensis*) generally inhabits the lower Rio Grande and Pecos Valleys in riparian zones and shelter belts with permanent streams. They are also common around manicured environments such as parks and golf courses. Riparian areas in this OU are limited in size and extent. In addition, this species has never been reported in the Los Alamos area.

Common black hawk (*Buteogallus anthracinus*) occurs at lower elevations in the Gila, San Francisco, and Mimbres drainages. This species requires cottonwoods and other riparian woodlands along permanent streams. The common black hawk is not expected to be in this OU due to limited suitable cottonwood and riparian woodland habitat. In addition, this hawk has never been recorded in Los Alamos County.

Peregrine falcon (*Falco peregrinus*) has been found in Los Alamos County and Laboratory land in the past in Los Alamos Canyon and Pueblo Canyon. This species occurs in ponderosa-piñon areas and requires steep cliffs in wooded or forested habitats for breeding. The terrain in OU 1157 is not suitable for this species and therefore the peregrine falcon is not expected to be in this area.

7.2.2 Species for Which Level 3 Surveys were Conducted

Based on the Level 1 (Reconnaissance) and Level 2 (Habitat Evaluation) surveys and data collected from previous studies, habitat requirements for the northern goshawk, spotted bat, meadow jumping mouse, Jemez Mountains salamander, and wood lily were found to potentially exist within the OU. Species specific surveys were conducted (where possible) to help establish the presence or absence of the species within the OU.

Northern goshawk (*Accipiter gentilis*) is a candidate species for the federal register that occurs in dense, mature, or old growth coniferous forests and primarily in ponderosa pine, mixed species, and spruce-fir habitat. The home range for the goshawk usually includes a variety of forest conditions and the foraging areas include a variety of habitats. Goshawk nests have been found on Santa Fe National Forest land adjacent to OU 1157. Post fledgling family area (PFA) and foraging areas for this species overlap into OU 1157 (Sinton & Kennedy, 1993). Additional surveys need to be conducted to minimize the number of unsuccessful territories missed during a survey and to determine if the goshawk is nesting on Laboratory land.

Mexican spotted owl (*Strix occidentalis lucida*) is distributed through New Mexico, Arizona, Texas, Colorado, Utah, and Mexico. This species inhabits forested mountains and canyons. The owl's habitat is primarily mixed conifer or ponderosa pine/Gambel oak forests of

uneven-aged, multi-storied stands. These stands should have closed canopies, large mature trees, stand decadence, broken tree tops, standing dead trees, and fallen logs (US Fish and Wildlife Service 1990). Results of the surveys indicate OU 1157 does not have enough closed canopy or forest maturity to support this species. However, a survey for this species should be performed to verify the presence or absence of the spotted owl.

Spotted bat (*Euderma maculatum*) is a state endangered species found in pinon-juniper, ponderosa, mixed conifer and riparian habitats. This species requires a source of water with standing pools, and roost sites such as caves in cliffs or rock crevices. Suitable roost sites were present in portions of Pajarito Canyon in the extreme eastern end of TA-9 and in neighboring TA-22, open water sources are somewhat limited to a narrow flowing stream. Mist net surveys on Laboratory land were conducted for this species. One such survey was conducted in TA-8.

As yet the spotted bat has not been found on Laboratory property. No spotted bats were captured. In addition, surveys conducted in lower Pajarito Canyon in 1992 resulted in no captures. This does not necessarily suggest the spotted bat does not occur in the OU.

Meadow jumping mouse (*Zapus hudsonius*) is a state endangered species confined to holarctic region, mesic habitats, permanent streams and wet meadows. It breeds in wetland areas. This species has been recorded for Los Alamos county in the past. The meadow jumping mouse has a small potential for occurring in upper Pajarito Canyon in riparian areas. One survey has been conducted for the meadow jumping mouse in this OU for 1992 however the survey was conducted prior to the optimal surveying season for this species. This does not suggest the meadow jumping mouse does not occur in this OU.

Wood lily (*Lilium philadelphicum var. andium*) has been found in Rio Arriba, Sandoval, San Miguel, and Santa Fe Counties in addition to Los Alamos County in the past. This species is found in moist areas in ponderosa pine to mixed conifer and ranges in elevation of 6000 to 10000. The wood lily was not found during vegetation surveys but is known to occur in the upper Pajarito Canyon area.

Helleborine orchid (*Epipactis gigantea*) has been found British Columbia to Montana, southern to western Texas, New Mexico, and California. This species has been found in Los Alamos County in the past. The orchid's habitat consists of damp woods, seepage slopes, springs, streams, and riparian areas within the elevation range of 6000 to 8500 feet.. The helleborine orchid was not found during vegetation surveys but could still occur in OU 1157.

7.3 Wetland and Floodplain Assessments

7.3.1 Wetland Survey

The springs and perennial reaches of stream below the springs met wetland criteria. NWI aerial maps provide general definition of the wetland. In addition, certain outfalls within OU 1157 may be classified as wetlands. Special precautions should be taken if sampling is to be done within these areas.

7.3.2 Floodplain Studies

Floodplains have been identified within OU 1157 in the canyon bottoms of Pajarito Canyon and Cañon de Valle. It should be noted that during heavy rainstorms experienced during the summer months, flooding does occur. Floodplain protection laws are designed to protect life and property. Since all facilities are on the mesa top and not within the floodplain, floodplains should not present any problems with sampling.

Riparian zones are generally associated with floodplains. In arid areas of the Southwest, these zones have a higher diversity of plants and animals, providing cover, food and breeding areas. Riparian areas are characterized by an abundance of deciduous and moisture-loving species. Although not protected by law, within these zones, best management practices should be followed.

8. IMPACTS

8.1 Non-Sensitive Species

8.1.1 Vegetation

Due to the topographic features and existing riparian zones of the project area and the potential use of heavy machinery, the following impacts could result:

- Removal or excessive disturbance to existing vegetative cover could result in an increase or initiation of erosion and/or alterations of drainage patterns both within the canyon bottoms (including stream channels) and along the canyon slopes.
- Disturbance/damage to riparian vegetation could result in partial or complete loss of wetlands which could further result in partial or complete loss of the associated riparian vegetation.

8.1.2 Wildlife

Due to the suitable nesting, foraging, perching, habitat, etc., within the OU for a variety of bird species and the suitable foraging and wintering areas for large mammals (in addition to suitable habitat for other wildlife species), excessive disturbance or disturbance during critical periods could result in one or a combination of the following:

- Direct removal of nesting, perching, cover, habitat, etc., both along the canyon slopes and within the riparian zones or canyon bottoms.
- Nest abandonment by birds resulting in nest failure.
- Depending on the time of year that the sampling takes place, excessive noise or other disturbance could result in an interference with critical periods, such as the breeding period, for wildlife species.
- Contamination of wildlife water sources from fuel spills or leakage of vehicles, machinery, etc.

8.2 Threatened, Endangered, and Sensitive Species

Site Characterization activities, which include surface sampling and core drilling, could result in impacts to northern goshawk and Mexican spotted owl habitat. Although these species have not been observed nesting in the OU area, excessive damage to potential foraging habitat could affect densities of associated prey species.

Surveys conducted for raptors in OU 1157 have not revealed any nesting goshawks, however, goshawks are known to occur in Santa Fe National Forest directly adjacent and west of OU 1157. Additionally, the habitat components necessary to goshawks do exist within OU 1157 and part of this OU is a known foraging area. Impacts to goshawk include human disturbance, canopy removal, and disturbance by heavy equipment during the mating and nesting season which is May through October.

Although the Mexican spotted owl has not been observed in OU 1157, it has not been ruled out as potentially occurring in OU 1157. The same impacts as the northern goshawk apply to this species for disturbance during mating and nesting seasons.

Any core drilling and sampling to be done inside delineated wetlands may cause damage to the habitat as stated in Section 8.1. Damage to a riparian or wetland area and consequent removal of vegetation and backfilling of stream channels, will reduce habitat for the meadow jumping mouse.

The spotted bat is affected by removal of roosting sites and available water sources. Destruction of caves in cliffs and rock crevices by heavy equipment will reduce the available habitat for the spotted bat. Use of any equipment larger than hand augers may adversely affect the previously-mentioned areas and nearby streams or water sources.

Damage to habitat or habitat alterations are the primary impacts to the Jemez Mountains salamander. Tree removal, excessive soil disturbance, and removal or excessive damage to vegetation (specifically downed logs) are the primary impacts to this species.

The wood lily and helleborine orchid are impacted primarily by over collection, overgrazing, and urbanization. The use of heavy equipment or vehicles traveling off established roads (paved or dirt) could present a threat to this species.

8.3 Wetlands and Floodplains

Sampling within the OU may include surface samples to a depth of 12 inches or deep core drilling up to than 14 ft. Heavy equipment and coring should remain outside of delineated wetlands. If sampling is to take place within or near wetlands or within the floodplain, the following impacts could occur:

- Disturbance to the stream channel or smaller drainages leading into the stream channel could result in an alteration of existing wetlands causing partial or complete loss of those wetlands.
- Excessive disturbance to vegetation and the surface could also result in an alteration of the water flow and/or widening of the channel.
- Disturbance along the drainages as well as the steeper slopes could result in increased or initiation of soil erosion. This could also cause localized alterations in the existing wetlands.
- Hazardous fuel spills or leakage from vehicles could negatively affect water quality in the riparian zones and could result in negative changes to vegetation within these areas.

9. MITIGATION

No significant release of contaminants into the environment is expected to occur during sampling. However, should release of contaminants rise above the predetermined action levels, workers must cease operations, shut down the site, and reassess the sampling.

9.1 Non-Sensitive Species

9.1.1 Vegetation

Revegetation could be required if sampling and subsequent corrective actions cause loss of vegetation that could potentially result in an increase or initiation of erosion. From the survey information gathered, species that could be used for revegetation include a mixture of native grasses, forbs, and other herbaceous plants. Species given in the vegetation section represent a few of the species that could be used. Further consultation with BRET and/or state or federal agencies can help determine use of other species. Additional mitigation measures include:

- Avoid unnecessary disturbance (i.e., parking areas, equipment storage areas, off-road travel, etc.) to surrounding vegetation during both the actual sampling and travel into the sampling sites.
- Avoid removal of vegetation along riparian areas and along drainage/stream channels.
- Avoid disturbance to vegetation along canyon slopes and especially existing drainages along these slopes.

Mitigation provided for wetlands and floodplains will also help in reducing potential impacts to vegetation.

9.1.2 Wildlife

Most potential impacts to wildlife species should be non-adverse and result in only temporary avoidance of the sampling sites during the period of actual disturbance. However, if heavy machinery use is expected, then the following mitigation measures should further reduce the potential for impact:

- Avoid crossing drainages with existing water; utilize existing roads or cross over level areas that are dry or level areas that are less vegetated.
- If possible, avoid sampling from March 1 to August 1.

Disturbance to wintering species should be relatively minor and mitigation provided for wetlands/floodplains and vegetation will help to further reduce the impact to wildlife species.

No significant release of contaminants into the environment is expected to occur during sampling. However, should release of contaminants rise above the predetermined action level, workers must cease operations, shut down the site, and reassess the sampling procedure.

9.2 Threatened, Endangered, and Sensitive Species

9.2.1 Vegetation

Although vegetation surveys conducted in 1992 did not record this species, the wood lily is known to occur in the upper Pajarito Canyon areas. Qualified personnel from BRET must conduct a walk through of any area where a vehicle or heavy equipment will be taken off established roads (paved or dirt). Similarly, the helleborine orchid has potential habitat in the upper Pajarito Canyon areas where seeps, springs, and streams are present. The same mitigation procedures outlined above must be followed.

9.2.2 Wildlife

Although current studies to found no goshawks nesting in OU 1157, many of the habitat components required for the goshawk are present and nests are known to occur immediately adjacent to OU 1157 in Santa Fe National Forest. In order to provide some protection of this possible goshawk habitat the following mitigation measures are required:

- Any machine sampling occurring between March 1 and October 1 must be cleared through BRET. BRET must be contacted 60 days prior to sampling to evaluate possible nest sites in and around the sampling area.
- If any sampling area over one-tenth acre will be disturbed, BRET must be contacted for a presampling site-specific survey.
- Any tree removal (live or snag) must be approved by BRET.

These same mitigation measures outlined above apply to the Mexican spotted owl.

No spotted bats have been reported from mist net surveys in the area to date, although potential habitat exists in the extreme eastern end of TA-9. If sampling will be conducted in this area with equipment other than hand augers on canyon slopes, a biologist from EM-8 will be present prior to sampling in order to conduct a survey of all rock crevices in the sampling area. If any evidence of spotted bats is found, all sampling with heavy equipment will be canceled. Any sampling that may alter existing water sources must be approved by EM-8 BRET personnel prior to disturbance.

Meadow jumping mouse may occur along stream-side areas of Pajarito Canyon. If any sampling is to be conducted in riparian areas, BRET must be contacted 60 days prior to sampling to evaluate the need for a site-specific survey. A meadow jumping mouse survey must be performed during the rainy season, the optimal time being July. This is the only time the survey can be performed. If a survey is required, sampling cannot proceed until the survey is complete.

The following mitigation measures are required for the Jemez Mountains salamander if sampling will be conducted on north-facing slopes within OU 1157:

- A biologist from EM-8 will be present during sampling. If any salamanders are discovered, all ground disturbance activities at that site will cease.
- Any trees that are cut will be left to enhance habitat.
- Activity will not be permitted when the soil surface has a high moisture content.
- All disturbance areas will be revegetated with native plants.

9.3 Wetlands and Floodplains

Sampling for site characterization could range from surface sampling to 8 inch diameter auger drilling. Sampling should remain outside designated wetlands. Delineation of the wetland boundary will be completed just prior to the time of sampling. This will allow for greater accuracy to ensure sampling occurs outside of areas that have designated wetland criteria. These delineations should be done within two years of the sampling. After two years the delineation is no longer valid and must be repeated.

If sampling will occur in an outfall area with wetland characteristics, BRET must be notified to delineate the wetland. In compliance with Federal Regulation 10CFR 1022, a floodplain/wetland notification will be submitted to the federal register for public comment. Under the nationwide permit, sampling can be conducted in a wetland area provided the sampling will not impact a total area of one acre. This includes the sampling area as well as impacts from vehicles or heavy equipment.

Sampling and subsequent corrective actions could require mitigation of a site by revegetation. From survey information gathered, available seed lists and lists prepared by Foxx and Tierney (1982), and Foxx and Pierce (1991), a listing of species that can be used for revegetation can be compiled. Personnel from BRET should be contacted for assistance with a species list for revegetation. Best management practices should be followed while sampling. Management practices suggested include:

- Avoid unnecessary disturbance (i.e. parking areas, equipment storage areas, off road travel) to surrounding vegetation during sampling and travel to sampling sites.
- Avoid removal of vegetation along riparian and wetland areas as well as drainage and stream channels.
- Avoid disturbance to vegetation along canyon slopes and especially existing drainages along these slopes
- Avoid canopy removal, such as tree removal.

10 CONCLUSIONS

To provide background information concerning the site, database containing historical information and biological reports of any previous surveys within the area were summarized. These summaries provide inventory information that may be used in future ecological risk assessments and pathway analyses.

Level 1 and 2 field surveys were conducted within OU 1157. In addition, the TES database was searched for a listing of potential species that could occur within the habitats associated with unit. As a result, a number of species on the state and federal protection list are known to occur in the habitats described for Los Alamos County and surrounding areas.

A Level 2 survey was conducted to determine if the specific requirements of the listed species could be met in the sampling locations. Additional information from Level 3 surveys outside of OU 1157 was used to determine the status of the northern goshawk, Jemez Mountains salamander, and wood lily in the sampling area.

Although the northern goshawk and Mexican spotted owl are not currently known to nest in the project area, they could be utilizing the area as feeding and future nesting grounds. Mitigation to avoid impacts are 1) minimization of vegetation destruction, and 2) any tree removal must be approved by BRET.

Although the spotted bat has not been recorded within OU 1157, it cannot be ruled out as a potential resident species in the extreme eastern end of TA-9. Mitigation for the possibility of the spotted bat in the area include 1) avoiding use of heavy equipment on or near caves in cliffs and rock crevices and 2) avoiding any alteration of water sources

The meadow jumping mouse occurs in riparian areas such as permanent streams and wet meadows. If any sampling is to be conducted in riparian areas, BRET must be contacted 60 days prior to sampling to evaluate the need for a site-specific survey. A survey for this species must be performed during the rainy season, the optimal time being July. If a survey is required, sampling cannot proceed until the survey is complete.

The Jemez Mountains salamander is known to occur in upper Pajarito Canyon above OU 1157. If sampling is to occur on north-facing slopes in this OU, BRET personnel must monitor the process. If a salamander is found during sampling, all activities must cease in that area. Sampling also may not be conducted when there is a high moisture content in the soil.

The wood lily has been found in Los Alamos County in the past and is listed as potentially occurring in the upper Pajarito Canyon area. Although this species was not encountered in the surveys of OU 1157, suitable habitat exists in the area. Before any sampling is conducted in riparian areas, especially if heavy equipment is to be used, BRET personnel must first conduct a walk through of the areas.

Within the OU, BRET used the National Wetland Inventory Maps combined with field checks to locate all wetlands and floodplains. Characteristics of wetlands, floodplains and riparian areas were noted using criteria outlined in the Federal Manual for Identifying and Delineating Jurisdictional Wetlands (Dunke, 1989). Because wetland systems and their boundaries undergo continual changes, delineation of wetland boundaries was not completed during these surveys. Boundary delineation will be conducted just prior to sampling.

Mitigation measures (or best management practices) to help reduce the potential for impacts to non-sensitive wildlife and plant species are similar to mitigation measures used for TES species and include timing of sampling, and avoiding excessive disturbance to the habitat.

11 DEFINITIONS

Biological Resources Evaluations Team (BRET): Persons within the Environmental Protection Group (EM-8) responsible for the biological assessments.

Critical habitat: Any air, land or water area and constituent elements, the loss of which would appreciably decrease the likelihood of survival and recovery of a listed species or a distinct segment of its population.

Facultative: A plant species equally likely to occur in wetlands or non wetlands (estimated probability 34-66%).

Facultative Upland: A plant species that usually occurs in non wetlands (estimated probability 67-99%), but is occasionally found in wetlands (estimated probability 1-33%).

Facultative Wetland: A plant species that usually occurs in wetlands (estimated probability 67-99%), but is occasionally found in non wetlands.

Federal Candidate (C1) Species: Taxa for which the USFWS currently has substantial information on biological vulnerability and threat(s) to support proposals to list them as endangered or threatened species.

Federal Candidate (C2) Species: Taxa for which current USFWS information indicates that proposing to list as endangered or threatened is possibly appropriate, but for which conclusive data on biological vulnerability and threat are not currently available to support proposed rules.

Federally Endangered Species: Any species which is in danger of extinction throughout all or a significant portion of its range.

Federally Threatened Species: Any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

Floodplains: Lowlands adjoining inland and coastal waters and relatively flat areas, and flood-prone areas of offshore islands including, at a minimum, that area inundated by 1% or greater chance of flood in any given year. The base floodplain is defined as the 100-year (1.0%) floodplain. The critical action floodplain is defined as the 500 year (0.2%) floodplain.

Hydric soil: A soil that is saturated, flooded, or ponded long enough during the growing season to develop anaerobic conditions in the upper part.

Hydrology: The presence of, distribution of, and circulation of water.

Hydrophyte: Any plant that grows in water or on a substrate that is at least periodically deficient in oxygen as a result of excessive water content; plants typically found in wetlands and other aquatic habitats.

Level 1 Survey: A reconnaissance survey to determine if a proposed project is in a developed Technical Area or in an area otherwise disturbed. Non-quantitative data about the area is obtained.

Level 2 Survey: A detailed quantitative vegetation survey that is used to evaluate whether critical habitat requirements for a threatened and endangered species is present at the proposed project area.

Level 3 Survey: A survey aimed at obtaining information on a specific threatened or endangered species, floodplain or wetland.

National Environmental Policy Act (NEPA): A major environmental law which became effective in 1970. The law requires all projects/programs which receive federal funds to be evaluated for environmental impacts.

Nationwide Permits (NWP): Permits issued by the Corps of Engineers that pertain to specific conditions related to wetland usage as stated in the regulations.

Obligate Upland: Plant species that occur in wetlands in another region, but occur almost always (estimated probability >99%) under natural conditions in non wetlands in the region specified. If a species does not occur in wetlands in any region, it is not on the "National List".

Obligate Wetland: Plant species that occur almost always (estimated probability >99%) under natural conditions in wetlands.

Riparian: Green-belts along streams, lakes, or other wet areas. These areas are presently only marginally protected by state and federal law but have recently become of concern.

Solid Waste Management Unit (SWMU): Any discernible unit at which solid wastes have been placed at anytime, whether or not the unit was intended for the management of solid or hazardous wastes.

Species Area Curve: Calculated by comparing total number of individual plant species recorded along a transect by total number of plots.

State Endangered Plant: A plant which has been listed on New Mexico's state endangered list. The plant is rare in numbers and/or occurrences and its further existence in the state is threatened unless it is protected.

State Endangered Group 1: Any wildlife species or subspecies whose prospects of survival or recruitment in New Mexico are in jeopardy.

State Endangered Group 2: Any wildlife species or subspecies whose prospects of survival or recruitment in New Mexico are likely to be in jeopardy within the foreseeable future. These species are protected by State law.

State Endangered Plant (1): The taxon is listed as threatened or endangered under the provisions of the Federal Endangered Species Act, or is considered proposed under the tenets of the act.

State Endangered Plant (2): The taxon is a rare plant across its entire range and of such limited distribution and population size that unregulated collection could adversely impact it and jeopardize its survival in New Mexico.

State Endangered Plant (3): The taxon may be widespread in its distribution and may occur in adjacent states or Mexico, but its numbers are being significantly reduced to such a degree that within the foreseeable future the survival of this species in New Mexico is jeopardized.

State Sensitive Plant: A plant species whose numbers or occurrences are low in the state. These species are monitored by the state to see if their status needs to be upgraded to endangered. Currently, state sensitive plants are not protected by state law.

Threatened and Endangered Species Database: A database constructed by LANL that lists and provides information on all state and federal threatened and endangered species in Los Alamos County and surrounding counties.

Wetlands: Those areas that are inundated by surface or ground water with a frequency sufficient to support, and under normal circumstances does or would support, a prevalence of vegetative or aquatic life that requires saturated or seasonally saturated soil conditions for growth and reproduction. Wetlands generally include swamps, marshes, bogs, and similar areas such as sloughs, potholes, wet meadows, river overflow, mud flats, and natural ponds.

12 SUMMARY OF PERTINENT REGULATIONS

Endangered Species Act (16 USC 1531 *et seq.*): declares the intention of Congress to conserve threatened and endangered species and the ecosystems on which those species depend.

Executive Order 11990: Protection of Wetlands. In furtherance of the National Environmental Policy Act of 1969 this EO calls for avoidance, "to any extent possible, the long and short term adverse impacts associated with the destruction or modification of wetlands...avoid direct or indirect support of new construction in wetlands...."

Executive Order 11998: Floodplain Management. This EO was initiated to "protect lives and property with the need to restore and preserve natural and beneficial floodplain values...."

National Environmental Policy Act: Declares a national policy to encourage a productive and enjoyable harmony between man and his environment. Section 102 requires "that presently unquantified environmental amenities and values may be given appropriate consideration in decision-making along with economic and technical considerations...."

Section 404 Clean Water Act: Provides for issuance of "permits," after notice and the opportunity for public hearings of discharged of dredged or fill materials into navigable waters..."

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Field personnel included Teralene Foxx, BRET Supervisor and Project Leader; Kathryn Bennett, Environmental Scientist; James Biggs, Wildlife Biologist; Dan Dunham, Botanist; Mary Salisbury, Mechanical Technician; Delia Raymer, Wildlife Biologist, Graduate Research Assistant (GRA); Alethea Banar, Ecologist, (GRA); Eric Pacheco, Undergraduate Research Assistant (UGS); David Lawrence (UGS); Angela Martz (UGS); and Gregory Gray (UGS).

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APPENDIX A

Plant Checklist for OU 1157

FAMILY	SCIENTIFIC NAME	COMMON NAME	INDICATOR STATUS
ANACARDIACEAE	<i>Rhus radicans</i>	Poison Ivy	
BERBERIDACEA	<i>Berberis fendleri</i>	Fendler barberry	NW
BORAGINACEAE	<i>Lithospermum sp.</i>	Puccoon	NW
	<i>Lithospermum multiflorum</i>	Puccoon	NW
CHENOPODACEAE	<i>Chenopodium album</i>	Lamb's quarters	
COMPOSITAE	<i>Achillea lanulosa</i>	Western yarrow	ECO
	<i>Antennaria parviflora</i>	Pussytoes	NW
	<i>Artemisia carruthii</i>	Wormwood	NW
	<i>Artemisa dracunculus</i>	False Tarragon	NW
	<i>Aster sp.</i>	Aster	NW,
	<i>Bahia dissecta</i>	Wild Chrysanthemum	NW
	<i>Chrysopsis foliosa</i>	Leafy golden aster	
	<i>Cirsium sp.</i>	Thistle	
	<i>Conyza canadensis</i>	Horseweed	ECO,UPL, FAC,FACU
	<i>Erigeron divergens</i>	Fleabane Daisy	NW
	<i>E. flagellaris</i>	Trailing Fleebane	NW,FAC, FACU
	<i>Grindelia sp.</i>	Gumweed	NW
	<i>Grindelia aphanactis</i>	Gumweed	NW
	<i>Helianthus sp.</i>	Sunflower	
	<i>Helianthus petiolaris</i>	Praire sunflower	ECO
	<i>Hymenoxys richardsonii</i>	Bitterweed	NW
	<i>Lactuca sp.</i>	Chicory	
	<i>Ratibida sp.</i>	Coneflower	
	<i>Senecio fendleri</i>	Bigelow groundsel	
	<i>Taraxacum officinale</i>	Common dandelion	COL
	<i>Townsendia incana</i>	Townsend's aster	NW
	<i>Tragopogon dubius</i>	Salisfy, Goatsbeard	ECO
	<i>Viguiera multiflora</i>	Goldeneye	
CONVOLVULACEAE	<i>Ipomonea spp.</i>	Morning glory	NW
CUPRESSACEAE	<i>Juniperus monosperma</i>	One-Seeded juniper	NW
CYPERACEAE	<i>Carex spp.</i>	Sedge	NW

FAGACEAE	<i>Quercus gambelii</i>	Gambel oak	NW
GERANIACEAE	<i>Geranium sp.</i>	Geranium	
	<i>Geranium caespitosum</i>	James geranium	
GRAMINEAE	<i>Agropyron sp.</i>	Wheatgrass	
	<i>Agrostis alba</i>	Redtop	FACW,OBL
	<i>Andropogon scoparius</i>	Little bluestem	NW
	<i>Bromus anomalus</i>	Nodding brome	NW
	<i>Bromus sp.</i>	Brome grass	
	<i>Buchloe dactyloides</i>	Buffalo grass	
	<i>Elymus canadensis</i>	Canada wildrye	NW, FACU, FAC
	<i>Hordeum sp.</i>	Barley	
	<i>Hordeum jubatum</i>	Foxtail barley	ECO,FAC, FACW
	<i>Koeleria sp.</i>	Junegrass	NW
	<i>Koeleria cristata</i>	Prairie junegrass	NW
	<i>Muhlenbergia montana</i>	Mountain muhly	NW
	<i>Poa spp.</i>	Bluegrass	
	<i>Poa fendleriana</i>	Bluegrass	NW
	<i>Sitanion hystrix</i>	Bottlebrush squirreltail	NW
	<i>Sporobolus cryptandrus</i>	Sand dropseed	NW,FAC, FACU,UPL
JUNCACEAE	<i>Juncus sp.</i>	Rush	NW
	<i>Juncus interior</i>	Inland rush	NW,FACU, FACW
LABIATAE	<i>Monarda menthaefolia</i>	Horsemint	NW
LEGUMINOSAE	<i>Melilotus albus</i>	White sweet clover	COL,FACU FAC
	<i>Melilotus officialis</i>	Yellow sweet clover	COL,FACU, FAC
	<i>Robinia neomexicana</i>	New Mexico locust	NW
	<i>Vicia americana</i>	American vetch	NW,FAC
LILIACEAE	<i>Allium cernuum</i>	Nodding onion	ECO
LINACEAE	<i>Linum neomexicanum</i>	New Mexico flax	
LOASACEAE	<i>Mentzelia sp.</i>	Blazing star	NW
MALVACEAE	<i>Sphaerlacea spp.</i>	Globe mallow	NW
ONAGRACEAE	<i>Oenothera caespitosa</i>	White stemless primrose	

ORCHIDACEAE	<i>Malaxis sp.</i>	Orchid	
PINACEAE	<i>Abies concolor</i>	White fir	NW
	<i>Pinus ponderosa</i>	Ponderosa pine	NW,FACU, FAC,UPL
	<i>Pseudotsuga menziesii</i>	Douglas fir	NW
PLANTAGINACEAE	<i>Plantago purshii</i>	Woolly indian-wheat	ECO,FACU, FACW
POLEMONIACEAE	<i>Ipomopsis aggregata</i>	Scarlet trumpet	NW
POLYGONACEAE	<i>Rumex sp.</i>	Dock/sorrel	
RANUNCULACEAE	<i>Clematis pseudoalpina</i>	Rocky Mt. clematis	
	<i>Thalictrum fendleri</i>	Fendler meadowrue	NW,UPL, FAC,FACU
ROSACEAE	<i>Fragaria americana</i>	Wild strawberry	
	<i>Potentilla sp.</i>	Cinquefoil	
	<i>Prunus virginia</i>	Chokecherry	NW,FAC, FACU
	<i>Robinia neomexicana</i>	New Mexico locust	
	<i>Rosa spp.</i>	Wild rose	
	<i>Rosa woodsii</i>	Wild rose	NW,FAC, UPL,FACU
	<i>Rubus strigosus</i>	Wild raspberry	
SALICACEAE	<i>Salix sp.</i>	Willow	NW,FAC, FACW
SAXIFRAGACEAE	<i>Jamesia americana</i>	Cliffbush	NW,UPL, FAC, NW,FACU
	<i>Ribes inreme</i>	Whitestem gooseberry	
SCROPHULARIACEAE	<i>Penstemon sp.</i>	Beardtongue	
	<i>Verbascum thapsus</i>	Mullein	ECO
TYPHACEAE	<i>Typha latifolia</i>	Cattail	NW,OBW
URTICACEAE	<i>Urtica gracilis</i>	Stinging nettle	
VALERIANACEAE	<i>Valeriana capitata</i>	Tobacco root	
VERBENACEAE	<i>Verbena sp.</i>	Vervain	
VIOLACEAE	<i>Viola adunca</i>	Western dog violet	
	<i>Viola canadensis</i>	Canada violet	NW

* INDICATOR CODES

NW =Non-weedy
COL =Colonizing

Indicator codes cont.

- ECO** =Economic
- FAC** =Facultative plants are equally likely to occur in wetlands or nonwetlands
- FACW** =Facultative wetland plants usually occur in wetlands.
- FACU** =Facultative upland plants usually occur in nonwetlands.
- OBL** =Obligate wetland plants occur almost always in wetlands.
- UPL** =Obligate upland plants occur almost always in nonwetlands.

APPENDIX B

Checklist of Mammals found in OU 1157

FAMILY	SCIENTIFIC NAME	COMMON NAME	SOURCE
CANIDAE	<i>Canis latrans</i>	Coyote	1,2
CERVIDAE	<i>Cervus elaphus</i> subsp. <i>canadensis</i>	Elk	1,2
	<i>Odocoileus hemionus</i>	Mule deer	1,2
CRICETIDAE	<i>Microtus longicaudus</i>	Long-tailed vole	1,3
	<i>Microtus montanus</i>	Montane vole	1,3
	<i>Peromyscus boylii</i>	Brush mouse	1,3
	<i>P. leucopus</i>	White-footed mouse	3
	<i>P. maniculatus</i>	Deer mouse	1,3
LEPORIDAE	<i>Sylvilagus</i> spp.	Cottontail	2
SUIURIDAE	<i>Eutamias</i> spp.	Chipmunk	2
	<i>Eutamias minimus</i>	Least chipmunk	1,3
	<i>Eutamias quadrivittatus</i>	Colorado chipmunk	1,3
	<i>Sciurus aberti</i>	Abert's squirrel	2
	<i>Spermophilus</i> spp	Squirrel spp	1
	<i>S. variegatus</i>	Rock squirrel	3
URSIDAE	<i>Ursus americanus</i>	Black bear	2

1=Outfall Study

2=Observations

3=1992 Survey

Checklist of Birds in OU 1157

FAMILY	SCIENTIFIC NAME	COMMON NAME	SOURCE
ACCIPITRIDAE	<i>Accipiter cooperii</i>	Cooper's hawk	1
	<i>A. striatus</i>	Sharp-shinned hawk	1
	<i>Buteo jamaicensis</i>	Red-tailed hawk	1,2
APODIDAE	<i>Aeronautes saxatalis</i>	White-throated swift	1
CAPRIMULGIDAE	<i>Chordeiles minor</i>	Common nighthawk	1
	<i>Phalaenoptilus nuttallii</i>	Common poorwill	1
CATHARTIDAE	<i>Cathartes aura</i>	Turkey vulture	2
COLUMBIDAE	<i>Columba fasciata</i>	Band-tailed pigeon	2
	<i>Zenaida macroura</i>	Mourning dove	2
CORVIDAE	<i>Amphelocoma coerulescens</i>	Scrub jay	1
	<i>Cyanocitta stelleri</i>	Steller's jay	1,2
	<i>Corvus corax</i>	Common raven	1,2
	<i>Nucifraga columbiana</i>	Clark's nutcracker	1,2
EMBERIZIDAE	<i>Agelaius phoeniceus</i>	Red winged blackbird	1
	<i>Carduelis pinus</i>	Pine siskin	1
	<i>Dendroica coronata</i>	Yellow-rumped warbler	1,2
	<i>D. graciae</i>	Grace's warbler	1
	<i>Junco hyemalis</i>	Dark-eyed junco	1,2
	<i>Melospiza lincolni</i>	Lincoln's sparrow	1
	<i>Molothrus aster</i>	Brown-headed cowbird	1
	<i>Oporonis tolmiei</i>	Macgillivaray's warbler	1
	<i>Pheucticus melanocephalus</i>	Black-headed grosbeak	1,2
	<i>Pheucticus erythrophthalmus</i>	Rufous-sided towhee	1,2
	<i>Pipilo chlorurus</i>	Green-tailed towhee	1
	<i>Piranga ludoviciana</i>	Western tanager	1,2
	<i>Poocetes gramineus</i>	Vesper sparrow	1
	<i>Spizella passerina</i>	Chipping sparrow	1,2
	<i>Sturnella neglecta</i>	Western meadowlark	1
	<i>Vermivora celata</i>	Orange-crowned warbler	1
	<i>Vermivora virginiae</i>	Virginia's warbler	1
<i>Vireo gilvius</i>	Warbling vireo	1	
<i>Vireo solitarius</i>	Solitary vireo,	1	
<i>Zonotrichia leucophrys</i>	White-crowned sparrow	2	

FALCONIDAE	<i>Falco sparverius</i>	American kestrel	1,2
FRINGILLIDAE	<i>Carduelis pinus</i>	Pine siskin	1
	<i>C. psaltria</i>	Lesser goldfinch	1
	<i>Hesperiphona vespertina</i>	Evening grosbeak	1
	<i>Loxia curvirostra</i>	Red crossbill	1,2
GALLINACEOUS	<i>Meleagris gallopavo</i>	Wild turkey	1
HIRUNDINIDAE	<i>Tachycineta thalassina</i>	Violet-green swallow	1
MIMIDAE	<i>Catharus guttatus</i>	Hermit thrush	1
MUSCICAPIDAE	<i>Myadestes townsendi</i>	Townsend's solitaire	1
	<i>Regulus calendula</i>	Ruby-crowned kinglet	1
	<i>Sialis currucoides</i>	Mountain bluebird	1,2
	<i>S. mexicana</i>	Western bluebird	1,2
	<i>Turdus migratorius</i>	American robin	1,2
PARIDAE	<i>Parus gambeli</i>	Mountain chickadee	1,2
PICIDAE	<i>Colaptes auratus</i>	Northern flicker	1,2
	<i>Melanerpes lewis</i>	Lewis's woodpecker	2
	<i>Picoides pubescens</i>	Downy woodpecker	1
	<i>P. villosus</i>	Hairy woodpecker	1,2
	<i>P. tridactylus</i>	Three-toed woodpecker	1
	<i>Sphyrapicus nuchalis</i>	Red-naped sapsucker	1
	<i>S. thyroideus</i>	Williamson's sapsucker	1
SITTIDAE	<i>Certhia americana</i>	Brown creeper	1
	<i>Sitta spp.</i>	Nuthatch	2
	<i>Sitta canadensis</i>	Red-breasted nuthatch	1
	<i>S. carolinensis</i>	White-breasted nuthatch	1
	<i>S. pygmaea</i>	Pygmy nuthatch	1,2
STRIGIDAE	<i>Glaucidium gnoma</i>	Northern pygmy-owl	1
STURNIDAE	<i>Sturnus vulgaris</i>	European starling	2
TROCHILIDAE	<i>Selasphorus playtcerus</i>	Broad-tailed hummingbird	1
TROGLODYTIDAE	<i>Troglodytes spp.</i>	Wren	2
	<i>Troglodytes aedon</i>	House wren	1,2
	<i>T. troglodytes</i>	Winter wren	1
TYRANNIDAE	<i>Contopus borealis</i>	Olive-sided flycatcher	1
	<i>Contopus sordidulus</i>	Western wood-pewee	1,2
	<i>Empidonax hammondii</i>	Hammond's flycatcher	1
	<i>E. oberholseri</i>	Dusky flycatcher	1
	<i>E. occidentalis</i>	Cordilleran flycatcher	1
	<i>Myiarchus cinerascens</i>	Ash-throated flycatcher	1

	<i>Sayornis saya</i>	Say's Phoebe	1,2
TYTONIDAE	<i>Bubo virginianus</i>	Great horned owl	1
VIREONIDAE	<i>Vireo gilvus</i>	Warbling vireo	1
	<i>V. solitarius</i>	Solitary vireo	1

1=Breeding Bird Atlas

2=Observations Sheets

Checklist of Reptiles and Amphibians Of OU 1157

FAMILY	SCIENTIFIC NAME	COMMON NAME	SOURCE
	SNAKES		
COLUBRIDAE	<i>Pituophis melanoleucus sayi</i>	Bull snake	2
	LIZARDS AND SKINKS		
IGUANIDAE	<i>Sceloporus undulatus</i>	Eastern fence lizard	1
	FROGS/TOADS/SALAMANDERS		
AMBYSTOMATIDAE	<i>Ambystoma tigrinum</i>	Tiger salamander	2
HYLIDAE	<i>Pseudacris triseriata</i>	Striped chorus frog	2

1=Outfall Study

2=Observation Sheets

Checklist Of Insects In OU 1157

SUBFAMILY	SCIENTIFIC NAME	HABITAT	SOURCE
CHRYSOPIDAE	<i>Chrysopa</i> spp.	Riparian	3
CULICIDAE	<i>Aedes</i> spp.	Riparian	2
DOLICHODERINAE	<i>Liometopum apiculatum</i>	Ponderosa pine-riparian	1
	<i>Li. luctuosum</i>	Ponderosa pine-riparian	1
	<i>Tapinoma sessile</i>	Ponderosa pine-riparian	1
FORMICINAE	<i>Acanthomyops interjectus</i>	Ponderosa pine	1
	<i>A. latipes</i>	Ponderosa pine-riparian	1
	<i>Camponotus herculeanus</i>	Spruce, riparian	1
	<i>C. laevigatus</i>	Ponderosa pine-riparian	1
	<i>C. sansabeanus</i>	Ponderosa pine	1
	<i>C. vicinus</i>	Pond.pine-riparian, pond.pine	1
	<i>Formica argentea</i>	Pond.pine-riparian, disturbed sites	1
	<i>F. densiventris</i>	Ponderosa pine-riparian	1
	<i>F. fusca</i>	Ponderosa pine-riparian	1
	<i>F. hewitti</i>	Pond.pine-riparian, grassy areas next to ponderosa pine, riparian	1 1
	<i>F. lasioides</i>	Ponderosa pine-riparian	1
	<i>F. limata</i>	Ponderosa pine-riparian	1
	<i>F. neogagates</i>	Highly disturbs areas	1
	<i>F. neorufibarbis</i>	Riparian	1
	<i>F. obscuripes obscuripes</i>	Ponderosa pine-riparian	1
	<i>F. obscuriventris clivia</i>	Ponderosa pine-riparian	1
	<i>F. occulta</i>	Ponderosa pine-riparian	1
	<i>F. pergandei</i>	Disturbed area	1
	<i>F. planipilis</i>	Ponderosa pine-riparian	1
	<i>F. podzolica</i>	Ponderosa pine-riparian	1
	<i>F. subnuda</i>	Ponderosa pine	1
	<i>Lasius alienus</i>	Ponderosa pine-riparian	1
	<i>L. crypticus</i>	Ponderosa pine-riparian	1
	<i>L. flavus</i>	Ponderosa pine-riparian	1
	<i>L. neoniger</i>	Ponderosa pine-riparian	1
	<i>L. pallitarsis</i>	Pond.pine-riparian, Pond.pine	1
	<i>L. sitiens</i>	Ponderosa pine	1

	<i>L. subumbratus</i>	Ponderosa pine-riparian	1
LIBELLULIDAE	<i>Libellula</i> spp.		3
MYRMICINEA	<i>Crematogaster cerasi</i>	Ponderosa pine, riparian	1
	<i>Leptothorax crassipilis</i>	Ponderosa pine-riparian	1
	<i>Le. muscorum</i>	Pond.pine-riparian, Pond.pine	1
	<i>Le. nitens</i>	Pond.pine-riparian, disturbed areas	1
	<i>Le. obliquicanthus</i>	Highly disturbes areas	1
	<i>Le. probancheri</i>	Riparian	1
	<i>Le. texanus texanus</i>	Ponderosa pine-riparian	1
	<i>Le. tricarinatus</i>	Ponderosa pine-riparian	1
	<i>Monomorium cyaneum</i>	Juniper, disturbes areas	1
	<i>Mo. minimum</i>	Ponderosa pine-riparian	1
	<i>Myrmecina americana</i>	Ponderosa pine-riparian	1
	<i>Myrmica bravispinosa</i>	Riparian	1
	<i>M. emeryana</i>	Riparian-Ponderosa pine	1
	<i>M. hamulata</i>	Ponderosa pine-riparian	1
	<i>Polyergus breviceps</i>	Ponderosa pine	1
	<i>Pheidole ceres</i>	Pond.pine, Pond.pine-riparian, disturbed areas	1
	<i>Ph. hyatti hyatti</i>	Riparian	1
	<i>Ph. sitarches soritis</i>	Disturbed areas	1
	<i>Ph. wheelerorum</i>	Pond.pine-riparian, disturbed sites	1
	<i>Pogonomyrmex occidentalis</i>	Pond.pine-riparian, Pond.pine, disturbed areas	1
	<i>Solenopsis molesta</i>	Riparian, Pond.pine-riparian, disturbed areas	1
	<i>Stenamma occidentale</i>	Ponderosa pine-riperian	1
NYMPHALIDAE	<i>Phyciodes</i> spp.		3
	<i>Vanessa virginiensis</i>		3
PAPILIOIDAE	<i>Papilio polyxenes asterius</i>		3
	<i>Papilio bairdii</i>		3
PONERINAE	<i>Hypoponera opaciceps</i>	Riparian	1

1= Mackay, W.

2= Outfall Study

3= Observation Sheets

APPENDIX C

ENDANGERED SPECIES PRINTOUT FOR OU 1157

HABITATS: PONDEROSA-PINON, PONDEROSA PINE, MIXED-CONIFER
WETLANDS AND RIPARIAN

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| ANIMALS |
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IRD

FAMILY ACCIPITRIDAE

SCIENTIFIC NAME: *Accipiter gentilis*

COMMON NAME: NORTHERN GOSHAWK

STATUS: CANDIDATE FOR FEDERAL REGISTER

FEDERAL/STATE REFERENCE: CURRENTLY, CANDIDATE FOR FEDERAL LISTING, FEDERAL REGISTER, 1991, VOL. 56, NO. 225, PP.58810.

DISTRIBUTION:

SPECIFIC REQUIREMENTS: DENSE, MATURE, OR OLD GROWTH CONIFEROUS FOREST.

HABITAT: PONDEROSA BREEDING HABITAT: PONDEROSA

MINIMUM ELEVATION: 0 MAXIMUM ELEVATION: 0

THREATS TO TAXON: LOGGING

BRIEF KEY DESCRIPTION: A LARGE ROBUST HAWK WITH A LONGISH TAIL, ROUNDED WINGS. CROWN AND CHECK BLACKISH; BROAD WHITE STRIPE OVER THE EYE. UNDER PARTS PALE GRAY, FINELY BARRED. SIZE = 20-26".

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: YES

LA REFERENCE OF OCCURRENCE: KENNEDY, P.L., 1987

GENERAL MAP LOCATION:

COMMENTS: STUDIES BY PAT KENNEDY INDICATE THE HIGHEST PERCENTAGE OF NEST WERE IN PONDEROSA PINE/GAMBEL'S OAK, PONDEROSA PINE/GRAY OAK, AND MIXED CONIFER (ABIES CONCOLOR-PSEUDOTSUGA MENZIESII-PINUS PONDEROSA/QUERCUS GAMBELII) HABITAT TYPES.

REFERENCE: KENNEDY, P.L., 1987, FED.REGISTER, 1991, VOL.56, NO.225

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| ANIMALS |
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BIRD

FAMILY ACCIPITRIDAE

SCIENTIFIC NAME: Buteogallus anthracinus

COMMON NAME: COMMON BLACK HAWK

STATUS: STATE-ENDANGERED

FEDERAL/STATE REFERENCE: New Mexico Endangered (Group 2). First listed
1/24/75 (NMGF Reg. 563).

DISTRIBUTION: Lower elevations in Gila, San Francisco and
Mimbres drainage. Has also occurred in smaller
numbers in Rio Grande Valley.

SPECIFIC REQUIREMENTS: In the Southwest, in cottonwoods and other
woodlands along permanent streams.

HABITAT: RIPARIAN ZONES

BREEDING HABITAT: RIPARIAN ZONES

MINIMUM ELEVATION: 0

MAXIMUM ELEVATION: 0

THREATS TO TAXON: DESTRUCTION OF RIPARIAN HABITAT AND SHOOTING HAWK.

BRIEF KEY DESCRIPTION: Medium-sized raptor, mainly black. Broader wings
than the Zone-Tail. Adults have bill black, iris
dark brown and cere and legs yellow. Length is
500-600 m.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: NO

LA REFERENCE OF OCCURRENCE: N/A

GENERAL MAP LOCATION: N/A

COMMENTS:

REFERENCE: NM DEPT. OF GAME AND FISH, HANDBOOK OF SPECIES ENDANGERED.

ANIMALS

PHIBIAN

FAMILY PLETHODONTIDAE

SCIENTIFIC NAME: *Plethodon neomexicanus*

COMMON NAME: JEMEZ MOUNTAINS SALAMANDER

STATUS: STATE-ENDANGERED

FEDERAL/STATE REFERENCE: New Mexico Endangered (group 2), first listed in 1/24/75 (nm reg. 563). There no exist a cooperative agreement between the U.S. Fish and Wildlife, U.S. Forest Service and NM Dept. of Game and Fish for the Protection of the Salamander.

DISTRIBUTION: Endemic to North-Central NM. Known in various locations of the Jemez Mountains, Sandoval, Los Alamos and Rio Arriba Counties, NM.

SPECIFIC REQUIREMENTS: Cool moist and shaded wooded habitats where elevations are 2190 - 2800 m.

HABITAT: SPRUCE-FIR

BREEDING HABITAT: SPRUCE-FIR

MINIMUM ELEVATION: 7225 MAXIMUM ELEVATION: 9250

THREATS TO TAXON: HABITAT ALTERATIONS

BRIEF KEY DESCRIPTION: Lungless salamander, hairline furrow that extends from nostril to edge of upper lip. Elongated with small fore and hind limbs, brownish with fine brassy strippling. Length is between 50-110 mm.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: YES

LA REFERENCE OF OCCURRENCE: SCHMITT, ET AL., 1985; EDESKUTY AND BENNETT, 1991

GENERAL MAP LOCATION: UPPER PAJARITO CANYON

REMARKS:

REFERENCE: NM DEPT. OF GAME AND FISH, HANDBOOK OF SPECIES ENDANGERED.

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| ANIMALS |
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IRD

FAMILY ACCIPITRIDAE

SCIENTIFIC NAME: *Haliaeetus leucocephalus*

COMMON NAME: BALD EAGLE

STATUS: FEDERALLY-ENDANGERED

FEDERAL/STATE REFERENCE: New Mexico endangered (group 2). First listed
1/24/75 (NMGF Reg. 563). Federally protected
since 03/11/67.

DISTRIBUTION: Migrates and winters from the northern border,
southward regularly to Gila, Lower Rio Grande,
Middle Pecos and Candian Valleys, Rio Arriba and
Sandoval Co.

SPECIFIC REQUIREMENTS: Found near streams, lakes and sometimes dry land.
Also found in riparian areas.

HABITAT: RIPARIAN ZONES BREEDING HABITAT: RIPARIAN ZONES

MINIMUM ELEVATION: 0 MAXIMUM ELEVATION: 0

THREATS TO TAXON: PESTICIDES AND STREAM DEGRADATION.

BRIEF KEY DESCRIPTION: Huge wingspan 2-2.4 m, white head and tail, iris,
cere, bill and legs yellow. Immature resemble
golden eagles.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: YES

LA REFERENCE OF OCCURRENCE: FIELD SIGHTINGS, 1991-1992

GENERAL MAP LOCATION: NEAR ANCHO CANYON IN WHITE ROCK CANYON

COMMENTS: Winter roost at Cochiti Lake and in Montoso
Canyon. Mortandad Canyon appears to have some
suitable roosting areas, but no confirmed roost.
Suitable roost sites consist of protection from
wind and large trees.

Potential roosting area has been found on LANL
property near the Rio Grande River. A bald eagle
was seen in the area in February 1992. Survey
efforts are underway to confirm.

REFERENCE: NM DEPT. OF GAME AND FISH, HANDBOOK OF SPECIES ENDANGERED.

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| ANIMALS |
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BIRD

FAMILY ACCIPITRIDE

SCIENTIFIC NAME: *Ictinia mississippiensis*

COMMON NAME: MISSISSIPPI KITE

STATUS: STATE-ENDANGERED

FEDERAL/STATE REFERENCE: New Mexico Endangered (Group 2). First listed in
Jan. 24, 1975 (NMGF Reg. 563).

DISTRIBUTION: In New Mexico summers regularly and breeds in the
Covis region, Portales, and Hobbs. Small numbers
occur in middle and lower Rio Grande and lower
Pecos valleys.

SPECIFIC REQUIREMENTS: Riparian zones, shelterbelts and golf courses.

HABITAT: RIPARIAN ZONES BREEDING HABITAT: RIPARIAN ZONES

MINIMUM ELEVATION: 0 MAXIMUM ELEVATION: 0

THREATS TO TAXON: DESTRUCTION OF RIPARIAN ZONES.

BRIEF KEY DESCRIPTION: Small raptor with length 335 mm and wingspan 1 m,
long. Has long pointed and notched wings. Has
whitish to black plumage.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: NO

LA REFERENCE OF OCCURRENCE: N/A

GENERAL MAP LOCATION: N/A

COMMENTS: .

REFERENCE: NM DEPT OF GAME AND FISH, HANDBOOK OF SPECIES ENDANGERED.

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| ANIMALS |
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IRD

FAMILY FALCONIDAE

SCIENTIFIC NAME: Falco Peregrinus

COMMON NAME: PEREGRINE FALCON

STATUS: FEDERALLY-ENDANGERED

FEDERAL/STATE REFERENCE: NM: Endangered (group 1), 1/24/75, (NM Reg. 563);
Federal "American", F.p. antum, Endangered 6/2/70;
Tundra F.P. tundrius, Threatened 3/20/84.

DISTRIBUTION: New Mexico subspecies "American" breeds locally in mountainous areas, and it occurs in migration and winter statewide.

SPECIFIC REQUIREMENTS: Breeding territories center on cliffs that are wooded/forested habitats.

HABITAT: PONDEROSA-PINON BREEDING HABITAT: PONDEROSA-PINON

MINIMUM ELEVATION: 0 MAXIMUM ELEVATION: 0

THREATS TO TAXON: DDT, DESTRUCTION OF HABITAT

BRIEF KEY DESCRIPTION: Typical falcon, long pointed wings and long tails, moderate size, 380-500 mm in length, wingspan 1.0-1.5 m, gray above, whitish below, tail is dark gray.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: YES
LA REFERENCE OF OCCURRENCE: LA-6898-PR, PP.94
GENERAL MAP LOCATION: PUEBLO CANYON

COMMENTS: Two young males seen in the spring of 1990.

REFERENCE: NM DEPT. OF GAME AND FISH, HANDBOOK OF SPECIES ENDANGERED

ANIMALS

BIRD

FAMILY STRIGIDAE

SCIENTIFIC NAME: *Strix occidentalis lucida*

COMMON NAME: MEXICAN SPOTTED OWL

STATUS: FEDERALLY-THREATENED

FEDERAL/STATE REFERENCE: Currently listed as federaly threatened, 50 CFR PART 17, Vol. 58, No. 49, March 16, 1993, "Endangered and Threatened Wildlife and Plants: Final Rule to list Mexican Spotted Owl as Threatened Species, pp.14248-14271.

DISTRIBUTION: New Mexico, Arizona, Texas, Colorado, Utah and Mexico.

SPECIFIC REQUIREMENTS: The owl inhabits forested mountains and canyons. Its habitat is primarily uneven-aged, multi-storied forest with closed canopies.

HABITAT: MIXED-CONIFER

BREEDING HABITAT: MIXED-CONIFER

MINIMUM ELEVATION: 0

MAXIMUM ELEVATION: 0

THREATS TO TAXON: LUMBERING

BRIEF KEY DESCRIPTION:

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: NO
LA REFERENCE OF OCCURRENCE: N/A
GENERAL MAP LOCATION: N/A

COMMENTS:

REFERENCE: FEDERAL REGISTER 50 CFR PARTT 17, VOL.55, NO.60, 3/28/90.

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| ANIMALS |
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BIRD

FAMILY TROCHILIDAE

SCIENTIFIC NAME: *Cynanthus latirostris*

COMMON NAME: BROAD-BILLED HUMMINGBIRD

STATUS: STATE-ENDANGERED

FEDERAL/STATE REFERENCE: New Mexico: Endangered (Group 2), 1/24/75 (NMGF Reg. 563).

DISTRIBUTION: Summers in Guadalupe Canyon (Hisalgo co.), Vagrants near Los Alamos, Bandelier National Monument, Las Vegas, Truth of Consequences, Las Cruces and Carlsbad Caverns.

SPECIFIC REQUIREMENTS: Riparian woodlands, low to moderate elevations.

HABITAT: RIPARIAN ZONES

BREEDING HABITAT: RIPARIAN ZONES

MINIMUM ELEVATION: 0

MAXIMUM ELEVATION: 0

THREATS TO TAXON: DESTRUCTION OF HABITAT

BRIEF KEY DESCRIPTION: Adult males have orange-red bills. Females and immatures similar to the violet-crowned hummingbird, but have small white line behind the eye. Upperparts of the hummingbird are greenish, the wings are blackish, and feet and eyes are dark. The tail is slightly forked.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: YES

LA REFERENCE OF OCCURRENCE: NM DEPT. OF GAME AND FISH, HANDBOOK OF ENDANGERED

GENERAL MAP LOCATION:

COMMENTS:

REFERENCE: NM DEPT. OF GAME AND FISH, HANDBOOK OF SPECIES ENDANGERED

ANIMALS

BIRD

FAMILY TYRANNIDAE

SCIENTIFIC NAME: *Empidonax traillii*

COMMON NAME: WILLOW FLYCATCHER

STATUS: CANDIDATE FOR FEDERAL REGISTER

FEDERAL/STATE REFERENCE: New Mexico: "Southwestern", E.T. extimus, only.
Endangered, Group 2, 01/09/88 (NMGF reg 657).
Federal: Notice of Review as
Endangered/Threatened. Listed as a C1 species

DISTRIBUTION: Breeds through central New Mexico. Species occurs
statewide in spring and autumn migration. E.t.
extimus breeds in Chama, Rio Grande, Zuni, Gila,
San Francisco.

SPECIFIC REQUIREMENTS: Confined to riparian woodlands in breeding
seasons. Riparian areas are dominated by
cottonwoods.

HABITAT: RIPARIAN ZONES BREEDING HABITAT: RIPARIAN ZONES

MINIMUM ELEVATION: 3700 MAXIMUM ELEVATION: 8900

THREATS TO TAXON: LOSS OF RIPARIAN HABITAT

BRIEF KEY DESCRIPTION: Small, double wingbars and eyering. Upperparts
are dark olive-brown, crown paler and more grayish
or brownish. Breast is light grayish-olive and
post. is pale yellow.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: NO
LA REFERENCE OF OCCURRENCE: N/A
GENERAL MAP LOCATION: N/A

COMMENTS:

REFERENCE: NM DEPT OF GAME AND FISH, HANDBOOK OF SPECIES ENDANGERED

ANIMALS

AMMAL

FAMILY VESPERTILIONIDAE

SCIENTIFIC NAME: *Euderma maculatum*

COMMON NAME: SPOTTED BAT

STATUS: STATE-ENDANGERED

FEDERAL/STATE REFERENCE: New Mexico :Endangered (Group 2), 01/09/88 (NMGF Reg. 657). Federal: Notice of review as endangered/threatened.

DISTRIBUTION: Rio Grande Valley westward, occurring regularly in the Jemez Mountains and on Mt. Taylor. Records also at Ghost Ranch and Lake Roberts.

SPECIFIC REQUIREMENTS: Riparian, Pinon-juniper, ponderosa, spruce-fir. Roost in cliffs or rock cervices. Needs a good source of water, a small area of standing water to slow moving water. Key food is moths.

HABITAT: MULTIPLE

BREEDING HABITAT: MULTIPLE

MINIMUM ELEVATION: 0

MAXIMUM ELEVATION: 0

THREATS TO TAXON: POSSIBLY PESTICIDES

BRIEF KEY DESCRIPTION: Upperparts are black with large white, roughly circular spots on the shoulders and another at the base of the tail, plus a small patch at the posterior base of each ear. Has very large ears (45-50 mm). Ears are naked, pinkish-red in color.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: NO

LA REFERENCE OF OCCURRENCE: N/A

GENERAL MAP LOCATION: N/A

COMMENTS: Note: Habitat can be varied--Riparian, Ponderosa, Spruce-Fir and Pinon Juniper.

REFERENCE: NM DEPT. OF GAME AND FISH, HANDBOOK OF SPECIES ENDANGERED.

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| ANIMALS |
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AMMAL

FAMILY ZAPODIDAE

SCIENTIFIC NAME: *Zapus hudsonius*

COMMON NAME: MEADOW JUMPING MOUSE

STATUS: STATE-ENDANGERED

FEDERAL/STATE REFERENCE: New Mexico: Endangered (Group 2), 07/22/83 (NMGF Reg. 624). Federal (Subspecies "New Mexico" *Z.H. luteus*) notice of review as endangered/threatened.

DISTRIBUTION: Localities in San Juan, Jemez and Sacramento Mountains in central-northern and central Rio Grande Valley. Has been recorded once in the Sangre de Cristo Mountains.

SPECIFIC REQUIREMENTS: Confined to holarctic region, mesic habitats, permanent streams and wet meadows.

HABITAT: WETLAND

BREEDING HABITAT: WETLANDS

MINIMUM ELEVATION: 0 MAXIMUM ELEVATION: 0

THREATS TO TAXON: HABITAT DESTRUCTION-GRAZING

BRIEF KEY DESCRIPTION: Well developed hind legs, long tail, jumping ability. Shades of brownish above and whitish below, sides yellow/orange brown. Feet are whitish. Length is 188-216 mm.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: YES

LA REFERENCE OF OCCURRENCE: NM DEPT. OF GAME AND FISH, HANDBOOK OF SPECIES END
GENERAL MAP LOCATION:

COMMENTS: Reports for Los Alamos are unsubstantiated or pre-1960 records.

REFERENCE: NM DEPT. OF GAME AND FISH, HANBOOK OF SPECIES ENDANGERED

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| ANIMALS |
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MOOLLUSK

FAMILY LYMNAEIDAE

SCIENTIFIC NAME: *Lymnaea caperata*

COMMON NAME: SAY'S POND SNAIL

STATUS: STATE-ENDANGERED

FEDERAL/STATE REFERENCE: New Mexico: Endangered (Group 1), first listed
07/22/83 (NMGF Reg. 624).

DISTRIBUTION: The species is known to occur only in the Cerro la
Jara area, Jemez Mountains (Sandoval Co.).

SPECIFIC REQUIREMENTS:

HABITAT: WETLAND

BREEDING HABITAT: WETLANDS

MINIMUM ELEVATION: 3700 MAXIMUM ELEVATION: 8600

THREATS TO TAXON: OVERGRAZING, POLLUTION, DEVELOPMENT AND DEATERING

BRIEF KEY DESCRIPTION: Medium sized (20 mm), absence of operculum on the
foot, shell is elongated and right spiralled.
Spiral length is greater than width of aperture.
Color is brown to brown-gray.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: NO
LA REFERENCE OF OCCURRENCE: N/A
GENERAL MAP LOCATION: N/A

COMMENTS:

REFERENCE: NM DEPT. OF GAME AND FISH, HANDBOOK OF SPECIES ENDANGERED

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| PLANTS |
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ORB

FAMILY LILIACEAE

SCIENTIFIC NAME: *Fritillaria atropurpurea*

COMMON NAME: CHECKER LILY

STATUS: STATE-SENSITIVE

FEDERAL/STATE REFERENCE:

DISTRIBUTION: Los Alamos county??

SPECIFIC REQUIREMENTS:

HABITAT: MIXED-CONIFER

BREEDING HABITAT: N/A

MINIMUM ELEVATION: 0

MAXIMUM ELEVATION: 0

THREATS TO TAXON:

BRIEF KEY DESCRIPTION:

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: YES

LA REFERENCE OF OCCURRENCE: TIERNERY, G.D., 1987

GENERAL MAP LOCATION:

COMMENTS:

REFERENCE: TIERNERY, G.D., 1987

PLANTS

ORB

FAMILY LILIACEAE

SCIENTIFIC NAME: *Lilium philadelphicum* var. *andium*

COMMON NAME: WOOD LILY

STATUS: STATE-ENDANGERED

FEDERAL/STATE REFERENCE:

DISTRIBUTION: OT, RA, SA, SF, SM

SPECIFIC REQUIREMENTS:

HABITAT: MIXED-CONIFER

BREEDING HABITAT: N/A

MINIMUM ELEVATION: 6000

MAXIMUM ELEVATION: 10000

THREATS TO TAXON: COLLECTION AND HABITAT DESTRUCTION.

BRIEF KEY DESCRIPTION: Stems to 2 ft, leaves linear to lance-shaped, margin smooth, lower leaves alternate. flowers large, showy red or orange-red with purplish-black spots at base.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: YES

LA REFERENCE OF OCCURRENCE: KOELLE, A., 1978; FOXX, T., 1979; KOSIEWICZ

GENERAL MAP LOCATION: UPPER PAJARITO, WATER AND FRIJOLES CANYON

COMMENTS: can be found in ponderosa to mixed-conifer.

REFERENCE: FOXX & HOARD, 1984; NRIS, 1986; HARRINGTON, 1964

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| PLANTS |
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FORB

FAMILY ORCHIDACEAE

SCIENTIFIC NAME: *Epipactis gigantea*

COMMON NAME: HELLEBORINE ORCHID

STATUS: STATE-ENDANGERED

FEDERAL/STATE REFERENCE:

DISTRIBUTION: Montana to British Columbia, southern to western Texas, New Mexico and California.

SPECIFIC REQUIREMENTS: Damp woods, seepage slopes, springs, streams and riparian areas.

HABITAT: RIPARIAN ZONES

BREEDING HABITAT: N/A

MINIMUM ELEVATION: 6000

MAXIMUM ELEVATION: 8500

THREATS TO TAXON:

BRIEF KEY DESCRIPTION: STEMS ALONG STEM. STEMS TO 2 1/2 FT. LEAVES TO 15 CM, OVAL. SEPALS GREENISH, PETALS PURPLE, LIP MARKED WITH PURPLE LINES.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: YES

LA REFERENCE OF OCCURRENCE: FOXX, T.S., 1984

GENERAL MAP LOCATION: SPRING IN WHITE ROCK CANYON

COMMENTS:

REFERENCE: FOXX, T.S. & HOARD, D, 1984, NM DEPART. OF NATURAL RES., 1993

PLANTS

FORB

FAMILY POLEMONIACEAE

SCIENTIFIC NAME: *Phlox caryophylla*, Wherry

COMMON NAME: PAGOSA PHLOX

STATUS: STATE-SENSITIVE

FEDERAL/STATE REFERENCE:

DISTRIBUTION: Rio Arriba County, New Mexico.

SPECIFIC REQUIREMENTS: Open slopes in open woods in mountains.

HABITAT: PONDEROSA-PINON BREEDING HABITAT: N/A

MINIMUM ELEVATION: 6500 MAXIMUM ELEVATION: 7500

THREATS TO TAXON: NONE KNOWN

RIEF KEY DESCRIPTION: Erect perennial, leaves narrow, 50 mm long;
flowers in loose clusters, bright pink or purple,
flower parts united in a tube. Flowers from late
May to July.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: NO

LA REFERENCE OF OCCURRENCE: N/A

GENERAL MAP LOCATION: N/A

COMMENTS:

REFERENCE: NM NATIVE PLANTS PROTECTION ADVISORY COMMITTEE, 1984.

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| PLANTS |
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ORB

FAMILY SAXIFRAGACEAE

SCIENTIFIC NAME: *Heuchera pulchella*, Woot. and Standl.

COMMON NAME: SANDIA ALUMROOT

STATUS: STATE-SENSITIVE

FEDERAL/STATE REFERENCE:

DISTRIBUTION: Bernalillo, Sandoval, San Miguel, Sierra, Socorro,
and Torrance Counties, New Mexico.

SPECIFIC REQUIREMENTS: Cliff-loving plant, endemic to the Mountains of
Central New Mexico.

HABITAT: MIXED-CONIFER

BREEDING HABITAT: N/A

MINIMUM ELEVATION: 8000

MAXIMUM ELEVATION: 12000

THREATS TO TAXON: NONE KNOWN

BRIEF KEY DESCRIPTION: Perennial herb with leaves clustered at the base;
leaf blades wide, toothed, upper surface with
hairs; low glandular flowers crowded along one
side. Flowers from July through September.

HAS THE SPECIES PREVIOUS BEEN FOUND IN LOS ALAMOS COUNTY?: NO

LA REFERENCE OF OCCURRENCE: N/A

GENERAL MAP LOCATION: N/A

COMMENTS:

REFERENCE: NM NATIVE PLANTS PROTECTION ADVISORY COMMITTEE, 1984.

APPENDIX D

APPENDIX D. Vegetation Hierarchical Classification System

Hierarchy Order

Vegetation Type
 Formation Type
 Climatic (thermal) Zone
 Biotic Community
 Series
 Habitat Type (association)
 Phase

Definitions

Vegetation Type: Refers to the vegetation established under existing climate and includes upland or wetland.

Formation Type: Refers to the formations that are vegetative responses to various environmental factors, primarily available soil moisture, and includes the following:

Upland	Wetland
tundra	wet tundra
forest and woodland	forest
scrubland	swamp scrub
grassland	marshland
desert land	strand
nonvascular	submergent

Climatic Zone: Refers to one of the four world climatic zones where minimum temperature is the primary determining factor in separation of formation types. These include Arctic-Boreal, Cold Temperate, Warm Temperate, and Tropical-Subtropical.

Biotic Community: Refers to a unit characterized by a distinctive evolutionary history within a formation and centered in a biogeographical region that has a particular precipitation pattern or climatic regime.

Series: Refers to principal plant and animal communities within each of the Biotic Communities. These are based on distinctive climax plant dominants.

Habitat Type: Based on the occurrence of particular dominant species that are local or regional in distribution.

Phase: Based on detailed data collection to determine dominants, understory species, and other species information.

For purposes of BRET application, only those formations, climatic zones, communities, etc., that occur at Los Alamos National Laboratory will be provided in this classification system. For a more complete description of all formations, etc., see Brown *et al.* (1982).

The following classification system is separated into the two vegetation types, upland and wetland.

APPENDIX D. Vegetation Hierarchical Classification System

Upland Vegetation

Formation

Climatic Zone

Community

Series

Habitat Type (HT)

Phase

Forest and Woodland Formation

Boreal Forests and Woodlands Climatic Zone

Rocky Mountain Subalpine Conifer Forest and Woodland Community

Picea engelmannii Series

Picea engelmannii (Pien)/Moss HT

Pien/*Vaccinium scoparium*/*Polemonium* HT

Picea engelmannii Phase

Abies lasiocarpa Phase

Pien/*Erigeron eximius* HT

Pien/*Geum rosii* HT

Pien/*Ribes montigenum* HT

Pien/*Elymus* sp. HT

Pien/*Acer glabrum* HT

Abies lasiocarpa Series

Abies lasiocarpa (Abla)/*Acer glabrum* HT

Abla/*Erigeron eximius* HT

Abla/*Vaccinium* HT

Typic Phase

Linnaea borealis Phase

Rubus parviflorus Phase

Abla/*Vaccinium*/*Linnaea borealis* HT

Abla/*Rubus parviflorus* HT

Vaccinium Phase

Acer glabrum Phase

Abla/*Erigeron superbus* HT

Abla/*Juniperus communis* HT

Abla/*Sanjuisorboides* HT

Abla/*Lathyrus arizonicus* HT

Abla/*Mertensia ciliata* HT

Abla/Moss HT

Cold Temperate Forests and Woodlands Climatic Zone

Rocky Mountain Montane Conifer-Forest Community

Picea pungens Series

Picea pungens (Pipu)/*Carex foenea* HT

Pipu/*Cornus stolonifera* HT

Pipu/*Arctostaphylos uva-ursi* HT

Pipu/*Erigeron eximius* HT

Typic Phase

Pinus ponderosa Phase

Pipu/*Festuca arizonica* HT

Pipu/*Linnaea borealis* HT

Pipu/*Poa pratensis* HT

APPENDIX D. Vegetation Hierarchical Classification System

- Abies concolor Series
 - Abies concolor (Abco)/Acer glabrum HT
 - Abco/Quercus gambelii HT
 - Quercus gambelii Phase
 - Festuca arizonica Phase
 - Abco/Arctostaphylos uva-ursi HT
 - Abco/Berberis repens HT
 - Abco/Erigeron eximius HT
 - Abco/Festuca arizonica HT
 - Festuca arizonica Phase
 - Poa fendleriana Phase
 - Quercus gambelii Phase
 - Abco/Lathyrus arizonicus HT
 - Abco/Robinia neomexicana HT
 - Robinia neomexicana Phase
 - Carex foenea Phase
 - Abco/Symphoricarpos HT
 - Pinus ponderosa Phase
 - Pinus flexilis Phase
 - Abco/Vaccinium myrtillus HT
- Pseudotsuga menziesii Series
 - Pseudotsuga menziesii (Psme)/Berberis repens HT
 - Psme/Bromus ciliatus HT
 - Psme/Festuca arizonica HT
 - Typic Phase
 - Pinus aristata Phase
 - Pinus flexilis Phase
 - Populus tremuloides Phase
 - Psme/Muhlenbergia montana HT
 - Pinus edulis Phase
 - Pinus flexilis Phase
 - Psme/Quercus gambelii HT
 - Quercus gambelii Phase
 - Festuca arizonica Phase
 - Muhlenbergia virescens Phase
 - Psme/Physocarpus monogynus HT
- Pinus flexilis (Pifl) Series
 - Pifl/Arctostaphylos uva-ursi HT
- Pinus ponderosa (Pipo) Series
 - Pipo/Artemisia arbuscula HT
 - Pipo/Arctostaphylos uva-ursi HT
 - Pipo/Bouteloua gracilis HT
 - Bouteloua gracilis Phase
 - Schizachyrium scoparium Phase
 - Andropogon hallii Phase
 - Artemisia tridentata Phase
 - Quercus gambelii Phase
 - Pipo/Cowania mexicana HT
 - Pipo/Festuca arizonica HT
 - Danthonia parryi Phase
 - Festuca arizonica Phase

APPENDIX D. Vegetation Hierarchical Classification System

Quercus gambelii Phase
Bouteloua gracilis Phase
Pipo/Muhlenbergia montana HT
Pipo/Poa HT
Pipo/Oryzopsis hymenoides HT
Pipo/Quercus gambelii HT
Quercus gambelii Phase
Festuca arizonica Phase
Pinus edulis Phase
Muhlenbergia montana Phase
Pipo/Quercus undulata HT
Pipo/Rockland HT
Pipo/Juniperus HT
Great Basin Conifer-Woodland Community
Pinyon (Pied)-Juniper (Jumo) Series
Pied/Andropogon hallii HT
Pied/Arctostaphylos pungens HT
Pied/Artemisia tridentata HT
Juniperus osteosperma Phase
Juniperus monosperma Phase
Juniperus scopulorum Phase
Pied/Bouteloua gracilis HT
Hill slope Phase
Juniperus osteosperma Phase
Juniperus monosperma Phase
Pied/Cowania mexicana HT
Cowania mexicana Phase
Artemisia tridentata Phase
Pied/Chrysothamnus nauseosus-Fallugia paradoxa HT
Pied/Cercocarpus montanus HT
Quercus undulata Phase
Quercus gambelii Phase
Pied/Festuca arizonica HT
Pied/Poa fendleriana HT
Pied/Purshia tridentata HT
Pied/Quercus gambelii HT
Pied/Quercus undulata HT
Pied/Stipa columbiana HT
Pied/Jumo/Bouteloua gracilis HT
Pied/Jumo/Muhlenbergia montanus HT
Jumo/Andropogon hallii HT
Jumo/Artemisia tridentata HT
Jumo/Bouteloua curtipendula HT
Jumo/Bouteloua gracilis HT
Jumo/Ceratoides lanata HT
Jumo/Chrysothamnus nauseosus-Fallugia paradoxa HT
Jumo/Quercus undulata

APPENDIX D. Vegetation Hierarchical Classification System

Scrub land Formation

- Arctic-Boreal Scrubland Climatic Zone
 - Rocky Mountain Alpine and Subalpine Scrub Community
 - Willow Series
 - Spruce elfinwood Series
 - Bristle cone pine elfinwood Series
- Cold Temperate Scrubland Climatic Zone
 - Great Basin Montane Scrub Community
 - Oak scrub Series
 - Mountain mahogany Series
 - Maple scrub Series
 - Serviceberry Series
 - Bitterbrush Series
 - Mixed deciduous Series
 - Plains Deciduous Scrub Community
 - Oak scrub Series
 - Sumac Series
 - Mixed deciduous Series

Grassland Formation

- Arctic-Boreal Grassland Climatic Zone
 - Rocky Mountain Alpine and Subalpine Grassland Community
 - Sedge-Forb-Grass Series
- Cold Temperate Grasslands Climatic Zone
 - Plains Grassland Community
 - Blue grama (Bogr) grass Series
 - Bogr/Western wheatgrass HT
 - Bogr/Buffalo grass HT
 - Bogr/Galleta HT
 - Bogr/Black grama HT
 - Bogr/Needlegrass HT
 - Bogr/Winterfat HT
 - Mixed grama Series
 - Sideoats grama (Bocu)/Bluestem/Jumo HT
 - Bocu/Bogr HT
 - Bocu/Black grama HT
 - Bocu/Curly mesquite HT
 - Bocu/Metcalf muhly/Jumo HT
 - Bocu/Bluestem HT
 - Mixed grama/Jumo HT
 - Buffalo grass/Blue grama Series
 - Shrub-Grass disclimax Series
 - Great Basin Shrub Grassland Community
 - Wheatgrass Series
 - Mixed bunchgrass Series
 - Rice grass/Galleta Series
 - Galleta/Rice grass/Jumo HT
 - Rice grass/Sagebrush Series
 - Galleta/Sagebrush HT
 - Western wheatgrass/Sagebrush HT
 - Sacaton/Saltbush Series
 - Sacaton/Shadscale/Fourwing HT
 - Mixed grama/western wheatgrass Series

APPENDIX D. Vegetation Hierarchical Classification System

Mixed grama/Juno HT
Cheatgrass disclimax Series
Rocky Mountain Montane Grassland Community
Fescue Series
Thurber fescue/Arizona fescue HT
Arizona fescue/Mountain muhly HT
Mumo/Pine dropseed Series
Carex/Tufted hairgrass Series
Mixed Meadow Series
Rush Series
Fern Series
Iris disclimax Series

Wetland Vegetation

Formation

Climatic Zone

Community

Series

Habitat Type

Phase

Forest Formation

Cold Temperate Swamp and Riparian Forest Climatic Zone

Plains and Great Basin Riparian-Deciduous Forest Community

Cottonwood/Willow Series

Fraxinus pennsylvanicus (Frpe) Series

Juglans major/Platanus wrightii Series

Platanus wrightii Series

Platanus wrightii/Frpe Series

Populus fremontii Series

Populus fremontii/Salix goodingii Series

Salix bonplandiana Series

Sapindus saponaria/Juglans major Series

Rocky Mountain Riparian-Deciduous Forest Community

Cottonwood/Willow Series

Mixed broadleaf Series

Acer negundo Series (? HT)

Acer negundo/Mixed deciduous Series (? HT)

Alnus oblongifolia Series (? HT)

Juglans major Series (? HT)

Acer grandidentatum/Abies concolor Series (? HT)

Picea pungens Series (? HT)

Populus angustifolia Series (? HT)

Swamp-Scrub Formation

Arctic-Boreal Swamp-Scrub Climatic Zone

Rocky Mountain Alpine and Subalpine Swamp and Riparian-Scrub Community

Alnus tenuifolia Series

APPENDIX D. Vegetation Hierarchical Classification System

Alnus tenuifolia/Mixed deciduous Series
Salix bebbiana Series
Salix exigua Series
Salix irrorata Series
Salix scouleriana Series
Plains and Great Basin Riparian-Scrub Community
Willow Series
Hymenoclea monogyra Series
Juglans microcarpa Series
Salt cedar disclimax Series
Rocky Mountain Riparian-Scrub Community
Willow/Dogwood Series

Marshland Formation

Arctic-Boreal Marshland Climatic Zone
Rocky Mountain Alpine and Subalpine Marshland Community
Rush Series
Manna Grass Series
Plains Interior Marshland Community
Rush Series
Bur-reed Series
Cattail Series
Bulrush Series
Rocky Mountain Montane Marshland Community
Rush Series
Great Basin Interior Marshland Community
Rush Series
Saltgrass Series

Strand Formation

Arctic-Boreal Strand Climatic Zone
Rocky Mountain Alpine and Subalpine Stream and
Lake Strand Community
Cold Temperate Strand Climatic Zone
Plains Interior Strand Community
Annual Series
Rocky Mountain Montane Stream and Lake Strand Community
Annual Series
Great Basin Interior Strand Community
Annual Series

APPENDIX E

PLANT SPECIES CODE LIST

SCIENTIFIC NAME	CODE	COMMON NAME
TREES		
<i>Abies concolor</i>	Abco	White fir
<i>Juniperus monosperma</i>	Jumo	One-seeded juniper
<i>Pinus ponderosa</i>	Pipo	Ponderosa pine
<i>Pseudotsuga menziesii</i>	Psme	Douglas fir
SHRUBS		
<i>Berberis fendleri</i>	Befe	Fendler barberry
<i>Jamesia americana</i>	Jaam	Cliffbush
<i>Prunus virginiana</i>	Prvi	Chokecherry
<i>Quercus gambelii</i>	Quga	Gambel oak
<i>Ribes inerme</i>	Riin	Whitestem gooseberry
<i>Robinia neomexicana</i>	Rone	New Mexico locust
<i>Rosa spp.</i>	Rosa	Wild Rose
<i>Rosa woodsii</i>	Rowo	Fendler's rose
<i>Rubus stringosus</i>	Rust	Wild raspberry
<i>Salix sp.</i>	Salix	Willow
GRASSES		
<i>Agropyron spp.</i>	Agrx	Wheatgrass
<i>Agrostis alba</i>	Agal	Red top
<i>Andropogon scoparius</i>	Ansc	Little bluestem
<i>Bromus anomalus</i>	Bran	Nodding brome
<i>Bromus sp.</i>	Brox	Brome grass
<i>Buchloe dactyloides</i>	Buda	Buffalo grass
<i>Elymus canadensis</i>	Elca	Canada wildrye
<i>Hordeum spp.</i>	Horx	Barley
<i>Hordeum jubatum</i>	Hoju	Foxtail barley
<i>Koeleria cristata</i>	Kocr	Junegrass
<i>Muhlenbergia montana</i>	Mumo	Mountain muhly
<i>Poa sp.</i>	Poax	Bluegrass
<i>Poa fendleriana</i>	Pofe	Mutton grass
<i>Sitanion hystrix</i>	Sihy	Bottlebrush squirreltail
<i>Sporobolus cryptandrus</i>	Spcr	Sand dropseed
FORBS		
<i>Achillea lanulosa</i>	Acla	Yarrow
<i>Allium sp.</i>	Allx	Wild onion
<i>Allium cernuum</i>	Alce	Nodding onion
<i>Antennaria parvifolia</i>	Anpa	Pussytoes
<i>Artemisia carruthii</i>	Arca	Wormwood
<i>Artemisia dracunculul</i>	Ardr	False tarragon
<i>Aster sp.</i>	Astx	Aster
<i>Bahia dissecta</i>	Badi	Wild chrysanthemum
<i>Carex sp.</i>	Carx	Sedge
<i>Chenopodium album</i>	Chal	Lamb's quarters

<i>Chrysopsis foliosa</i>	Chfo	Leafy golden aster
<i>Cirsium sp.</i>	Cirx	Thistle
<i>Clematis pseudoalpina</i>	Clps	Rocky Mt. clematis
<i>Coryza canadensis</i>	Coca	Horseweed
<i>Erigeron divergens</i>	Erdi	Spreading fleabane
<i>Erigeron flagellaris</i>	Erfl	Trailing fleabane
<i>Fragaria americana</i>	Fram	Wild strawberry
<i>Geranium caespitosum</i>	Geca	James geranium
<i>Grindelia sp.</i>	Grix	Gumweed
<i>Helianthus petiolaris</i>	Hepe	Praire sunflower
<i>Hymenoxys richardsonii</i>	Hyri	Pingue, Bitterweed
<i>Ipomopsis aggregata</i>	Ipag	Desert trumpet
<i>Juncus interior</i>	Juin	Inland rush
<i>Lactuca sp.</i>	Lacx	Chicory
<i>Linum neomexicana</i>	Line	NM yellow flax
<i>Lithosperma spp.</i>	Litx	Puccoon
<i>Malaxis sp.</i>	Malx	Orchid
<i>Melilotus albus</i>	Meal	White sweet clover
<i>Melilotus officinalis</i>	Meof	Yellow sewet clover
<i>Mentzelia sp.</i>	Menx	Blazing star
<i>Monarda menthaefolia</i>	Mome	Horesmint
<i>Oenothera caespitosa</i>	Oeca	White-stemless primrose
<i>Penstemon sp</i>	Penx	Beardtongue
<i>Potentilla sp.</i>	Potx	Cinquefoil
<i>Plantago purshii</i>	Pipu	Wolly indian-wheet
<i>Ratibida sp.</i>	Ratx	Coneflower
<i>Rhus radicans</i>	Rhra	Poison ivy
<i>Rumex sp.</i>	Rumx	Dock/Sorrel
<i>Senecio fendleri</i>	Sebi	Bigelow groundsel
<i>Sphaeralcea sp.</i>	Sphx	Globe mallow
<i>Taraxacum officinale</i>	Taof	Common dandelion
<i>Townsendia incana</i>	Toin	Townsend's aster
<i>Thalictrum fendleri</i>	Thfe	Fendler meadowrue
<i>Thelesperma dubius</i>	Trdu	Salsify, goatsbeard
<i>Typha latifolia</i>	Tyla	Cattail
<i>Urtica gracilis</i>	Urgr	Stining nettle
<i>Valeriana capitata</i>	Vaca	Tobacco root
<i>Verbascum thapsus</i>	Veth	Mullein
<i>Verbena sp.</i>	Verx	Vervain
<i>Vicia americana</i>	Viam	American vetch
<i>Viguiera multiflora</i>	Vimu	Golden-eye
<i>Viola adunca</i>	Viad	Western dog violet
<i>Viola canadensis</i>	Vica	Canada violet

APPENDIX F

OVERSTORY

Drainage Channel on Pajarito Mesa

		#Stems	Rel			Rel.		Rel.	Import	
		#Stems	Rel			Rel.		Rel.	Import	
		#Stems	Per Acre Density	AVG DBH	%Cover	Cover	%Freq.	Freq.	Index	
<hr/>										
Trees	Trees									
JUMO	JUMO	3	7.692307	5.77	2.20	3.37	16.53	0.857142	46.15	22.82
PIPO	PIPO	49	125.6410	94.23	5.69	17.00	83.47	1	53.85	77.18
<hr/>										
Total =	Total =	52	133.3333	100	7.891836	20.36666	100	1.857142	100	100
<hr/>										
Shrubs	Shrubs									
RIIN	RIIN	8	20.51282	1.66	0.01	0.10	0.11	0.5	10.34	4.04
ROSA	ROSA	27	69.23076	5.59	0.01	10.05	-10.99	0.666666	13.79	10.13
PRVI	PRVI	5	12.82051	1.04	0.00	5.00	5.47	0.666666	13.79	6.77
SALX	SALX	50	128.2051	10.35	0.00	35.00	38.28	0.5	10.34	19.66
ROWO	ROWO	114	292.3076	23.60	0.02	4.04	4.42	0.833333	17.24	15.09
RONE	RONE	15	38.46153	3.11	0.01	1.73	1.90	0.666666	13.79	6.26
QUGA	QUGA	264	676.9230	54.66	0.77	35.50	38.83	1	20.69	38.06
<hr/>										
Total =	Total =	483.00	1238.46	100.00	0.83	91.42	100.00	4.83	100.00	100.00

Open Meadow Near Sewage Lagoon, TA-9 on Pajarito Mesa

Species	Species	Trees/ Acre	Rel Density	%Cover	Rel %Cover	Freq	Rel Freq	Importanc Index
JUMO	JUMO	0.44	33.33	1.00	80.00	0.05	25.00	46.11
PIPO	PIPO	0.87	66.67	0.25	20.00	0.15	75.00	53.89
Total = Total =		1.31	100.00	1.25	100.00	0.20	100.00	100.00

Species	Species	Stems/ Acre	Rel Density	Cover	Rel Cover	Freq	Rel Freq	Importanc Index
QUGA	QUGA	4.36	100.00	1.43	100.00	0.05	100.00	100.00
Total = Total =		4.36	100.00	1.43	100.00	0.05	100.00	100.00

Southerly-sloping Portion of Pajarito Mesa

Species	Species	Trees/ Trees/ Acre	Rel Rel Density	%Cover	Rel Rel %Cover	Freq	Rel Rel Freq	Importanc Importanc Index
ABCO	ABCO	3.11	0.73	0.00	0.00	0.07	0.72	0.48
PIPO	PIPO	423.15	99.27	43.51	100.00	9.71	99.28	99.52
Total = Total =		426.27	100.00	43.51	100.00	9.78	100.00	100.00

Species	Species	Stems/ Acre	Rel Density	Cover	Rel Cover	Freq	Rel Freq	Importanc Index
QUGA	QUGA	56.01	100.00	3.03	100.00	1.29	100.00	100.00
Total = Total =		56.01	100.00	3.03	100.00	1.29	100.00	100.00

Pajarito Mesa Top

Species	Species	Trees/ Trees/ Acre	Rel Rel Density	%Cover	Rel Rel %Cover	Freq	Rel Rel Freq	Importanc Importanc Index
JUMO	JUMO	6.22	1.09	0.00	0.00	0.14	1.07	0.72
PIPO	PIPO	563.17	98.37	63.40	98.01	12.93	98.40	98.26
PSME	PSME	3.11	0.54	1.29	1.99	0.07	0.53	1.02
Total = Total =		572.50	100.00	64.69	100.00	13.14	100.00	100.00

Pajarito Canyon Tributary North of TA-9 Main Buildings

		#Stems	Rel			Rel.		Rel.	Import	
		#Stems	Rel			Rel.		Rel.	Import	
#Stems	Per Acre	Density	AVG DBH	%Cover	Cover	%Freq.	Freq.	Index		

Trees	Trees									
PIPO	PIPO	32	65.64102	94.12	16.33	23.63	61.17	0.571428	44.44	66.58
ABCO	ABCO	1	2.051282	2.94	2.10	5.00	12.94	0.285714	22.22	12.70
PSME	PSME	1	2.051282	2.94	18.17	10.00	25.89	0.428571	33.33	20.72

Total =	Total =	34	69.74358	100	36.60188	38.62962	100	1.285714	100	100

Shrubs	Shrubs									
BEFE	BEFE	33	67.69230	15.79	0.11	5.00	10.12	0.428571	18.75	14.89
PRVI	PRVI	60	123.0769	28.71	0.11	7.50	15.18	0.428571	18.75	20.88
QUGA	QUGA	110	225.6410	52.63	1.38	31.90	64.58	1	43.75	53.65
JAAM	JAAM	6	12.30769	2.87	0.02	5.00	10.12	0.428571	18.75	10.58

Total =	Total =	209.00	428.72	100.00	1.61	49.40	100.00	2.29	100.00	100.00

Pajarito Canyon Tributary North of First Tributary

Species	Species	Trees/ Acre	Rel Density	%Cover	Rel %Cover	Freq	Rel Freq	Importanc Index
JUMO	JUMO	6.22	1.38	0.00	0.00	0.14	1.38	0.92
PIPO	PIPO	435.60	96.55	17.50	100.00	10.00	96.59	97.71
PSME	PSME	9.33	2.07	0.00	0.00	0.21	2.03	1.37
Total = Total =		451.15	100.00	17.50	100.00	10.35	100.00	100.00

Species	Species	Stems/ Acre	Rel Density	Cover	Rel Cover	Freq	Rel Freq	Importanc Index
QUGA	QUGA	115.12	92.50	4.29	100.00	5.29	92.48	94.99
ROWO	ROWO	6.22	5.00	0.00	0.00	0.29	5.07	3.36
MALUS	MALUS	3.12	2.51	0.00	0.00	0.14	2.45	1.65
Total = Total =		124.46	100.00	4.29	100.00	5.72	100.00	100.00

North-facing Slope of Pajarito Canyon

Species	#Trees	#Trees Per Acre	Rel. Density	Avg. DBH	%Cover	Rel. %Cover	Freq.	Rel. Freq.	Importance Index
Trees									
JUMO	2.00	8.71	1.33	0.10	0.00	0.00	0.20	4.17	1.83
PIPO	119.00	518.36	79.34	9.71	105.44	85.07	2.00	41.67	68.69
PSME	11.00	47.92	7.33	0.35	0.82	0.66	0.80	16.67	8.22
ABCO	3.00	13.04	2.00	3.83	2.00	1.61	0.20	4.17	2.59
QUGA	15.00	65.34	10.00	4.746666	15.68	12.65	1.60	33.33	18.66
TOTAL:	150.00	653.37	100.00	18.73	123.94	100.00	4.80	100.00	100.00

Species	#Stems	#Stems Per Acre	Rel. Density	%Cover	Rel. Cover	Freq.	Rel. Freq.	Importance Index
Shrubs								
QUGA	114.00	496.58	59.38	15.68	99.37	1.60	72.73	77.16
BEFE	72.00	313.63	37.50	0.10	0.63	0.50	22.73	20.29
JAAM	6.00	26.14	3.13	0.00	0.00	0.10	4.55	2.56
Total =	192.00	836.35	100.00	15.78	100.00	2.20	100.00	100.00

UNDERSTORY

Drainage Channel on Pajarito Mesa

Species	620	630	640	650	Plant Cover	Rel.		Importance Index
						Plant Cover	Rel. Freq.	
BARE SOIL			64.9					
ROCK								
LITTER	20	70	10	94.9				
MOSS/LICHEN					0.00	0.00	0.00	0.00
GRASS1					0.31	0.96	0.06	1.76
BROX					0.31	0.96	0.06	1.76
POAX		20	0.1	5	4.23	13.12	0.37	14.25
AGAB	10	5			3.00	9.50	0.20	8.82
MUMD					0.23	0.72	0.05	1.92
CARX					0.23	0.72	0.03	1.28
JUNX	70				13.08	40.53	0.40	28.60
SIHY					0.23	0.72	0.06	1.64
ROSX		5		0.1	0.94	2.90	0.28	7.22
THFE					1.16	3.58	0.12	4.35
QUGA					1.16	3.59	0.15	5.00
RHRA					0.46	1.44	0.08	3.21
VICA					0.38	1.19	0.03	1.28
					0.00	0.00	0.02	0.64
GERX			5		0.31	0.96	0.08	3.21
LITX					0.15	0.48	0.03	1.28
					0.00	0.00	0.00	0.00
TOIN			5		0.23	0.72	0.03	1.28
MEAL					0.23	0.72	0.02	0.64
ARDR					0.46	1.43	0.03	1.28
					0.00	0.00	0.00	0.00
ARCA					0.23	0.72	0.02	0.64
					0.00	0.00	0.02	0.64
URGR					0.00	0.00	0.02	0.64
VETH					0.00	0.00	0.02	0.64
TYPX					0.38	1.19	0.02	0.64
SALX					0.00	0.00	0.02	0.64
PONX			10		0.77	2.38	0.03	1.28
HORX			5		0.08	0.24	0.02	0.64
HELX					0.08	0.24	0.02	0.64
Total =	100	100	100	100	32.269	100	2.4	100

Open Meadow Behind Building 70, TA-8 on Pajarito Mesa

Species	790	800	Rel.		Rel. Import	
			Plant Cover	Plant Cover	Freq.	Freq. Index

BARE SOIL						
ROCK						
LITTER	70	10				
ARCA			0.82	2.67	0.18	5.88 4.28
ARDR			2.26	7.39	0.43	14.29 10.84
ELCA			0.32	1.03	0.08	2.52 1.77
TRDU	5		1.20	3.90	0.23	7.56 5.73
SIHY			1.01	3.30	0.25	8.40 5.85
GLOBEMALLOW			0.13	0.41	0.01	0.42 0.41
ERD1			0.50	1.64	0.09	2.94 2.29
POFE	25	89.9	17.34	56.58	0.91	30.67 43.62
ASTER			0.88	2.88	0.21	7.14 5.01
HORX			0.31	1.02	0.04	1.26 1.14
AGCR			1.81	5.92	0.18	5.88 5.90
ERFL			1.50	4.90	0.10	3.36 4.13
IPAG			0.19	0.62	0.05	1.68 1.15
GRINDELIA			0.94	3.06	0.09	2.94 3.00
BADI			0.13	0.41	0.01	0.42 0.41
NOOBROME			0.06	0.20	0.01	0.42 0.31
COCA			0.06	0.20	0.01	0.42 0.31
POAX			0.75	2.45	0.03	0.84 1.64
LINE			0.06	0.20	0.01	0.42 0.31
VIGX			0.06	0.21	0.03	0.84 0.52
LARKSPUR			0.25	0.82	0.01	0.42 0.62
MENTZELIA			0.06	0.21	0.03	0.84 0.52

Total =	100	100	30.64	100	2.975	100 100

Open Meadow Near Sewage Lagoon, TA-9 on Pajarito Mesa

Species	890	900	910	920	930	940	950	960	970	980	990	1000	Plant Cover	Rel. Plant Cover	Freq.	Rel. Freq.	Importance Index
	BARE SOIL	79.8	89.9	94	94	88	79	88	69	63	83						
ROCK LITTER	5				5	5			10		75	85					
HOJU													0.15	0.86	0.03	1.15	1.00
POAX						5	10	25	25	10	25	5	5.30	30.38	0.46	17.62	24.00
AGSM													0.76	4.36	0.20	7.66	6.01
SINY												5	0.46	2.64	0.09	3.45	3.04
BRTE																0.00	0.00
JJIN													0.05	0.29	0.01	0.38	0.33
BUFFALO GRASS													0.26	1.49	0.02	0.77	1.13
CARX													0.06	0.34	0.02	0.77	0.56
AGAL													0.05	0.29	0.01	0.38	0.33
SPCR													0.10	0.58	0.03	1.15	0.86
ERFL	5	10	5	5				5					4.35	24.93	0.35	13.41	19.17
ARDR	5				5	5							1.37	7.85	0.24	9.20	6.52
TRDU									1	1			0.03	0.17	0.03	1.15	0.66
COCA													0.07	0.40	0.03	1.15	0.78
VERX													0.25	1.43	0.01	0.38	0.97
HYRI													0.30	1.72	0.05	1.92	1.81
ARCA	5				1	5				5		5	0.90	5.16	0.21	8.05	6.60
LACX													0.04	0.23	0.04	1.53	0.88
GRAP													0.74	4.24	0.14	5.36	4.80
CHFO													0.65	3.73	0.05	1.92	2.82
VEBA													0.05	0.29	0.01	0.38	0.33
ERDI													0.16	0.92	0.03	1.15	1.03
ANPA													0.10	0.57	0.01	0.38	0.48
BADI													0.03	0.17	0.03	1.15	0.66
MEAL													0.05	0.29	0.01	0.38	0.33
POTX													0.10	0.57	0.02	0.77	0.67
HEPE													0.01	0.06	0.01	0.38	0.22
LINE	0.1	0.1											0.02	0.09	0.06	2.30	1.19
OECA								1					0.10	0.57	0.06	2.30	1.44
PLPU	0.1												0.08	0.46	0.05	1.92	1.19
VIAM			1	1		1	1	1	1	1			0.24	1.38	0.20	7.66	4.52
RABX													0.36	2.06	0.04	1.53	1.80
MEOF													0.05	0.29	0.01	0.38	0.33
GACA					1								0.01	0.06	0.01	0.38	0.22
ROWD																0.00	0.00
MOSS													0.20	1.15	0.04	1.53	1.34
Total =	100	17.447	100	2.61	100	100											

Southerly-sloping Portion of Pajarito Mesa

Species	530	540	550	560	570	580	590	600	610	620	630	640	650	660	670	680	690	700	Plant Cover	Plant Cover	Rel. Freq.	Importance Index
BARE SOIL																						
ROCK								50														
LITTER	100	95	95	95	95	100	100	50	95	95			90	90	85	90	100	90				
MUMD			5												5				2.43	36.17	0.33	57.50
ANSC																5		10	0.21	3.19	0.03	5.00
																			0.00	0.00	0.00	0.00
																			0.00	0.00	0.00	0.00
																			0.00	0.00	0.00	0.00
MOSS														10	10				0.36	5.32	0.04	7.50
KOCR										5	100	100							3.00	44.68	0.06	10.00
CARX		5		5	5				5				10						0.71	10.64	0.11	20.00
Total =	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	95	100	100	6.7142	100	0.5714	100

Pajarito Mesa Top

Species	510	520	530	540	550	560	570	580	590	600	610	620	630	640	Plant Cover	Rel. Plant Cover	Rel. Freq.	Importance Index

BARE SOIL																		
ROCK																		
LETTER	100	100	100	95	100	100	100	100	100	100	100	100	100	45				
MUHO														5	0.39	29.07	0.06	39.53
															0.00	0.00	0.00	0.00
IPAG															0.02	1.16	0.02	6.83
ANSC															0.08	5.81	0.02	9.16
															0.00	0.00	0.00	0.00
															0.00	0.00	0.00	0.00
															0.00	0.00	0.00	0.00
															0.00	0.00	0.00	0.00
SOILCRUST				5											0.86	63.95	0.03	44.48

Total =	100	100	100	100	100	100	100	100	100	100	100	100	100	50	1.3437	100	0.125	100

Pajarito Canyon Tributary North of First Tributary

Species	530	540	550	560	570	580	590	600	610	620	630	640	650	660	670	680	690	700	Plant Cover	Plant Cover	Rel. Freq.	Importance Index	
BARE SOIL											14												
ROCK			25	50			100		49			100	100	45									
LITTER	90	100	50	45	45	100		95	45	100	5			25	100	100	100	100					
AGAL																			0.00	0.00	0.00	0.00	0.00
JUIN																			1.36	10.76	0.13	13.85	12.30
MUMO					5														0.50	3.96	0.09	9.23	6.60
																			2.71	21.52	0.24	26.15	23.84
																			0.00	0.00	0.00	0.00	0.00
																			0.00	0.00	0.00	0.00	0.00
BEFE																			0.00	0.00	0.00	0.00	0.00
ANPA											5								0.14	1.13	0.03	3.08	2.10
																			0.21	1.70	0.03	3.08	2.39
	10			5															0.64	5.10	0.06	6.15	5.63
MOSS			25		50				5		75			5					6.27	49.72	0.21	23.08	36.40
																			0.00	0.00	0.00	0.00	0.00
SINY								5											0.09	0.68	0.03	3.08	1.88
BRAN																			0.07	0.57	0.01	1.54	1.05
POAX																			0.14	1.13	0.03	3.08	2.10
																			0.07	0.57	0.01	1.54	1.05
ACLA																			0.01	0.11	0.01	1.54	0.83
																			0.00	0.00	0.00	0.00	0.00
																			0.00	0.00	0.00	0.00	0.00
																			0.00	0.00	0.00	0.00	0.00
																			0.00	0.00	0.00	0.00	0.00
																			0.00	0.00	0.00	0.00	0.00
FRAM									1		1								0.03	0.23	0.03	3.08	1.65
														25									
Total =	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	12.614	100	0.9285	100	100

North-facing Slope of Pajarito Canyon

Species	Cover	Plant Cover	Rel. Plant Cover	Rel. Freq.	Rel. Freq.	Importance Index
Bare Soil	0.00					
Rock	1.50					
Litter	95.19					
ACLA		0.22	6.67	0.01	14.29	10.472
VAAC		0.06	1.81	0.00	2.60	2.204
SIHY		0.00	0.03	0.00	1.30	0.664
GECA		0.01	0.30	0.00	1.30	0.800
BROX		0.00	0.03	0.00	1.30	0.664
TROF		0.15	4.53	0.00	5.19	4.861
CAREX		0.92	27.77	0.02	23.38	25.573
VIAM		0.01	0.30	0.00	1.30	0.800
THFE		0.10	3.02	0.00	2.60	2.808
POFE		0.20	6.04	0.00	5.19	5.616
VIAD		0.05	1.51	0.00	1.30	1.404
BEFE		0.01	0.30	0.00	1.30	0.800
ANPA		0.46	13.88	0.01	14.29	14.085
POTx		0.05	1.51	0.00	1.30	1.404
MUMO		0.60	18.11	0.01	12.95	15.549
PSME		0.05	1.51	0.00	1.30	1.404
SEBI		0.05	1.51	0.00	1.30	1.404
ANSC		0.20	6.04	0.00	1.30	3.668
FAAM		0.06	1.81	0.00	2.60	2.204
HYRE		0.05	1.51	0.00	1.30	1.404
CLPS		0.06	1.81	0.00	2.60	2.204

Total =	96.687	3.313	100	0.077	100	100

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