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Threatened and Endangered Species Habitat Management Plan Summary of Tasks Completed in FY96–FY98

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1.0 Introduction

This compact disk contains the information gathered toward preparation of a Habitat Management Plan (HMP) for species of concern (SOC) and those threatened and endangered species (TES) that may occur on or utilize the 112 km^2 (43 mi^2) of Los Alamos National Laboratory (LANL). The Record of Decision (ROD) for the Dual Axis Radiographic Hydrodynamic Test (DARHT) Facility Environmental Impact Statement (EIS) (October 1995) mandates completion of the HMP by October 10, 1998. The information presented in this compact disk represents studies and products from all three years of this three-year project.

The data reported here represents the combined efforts of personnel within LANL, including individuals in the Ecology Group (ESH-20), Environmental Sciences Group, Facility for Information Management, Analysis, and Display, Facilities Management Unit 67, and Computing, Information, and Communications Group. The effort also represents collaboration with Mike Bogan and Tom O'Shea of the United States Geological Survey (USGS), Midcontinent Ecological Science Center, Biological Research Division, LANL, and Bandelier National Monument (BNM) for the study of bats and rare bat species. Various consultants supplemented the internal Laboratory expertise in supplying information about specific species: Terrell Johnson for bald eagle *(Haliaeetus leucocephalus)*, American peregrine falcon *(Falco peregrinus anatum)*, and Mexican spotted owl *(Strix occidentalis lucida)*; Nelson Jarmie and Fran Rogers for fungi; David Hafner (Museum of Natural History) for Goat Peak pika *(Ochotona princeps nigrescens)*; and Louise Trippe, US Forest Service, for salamanders. Juanita Ladyman, Esteban Muldavin, and Steve Yanoff of the NM Natural Heritage Program, University of New Mexico provided expertise in the study of Jemez Mountains salamander (*Plethodon neomexicanus*) and ecological conditions in selected canyons.

The HMP effort covers species that are considered threatened or endangered under the Endangered Species Act (ESA). Additionally, we considered all "species of concern," previously known as candidate species (C 1 and C 2), and species listed by the State of New Mexico as sensitive, threatened, or endangered. In this document "species of concern" and state listed species will collectively be called species of concern (SOC). For definitions of terms used in this report see Appendix A. See Appendix B for a list of acronyms.

2.0 Background

The Department of Energy (DOE) published a Final EIS on the DARHT Facility at LANL (DOE 1995a). The US Environmental Protection Agency (EPA) published a Notice of Availability of this EIS in the Federal Register on September 8, 1995 (DOE 1995b). The Final EIS identifies and discusses measures that DOE considered in order to mitigate potential adverse effects resulting from the various alternatives promulgated in the Draft EIS.

DOE issued a ROD on the DARHT proposal on October 10, 1995, and published the ROD Monday, October 16, 1995 (60 FR 53588), pursuant to regulations of the Council of Environmental Quality (40 CFR 1500-1508). Among other things, the ROD states that DOE will develop several mitigation actions to protect soils, water, and biotic resources. In these mitigation measures, DOE will take special precautions to protect the Mexican spotted owl, will prepare a Laboratory-wide HMP for all TES species occurring at LANL, and will implement mitigation measures discussed in Section 5.11, Volume 1 of the DARHT Final EIS. The Mitigation Action Plan for the DARHT, published January 23, 1996, provides additional information on how DOE and LANL will meet the commitments made in the DARHT ROD. The HMP must be completed within three years of the ROD, or by October 10, 1998.

In addition to the mandate resulting from the DARHT ROD, the Endangered Species Act of 1973 (16 USC 1531 et seq.) mandates protection, conservation, and perpetuation of species. This law was enacted to help prevent the extinction of animals and plants considered TES. Under the law, the Secretary of the Interior, acting through the US Fish and Wildlife Service (USFWS), is granted broad powers to protect and conserve terrestrial and nonmarine wildlife and plants in serious jeopardy of extinction. Noncompliance with the ESA can result in fines and jail terms.

Under the ESA it is illegal to kill, collect, remove, harass, import, or export a TES. The Act also calls for interagency cooperation and imposes three requirements on all federal agencies through Section 7: (1) the Act directs federal agencies to utilize their authorities to carry out conservation programs for listed species; (2) every federal agency is required to ensure that its activities or programs will not jeopardize the continued existence of a listed species; and (3) all federal agencies are directed to ensure their activities or programs do not result in the destruction or adverse modification of a critical habitat.

Section 4 (F) (1) of the ESA of 1973 requires the Secretary of the Interior (usually delegated to the Director of the USFWS to ". . . develop and implement (recovery) plans for the conservation of endangered species and threatened species . . . unless he finds that such a plan will not promote the conservation of the species. Recovery teams, composed of specialists on a species, develop recommendations on steps necessary to remove a species from the List of TES Wildlife and Plants." Federal agencies may be involved in implementation of recovery plans.

Beyond the federal protection under the ESA, New Mexico's Wildlife Conservation Act and New Mexico's Endangered Plant Species Act (EPSA) are state laws designated to protect the plant and animal resources of the State of New Mexico. The HMP will also consider species listed as TES under state law and will coordinate with state authorities in an effort to identify and conserve these species. Although state-listed species are not protected under the ESA, they may be protected under other federal laws such as the Migratory Bird Treaty Act, the Bald Eagle Protection Act, and other regulations protecting biota (see Appendix C). Additionally, state-listed species are generally prime candidates for federal listing if populations decline and may be considered SOC by USFWS. The inclusion of these species in the HMP will also help to avoid future project delays.

3.0 Description of the Area

3.1 Geographic Setting

LANL is situated in Los Alamos County in north-central New Mexico, approximately 100 km (60 mi) north-northeast of Albuquerque and 40 km (25 mi) northwest of Santa Fe (Figure 1). The County is approximately 283 km^2 (109 mi^2) and is situated in the Jemez Mountains. The western boundary encompasses some peaks of the Sierra de los Valles, the mountainous rim of the Valles Caldera, and portions of the table-like extension on the eastern slopes, known as the Pajarito Plateau. This plateau extends approximately 16 km (10 mi) from the base of the mountain slopes and ends at the Rio Grande. It is dissected by narrow precipitous canyons separated by finger-like mesas. LANL is located at the base of the Sierra de los Valles and on portions of the plateau. It comprises 112 km^2 (43 mi^2) of the lands within the County. Because of the rugged topography, most of the facilities are confined to the mesa tops and concentrated in developed technical areas. The remoteness, the lack of development, and the rugged topography provide habitat for a variety of plant and animal species including species listed as endangered or threatened and SOC under the ESA.

3.2 Geologic Setting

The Jemez Mountains are a remnant of a massive volcano that erupted 1.4 to 1.1 million years ago. Ash from the eruptions laid down 300 m (985 ft) of welded and nonwelded tuff on the eastern flanks. The rim of the collapsed volcano is called the Sierra de los Valles. The rim has nine peaks including Cerro Grande, Pajarito Mountain, and Caballo Mountain. The tops of the mountains range from 2895 m (9500 ft) to over 3353 m (11,000 ft) in elevation. On the eastern flank of the mountains, an apron-like plateau, the Pajarito Plateau, is formed from a consolidated ash tuff. The plateau is dissected into canyons and mesas (Burton 1982).

4.0 Goals, Strategies, and Tasks

The goal of this project is to integrate Laboratory mission requirements with protection, monitoring, and recovery of endangered, threatened, and candidate species as required under the ESA. Development of the HMP will provide knowledge of species inhabiting or existing on the margins of the

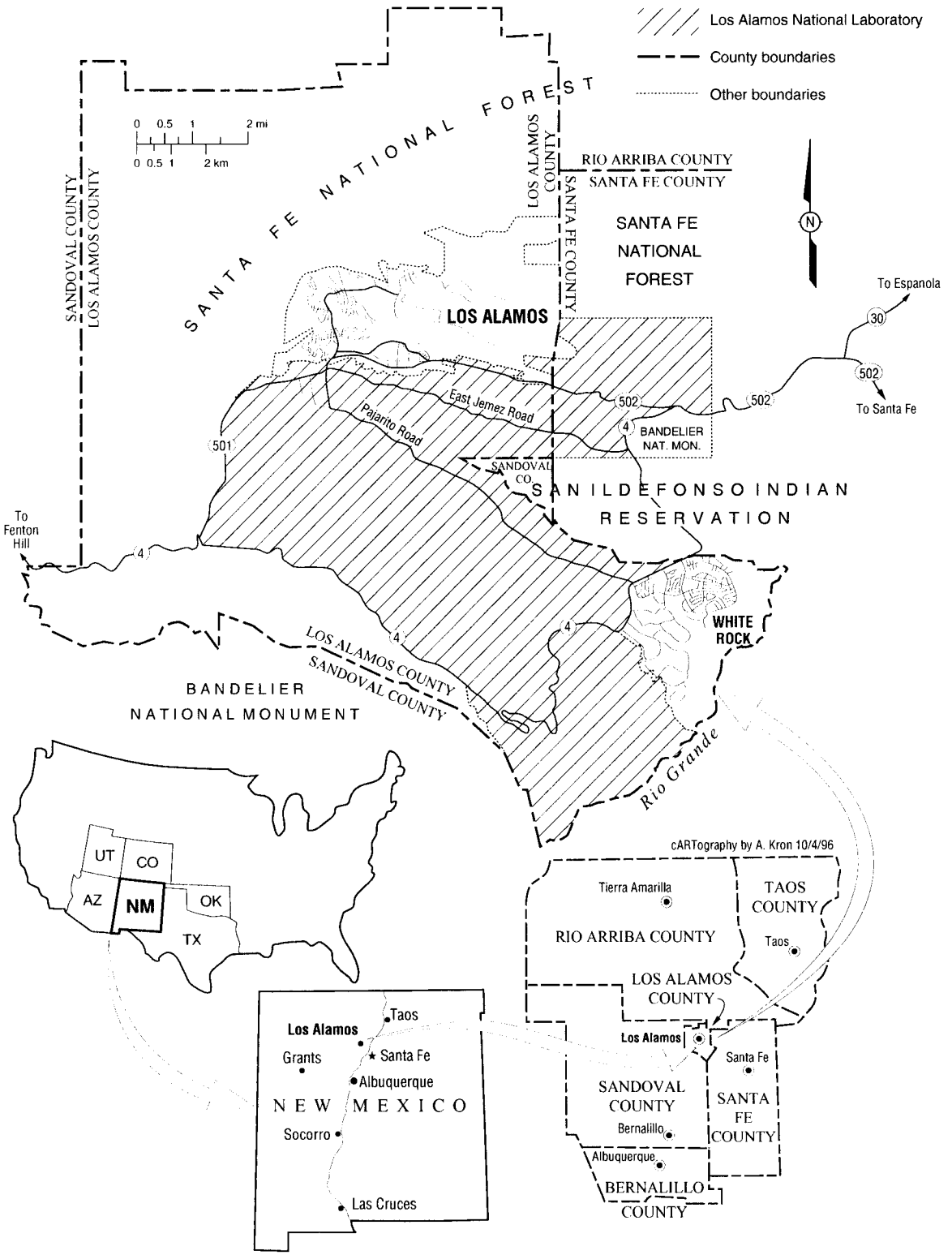

Figure 1. The location of Los Alamos National Laboratory in New Mexico.

Laboratory and would allow for future planning and reduce project delay.

As stated in the Work Plan (Foxx 1996), the development of a TES HMP will require a systematic step-by-step approach based on ecosystems management. TES populations (both current and goal) will have to be assessed, TES habitats (present and future) must be identified, and LANL mission requirements (present and future) for the identified areas will be defined. Detailed analyses of the above factors and the interrelationships will be developed. The data gathering for the HMP must span three years to provide the necessary survey data required by USFWS protocols for determination of species presence and population levels. Additionally, the extensive work needed to develop the geographic information system (GIS) applications, to model the individual species for ecological risk, to develop monitoring plans, and to understand Laboratory activities will require the first two years. The third year has been devoted to integration of all information into a tool that can be used for proactive assessment of impact of activities to TES and SOC, provide for guidance in management of the habitat, and integrate recovery plans for individual species.

5.0 Results

All activities in the first two years were directed to getting basic information about Laboratory baseline activities, the species habitats on LANL, and species information needed for developing a management plan. This effort led to the development of the concept "areas of environmental interest" (AEIs) for each species, with associated habitat management strategies. Working with appropriate Laboratory personnel, AEI Site Plans have been developed in fiscal year 1998 (FY98) and submitted to USFWS for concurrence.

Table 1 defines various tasks that have been undertaken to meet the goal of integration of mission requirements and species protection. Much of the information is baseline from lists of species to more complicated determinations of ecological risk. Development of the HMP, Site Plans, and Monitoring Plans cannot be accomplished without this background information, much of which did not exist in 1995. Tasks 1 and 2 depend on Tasks 3–12 (Table 1).

The products completed in 1996 from activities related to each task and subtask are presented in a notebook entitled "Threatened and Endangered Species Habitat Management Plan, Annual Review, October 16, 1996." In 1997, many of the tasks were continued and any papers resulting from activities are listed in Appendix D. Because of budgetary constraints, several vital subtasks that were scheduled for FY97 were delayed until FY98, including development of monitoring plans and nontoxicological modeling.

The results and products of 1996, 1997, and 1998 are presented separately under each subtask designated on Table 1. The tasks for FY98 and the implementing tasks are shown in Table 1.

5.1 Integrating Mission Requirements and Species Protection and Recovery

A key element of the TES HMP is the mission requirement task. This task

identified and considered the current and future DOE and University of California "mission" for LANL as part of the plan. In the management of the TES and SOC, the goal is to evaluate the relationship between activities done toward the mission and the requirements for protection, conservation, and recovery of TES and SOC (Foxx et al. 1996a). This goal integrates the information gained in Tasks 2–12 and provides a mechanism to plan for future projects and to manage TES habitats.

5.1.1 Development of a Project Assessment Tool

1996: During FY96, we have developed a pilot ArcView application that is used to identify and evaluate the interactions between mission-related activities and TES, SOC, and their habitats.

1997: We enhanced the ArcView Project Screening application during 1997. The application now allows the user to access more TES information, place buffers around spatial objects, and access all new updated and new biological themes. In addition, the application is now available for use by the entire Biology Team of ESH-20. A manual was prepared: "How to Use the Project Screening Application Developed in ArcView," (Bennett 1997).

1998: Using the ArcView Project Screening application, we tested its use on various projects through the ESH-ID project review process.

5.1.2 Development of Areas of Environmental Interest

1997: The most significant accomplishment in integrating mission requirements and species protection was the development of the concept of "areas of environmental interest" (AEIs); and the subsequent definition of specific boundaries, zones, and activities within these, for each species. AEIs are areas within LANL that contain the habitat of TES. Through surveys and analysis, habitats for TES present at LANL were identified, and these created the basis for the core zone for each AEI. Buffer zones, based on disturbance factors for each species, were also delineated. Finalizing definitions for allowable and restricted activities within each zone, such as for construction, operations, and maintenance, is currently underway. Specific site plans, based on the elements described above, are being developed and will be agreed upon by LANL facility managers and the USFWS. These plans are intended to ensure that TES are protected, as well as to facilitate better planning at LANL in order to minimize adverse impacts on mission and associated operations.

1998: During 1998, the AEIs were further defined and the information presented to personnel in the Dynamic Experimentation Division, the Engineering Sciences and Applications

Division, the Facilities Engineering Division, the DOE Los Alamos Area Office, and the DOE Albuquerque Operations Office. The allowable activities were determined for both the core and the buffer. This information was written into Site Plans for each AEI as related to each species.

5.2 Threatened, Endangered, and Species of Concern Profiles

Under the ESA, any organizations undertaking projects with federal funds must obtain an updated list before doing

Table 1. A general overview of the three-year schedule outlined in the 1996 Work Plan.

No.	Task	Year 1	Year 2	Year 3	Plan Implementation
1	Document preparation			Development of the HMP with associated documentation • Site Plans for each AEI • Monitoring Plans for each species • NEPA documenta-tion as needed	Annual review of HMP and associated documentation
2	Determining and integrating LANL mission requirements with TES habitat requirements	Development of an ArcView application for project review	Refinement of the ArcView application Development of the AEI concept	Integrating mission requirements and species protection in developing AEIs and associated plans	Continual updating of information for AEIs and an annual review of performance measures
3	Development of a TES list and profiles	TES lists and profiles prepared	TES lists and profiles updated	TES lists and profiles updated	Species lists and profiles must be updated twice annually
4	Surveying for species	Surveys for each species conducted	Surveys for each species and report of status	Surveys for each species and report of status	Species surveys conducted on an annual basis
5	Development of land cover data and cover classification	Development of land cover data and cover classification	Quality check of maps and publication of supporting documentation		Progressive, additive, and dynamic update of maps as appropriate to new information and USFWS consultation; development of stand maps
6	Database design and development	Accumulation of historical data into the GIS	Use of the historical data and new data in modeling efforts	Input of new data into the GIS	Integrated data management and data availability. Progressive, continual, and dynamic input of data into GIS as new information is gathered.
7	Compilation of non-TES data for models	Development of annotated checklists for vascular and non-vascular plants	Development of annotated checklists from historical data for animal species	Placement of lists on Web page	Progressive and continual updating of lists as new species are identified for LANL and surrounding area
8	Development of models to determine potential habitat of TES	Development of topographic and vegetation models for TES	Development of topographic models for SOC	Completion of models for SOC	Progressive refinement of models as new information about species is available
9	Assessing toxicological risk	Development of ecological risk models for Mexican spotted owl	Development of ecological risk assessment for American peregrine falcon and bald eagle	Development of ecological risk assessment for southwestern willow flycatcher and Jemez Mountains salamander	Annual spot check of the Environmental Restoration database for additional sampling data to determine if there is any substantial change
10	Assessing non-toxicological risk		Development of a habitat evaluation procedure (HEP) for American peregrine falcon	Continued development of HEP model for American peregrine falcon and Mexican spotted owl	Use of models in ArcView project application for project assessment
11	Literature review	Development of species tables to support ecorisk and determination of influence factors	Continued development of species tables to support ecorisk and determination of influence factors	Updating literature database as appropriate	Continued updating of literature as appropriate
12	New species or delisted species				Changes in the status of species will require modification of AEIs, surveys, and definition of habitat within LANL

an analysis of the impact of the project on endangered, threatened, or candidate species (50 CFR 402.12 Fed. Reg. 51 (106):19926, June 3, 1986). This list can fluctuate with inclusion of new species based on new information or delisting of species.

1996: The most recent listings for TES and SOC were obtained from the USFWS and the State of New Mexico. From these listings the species that were reported to occur, or potentially could occur in Los Alamos County, were extracted and species profiles were developed. This information is reported in "Threatened, Endangered, and Sensitive Species Profile" (Hinojosa and Nguyen 1996).

This profile is intended to provide a thumbnail description of various plant and animal species on state and federal lists. Additionally, we have begun a listing of species we call "local concern." These species are ones that are rarely found in the area and are often associated with unique habitats. Under state and federal regulations they are not protected but they often occur in areas such as wetlands that are considered sensitive or they are found in habitats that are disappearing because of urbanization.

We have eliminated black hawk (*Buteogallus anthracinus*) from our list at the recommendation of Terrell Johnson and Sandy Williams (State of New Mexico, Endangered Species Unit). We have added zone-tailed hawk (*Buteo albonotatus*) to our list, also at their recommendation.

1997: The profiles were revised to reflect new information about species and species distribution. The new USFWS lists added Arctic peregrine falcon (*Falco pereginus tundrius*) for the mountainous regions of New Mexico. No federally listed species were delisted and we did not change the SOC species for the Los Alamos area.

1998: Two species have been proposed for delisting by the USFWS: peregrine falcon and bald eagle. The process for delisting was begun by the USFWS for the peregrine falcon. However, once delisted, the species must be monitored for five years (USFWS 1998). Although the delisting process has begun, there is no change in the status of species covered by this HMP.

5.3 Field Surveys and Studies to Determine the Status of TES and SOC on LANL and in Los Alamos County

Field surveys are essential to the protection, monitoring, and recovery of species. Surveys provide a yearly accounting of the presence, absence, and status of species within a managed area. All potential habitat is considered occupied until determined that it is unoccupied for that specific year. Once occupancy status has been determined, mitigation measures are lifted for that year if no occupancy is determined.

During 1996 and 1997, field surveys were conducted for Mexican spotted owl, peregrine falcon, and southwestern willow flycatcher *(Empidonax traillii extimus)*. The results of these surveys are reported by Keller et al. (1996 and 1997). Johnson (Keller et al. 1996 and 1997) has studied bald eagle and golden eagle *(Aquila chrysaetos)* along the Rio Grande. He has also monitored the status of peregrine falcon in the Jemez

for many years. Trippe and Haarmann (1996) did an evaluation of the use of satellite imagery as a tool to predict the presence of Jemez Mountains salamander.

1997: For a third year, the two primary areas were surveyed for the southwestern willow flycatcher. A migrant southwestern willow flycatcher was located in Pajarito Canyon and at the Rio Grande. No nesting birds were found on LANL or in the adjacent Rio Grande location (Keller et al. 1997).

1998: Surveys were conducted for the southwestern willow flycatcher and no nesting species were found (Keller et al. 1998).

5.3.1.3 Surveys for Wintering Bald Eagle

The bald eagle primarily occurs in habitats along permanent streams and lakes. Although this species can occasionally be found along other types of riparian areas, it prefers areas with permanent water and suitable shelter for roosting. Winter roosts have been observed at Cochiti Lake and north of the lake along the Rio Grande. Wintering bald eagles have been sighted regularly along the eastern edge of Laboratory property near the Rio Grande, where it winters in moderate numbers.

1996: Potential roost trees in White Rock Canyon have been mapped and will be monitored for signs of use (Keller et al. 1996).

1997: Numbers of wintering bald eagles in White Rock Canyon have generally increased, but were notably lower in 1997. As bald eagles become more numerous and the river delta above Cochiti Lake expands, bald eagle use of LANL is expected to increase. In 1997, potential roost trees and foraging perches were monitored for use. Use was found primarily around foraging perches (Keller et al. 1997).

1998: The number of bald eagles slightly increased from 1997, but the value continues to be low (Keller et al. 1998).

5.3.1.4 Surveys for American Peregrine Falcon

Topography is the primary determining factor in characterizing breeding habitat for the peregrine falcon (Johnson 1992). This species nests where they can establish breeding territories near cliffs that are within areas of ponderosa pine *(Pinus ponderosa)* and piñon *(Pinus edulis)* and large nearby gulfs of air that permit peregrine falcons to attack their prey from above. No nesting areas are found within LANL but nesting areas have been found on County lands. Because the foraging range can be greater than 16 km (10 mi), knowledge of nest occupancy is important to LANL. These sites are monitored yearly by Terrell Johnson. The State of New Mexico retains a listing of occupancy. An interagency agreement between the Forest Service, State of New Mexico, and USFWS requires non-disclosure of the occupancy rates and the nest sites.

5.3.1.5 Status of Black-Footed Ferret

The black-footed ferret has a historical range that includes 12 states, one of which is New Mexico. They prey primarily on prairie dogs and use their burrows for shelter and reproduction.

Black-footed ferret range is coincident with that of prairie dogs with no documenta-tion of black-footed ferrets breeding outside of prairie dog colonies. Only prairie dog colonies with a combined area greater than 32 ha (80 ac) are large enough to support black-footed ferrets.

Black-footed ferret has not been reported in New Mexico since 1934 and LANL does not have extensive prairie dog towns to support the species. Therefore, systematic surveys have not been conducted.

5.3.1.6 Status of Arctic Peregrine Falcon

This subspecies breeds in Arctic America and winters from Baja California and the Gulf Coast southward into South America. Migrants of this race occur widely, but most frequently in coastal areas. It is slightly smaller and paler than the American peregrine falcon, although the two are difficult to distinguish except upon close examination. The Arctic peregrine falcon is not likely to occur on Laboratory property or in the surrounding region.

The Arctic peregrine falcon is surveyed along with many other raptors by observing bird populations at previously established locations. None were located in the routine bird surveys conducted at LANL. Additionally, a large network of observation stations distributed throughout North America is monitored during the fall and spring migration periods. There are Hawk Watch locations in the State of New Mexico, the closest being in the Manzano Mountains.

5.3.1.7 Status of Whooping Crane

The whooping crane nests in the Pacific Northwest and Canada along the marshy areas among bulrushes, cattails, and sedges that provide food and protection from predators. In September they migrate south with sandhill cranes to refuges such as the Bosque del Apache in New Mexico. The flight path is over portions of LANL, White Rock, and Pajarito Acres.

There have been efforts to recover the nearly extinct flock by using sandhill cranes as "foster parents." Unfortunately, the whooping cranes imprinted on the sandhills and did not mate with other whooping cranes. Today, there are three whooping cranes left in this flock. Newer initiatives are being attempted by the use of ultra-light planes to direct the migration rather than sandhills. The success of this program is still unknown.

Presently, the birds from both of the experiments are the only occurrences in New Mexico.

5.3.2 Species Protected Under the Bald Eagle Protection Act

5.3.2.1 Golden Eagle

Golden eagles regularly breed in White Rock Canyon and have nested in LANL. A sensitive zone around an historic nesting cliff has been mapped to trigger review of potentially disturbing activities (Keller et al. 1996). No specific surveys are done, but sightings are recorded in ESH-20's Wildlife Observation Database.

5.3.3 State Protected Species

Under the Wildlife Conservation Act and EPSA, some species we have designated in this report as SOC are protected by the State of New Mexico. These species are of interest because if they are declining throughout the US they may be listed as federally threatened or endangered in the future. Some of these species were previously listed as C1 and C2 species by USFWS and since have been considered SOC. Knowledge of the presence or absence of these species will provide a "no-surprise" management.

5.3.3.1 Jemez Mountains Salamander

The Jemez Mountains salamander is listed by the state as state threatened. This species is a lungless salamander that is found in moist wooded areas, along canyon slopes with loose, rocky soils.

The presence of the species has been confirmed for the County, BNM, and Santa Fe National Forest and potentially is in the higher-elevation canyons of LANL. Surveys for the species are time-consuming and require moist climatic conditions. Therefore, a modeling approach to defining potential habitat was attempted in 1996. Models based on overstory components such as mixed conifer proved to be too broad to successfully predict potential habitat. Therefore, a microhabitat study was initiated in 1997.

1996: Trippe and Haarmann (1996) designed a study to determine the accuracy and feasibility of using satellite imagery technology to locate and predict specific habitat, using the Jemez Mountains salamander as a model species. The satellite imagery did not prove successful in predicting the habitat sites but proved to be a good first-cut tool in predicting areas of potential habitat. Additionally, informal surveys provided the researchers with experience and information as to the types of conditions in which the animals live.

1997: Since satellite imagery did not successfully predict salamander habitat sites, we began a study to determine a habitat component study. Elements of the study are being reported at the Annual Review in a paper by Juanita Ladyman et al. (Keller et al. 1997) entitled "Pilot Study to Evaluate the Use of Microhabitat Plant Species Characteristics to Predict the Presence of Jemez Mountain Salamander (*Plethodon neomexicanus*)."

1998: The pilot study to evaluate the microhabitat of the Jemez Mountains salamander was completed. The results show that there may be some microhabitat components commonly found in sites where the Jemez Mountains salamander is present (Ladyman and Altenbach 1998).

5.3.3.2 Bats in the Jemez Mountains

In 1995, a multiyear study for bats that are considered SOC was initiated. In a cooperative study between the USGS Biological Research Division, LANL, and BNM, bats have been mist netted and tracked with radiotelemetry for the past three years. The goals of the study were to assess the current status of bats (particularly SOC), elucidate distribution and relative abundance, and obtain information on sites used by bats as roosts.

1996: In 1996, 828 bats of 15 species were captured and released. In 1995, the first spotted bats were captured at BNM and in 1996 they were heard at several locations on LANL. General searches of cliffs in canyons revealed active night roosts and recently-used day roosts of several species, including a previously unknown colony of over 500 free-tailed bats *(Tadarida)*. Eight SOC were netted in the Jemez. Many of these bats *(Myotis evotis, M. thysanodes,* and *M. volans)* were frequently captured and a fourth *(E. maculatum)* was captured occasionally and heard frequently (Bogan et al. 1996). Additionally, from this study a video on bats is being produced for Bradbury Science Museum as part of their natural resources display.

1997: The third year of a multiyear study for bats was completed. Fifteen species of bats and 1532 individuals were collected in the Jemez Mountains during the three-year study. Over 100 bats representing 14 species were collected on LANL. The captures included eight SOC and one state-listed species. On LANL the most frequently captured species were *L. noctivagan*, *E. fuscus*, and *M. ciliolabrum*. One species, *N. macrotis*, was found in the Jemez but not on LANL. With radiotelemetry, we found spotted bat, a state-listed species on LANL. A complete report of findings is in Bogan et al. (1998).

1998: The spotted bat was further tracked during 1998. Roost sites were found in Los Alamos Canyon. Additionally, big brown bat and pallid bat were collected for sampling.

5.3.3.3 Status of Goat Peak Pika and New Mexico Meadow Jumping Mouse

The Goat Peak pika and the New Mexico meadow jumping mouse are state-listed species. The Goat Peak pika is considered more common than previously thought. They have been found in the higher peaks of the Jemez Mountains but not at LANL. New Mexico meadow jumping mouse is usually found in lush grassy or weedy meadows or along streams. It has been identified in the Jemez Mountains but not at LANL.

1996: Two mammal species, other than bats, have been considered SOC for the County of Los Alamos. They are the Goat Peak pika and the New Mexico meadow jumping mouse. No surveys were done for these species during FY96. Once the land cover map is completed, an assessment of potential habitat will be done. Experts were queried for further information about these species. Species such as the New Mexico meadow jumping mouse have been surveyed for at LANL in past years but have not been found (Keller et al. 1996). Goat Peak pika has been found in Los Alamos County but only on the high mountain peaks.

1997: Before conducting surveys for meadow jumping mouse and Goat Peak pika, habitat suitability screening models will be developed using the GIS and habitat variables measured at known occupied locations. The screening models will delineate habitat that could potentially support the existence of these species on LANL property. During FY97, habitat variables (i.e., vegetation type, percent plant cover, plant height,

size of occupied habitat, distance of riparian area, marsh, etc. to drier upland areas, and type of water source) characterizing meadow jumping mouse habitat were taken from published literature describing data collected at known occupied sites of this species. In FY98, this data will be used to develop the model identifying potential meadow jumping mouse habitat at LANL. Habitat variables necessary to support Goat Peak pika were also identified through the literature. These will be incorporated into the development of screening models for each of these species during FY98.

1998: We developed monitoring plans for each of the species including the Goat Peak pika.

5.3.3.4 Surveys for Northern Goshawk

The northern goshawk *(Accipiter gentilis)* is considered in this report as a SOC. Nest sites have been found in the Santa Fe National Forest adjacent to the Laboratory and foraging extends beyond the National Forest-LANL boundary. Through federal register publication, the USFWS has proposed not to list this species. However, the decision is being challenged in federal court. Pending the outcome of the court case, we will continue to monitor this species.

1996: A known nesting location adjacent to the Laboratory has been followed by Pat Kennedy of Colorado State University for a number of years. No known nesting locations are found on LANL, but foraging can occur.

1997: No known nesting locations are located on LANL, however foraging can occur from nests on Forest Service lands. LANL personnel assisted US Forest Service personnel in northern goshawk surveys. No goshawks were found. In the spring of 1998, further surveys will be conducted for this species in the adjacent Santa Fe National Forest and on LANL.

1998: The USFWS determined that the goshawk should not be listed. We assisted the Forest Service with surveys.

5.3.3.5 Roadside Bird Survey

Roadside bird surveys were initiated in 1997 to determine the status of sensitive species including the gray vireo and loggerhead shrike.

1997: In 1997, a roadside songbird survey was initiated on LANL and DOE land in Los Alamos County to provide data on bird species which were not listed as threatened or endangered but are SOC that may in the future become listed as "threatened." Some species are listed by the State of New Mexico as sensitive.

The roadside bird surveys provide an opportunity to detect (1) LANL impacts on local populations over time and (2) the presence of species listed as sensitive or as SOC.

In 1997, songbirds were counted at 62 point stations. These stations were located in five different canyons and three different mesas. Five different land cover types were represented, with the most birds counted in piñon-juniper and ponderosa pine forest. Neither the gray vireo nor loggerhead shrike was detected in these surveys. A synopsis of the results is found in the annual monitoring report (Keller et al. 1997).

1998: Songbirds were surveyed in 1998 at 61 point stations. These stations were located in five different canyons and three different mesas. The canyons and mesas were the same as in 1997 with the exception that Potrillo Canyon was surveyed rather than Rendija Canyon. Six different land cover types were represented, with the most birds counted in piñon-juniper and ponderosa pine forest. Neither the gray vireo nor loggerhead shrike was detected in these surveys. A synopsis of the results is found in the annual monitoring report (Keller et al. 1998).

5.3.3.6 Status of Woodlily, Helleborine Orchid, and Yellow Lady's Slipper

These woodland species are often found along perennial streams and around springs. No locations of these species have been recorded on LANL. These species are not likely to occur on LANL as there are few perennial stretches of streams. Specific surveys have not been conducted but spot checks of possible locations have been done throughout the years.

1996: Surveys for the woodlily (*Lilium philadelphicum* var. *andinum*), helleborine orchid (*Epipactis gigantea*), and yellow lady's slipper (*Cypredium calceolus* var. *pubescens*) were not conducted. Until July 1996, New Mexico was in extreme drought conditions. Preliminary surveys of vegetation indicated that common species were not blooming, stream beds were dry, and environmental conditions were not acceptable for valid surveys. In FY97, we will do surveys if normal rain patterns exist.

1997: No specific surveys were conducted for these species in 1997. However, no plants were found during routine vegetation surveys.

1998: No specific surveys were conducted for these species in 1998. Monitoring plans were developed as a component of the HMP.

5.3.3.7 Surveys for Grama Grass Cactus

Grama grass cactus *(Toumeya papryacantha)* is of local interest and has not been located on LANL. Populations occur in and around the Laboratory in basalt outcrops. Spot checks of species in 1996 showed drought stress and many of the smaller cacti had died. Species were checked in known county locations in 1997. They did not show signs of drought stress because of the increasing rainfall. In 1998, specimens were found in the county locations.

5.4. Development of a Land Cover Map and Land Cover Classification

Basic to the HMP is the development of land cover maps that define the vegetation types within the 43 square miles. This basic map can now be used to model potential habitats or be used within a component of a model to define habitat requirements. Basic to the land cover map was a land cover classification of the plant cover types, defining the levels of the plant cover related to the cover types, and the use of consistent terminology.

5.4.1 Land Cover Map

1996: The HMP calls for identifying areas on LANL property that are suitable or potentially suitable habitat for TES. The production of a land cover map is the first step necessary to meet that goal. Landsat Thematic Mapper images were classified into 50 classes using an Iterative Self-Organizing Data Analysis (ISODATA) clustering technique in an unsupervised classification. This process resulted in a land cover map with 10 classes. Classification of the forest and woodland areas had the highest accuracy, however, the differentiation of grasslands/shrublands/savanna was not well determined and will require additional field study to give the map a more accurate definition in those cover classes (Koch et al. 1996).

1997: In 1997, a 1992 Landsat Thematic Mapper image was classified into 30 classes using the ISODATA in the ERDAS IMAGE program (Koch et al. 1997). These 30 classes were aggregated into 10 land cover types through field surveys, aerial photo interpretation, and the incorporation of topographic information. The resulting cover types include major vegetation zones and physiognomic types that are important to the distribution and abundances of several TES. The final land cover map has been integrated into an ARC/INFO GIS, along with habitat criteria, and other environmental and biological data.

Accuracy assessments for identifying and verifying the problem areas within the map were done. This was accomplished through the use of two different methods. The first of which was to ground truth several of the designated problem areas in order to determine what community type was correlated with the specific unknown spectral classes. The second method used for these accuracy assessments was photo truthing. We used a stereoscope along with a large collection of archived aerial photographs (covering LANL property) to photo truth problem areas on a larger scale.

5.4.2 Preliminary Land Cover Classification

1996: Major land cover types were identified by using satellite imagery. To describe the land cover types and to further classify them into community types, a Working Draft Key was developed. The land cover types found in the area were classified according to physiognomic and floristic characteristics. The hierarchical classification is modeled from the New Mexico Natural Heritage Program New Mexico Gap Analysis Map Legend. We identified the following cover types: mixed conifer, ponderosa pine, piñon-juniper, and juniper woodlands. The grassland and shrubland classes were not classified into cover types at this time. We also will do additional classification of the riparian/wetland areas (Foxx et al. 1996b).

1997: A report presenting a preliminary, descriptive land cover classification that includes the major vegetated cover types, as well as many of the major unvegetated cover types, in the Los Alamos region was completed (Balice et al. 1997a). The report entitled "Preliminary Vegetation and Land Cover Classification for the Los Alamos Region" presents a classification which

consists of (1) a dichotomous key to these selected cover types and (2) descriptive notes to the structures and distributions of vegetated cover types. Where information is available, the potential for these plant community types to support TES or other wildlife species of interest, and the implications of these relationships to management are assessed.

1998: Further classification was done for the higher-elevation plant communities. This information is recorded in Balice (1998).

5.5 The GIS Phase, Development of a Database Design

As the ecological databases are transferred to the GIS, the task to integrate the ecological data with the mission-related activities is possible. Information residing in the various databases (ecological and informational) and map layers (roads, land cover, topography, sensitive areas) can be used for purposes of evaluating the potential impacts of a project to a species. The integration task relies on information gathered in all other tasks including the GIS Phase, development of the land cover map, mission information, and survey information. This task is essential to identifying habitats, locations of species, population sizes and dynamics, and long-term management of species.

1996: Personnel within ESH-20 began development of a GIS database for the TES HMP. The database is used to store ecological data, both spatial and tabular, and the GIS can be used to query, analyze, model, and display data. In FY96, we developed a GIS data dictionary, a database design, and have imported data into the design.

Four subtasks were completed: development of a draft data dictionary, data inventory/database design/naming conventions, data entry/conversion, and map production.

1997: Currently the database contains over 12,000 records. The data that have been imported into the database can be queried, displayed, and analyzed. The data has been used in habitat modeling, development of AEIs, and a project review application.

5.6 Compilation of Non-TES Species Data

Non-TES species data is important to understanding the potential prey base and the available food chain for threatened, endangered, and sensitive species. We compiled existing data on vascular and nonvascular plants as well as mammals and other animals. During 1998, two different prey studies were initiated. The first one is food chain contaminants of the American peregrine falcon. Participants in this study are G. Gonzales, T. Haarmann, and J. Podolsky. Additionally, fish from the Rio Grande were examined for organic contaminants by G. Gonzales, P. Fresquez, M. Mullen, and J. Beveridge. These studies are being written for publication.

5.6.1 Annotated Checklist of Vascular Plants of the Jemez Mountains

Basic to a classification for land cover and habitat modeling is an understanding of the species that occur in an area. Therefore, we have completed an update

of a checklist that was developed by Foxx and Tierney (1985). The information presented for this review builds on the checklist done in the 1980s.

1996: We have annotated the checklist with information about biology and ecology of each species. The checklist is annotated with taxonomic information, geographic and biological information, economic uses, wildlife cover, revegetation potential, and ethnographic uses. There are nearly 1000 species that have been noted for the Jemez Mountains (Foxx et al. 1998).

1997: The annotated checklist was compared to the US Department of Agriculture plants database, and taxonomic names were updated. The list will be placed on a Web Page and will be a Los Alamos Manuscript (LAMS) publication. Additionally, historical information on succession of old fields was compiled and prepared for publication (Foxx et al. 1997).

1998: The annotated checklist of vascular plants (Foxx et al. 1998) was published.

5.6.2 Checklist of Mammals of Los Alamos County

A draft checklist describing mammal species known to occur or that are expected to occur based on suitability of habitat was initiated in FY97. This list will be completed in early FY98 (Biggs et al. 1997). The checklist provides species name, common name, family, and order. The species list was obtained from reports of biological surveys conducted by members of the Biology Team and other organizations at LANL. The checklist uses surveys conducted from the mid-1970s to present day. Species information was also collected from the BISON database, a compilation of known species surveys throughout New Mexico, including Los Alamos County, developed by the New Mexico Department of Game and Fish.

5.6.3 Survey of Los Alamos County and Bandelier National Monument for Macroscopic Fungi

Fungi are ecologically important to forest systems. Therefore, a knowledge of the fungal flora is important in developing a HMP. Additionally, rare fungi have been found in association with the Jemez Mountains salamander.

1996: In 1991, we began a survey of the macroscopic fungi living within the ecosystems of the Pajarito Plateau. During FY96, we completed the database for the specimens collected. A species list has been generated. Although most of the work was done before 1996, the information is useful to this project and will become part of the databases developed and maintained on the GIS. To date we have catalogued 1048 specimens and identified 241 species. Fifty-one species are new to the State of NM mycology lists. Six species are considered rare (Jarmie and Rogers 1996).

1997: We have completed a five-year survey (1991–1995) of macromycetes found in Los Alamos County, LANL, and BNM. The data was further analyzed and a paper was prepared entitled "A Survey of Macromycete Diversity in Los Alamos National Laboratory, Bandelier National Monument, and Los Alamos County, A Preliminary Report," (Jarmie and Rogers 1997).

5.6.3.1 Distribution and Diversity of Fungal Species

Previously archived information (see Jarmie and Rogers 1997) representing 43 sample locations was used to perform a preliminary evaluation of the distributions and diversity of fungal species at LANL and in adjacent environments. Presence-absence data for 71 species of fungi in five habitats, piñon-juniper (P-J), canyon-bottom ponderosa pine (CBPP), ponderosa pine (PP), canyon bottom mixed conifer (CBMC), and mixed conifer (MC), were analyzed. The results indicate that even though fungi occur in each of the habitats, fungal species are not distributed evenly in these habitats. The richness of fungal species is greater in the CBMC and MC habitats than the P-J, CBPP, or PP habitats. All but three of the fungal species were recorded in either the CBMC or the MC habitats, and all but seven of the fungal species were found in the MC habitat. In addition, species fidelity increases from the P-J to the MC. Five of the species have high fidelity to MC and 13 species have high fidelity to either the CBMC or the MC habitats. In contrast, only eight fungal species were found in the PJ habitat and none of these were found with high fidelity or in high abundance. Finally, only two species of fungi were collected in all five habitats. The data is reported in a paper entitled "Distributions and Diversity of Fungal Species in and Adjacent to the Los Alamos National Laboratory" (Balice et al. 1997b).

5.6.4 Development of Checklists for All Species Occurring at LANL

Using previous studies and biological assessments, "A Checklist of Plant and Animal Species at Los Alamos National Laboratory and Surrounding Areas" was compiled (Hinojosa 1997).

5.7 Habitat Components for TES and SOC

5.7.1 Mexican Spotted Owl

Standard USGS Digital Elevation Model (DEM) data did not accurately represent the topography at known spotted owl habitat at LANL. Therefore, a more accurate DEM at the standard USGS 30-meter resolution was developed from higher resolution LANL data for LANL and surrounding land. This was then used as an improved basis for the topographic model of potential spotted owl habitat that was developed earlier. Development of a suitable habitat model that combines topographic data and spectral category data from a Landsat vegetation image is in progress.

Using the topographic model and the vegetation map, we have defined areas of modeled potential habitat for Mexican spotted owl. We began an analysis of the potential nesting site habitats of the Mexican spotted owl. For this study, we completed a total of 12 (200-m) vegetation transects within various canyons on Laboratory property. Six of these transects were within a potential spotted owl nesting site habitat (according to our GIS maps), and six were directly adjacent to these potential nesting site habitats. Various methods were used in order to obtain data regarding overstory, understory, and canopy structure.

5.7.2 Modeling of Jemez Mountains Salamander Habitat

In 1996, we attempted to model potential habitat of the Jemez Mountains salamander. using satellite imagery. To narrow down the habitat components, a microhabitat study was done in 1997 (Ladyman and Altenbach 1998).

5.7.3 Model of Habitat for Meadow Jumping Mouse

During FY97, habitat variables (i.e., vegetation type, percent plant cover, plant height, size of occupied habitat, distance of riparian area, marsh, etc. to drier upland areas, and type of water source) characterizing meadow jumping mouse habitat were taken from published literature describing data collected at known occupied sites of this species. In FY98, this data was used to develop the model identifying potential meadow jumping mouse habitat at LANL.

5.8 Ecological Risk Assessment for Threatened and Endangered Species

1996: Special measures must be taken to protect certain species that are considered TES. To do so, risk to species from any radiological or nonradiological contaminants must be evaluated. During FY96 a preliminary ecological risk assessment on the Mexican spotted owl in two ecological exposure units was performed using a modified EPA quotient method, the FORTRAN model "ECORSK3" and a GIS. Estimated doses to the owl were compared against reference doses generating hazard indices for three risk source types. Hazard quotient results, based on modeling assumptions and conditions, indicated no unacceptable risk to the owl, including a measure of cumulative effects from multiple contaminants that assumes a linear additive toxicity type. Information on risk by specific geographical location was generated, which can be used to manage contaminated areas, owl habitat, facility siting, and facility operations in order to maintain risk from contaminants to acceptably low levels (Gallegos et al. 1996a).

1997: In FY97, preliminary assessments were conducted of the potential risk from legacy waste to the American peregrine falcon and the bald eagle. The risk assessments were performed using a custom FORTRAN model, ECORSK5, and the GIS. Also, an assessment performed in FY96 on the Mexican spotted owl using ECORSK3 was revised using the improved version of the model. Estimated doses from soil ingestion and food consumption contaminant pathways were compared against toxicity reference values to generate hazard indices that included a measure of cumulative effects from multiple contaminants (radionuclides, metals, and organic chemicals). On average, results indicate a small potential for impact to the peregrine falcon, but no appreciable impact to the spotted owl nor the bald eagle. Following the release of ECORSK3 in FY96, model improvements requested by the USFWS and the New Mexico Environment Department resulted in the production of ECORSK4 and then ECORSK5. The improvements centered on increasing model realism and included the addition of (1) a bioaccumulation component to the soil ingestion contaminant exposure

pathway, (2) a food consumption contaminant pathway including a biomagnification component; and the option to (3) weight simulated foraging frequency exponentially on the basis of distance to nesting habitats, (4) scale the dimensions of home ranges, (5) slope the home range, and (6) the inclusion of a simulated aquatic foraging routine with the ability to vary the ratio of foraging on terrestrial vs. aquatic systems. In all assessments, information on risk by specific geographical location was generated for use in management of contaminated areas, species habitat, facility siting, and/or facility operations in order to maintain risk from contaminants at acceptably low levels. Papers related to this task are "Preliminary Ecological Risk Assessment of the Mexican Spotted Owl at the Los Alamos National Laboratory" (Gallegos et al. 1996a), "A Spatially-Dynamic Preliminary Risk Assessment of the American Peregrine Falcon at the Los Alamos National Laboratory (Version 1)" (Gallegos et al. 1996b), and "A Spatially-Dynamic Preliminary Risk Assessment of the Bald Eagle at the Los Alamos National Laboratory" (Gonzales et al. 1998a).

1998: An ecological risk assessment was completed for the southwestern willow flycatcher (Gonzales et al. 1998b)

5.9 Habitat Evaluation Procedure Models

Habitat evaluation procedure models can define habitat suitability of different areas of the Laboratory as well as to estimate cumulative effects of actions. To provide a numerical ranking of the various zones as related to disturbance, habitat evaluation procedure models are being developed for American peregrine falcon and Mexican spotted owl.

We are working to develop a geographically-based habitat suitability index model for peregrine falcon on the Laboratory. The purpose of this model is to provide a tool for ranking the relative habitat quality of various areas of the Laboratory. This model will allow us (1) to compare habitat suitability of different areas of the Laboratory (primarily for planning purposes) and (2) to estimate the cumulative effects of new projects on the overall habitat suitability of the Laboratory for peregrines. We have completed a first draft of the mathematical relationships of model components to habitat suitability, and are working to apply the model to a GIS environment. We expect to make further refinements to the model once the GIS application of the model is completed. Model components include estimated prey biomass, distance to a nest site, human disturbance levels, cover type, and topography.

Seven of ten data layers were developed for the model. These layers grade the suitability of LANL for peregrine falcon based on the intensity of various disturbances and the availability of prey and nest sites.

5.10 Ecological Condition Studies

To provide guidance to establishment of management areas, we initiated an ecological condition study of two canyons at LANL. The purpose of this study was to provide for a third-party assessment of the vegetation within these canyon systems, the condition of the vegetation relative to other areas

within the region and the State, and to make management recommendations to enhance the habitats.

5.11 Influence Factors

We have defined influence factors as those factors that will cause a species not to use or utilize a habitat. To determine what are the most disturbing factors, we have conducted a literature study and developed some baseline data on noise.

5.11.1 Literature Based Information

During 1997, the habitat characteristics for each species was researched in the literature. This included factors that may enhance or degrade habitat for individual species. Tables were developed for bat species, goshawk, owl, peregrine falcon, and bald eagle. These tables have been put as a look-up table in an ArcView program application.

5.11.2 Baseline Noise Study

Two physical conditions of the environment were of concern in developing the base-line condition for the habitats—light and noise. To obtain background information, a small study related to noise within the canyons of the County was initiated (Huchton et al. 1997).

Sound levels were measured in five different canyons on LANL and DOE lands in Los Alamos County. The most common source of loud noise was car and truck traffic. Thunder was the loudest sound measured. Other environmental sound sources such as running water and rustling leaves were high compared to background. These baseline measurements can be used to determine the impacts of planned projects.

5.12 Literature

Knowledge of the most recent studies related to TES is important to on-going management of a species. Both the Internet and the paper literature were searched for information related to TES and SOC.

1996: During FY96, we did a systematic search of the literature to find information about TES and SOC. To date, we have entered references related to these species into a bibliographic database called ProCite. From the literature, we have developed habitat use and feeding habits tables for 10 of the species (Gonzales et al. 1996).

In 1996 we accumulated and entered 300 references. From these references we have reviewed the literature for habitat use and feeding habits of the following species:

- Mexican spotted owl
- Bald eagle
- American peregrine falcon
- Southwestern willow flycatcher
- Jemez Mountains salamander
- Northern goshawk
- New Mexico meadow jumping mouse
- Whooping crane
- Black-footed ferret
- Spotted bat

1997: To date we have accumulated and entered 403 references in ProCite. From these references we have reviewed the literature for habitat use and feeding habits of the following species:

- Common black hawk
- Yellow lady's slipper orchid

- Helleborine orchid
- Loggerhead shrike
- Occult little brown bat
- Long-legged myotis
- Big free-tailed bat
- Goat Peak pika
- Flathead chub (*Platygobio gracilis*)
- White-faced ibis (*Plegadis chihi*)
- Gray vireo

1998: To date we have accumulated and entered 456 references in ProCite. The information gathered in the literature review has been compiled in a publication by Gonzales et al. (1998c).

5.13 Documentation

Four major documents are needed by October 10, 1998, for the completion of the study phase of this project: Monitoring Plans, AEI Site Plans, Habitat Management Plan, and associated National Environmental Policy Act (NEPA) documentation.

1998: During 1998 the Monitoring Plans, AEI Site Plans, and the Overview Document were completed and submitted to USFWS on August 7, 1998. The associated NEPA documentation has been completed and will be submitted to DOE in November 1998 as a categorical exclusion.

5.13.1 The HMP

The HMP will provide the umbrella document for managing TES habitat. The plan will provide a detailed look at what, why, how, and when. It will integrate the information collected in previous years and outline implementation in out-years.

5.13.2 Monitoring Plans

Standard operating procedures have been developed to standardize surveys for the various species. These have been expanded into Monitoring Plans that will assure long-term monitoring of identified species and procedures for newly listed species. These plans were to be developed in FY97 but because of funding restraints in FY97 were completed in FY98.

5.13.3 AEI Site Plans

These plans were developed for each species and each species AEI. They incorporate information about baseline activities, information about biology of the species, and define the AEI and associated zones. These plans were completed in FY98.

5.13.4 NEPA Documentation

This plan provides for passive management of the TES species at this point in time. The activities implemented within this plan are encompassed within a DOE NEPA categorical exclusion for field and laboratory research and information collected directly related to conservation of wildlife (10 CRR 1021; Appendix B3.3). The appropriate NEPA documentation and DOE determination will be provided as part of this plan.

5.14 Related Research and Activities

The information gathered in the HMP has been extended beyond the funding.

5.14.1 Outreach

This project has provided a mechanism for integration, interaction, and outreach with other organizations. The outreach activities have included assisting other agencies with surveying for TES in a mutual desire to integrate the information on a regional level rather than just a Laboratory boundary level.

Personnel within ESH-20 assisted other organizations with surveys and expertise. There was a survey for northern goshawk on Forest Service land. Additionally, personnel assisted the State of New Mexico to survey for Jemez Mountains salamander and assisted Santa Clara Pueblo with a plant survey.

5.14.2 Laboratory Directed Research and Development

There are a number of basic research questions related to endangered, threatened, and sensitive species. The answers to some of the questions may help managers assure the recovery of a species. Of particular interest is species dispersal and reproductive success. Personnel within the Genomic Group (LS-3) and ESH-20 have been awarded Laboratory Directed Research and Development funds to examine the genetics of the Mexican spotted owl in the Jemez Mountains using a nonintrusive evaluation of DNA in feathers. This two-year project is a collaborative effort between LS-3, ESH-20, Terrell Johnson, BNM, and other researchers. The project is entitled "Molecular Analysis of Mexican Spotted Owl Populations."

6.0 Future Activities and Implementation

This HMP project received funding in mid-year 1996. We have accomplished all the tasks set forth in the Work Plan for FY96 and the majority of the tasks in FY97. The major efforts, completed in 1998, were the HMP, Monitoring Plans, and AEI Site Plans. These plans were integrated with USFWS under the ESA. Supporting activities such as surveys, data acquisition, and ongoing improvements in maps will continue in the implementation stage.

It must be emphasized that the HMP is a living document and there must be a continued program of monitoring TES. Under Section 7 of the ESA, the federal agency must retain the ability to enforce the terms and conditions through the life of an action. To assure that the Laboratory and DOE can enforce the terms and conditions of this plan, the actions under implementation on Table 1 must be planned for and executed.

The endangered species program must be fluid and constant to prevent a "no surprise" management approach. New species are continually listed and other species are delisted. Recommendations for implementation will be outlined in the HMP.

7.0 Record of Products

We have compiled all of the information related to the production of the HMP on a compact disk. The disk includes products and references that were commonly used.

8.0 Reference and Guidance Documents

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APPENDIX A

Definitions

The following definitions are used in this report.

Endangered Plant Species Act: A New Mexico State statute that provides the designation and protection of plant species that are in danger of becoming extinct.

Endangered Species Act: A federal statute that provides for designation and protection of wildlife, fish, and plant species that are in danger of becoming extinct and to the ecosystems on which that species depends.

Federal Candidate Species: This designation has been formerly called a "C 1" or C 2" species. Because of changing concerns in Congress, the USFWS recommends these species be called "species of concern" (SOC) (personal information from USFWS to T. Foxx and D. Keller, 2/16/96).

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

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

Formal Consultation: Is initiated with USFWS when a federal agency determines a proposed project is likely to impact a TES or critical habitat.

SOC: See Federal Candidate Species. In the context of this Plan it will also

designate state sensitive species and federal candidate species.

State Endangered Plant: A plant that 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 without protection.

State Group 1 and 2 Species: Group 1 and 2 are animal species considered to be TES in the State of New Mexico. Group 2 species are those species whose prospects of survival or recruitment within the state are likely to become jeopardized in the near future.

Threatened and Endangered Species (TES): In the context of this plan, TES shall represent both Federal and State TES.

Wildlife Conservation Act: A state statute that became effective on July 1, 1974. This Act provides for the protection of all animal species that are threatened or endangered within the state.

APPENDIX B

LIST OF ACRONYMS

AEI	area of environmental interest
ARC/INFO	a geographic information system developed by Environmental System Research Institute, Inc.
BNM	Bandelier National Monument
BRD	Biological Research Division
DARHT	Dual Axis Radiographic Hydrodynamic Test Facility
DEM	Digital Elevation Model
DOE	Department of Energy
EIS	Environmental Impact Statement
EPA	Environmental Protection Agency
EPSA	Endangered Plant Species Act
ESA	Endangered Species Act
ESH-20	Ecology Group
GIS	geographic information system
HEP	Habitat Evaluation Procedure
HMP	Habitat Management Plan
ISODATA	Interactive Self-Organizing Data Analysis Technique
LANL	Los Alamos National Laboratory
NEPA	National Environmental Policy Act
ROD	Record of Decision
SOC	species of concern
TES	threatened and endangered species
USFWS	United State Fish and Wildlife Service
USGS	US Geological Survey

APPENDIX C

Regulatory Drivers

Bald and Golden Eagle Protection Act (16 USC 668)

Clean Water Act (33 U.S.C. 1251 et seq.)

Endangered Species Act (16 USC 1531 et seq.)

Executive Order 11988, Floodplains Management, also 10 CFR 1022

Executive Order 11990, Wetlands Management, also 10 CFR 1022

Fish and Wildlife Conservation Act (P.L. 96-366, 16 USC 2901)
Fish and Wildlife Coordination Act (16 USC 661 et seq.)
Migratory Bird Treaty Act (16 USC 703 et seq.)
National Environmental Policy Act (42 USC 4341), and also 40 CFR 1500-1508 (Compliance with NEPA, Council on Environmental Quality [CEQ] and 20 CFR 1022)
Wildlife Conservation Act (NMSA 17-2-37 through 17-2-46, July 1, 1974)
New Mexico Endangered Plant Species Act (NM 75-6-1) of 1985 and attendant regulation NRD Rule 85-3.

APPENDIX D

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