# Annual Monitoring Report on the Status of Threatened, Endangered and Sensitive Species at Los Alamos National Laboratory


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# Threatened and Endangered Bird Surveys at Los Alamos National Laboratory: Mexican Spotted Owl

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**Abstract**

During the 1994, 1995, 1996, and 1997 field seasons, four primary areas at Los Alamos National Laboratory were surveyed for the Mexican spotted owl (*Strix occidentalis lucida*). The surveys revealed a nesting pair of owls that subsequently fledged a pair of young during all four years.

## 1.0 Introduction

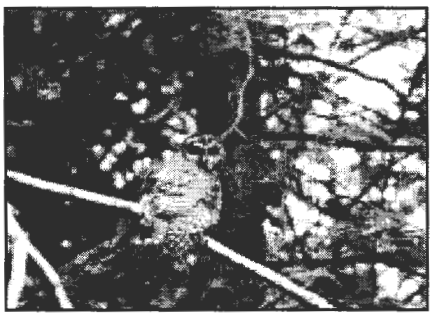
Mexican spotted owls (*Strix occidentalis lucida*) are between 41 to 48 cm (16 to 19 in.) in length with white spots on the head and back, white horizontal stripes on the chest, and no ear tuffs. This owl is also only one of two species, the other being the flammulated owl (*Otus flammeolus*), in the southwest that has completely dark eyes (NGS 1983). The Mexican spotted owl inhabits mixed-conifer and ponderosa pine-Gambel oak forests in mountains and canyons in the southwestern United States and northern Mexico. High canopy closure, high stand diversity, multilayered canopy resulting from an uneven-aged stand, large, mature trees, downed logs, snags, and stand decadence as indicated by the presence of mistletoe are characteristic of Mexican spotted owl habitat. The Mexican spotted owl requires approximately 800 ha (2,000 ac) of suitable habitat to insure reproductive success. In addition, spotted owls favor narrow, steep canyons where there is little light penetration and cool temperatures. They tend to prefer north-facing slopes and to nest in trees, crevices, or small caves (USDI FWS 1995, Travis 1992).

During the 1994, 1995, 1996, and 1997 breeding seasons, I was surveying the canyons in the western portion of Los Alamos National Laboratory (LANL). Also, as part of the mitigation measures for the construction of the Dual Axis Radiographic Hydrodynamic Test facility, this site was also monitored during the 1995, 1996, and 1997 breeding seasons. During the course of these surveys, a pair of Mexican spotted owls was located in 1995, 1996, and 1997. In subsequent monitoring of these locations, nests were found all three years, each with two young that ultimately fledged. Based on the proximity of each nest location, it is reasonable to assume that this is the same pair of owls and continue to be the only pair utilizing LANL lands for breeding.

Terrell Johnson (1994), a recognized spotted owl authority, developed a topographic model of potential spotted owl habitat in New Mexico and is in the process of developing a similar model to be used for LANL. Results from initial modeling indicate three areas within Laboratory boundaries that could have potential owl habitat. All of the areas indicated in this model have been monitored for at least three years and historically occupied habitat will continue to be monitored on a yearly basis.

## 2.0 Methodology

Surveying for the Mexican spotted owl follows the US Department of Agriculture Forest Service protocol. Once an area of potential habitat is identified based on habitat type, a survey route is planned. A route is



designed to cover all of the available habitat within 0.8 km (0.5 mi) of the calling route. From approximately 2 AM until sunrise, surveys are performed by broadcasting the call of the spotted owl and waiting for an owl to respond. The surveyor will walk a canyon edge or bottom and play the call to cover the habitat in the area of the survey. The area is covered completely in one survey outing. Once an owl is found, the preliminary surveys can be discontinued and more intensive nest location surveys can begin. All owl species detected during the survey are recorded. Table 1 shows the results of the surveys conducted in 1994, 1995, 1996, and 1997. The biologist records the time, species, and the location of each owl detected.

Once a Mexican spotted owl is located, the next step is to discover if there is a pair of owls and if they have a nest in the location of interest. The owl, after detected during a night survey, is usually followed until dawn, and a physical description of the area where the owl quit calling and the location are recorded. The area where the owl is near dawn is the most likely roost location. If a pair has young, the owl is usually near the nest location. Once a roost location is suspected, the next day the biologist searches the area for any evidence of nests or a pair of owls. Droppings, pellets, and the remains of dead prey can be a clue to the nest location. The next step is for the biologist to give the owl under surveillance a mouse. In the mousing process one or both owls are given a mouse and the biologist follows an owl to determine the fate of the mouse. Only male mice are used to ensure that a non-native mouse species is not introduced to the study area. When the female owl is given a mouse, she will then usually take this mouse to a nest, revealing its location. The male owl will often give the mouse to the female and the nest can be located. If the mouse is consumed or stored by the owl, nesting might not be taking place but further mousing is conducted to confirm that the pair is not nesting. Once several mousing attempts, noting male and female owl behavior, result in no nest being located, it is reasonable to assume that a pair is not nesting. If an area is surveyed and no owls are found, a series of four or more surveys per breeding season is required for two years before a site can be cleared for disturbance activities during the spotted owl breeding season.

## 3.0 Results

During the 1994, 1995, 1996, and 1997 field seasons, 32 regular call broadcast surveys were conducted at LANL. Of these surveys, 10 resulted in the detection of a Mexican spotted owl. All of these located endangered owls were in or near the same canyon complex. During the course of this summer's surveys, no owls were found to be nesting in Los Alamos Canyon for the third year of surveys.

Following the identification of the roosting locations from owls detected during surveys, two or three additional field outings were required to locate the owl pair and the nestlings. The first and second trip to the nest area revealed a pair of adult owls and chicks on the nest. The third visit revealed the adult owl pair and two chicks out on a tree away from the nest. Once the nest location is confirmed, physical measurements are established as to the makeup of the nest locations. Castings, owl pellets, are collected at the site to determine the prey abundance and characteristics of the owls diet.

Table 1. Results of the four years of Mexican spotted owl surveys.

| Date of Survey | Location of Survey | Result of Survey |
|---|---|---|
| 6/30/94 | Site 1 | None |
| 7/18/94 | Site 1 | None |
| 8/3/94 | Site 1 | None |
| 8/23/94 | Site 1 | None |
| 5/10/95 | Site 2 | Great Horned Owl *(Bubo virginianas)* (4) |
| | | Flammulated Owl (1) |
| 5/16/95 | Site 2 | Mexican Spotted Owl (1) |
| | | Great Horned Owl (1) |
| 5/18/95 | Site 3 | Mexican Spotted Owl (2) |
| | | Great Horned Owl (2) |
| | | Flammulated Owl (1) |
| 5/23/95 | Site 2 | Flammulated Owl (1) |
| 5/25/95 | Site 3 | Flammulated Owl (1) |
| | | Great Horned Owl (1) |
| 6/2/95 | Site 2 | Great Horned Owl (2) |
| | | Flammulated Owl (1) |
| 6/8/95 | Site 3 | Mexican Spotted Owl (2) |
| 6/15/95 | Site 3 | Northern Pygmy-Owl *(Glaucidium gnoma)* (1) |
| | | Mexican Spotted Owl (1) |
| | | Great Horned Owl (1) |
| 6/22/95 | Site 1 | Great Horned Owl (1) |
| 7/6/95 | Site 1 | None |
| 7/27/95 | Site 1 | None |
| 8/9/95 | Site 1 | None |
| 4/26/96 | Site 3 | Great Horned Owl (2) |
| | | Mexican Spotted Owl (1) |
| 5/1/96 | Site 2 | Northern Pygmy-Owl (1) |
| 5/7/96 | Site 3 | Great Horned Owl (1) |
| | | Mexican Spotted Owl (1) |
| | | Northern Pygmy-Owl (1) |
| 5/17/96 | Site 2 | None |
| 6/5/96 | Site 2 | Northern Pygmy-Owl (1) |
| 6/25/96 | Site 2 | Mexican Spotted Owl (1) |

Table 1 (cont.)

| Date of Survey | Location of Survey | Result of Survey |
|---|---|---|
| 4/18/97 | Site 3 | Great Horned Owl (3) |
| | | Mexican Spotted Owl (1) |
| 4/30/97 | Site 3 | Mexican Spotted Owl (1) |
| 5/1/97 | Site 1 | None |
| 5/16/97 | Site 1 | Flammulated Owl (1) |
| 5/30/97 | Site 1 | Flammulated Owl (1) |
| | | Great Horned Owl (1) |
| 6/13/97 | Site 1 | Flammulated Owl (1) |
| 6/26/97 | Site 4 | Great Horned Owl (3) |
| 7/11/97 | Site 4 | Great Horned Owl (1) |
| 7/25/97 | Site 4 | Great Horned Owl (2) |
| | | Western Screech-Owl |
| | | (*Otus kennicottii*)(1) |
| | | Mexican Spotted Owl (1) |

## 4.0 Conclusions

For the third year in a row, a pair of Mexican spotted owls at LANL have successfully reared and fledged a pair of chicks. The habitat surrounding the nest location is currently protected from major disturbance and continued protection of this area will ensure that LANL will play a role in the conservation and recovery of the Mexican spotted owl. The lands of LANL are capable of supporting more than one pair of Mexican spotted owls and an aggressive monitoring program will ensure that biologists know the location of nesting birds and are able to assist in the planning of projects that could be impacted by the location of these birds. The continued monitoring of owl nest locations will be a valuable tool to planners to ensure that owls and the mission of the Laboratory can coexist.

## Acknowledgments

I wanted to thank Rhonda Robinson, Martin MacRoberts, Doug Cram, Eric Pacheco, Steve Koch, and Kathy Bennett for getting up early and stumbling around in the dark to see if we could hear some owls.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# Threatened and Endangered Bird Surveys at Los Alamos National Laboratory: Southwestern Willow Flycatcher

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**Abstract**

During the 1995, 1996, and 1997 field seasons, two primary areas were surveyed for the southwestern willow flycatcher (*Empidonax traillii extimus*). The areas searched were Pajarito Canyon and the Rio Grande near Buckman Crossing. The southwestern willow flycatcher was found during the 1997 spring migration.

## 1.0 Introduction

The southwestern willow flycatcher (*Empidonax traillii extimus*) is a small insectivorous bird approximately 15 cm (5.75 in.) long. It has a grayish-green back and wings, whitish throat, light gray-olive breast, and light yellowish belly. Two wingbars are visible and an eye ring is faint or absent. The upper beak is dark and the lower is light. The song is a wheezy "fitz-bew" or "fit-za-bew," the call a repeated "whitt." The southwestern willow flycatcher has experienced extensive loss and modification of its habitat and is also endangered by nest parasitism by the brown-headed cowbird (*Molothrus ater*). The breeding range of the southwestern willow flycatcher includes southern California, southern Nevada, southern Utah, Arizona, New Mexico, western Texas, and northern Mexico. The southwestern willow flycatcher winters in Mexico, Central America, and northern South America.

Southwestern willow flycatchers inhabit areas near water with 4- to 7-m- (13- to 23-ft-) high thickets of willow (*Salix* spp.), buttonbush (*Cephalanthus occidentalis* var. *pubescens*), seepwillow (*Baccharis glutinosa*), and tamarisk (*Tamarix pentandra*) (Tibbitts et al. 1994). There is occasionally a sparse overstory of cottonwoods (*Populus* spp.) associated with this species. At some nest sites surface water may be present early in the breeding season but only damp soil is present by late June or early July. Habitat patches as small as 0.5 ha (1.2 ac) can support one or two nesting pairs. This species has not previously been found on Los Alamos National Laboratory (LANL) property or Los Alamos County. Areas in lower Pajarito Canyon near the Pajarito wetlands contain marginal southwestern willow flycatcher habitat.

The nest is a compact cup of bark and grass with feathers on the rim lined with a layer of grass or silky plant material. It is located in a fork or on a horizontal tree branch 1 to 4.5 m (3.2 to 15 ft) above ground in a medium-sized bush or small tree, with dense vegetation all around the nest.

The southwestern willow flycatcher is present and singing on breeding territories by mid-May. This flycatcher builds nests and lays eggs in late May and early June and fledges young in early to mid-July.

During the 1995, 1996, and 1997 breeding seasons, monitoring of the potential southwestern willow flycatcher habitat did reveal the presence of this federally endangered species. To date, in three consecutive years of surveys, this flycatcher has been found on LANL lands in 1997. However, this flycatcher is only using LANL lands during migration and has not been found to be nesting.

## 2.0 Methodology

Once an area of potential habitat is identified, based on habitat type, a survey route is planned. A route is designed to cover all of the available habitat. Surveying for the southwestern willow flycatcher is conducted from approximately dawn until the survey area is completed. Surveys are performed by broadcasting the call of this flycatcher and waiting for it to respond. The surveyor will walk a wetland area and play the call enough to cover the habitat in the area of the survey. Once a flycatcher is found, the preliminary surveys can be discontinued and more intensive nest location surveys can begin. The physical description of the site and the nest location are recorded but the nest site is not disturbed.

If an area is surveyed and no flycatchers are found, a series of three or more surveys per breeding season is required each year before a site can be cleared for disturbance activities during the breeding season.

## 3.0 Results

During the 1997 field season, six regular call broadcast surveys were conducted at LANL and adjacent lands. Of these surveys two of them resulted in the location of a southwestern willow flycatcher. Table 1 shows the results of the surveys conducted in 1995, 1996, and 1997.

## 4.0 Conclusions

For the first time in three years a southwestern willow flycatcher has been located at LANL. As of the 1997 field season, the southwestern willow flycatcher is only using LANL wetland habitat during migration. The existing habitat at LANL is suitable for this flycatcher and I believe it should be periodically monitored for future colonization by this species. The mapping and designation of potential habitat will provide a tool for any projects building near this habitat. This potential nesting habitat has been established in the geographical information system, and any potential conflicts between LANL activities and endangered species are dealt with very early in the planning stages of a habitat disturbing activity.

## Acknowledgments

I wanted to thank Rhonda Robinson and Eric Pacheco for getting up early and battling the mosquitoes to find this shy bird.

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Table 1. Results of 1995, 1996, and 1997 southwestern willow flycatcher surveys.

| Date of Survey | Location of Survey | Result of Survey |
|---|---|---|
| 6/14/95 | Pajarito Canyon | None |
| 6/22/95 | Rio Grande | None |
| 7/13/95 | Pajarito Canyon | None |
| 7/19/95 | Rio Grande | None |
| 5/30/96 | Pajarito Canyon | None |
| 5/31/96 | Rio Grande | None |
| 6/13/96 | Rio Grande | None |
| 6/14/96 | Pajarito Canyon | None |
| 7/17/96 | Pajarito Canyon | None |
| 7/18/96 | Rio Grande | None |
| 5/23/97 | Pajarito Canyon | Male Heard Singing |
| 5/28/97 | Rio Grande | Male Heard Singing |
| 6/5/97 | Rio Grande | None |
| 6/6/97 | Pajarito Canyon | None |
| 6/19/97 | Rio Grande | None |
| 6/20/97 | Pajarito Canyon | None |

# Peregrine Falcon Habitat Management at Los Alamos National Laboratory

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**Abstract**

Suitable breeding habitat for the American peregrine falcon (*Falco peregrinus anatum*) is located in and around Los Alamos National Laboratory (LANL), and the entire area is foraging habitat. Statewide, the peregrine population has been increasing, but reproduction has been declining for a decade, which threatens to reverse this population trend. If peregrine falcons continue to increase in New Mexico, peregrine use of LANL is expected to increase. Four suitable nesting areas in and around LANL have been identified, and sensitive zones have been mapped to trigger review of potentially disturbing activities. Site management plans are being drafted to address LANL activities within the sensitive zones. Management of the suitable habitat involves several other agencies and will require interagency cooperation to be successful.

## 1.0 Introduction

The American peregrine falcon (*Falco peregrinus anatum*) is federally listed as endangered and state listed as threatened. Peregrine falcons nest on cliffs with defensible and protected nest ledges that are in good foraging habitat. Peregrine breeding habitat occurs throughout the mountains of New Mexico, including lands in and around Los Alamos National Laboratory (LANL). Peregrine falcons forage up to 20 km (12 mi) from nesting areas almost entirely for birds, which are attacked and caught in the air. Avian prey is vulnerable when it is without cover, which may occur in a large gulf of air, as found over a canyon, or over large grasslands or bodies of water. Peregrines are resident from early March through mid October. Breeding peregrine falcons have been increasing in New Mexico for more than a decade, but pesticides evidently continue to impair reproduction, and occupancy of breeding territories remains below recovery levels (Johnson 1996).

By agreement among the wildlife agencies and major land management agencies in New Mexico, all suitable peregrine habitat is managed as if occupied, in the absence of a current determination of vacancy. Suitable habitat has been identified throughout much of the state, based on an objective evaluation of historic habitat. The suitable habitat approach has proven to be the most efficient and effective management strategy because it maintains the distinction between the relative permanence of habitat and the transience of habitat use by individuals of the species. This approach maintains habitat for population expansion and protects peregrines wherever they may breed. At the same time, it permits coordination of other activities in a predictable manner. Attempts to coordinate activities based on occupancy in any given year have proven complicated and inefficient, and have usually disappointed expectations and resulted in more disclosure than would be with coordinating activities based on predetermined habitat management.

Observations have shown how peregrines respond to human activity (Johnson 1988a). Disturbance can prevent birds from occupying habitat or can cause mortality of young by interrupting essential parental care. Nesting areas in New Mexico with frequent human

activity are generally occupied irregularly, and peregrines in areas with occasional disturbance suffer reproductive failure more often than those in undisturbed areas (Johnson 1994). While pesticide impacts on reproduction result from national or international factors, local management of peregrine habitat focuses on minimizing disturbance and maintaining habitat quality. Preserving the confidentiality of nesting areas is essential to minimizing disturbance because the peregrine has such notoriety that disclosure inevitably results in disturbance.

In cooperation with the US Fish and Wildlife Service and federal land management agencies, the New Mexico Department of Game and Fish takes the lead in monitoring and compiling information on peregrine falcons in New Mexico. LANL has been coordinating peregrine habitat management with state and federal wildlife agencies for two decades, supporting habitat monitoring at two suitable nesting areas, and ensuring that activities do not impact habitat, individuals, or the species.

## 2.0 Methodology

Suitable nesting areas are monitored for occupancy and nesting activity by observing with binoculars and spotting scopes from a distance of typically 450 m (495 yd). This allows complete aural and visual observation of nesting activity and resolution of individual plumage characteristics with minimal disturbance (Johnson 1988b). Nesting areas are visited at least twice every year, but as often as necessary to determine occupancy and reproduction. Results have been standardized by having four highly experienced observers do nearly all the peregrine monitoring in the state. Individual plumages can be used to determine identity, and are recorded whenever possible.

Habitat identification is based on analysis of foraging and nesting topography and cliff characteristics associated with peregrine falcon nesting areas (Johnson 1992). Factors of elevation and slope model prey abundance, diversity, and vulnerability to index the suitability of breeding territories; and factors of cliff size, structure, position, and temperature index the suitability of nesting cliffs. Four sensitive zones around each suitable nesting area have been defined relative to peregrine responses to disturbance (Johnson 1983) and extend from 900 m (990 yd) up to 3400 m (3740 yd) from suitable nesting cliffs. These zones are used to evaluate and schedule activities occurring in the zones to prevent disturbance (Johnson 1994).

## 3.0 Results

Sensitivity of the information precludes disclosure of local monitoring data, which are not statistically significant by themselves but are consistent with statewide data. Occupancy of breeding habitat in New Mexico has increased since 1980, but reproduction has declined since 1988 (Figure 1). Recent reproduction has not been far above the level required to maintain the population, and if it continues to decline, the population will soon begin to decrease (Johnson 1996). Identification of breeding habitat in and around LANL began in 1979, and has continued as habitat criteria have been refined since. Four suitable nesting areas have been identified in and around LANL, all of which involve shared responsibility with other land

management agencies. The Department of Energy (DOE) has primary federal responsibility for two of these suitable nesting areas, but needs only to ensure that LANL activities do not impact the other two areas. A habitat management plan was drafted for one suitable nesting area, and sensitive zones were delineated for another area in 1992. Sensitive zones were delineated for all four suitable nesting areas in 1997, and site management plans are being drafted to guide LANL activities within the sensitive zones. The entire LANL area is peregrine foraging habitat.

## 4.0 Conclusions

Peregrine falcon breeding activity in and around LANL should increase if the peregrine population continues to increase. Annual monitoring of the two suitable nesting areas for which the DOE has primary federal responsibility provides important management information and should continue. Sensitive zones should be used to flag review of LANL activities to prevent disturbance of breeding peregrine falcons in or near the LANL area, and site plans to address LANL activities within the sensitive zones should be completed. As a rule, all potentially disturbing activities should be scheduled outside of the breeding season, but biological monitoring information may be used to evaluate critical activities within the breeding season. LANL land use planning should also recognize the contribution of terrestrial foraging areas, and should cluster future developments to maintain large blocks of open land. Cooperation with adjacent land management and wildlife agencies is essential for successful habitat management for this species.

## Acknowledgments

S.O. Williams III of the New Mexico Department of Game and Fish has kindly provided data summarizing the status of the peregrine falcon throughout New Mexico.

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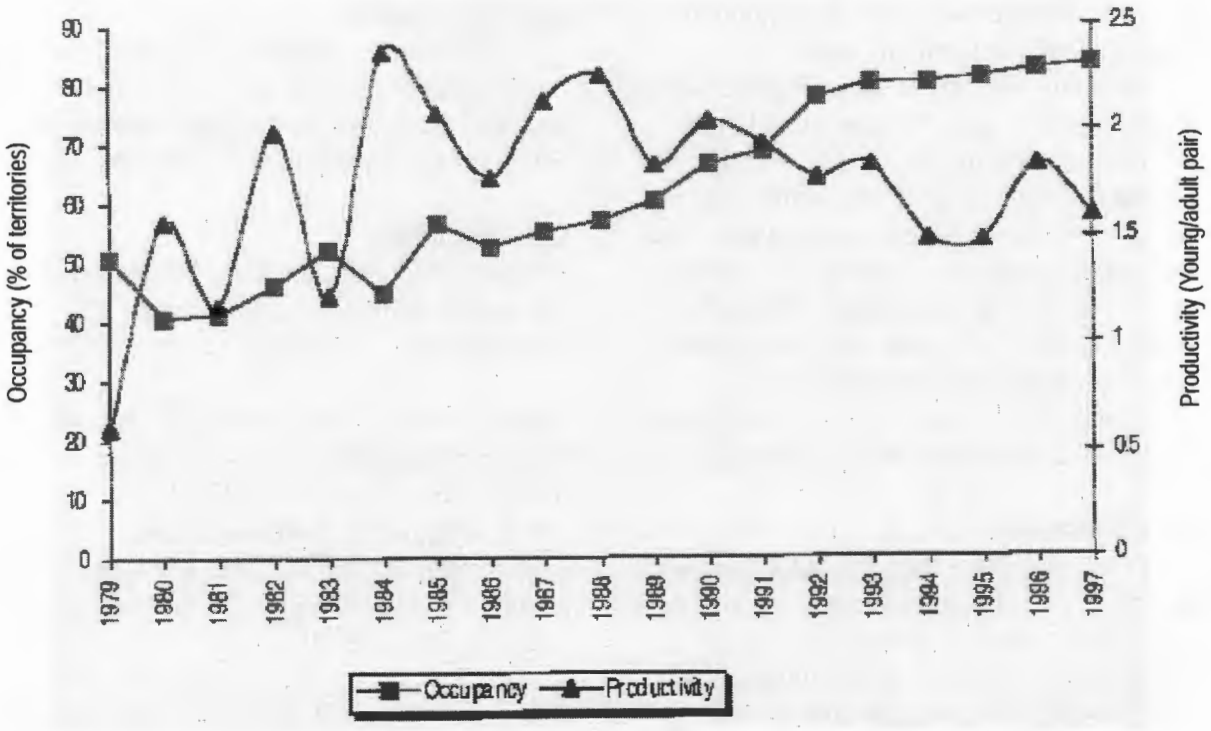


Figure 1. Occupancy of historic breeding territories by any peregrine (square) and reproduction by adult pairs (triangle) in New Mexico during 1979–1997. Occupancy represents population, and has been increasing, but that trend depends on prior reproduction, which has declined in the last decade to near the minimum maintenance level (Johnson 1996).

# Bald Eagle Habitat Management at Los Alamos National Laboratory

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**Abstract**

Bald eagles (*Haliaeetus leucocephalus*) winter along the Rio Grande, but are not known to nest in the area. Most wintering bald eagles congregate downstream from Los Alamos National Laboratory (LANL), but LANL contains winter foraging and roosting habitat and potential nesting habitat. 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. Interagency coordination will increase the effectiveness of bald eagle habitat management in the area. Potential nest and roost trees in White Rock Canyon and sensitive zones around them have been mapped to trigger review of potentially disturbing activities. Potential nest trees, roost trees, and foraging perches in LANL are monitored annually for signs of use, and most bald eagle use in 1997 occurred at foraging perches.

## 1.0 Introduction

The bald eagle (*Haliaeetus leucocephalus*) is federally listed as threatened throughout the lower 48 states and state listed as threatened in New Mexico. Bald eagles winter along the Rio Grande, including Department of Energy (DOE) land in and around White Rock Canyon, and several dozen often congregate downstream near Cochiti Lake. Some are resident from November through March, but others move about, and peak numbers usually occur in January or early February. Bald eagles forage for fish and waterfowl along the river and lake, and for carrion and rabbits over land. While they forage most often in the vicinity of Cochiti Lake, they use all of White Rock Canyon regularly, and the entire Pajarito Plateau occasionally. Bald eagles roost overnight in canyons that offer weather protection, security, and convenience to foraging areas, usually in tall ponderosa pines in lower portions of tributary canyons. Bald eagles around Cochiti Lake behave as if they are hunted, weaving and dodging in flight to avoid people. Evacuation of foraging and roosting areas in response to human presence within 200 to 800 m (220 to 880 yd) is typical behavior. Because few bald eagles nest in New Mexico, their nesting habitat is not well characterized, but a secure tree or cliff nest site near suitable aquatic habitat is probably required.

Several agencies have funded or conducted studies of bald eagles in this area. Johnson (1993) has monitored bald eagle winter population and diet near Cochiti Lake since 1979, funded by the National Park Service, the US Army Corps of Engineers (COE), the US Forest Service (USFS), and the US Bureau of Reclamation. The USFS funded a study of bald eagles by Dodd (1979) in White Rock Canyon, and Public Service Company of New Mexico funded a study by Stahlecker (EES 1986) in the upper portion of White Rock Canyon. The New Mexico Department of Game and Fish (NMDGF) has performed mid-winter fixed-wing aerial counts of bald eagles almost every year since 1978, and the COE has performed helicopter counts most years since 1984. LANL funded a survey for roosting and potential nesting habitat at LANL in 1992, and has begun annual surveys for signs of winter use of suitable trees.

## 2.0 Methodology

Roosting counts provide the most effective way to census wintering bald eagles, which tend to congregate at regular roosts (Johnson 1993). Late afternoon and early morning counts along flyways to and from roosts are more effective than counts of eagles at roosts, where growing darkness and the distance required to avoid disturbance limit visibility. Aerial counts cover more ground and sample aquatic foraging areas, but tend to detect relatively fewer immature eagles. Collection of castings and other prey remains under roost trees provide the most comprehensive picture of diet, but underrepresent the absolute proportion of fish in the diet. Late winter surveys of suitable roost trees for accumulated castings, feathers, and droppings have proven to be the most efficient method of documenting occasional use of trees for roosting and perching.

## 3.0 Results

Winter roosting counts of bald eagles in the Cochiti area have generally increased over the years (Johnson 1993), as have statewide aerial counts (S.O. Williams III, pers. comm.). Since 1979, average winter counts near Cochiti have generally doubled (Figure 1). As total counts have increased, the number of bald eagles using areas farther upstream has also increased. However, bald eagle use of the Cochiti headwaters was markedly lower in 1997 (Figure 1). It is not known whether this decrease was widespread or local, as neither the NMDGF nor the COE performed aerial surveys in 1997.

Since 1979, the wetland habitat of the delta above Cochiti Lake has expanded to about 12 km (7 mi) of delta between Frijoles Canyon and the lake in the 20 years since the lake was filled. This delta provides diverse aquatic and wetland habitat for fish, wintering waterfowl, and bald eagles (Allen 1993). Castings indicate that wintering bald eagles consume fish, waterfowl, and significant amounts of carrion, especially deer and elk. Water management may affect bald eagle habitat (Johnson 1988), especially that of the delta wetlands.

A survey of potential roost trees near the mouths of Water, Ancho, and Chaquehui Canyons in March 1992, indicated occasional bald eagle use of trees near the mouth of Water and Chaquehui Canyons, as droppings but no castings or feathers were found. The same habitat has potential for nesting. A survey on March 12, 1997, found similar evidence of use, with definite sign under foraging perches, possible sign under roost trees, and no sign of nesting. Two immature bald eagles were also sighted at the mouth of Ancho Canyon. Bald eagle use of the Pajarito Plateau is too sparse to study or to attract much attention, but a detailed report of an immature bald eagle in Los Alamos Canyon above the Omega reactor (A. Kron, pers. comm.) and a number of reports of bald eagles seen along State Highway 4 west of the Bandelier National Monument entrance, illustrate that the bald eagle does occur. Fifteen suitable roost and five potential nest trees in the lower tributary canyons and sensitive zones extending up to 1700 m (1870 yd) from roost and 900 m (990 yd) from potential nest trees were mapped in 1992 (Johnson 1992). Sensitive zones indicate an area in which LANL activities should be reviewed for potential impact on roosting (November 1 to March 31) or nesting (January 1 to July 31) bald eagles, and outside of which no effect is anticipated.

## 4.0 Conclusions

Bald eagle use of DOE land in White Rock Canyon should increase as the Cochiti Lake delta continues to expand upstream and numbers of wintering eagles increase. The

1997 decrease in numbers above Cochiti Lake was unprecedented, and its cause is unknown, but it could conceivably be related to unprecedented flooding after the 1996 Dome Fire that dumped ash directly into the Cochiti Lake delta. Indications of bald eagle use on DOE land in White Rock Canyon in 1992 and 1997 were too slight to justify direct bald eagle counts, but annual survey for signs of use is an appropriate method to monitor and document bald eagle winter use there. Infrequent and scattered use of terrestrial areas does not justify direct survey for bald eagles in terrestrial areas, but management planning should recognize that it does occur at low levels, and may be associated with elk or deer carrion. Likewise, bald eagle nesting in White Rock Canyon or adjacent areas is a possibility that should not be discounted.

Sensitive zones should be used to flag review of LANL activities to prevent disturbance of roosting or nesting bald eagles. Potentially disturbing activities should be scheduled outside of the sensitive season, unless nonoccupancy has been determined at that time. These zones are mainly undeveloped and should remain so. LANL land use planning should also recognize the contribution of terrestrial foraging areas, and cluster future developments to maintain large blocks of open land, especially near White Rock Canyon. Water management agencies have increasingly involved land and wildlife management agencies in water management decisions, and an interagency group has developed an ecological framework for managing the Cochiti delta wetlands (Allen 1993). The DOE and LANL should continue to participate in the Cochiti Lake Advisory Committee, which is now being organized to provide ongoing input into river and reservoir management.

**Acknowledgments**

S.O. Williams III of the New Mexico Department of Game and Fish has kindly provided summaries of midwinter counts of bald eagles throughout New Mexico. David Keller and Steve Koch participated in the March 12, 1997, survey.

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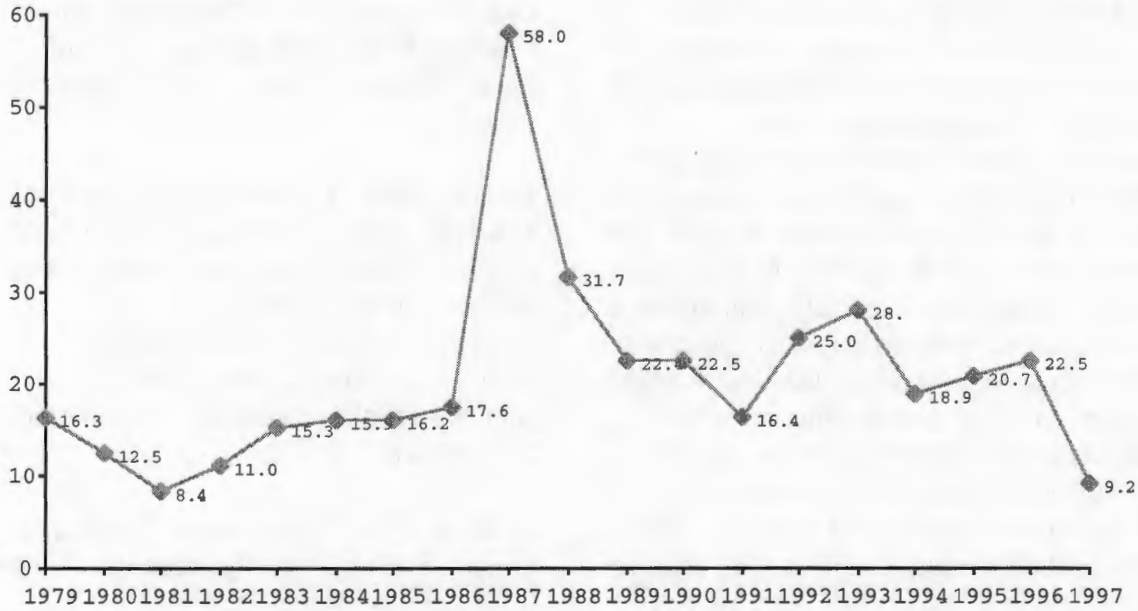


Figure 1. Average numbers of bald eagles roosting above Cochiti Lake during the winters of 1979–1997. An increasing trend underlies annual variations, which are dependent on water management and weather (Johnson 1993). The cause of the 1997 decrease is unknown.

# The 1997 Songbird Survey at Los Alamos National Laboratory

*Steven W. Koch* and Esther Nelson**

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**Abstract**

In 1997, a roadside songbird survey was initiated on Department of Energy land in Los Alamos County in order to provide data about bird species that are not listed as threatened or endangered. This type of survey provides an opportunity to detect 1) Laboratory impacts on local populations over time and 2) the presence of species listed as 'sensitive' or as 'species of concern.' Our objectives in this study were (1) to determine what species are present, (2) to determine if any species of concern are on Laboratory property, and (3) to monitor trends in populations Piñon-juniper woodland and ponderosa pine forest were the most often surveyed cover types with 23 stations and 20 stations in each type, respectively.

## 1.0 Introduction

In 1997, a roadside songbird survey was initiated on Department of Energy (DOE) land in Los Alamos County in order to provide data about bird species that are not listed as threatened or endangered. This type of survey provides an opportunity to detect 1) Laboratory impacts on local populations over time and 2) the presence of species listed as 'sensitive' or as 'species of concern.' Since such species could become listed as 'threatened,' it behooves us to monitor the presence of these species on Laboratory property. Two such species are the gray vireo (*Vireo vicinior*) and the loggerhead shrike (*Lanius ludovicianus*).

Our objectives in this study were (1) to determine what species are present, (2) to determine if any species of concern are on Laboratory property, and (3) to monitor trends in populations.

The survey technique which most efficiently meets the study objectives is on-road point counts (Ralph et al. 1993, Ralph et al. 1995).

## 2.0 Methods

Point counts involve an observer standing in one spot (the station) and recording all birds seen or heard. Point count stations are placed one-half mile apart on secondary and tertiary roads with the observer driving between stations. Traffic noise on each road must not interfere with birdsong detection. Counts begin at sunrise and end four hours later with each count lasting for six minutes. Bird distance from the observer is estimated and placed into one of five categories: 0–25 m; 25–50 m; 50–75 m; 75–100 m; and >100 m. The habitat is assessed at each station in order to link bird populations and habitat. Each habitat, or cover type, is described in Balice et al. (1997).

## 3.0 Results

In 1997, five canyons and three mesas were censused. The canyons surveyed were Cañada del Buey, Water Canyon, Los Alamos Canyon, Mortandad Canyon, and Rendija Canyon. The mesas surveyed were in Technical Areas (TAs) 70, 33, and 67. From 5 to 15 stations were censused in each canyon (Table 1), depending on the canyon length. Five land cover types were represented in the survey with 10 stations in mixed conifer, 23 in

piñon-juniper woodland, 20 in ponderosa pine forest, 3 in shrubland, and 6 in the wetland/ riparian zone.

The most commonly detected bird was the spotted towhee (*Psaltriparus maculatus*) with 53 detections, followed by the ash-throated flycatcher (*Myiarchus cinerascens*) and the Virginia's warbler (*Vermivora virginiae*) with 24 counts each. The complete list of counted birds is listed in Table 2.

Each species density was calculated for each cover type. Table 3 to Table 7 list species density in each cover type.

No gray vireos or loggerhead shrikes were detected in 1997.

## 4.0 Conclusions

The above tables represent only one of many ways to analyze survey data. As surveys are conducted in future years, statistical tests appropriate to multi-year comparisons will be used. In addition, the density calculations should be used with caution. They are not meant to be an absolute density value for each listed cover type. Rather, they should be viewed as base values to compare with future monitoring data.

Future surveys will include stations in areas that we were not allowed to access in 1997. By surveying additional areas of piñon-juniper we can more confidently determine the status of the gray vireo and loggerhead shrike at Los Alamos National Laboratory.

## Acknowledgements

Thanks to Carey Bare for assistance in conducting surveys and David Keller for advice on methodology and data analysis.

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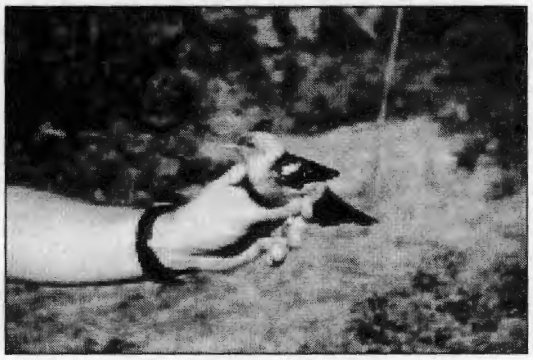

Table 1. Cover Type at Each Station along each Route.

| Station | Cañada del Buey | Lower Water Canyon | Middle Water Canyon | Los Alamos Canyon | Mortandad Canyon |
|---|---|---|---|---|---|
| 1 | Piñon-Juniper Woodland | Piñon-Juniper Woodland | Shrubland | Mixed Conifer | Piñon-Juniper Woodland |
| 2 | Piñon-Juniper Woodland | Mixed Conifer | Ponderosa Pine Forest | Piñon-Juniper Woodland | Piñon-Juniper Woodland |
| 3 | Piñon-Juniper Woodland | Piñon-Juniper Woodland | Ponderosa Pine Forest | Mixed Conifer | Piñon-Juniper Woodland |
| 4 | Piñon-Juniper Woodland | | Ponderosa Pine Forest | Mixed Conifer | Piñon-Juniper Woodland |
| 5 | Shrubland | | Wetland/Riparian Area | Ponderosa Pine Forest | Piñon-Juniper Woodland |
| 6 | Ponderosa Pine Forest | | Ponderosa Pine Forest | Mixed Conifer | Ponderosa Pine Forest |
| 7 | Shrubland | | Mixed Conifer | Mixed Conifer | Ponderosa Pine Forest |
| 8 | Ponderosa Pine Forest | | | Ponderosa Pine Forest | Wetland/Riparian Zone |
| 9 | | | | Mixed Conifer | Ponderosa Pine Forest |
| 10 | | | | Mixed Conifer | Ponderosa Pine Forest |
| 11 | | | | Mixed Conifer | |
| 12 | | | | Wetland/Riparian Zone | |
| 13 | | | | Wetland/Riparian Zone | |
| 14 | | | | Wetland/Riparian Zone | |
| 15 | | | | Wetland/Riparian Zone | |
| **Totals** | 8 | 3 | 7 | 15 | 10 |

| Station | Rendija Canyon | TA-70 | TA-33 | TA-67 |
|---|---|---|---|---|
| 1 | Ponderosa Pine Forest | Piñon-Juniper Woodland | Piñon-Juniper Woodland | Ponderosa Pine Forest |
| 2 | Ponderosa Pine Forest | Piñon-Juniper Woodland | Piñon-Juniper Woodland | Ponderosa Pine Forest |
| 3 | Ponderosa Pine Forest | Piñon-Juniper Woodland | Piñon-Juniper Woodland | Ponderosa Pine Forest |
| 4 | Ponderosa Pine Forest | Piñon-Juniper Woodland | Piñon-Juniper Woodland | Piñon-Juniper Woodland |
| 5 | Ponderosa Pine Forest | | | Piñon-Juniper Woodland |
| 6 | | | | Piñon-Juniper Woodland |
| **Totals** | 5 | 4 | 4 | 6 |

Table 2. Species Detected on Counts (ranked by total detections).

| Species | | | Species | | |
|---|---|---|---|---|---|
| **Common Name** | **Scientific Name** | **Totals** | **Common Name** | **Scientific Name** | **Totals** |
| spotted towhee | *Psaltriparus maculatus* | 53 | cordelleran flycatcher | *Empidonax occidentalis* | 3 |
| ash-throated flycatcher | *Myiarchus cinerascens* | 24 | green-tailed towhee | *Pipilo chlorurus* | 3 |
| Virginia's warbler | *Vermivora virginiae* | 24 | northern flicker | *Colaptes auritus* | 3 |
| American robin | *Turdus migratorius* | 23 | Grace's warbler | *Dendroica graciae* | 2 |
| chipping sparrow | *Spizella passerina* | 20 | hepatic tanager | *Piranga flava* | 2 |
| black-headed grosbeak | *Pheucticus melanocephalus* | 15 | piñon jay | *Gymnorhinus cyanocephalus* | 2 |
| canyon wren | *Catherpes mexicanus* | 14 | hermit thrush | *Catharus guttatus* | 2 |
| house finch | *Carpodacus mexicanus* | 14 | plain titmouse | *Parus inornatus* | 2 |
| mourning dove | *Zenaida macroura* | 12 | vesper sparrow | *Pooecetes gramineus* | 2 |
| white-breasted nuthatch | *Sitta carolinensis* | 12 | western bluebird | *Sialia mexicana* | 2 |
| brown-headed cowbird | *Molothrus ater* | 11 | yellow-rumped warbler | *Dendroica coronata* | 2 |
| common raven | *Corvus corax* | 11 | Bewicks' wren | *Thryomanes bewickii* | 1 |
| mountain chickadee | *Parus gambeli* | 10 | blue-gray gnatcatcher | *Polioptila caerulea* | 1 |
| Say's phoebe | *Sayornis saya* | 10 | Bullocks oriole | *Icterus bullockii* | 1 |
| solitary vireo | *Vireo solitarius* | 9 | canyon towhee | *Psaltriparus fuscus* | 1 |
| Steller's jay | *Cyanocitta stelleri* | 9 | gray flycatcher | *Empidonax wrightii* | 1 |
| dark-eyed junco | *Junco hyemalis* | 5 | house wren | *Troglodytes aedon* | 1 |
| pygmy nuthatch | *Sitta pygmaea* | 5 | MacGillivray's warbler | *Oporornis tolmiei* | 1 |
| western tanager | *Piranga ludoviciana* | 5 | pine siskin | *Carduelis pinus* | 1 |
| Cassin's kingbird | *Tyrannus vociferans* | 4 | yellow warbler | *Dendroica petechia* | 1 |
| western wood-pewee | *Contopus sordidulus* | 4 | | | |

Table 3. Density in Mixed Conifer Cover Type (# of birds per 40 ha).

| Species | Density |
|---|---|
| house finch | 7.64 |
| common raven | 6.37 |
| solitary vireo | 5.09 |
| spotted towhee | 5.09 |
| Virginia's warbler | 5.09 |
| Say's phoebe | 3.82 |
| American robin | 2.55 |
| ash-throated flycatcher | 2.55 |
| Cassin's kingbird | 2.55 |
| chipping sparrow | 2.55 |
| dark-eyed junco | 2.55 |
| mountain chickadee | 2.55 |
| pygmy nuthatch | 2.55 |
| canyon wren | 1.27 |
| cordelleran flycatcher | 1.27 |
| hepatic tanager | 1.27 |
| mourning dove | 1.27 |
| northern flicker | 1.27 |

Table 4. Density in Piñon-Juniper Cover Type (# of birds per 40 ha).

| Species | Density |
|---|---|
| spotted towhee | 7.20 |
| ash-throated flycatcher | 6.09 |
| chipping sparrow | 4.43 |
| Virginia's warbler | 3.88 |
| American robin | 2.77 |
| black-headed grosbeak | 2.21 |
| brown-headed cowbird | 1.66 |
| green-tailed towhee | 1.66 |
| house finch | 1.66 |
| mountain chickadee | 1.66 |
| mourning dove | 1.11 |
| piñon jay | 1.11 |
| white-breasted nuthatch | 1.11 |
| yellow-rumped warbler | 1.11 |
| Bewick's wren | 0.55 |
| canyon towhee | 0.55 |
| canyon wren | 0.55 |
| gray flycatcher | 0.55 |
| MacGillivray's warbler | 0.55 |
| northern flicker | 0.55 |
| plain titmouse | 0.55 |
| pygmy nuthatch | 0.55 |
| Say's phoebe | 0.55 |
| Steller's jay | 0.55 |
| vesper sparrow | 0.55 |
| western tanager | 0.55 |

Table 5. Density in Ponderosa Pine Cover Type (# of birds per 40 ha).

| Species | Density |
|---|---|
| spotted towhee | 15.28 |
| American robin | 7.64 |
| ash-throated flycatcher | 5.09 |
| brown-headed cowbird | 4.46 |
| white-breasted nuthatch | 4.46 |
| canyon wren | 3.18 |
| Say's phoebe | 3.18 |
| Steller's jay | 3.18 |
| Virginia's warbler | 3.18 |
| black-headed grosbeak | 1.91 |
| solitary vireo | 1.91 |
| western tanager | 1.91 |
| western wood-pewee | 1.91 |
| Grace's warbler | 1.27 |
| mountain chickadee | 1.27 |
| mourning dove | 1.27 |
| pygmy nuthatch | 1.27 |
| blue-gray gnatcatcher | 0.64 |
| Bullocks oriole | 0.64 |
| chipping sparrow | 0.64 |
| dark-eyed junco | 0.64 |
| hepatic tanager | 0.64 |
| house finch | 0.64 |
| pine siskin | 0.64 |
| vesper sparrow | 0.64 |
| western bluebird | 0.64 |
| yellow warbler | 0.64 |

Table 6. Density in Shrubland Cover Type (# of birds per 40 ha).

| Species | Density |
|---|---|
| spotted towhee | 16.98 |
| black-headed grosbeak | 12.73 |
| ash-throated flycatcher | 4.24 |
| brown-headed cowbird | 4.24 |
| Cassin's kingbird | 4.24 |
| mountain chickadee | 4.24 |
| Say's phoebe | 4.24 |
| solitary vireo | 4.24 |
| Steller's jay | 4.24 |
| Virginia's warbler | 4.24 |
| white-breasted nuthatch | 4.24 |
| western bluebird | 4.24 |
| western wood-pewee | 4.24 |

Table 7. Density in Riparian Cover Type (# of birds per 40 ha).

| Species | Density |
|---|---|
| Virginia's warbler | 12.73 |
| American robin | 6.37 |
| black-headed grosbeak | 4.24 |
| cordelleran flycatcher | 4.24 |
| white-breasted nuthatch | 4.24 |
| ash-throated flycatcher | 2.12 |
| canyon wren | 2.12 |
| dark-eyed junco | 2.12 |
| hermit thrush | 2.12 |
| house finch | 2.12 |
| house wren | 2.12 |
| mountain chickadee | 2.12 |
| plain titmouse | 2.12 |
| spotted towhee | 2.12 |
| western tanager | 2.12 |

# Monitoring Report for the Jemez Mountains Salamander for 1997

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**Abstract**

During 1997, in conjunction with the New Mexico Department of Game and Fish and the University of New Mexico (NM Natural Heritage Program), over 15 locations were surveyed for the presence of Jemez Mountains salamander (*Plethodon neomexicanus*). The sites were located throughout the eastern portion of the Jemez Mountains.

## 1.0 Introduction

Jemez Mountains salamander (*Plethodon neomexicanus*), a state threatened species, is a member of the lungless salamander family, Plethodontidae. It is described as a small, slender salamander, uniformly brown with shiny, brassy flecking along the back, sooty to pale gray below, and paler on the throat and tail (Stebbins and Riemer 1950). The fifth hind toe is absent or reduced. This species represents a biological anomaly as it is the only representative of this genus found in the southern Rocky Mountains. It is a terrestrial salamander endemic to north-central New Mexico, where it inhabits high-elevation coniferous forests and associated habitats within the Jemez Mountains. The entire range of this species extends for less than 1,632 $km^2$ (1,011 $mi^2$) located in Sandoval, Rio Arriba, and Los Alamos Counties. Within its range, Jemez Mountains salamander appears to exist as a series of disjunct populations, separated by geophysical and vegetational features (Painter 1993). Populations are found primarily on land administered by the US Forest Service, Santa Fe National Forest, although it has been reported to occupy land owned by the Santa Clara Indian Pueblo, Bandelier National Monument, Los Alamos National Laboratory (LANL), and private individuals. This species has been recorded from 2190 to 3290 m (7183 to 10,791 ft). A site located on LANL property represents the lowest known elevation (2190 m [7183 ft]) that this salamander has been found (Ramotnik 1986).

Jemez Mountains salamander is most often found under decaying logs and under rocks in mixed coniferous forests (Reagan 1967, Ramotnik 1986). The most common tree species associated with Jemez Mountains salamander are white fir (*Abies concolor*), Engelmann spruce (*Picea engelmanii*), blue spruce (*Picea pungens*), quaking aspen (*Populus tremuloides*), Douglas fir (*Pseudotsuga menziesii*), ponderosa pine (*Pinus ponderosa*), and Rocky Mountain maple (*Acer glabrum*) (Reagan 1967, Ramotnik 1986).

The most consistent and perhaps the most important component of Jemez Mountains salamander habitat is thought to be the presence of fragmented rock in the soil profile (substrate) (Painter, personal comm.). Reagan (1972) describes the presence of talus at all locations where salamanders were found. This type of substrate, in which extrusive rhyolite is broken down to produce a talus slope, stems from the volcanic origin of the Jemez Mountains. Talus is known to be an important feature for several *Plethodon* species. Given the narrow range of climatic conditions that are necessary for *Plethodons* to exist, it is believed that these animals move through the

permeable talus interstices during unfavorable surface conditions to seek preferred temperature and moisture regimes (Herrington 1988).

Several studies have suggested that slope is an important factor in suitable Jemez Mountains salamander habitat (Ramotnik 1986, Reagan 1972). Ramotnik (1986) identified slope as the most useful variable in determining the presence of Jemez Mountains salamander. Although the salamander does not appear to be confined to slopes of a particular aspect, much of the published data suggests that suitable habitat is most often found on north-facing slopes or sheltered canyons. Because a north-facing slope is more protected from direct solar radiation, evaporation and sublimation occur at a slower rate (West 1959). Gradual snow melt enables water to soak into substrates rather than being lost by sublimation or runoff (Anderson 1963). Narrow canyon walls also provide protection from wind and direct solar radiation, thus allowing for similar conditions with respect to snow accumulation. Ramotnik (1986), however, found that elevation had a greater effect on microhabitat variables such as ground cover, temperature, and moisture of logs than either slope or aspect.

Likewise, moisture is an important component of Jemez Mountains salamander habitat. This species is a lungless salamander which requires that its skin be in contact with moist surfaces for respiration (Goin et al. 1978). Observations of Jemez Mountains salamander on the surface are typically during the summer months following periods of heavy rain. This species may be opportunistically responding to suitable surface conditions such as moisture and temperature (Ramotnik 1986, Reagan 1972).

## 2.0 Methodology

While no surveys were conducted on LANL property, LANL personnel participated in ongoing monitoring of the Jemez Mountains salamanders by the New Mexico Department of Game and Fish (NMDGF). Charlie Painter, State Herpetologist, was assisted by LANL personnel during several surveys throughout the summer. Standard NMDGF surveys were conducted.

Together with LANL personnel, Marilyn Altenbach and Juanita Ladyman of the University of New Mexico (UNM) conducted various surveys throughout the Jemez Mountains using the standard survey methodology (Haarmann 1997).

## 3.0 Results

During the 1997 surveys, salamanders were located within all study plots where they were known to occur. Salamanders were also discovered in one location where they had not been previously found. Because of the abundant rainfall, it was a very successful year for locating salamanders. Charlie Painter maintains the results of the NMDGF salamander suveys. Juanita Ladyman will report the results of the UNM surveys.

## 4.0 Conclusions

During 1998, surveys will be conducted on LANL property to assess the distribution and location of salamanders. Likewise, LANL will continue to provide assistance to NMDGF, UNM, and US Forest Service in conducting salamander surveys.

## Acknowledgements

Thanks to all who participated in the salamander surveys and contributed to this study: Charlie Painter, Marilyn Altenbach, Juanita Ladyman, Nancy Monteith, Esther Nelson, Penny Gomez, Scott Ferran, and Louise Trippe.

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# Pilot Study to Evaluate the Use of Microhabitat Plant Species Characteristics to Predict the Presence of Jemez Mountains Salamander

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**Abstract**

We are in the early stages of a study to correlate specific land cover characteristics with the presence of Jemez Mountains salamander (*Plethodon neomexicanus*). We have characterized six locations of known salamander occurrence and five locations not previously reported to contain salamanders with regard to elevation, aspect, cryptogamic content, vascular plant cover, and other assorted ground covers. Data gathering has been completed and analyses is underway. Preliminary findings show a similarity of characteristics in the locations where salamanders were found.

## 1.0 Introduction

The initial hypothesis behind this study was two-fold. First, it was proposed that suitable salamander habitat, which is wet and temperate, will be indicated by the presence of plant life forms that require similar microhabitat. Second, areas of high phyto-diversity were proposed as being the preferred habitat of the Jemez Mountains salamander (*Plethodon neomexicanus*).

## 2.0 Methods

Five sites were selected where relatively high numbers of salamanders had been detected, and five sites were selected where no salamanders had been found in previous years. These selections were to be paired with respect to elevation and aspect. However, when the sites were examined in detail, one of the best positive salamander sites (i.e., one that had been consistently inhabited by many salamanders) had no equivalent site (with respect to elevation, etc.) where salamanders were absent. Rather than eliminate this site (namely site 82 at "Posos;" Table 1), a total of six sites with relatively high numbers of salamanders and five sites where no salamanders had been found were selected for the study. The other sites were all paired with respect to geology, elevation, and aspect.

At each of the six positive sites there were at least three discrete areas where salamanders had been found in the past. At each of these three areas, a 2-m (6.6-ft) -long transect was laid. The ground cover along the transect was recorded using 16 "subquads" (0.25 by 0.125 m [0.825 by 0.412 ft]) making a total of 48 "subquads" per area. Four transects were laid at the two Dome sites (Table 1) where there seemed to be a high degree of cover variation.

The cover studies were made in June and July. In August, as the conditions became suitable, surveys for salamanders were made. Salamanders were found on seven of the eleven sites. One of the positive areas (Upland A; Table 1) where transects had been established was further upslope from a previous negative survey area. At one site (Oat B), one of the three original transects was not relocated by the salamander search crews, but the hillside in the region of the transect was searched and no salamanders were found. It was decided at the time of the survey that a positive transect would be one where

salamander(s) were found within 15 m (50 ft) of the transect. This was somewhat arbitrary. However, 17 transects were positive for salamander presence while 18 were negative. On one transect (Dome B, transect B) a salamander was actually found on the transect. A summary of salamander presence at the sites and on the transects is given in Table 1.

The cryptogram cover was divided into various life forms—moss, crustose lichen, fruticose lichen, foliose lichen, liverworts, algae, black algae/lichen mix, and fungi. These were subdivided by color and substrate preference (e.g., cream foliose soil lichen, orange crustose rock lichen, or green foliose rock lichen). Cryptogram specimens were collected and genus and species identifications will be made where a particular species is abundant and easily recognizable by a nonspecialist. Vascular plants were divided into forbs, grasses, and shrubs, and species identification will be made to the extent that there are sufficient plant organs available (sometimes species cannot be determined without the presence of flowers or fruits). Woody debris, litter, gravels, soil, rocks, and other ground cover were also recorded. A photograph was taken of each quad and has been digitized for further analysis.

## 3.0 Preliminary Results and Discussion

At the present time, collected data are being analyzed. The final report is due at the end of March 1998, and the bulk of the analyses will be completed in January and February.

The terrestrial fruticose lichen was predominantly species of *Cladonia*, and the terrestrial foliose lichen was predominantly species of *Peltigera*, which are cream colored. Moss species were variable. Foliose and fruticose lichen are life forms that require relatively damp and cool conditions. There are significant differences between sites for the total *Cladonia*, *Peltigera*, and moss cover. Comparing the individual positive transects to the negative transects, there is significantly more moss, *Cladonia*, and *Peltigera* cover on the positive transects (Table 2). Amounts of gravel less than 2 cm (0.8 in.) in diameter were also greater on positive plots. Cryptogram cover in woodlands (piñon-juniper) at lower elevations were positively associated with 1- to 2-cm (0.4- to 0.8-in.) -sized gravel, which was why these size classes were chosen in this study. Litter and basal vegetation were slightly lower on positive sites. All percentage cover readings were transformed using an arcsin transformation before analysis of variance. Means are reported as percent cover.

There was also significantly more grass cover on the positive plots (Table 3). However, there was no difference between the positive and negative transects for shrub or forb canopy cover. Even so, total cover need not reflect species richness, which will be determined for each site and analyzed by analysis of variance. Spearman's rank correlation will be used to measure the interspecific covariation occurring at the sites.

Each photograph taken for each quad has been transferred to a CD-ROM for later analysis of image features (e.g., colors). The goal is to determine if it will be possible to use color or texture features of the cover of a quad to predict presence of salamanders.

## 4.0 Conclusion

Our results, to date, are very promising. We have found differences in microhabitat characteristics between areas where salamanders are found and where salamanders are not found. As well as more rigorous

biological analysis of this data, we plan to see if we can use digitized photography to further identify these regions. This will lead to objective parameters—parameters that are relatively straightforward for use by nonexperts—being incorporated into the search parameters for suitable salamander habitat.

Table 1. Sites and Transects Surveyed in 1997.

| Site Name | Site Number | Transect | Presence of pleneo | | Number of pleneo | Distance from transect: |
|---|---|---|---|---|---|---|
| | | | pre-1997 | 1997 | | m (ft) |
| Posos | 82 | A | yes | yes | 1 | 1.2 (4) |
| | | B | | yes | 1 | 1.8 (6) |
| | | C | | yes | 2 | 0.9 (3) |
| Guaje Trail A | 421 | A | no | no | | |
| | | B | | no | | |
| | | C | | no | | |
| Guaje Trail B | 84 | A | yes | yes | 1 | 6.0 (20) |
| | | B | | no | | |
| | | C | | no | | |
| Dome A | 513 | A | no | no | | |
| | | B | | no | | |
| | | C | | no | | |
| | | D | | no | | |
| Dome B | 977 | A | yes | yes | 1 | 6.0 (20) |
| | | B | | yes | 1 | 0 |
| | | C | | yes | 1 | 4.5 (15) |
| | | D | | yes | 1 | 1.2 (4) |
| Upland A | 413 | A | no | yes | 1 | 15 (50) |
| | | B | | yes | 1 | 10.5 (35) |
| | | C | | no | | |
| Upland B | 95 | A | yes | yes | 2 | 9.0 (30) |
| | | B | | yes | 1 | 4.5 (15) |
| | | C | | no | | |
| Barley A | 412 | A | no | no | | |
| | | B | | no | | |
| | | C | | no | | |
| Barley B | 90 | A | yes | yes | 2 | 9.0 (30) |
| | | B | | yes | 2 | 15.0 (50) |
| | | C | | yes | 1 | 4.5 (15) |
| Oat A | 379 | A | no | no | | |
| | | B | | no | | |
| | | C | | no | | |
| Oat B | 69 | A | yes | yes | 3 | <3.0 (<10) |
| | | B | | yes | 2 | <3.0 (<10) |
| | | C | | no* | | |

* The transect was not relocated, but search crews found no salamanders in the area.

Table 2. Mean Percent Cover of Some of the Parameters Measured at each Quad.

| Site | Mean | | | | | |
|---|---|---|---|---|---|---|
| | *Cladonia* | *Peltigera* | Moss | Gravels | | Litter and Basal Vegetation |
| | | | | <1 cm (0.4 in.) | 1 to 2 cm (0.4 to 0.8 in.) | |
| Negative | 1.7 | 0.4 | 6.9 | 1.3 | 0.8 | 75.3 |
| Positive | 3.7 | 1.4 | 9.3 | 2.0 | 1.2 | 64.9 |
| s.e. | 0.4 | 0.2 | 0.8 | 0.2 | 0.1 | 2.1 |
| probability | 0.0007 | 0.0033 | 0.0331 | 0.0448 | 0.0406 | 0.0005 |

Table 3. Percent Cover of Vascular Plant Canopy.

| Site | Canopy Cover | | |
|---|---|---|---|
| | **Shrub** | **Forb** | **Grass** |
| Negative | 5.5 | 9.4 | 0.6 |
| Positive | 7.3 | 9.4 | 1.8 |
| s.e. | 1.3 | 1.0 | 0.3 |
| probability | not significant | not significant | 0.0039 |

# Monitoring of Bat Populations at Los Alamos National Laboratory

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**Abstract**

In 1995, Los Alamos National Laboratory, Bandelier National Monument (BNM), the US Geoligical Survey, and the Midcontinent Ecological Science Center (MESC) initiated a multiyear study of bats in the eastern Jemez Mountains. Although some previous bat research has been conducted here, our goals were to assess the current status of bats (particularly species of concern), elucidate distribution and relative abundance, and obtain information on sites used by bats as roosts. We finished our third year of study in 1997. Species captured to date include California myotis (*Myotis californicus*), western small-footed myotis (*M. ciliolabrum*), long-eared myotis (*M. evotis*), fringed myotis (*M. thysanodes*), long-legged myotis (*M. volans*), Yuma myotis (*M. yumanensis*), silver-haired bat (*Lasionycteris noctivagans*), hoary bat (*Lasiurus cinereus*), western pipistrelle (*Pipistrellus hesperus*), big brown bat (*Eptesicus fuscus*), spotted bat (*Euderma maculatum*), Townsend's big-eared bat (*Corynorhinus townsendii*), pallid bat (*Antrozous pallidus*), Brazilian free-tailed bat (*Tadarida brasiliensis*), and big free-tailed bat (*Nyctinomops macrotis*). The most abundant species were silver-haired bat, long-eared myotis, big brown bat, long-legged myotis, pallid bat, western small-footed myotis, and fringed myotis. Most of these species are typical of ponderosa pine-mixed conifer forests.

## 1.0 Introduction

It is generally believed that bat populations have declined in recent decades in the United States and elsewhere. Several species are listed as endangered or threatened by the U. S. Fish and Wildlife Service (USFWS), and additional species were designated as Category 1 and Category 2 Candidates for listing. In 1995, the USFWS stopped maintaining a list of Category 2 Candidate Species in order to concentrate on higher priority listing needs (memorandum, Director, USFWS, July 1995). It is hoped that other entities and individual states will assist in maintaining lists and acquiring information on these species of concern.

Many states now protect bats and rank various species among taxa of special concern. The public has developed an increased interest in this diverse group of mammals, as exemplified by support for Bat Conservation International and bat societies in several states (e.g., Colorado). Federal land management agencies also have responsibilities relative to bat inventory, monitoring, and conservation and carry out surveys in areas under their jurisdiction (see, for example, Green et al. 1994, Lackie et al. 1993, Thomas 1988).

Pursuant to agreements between the Midcontinent Ecological Science Center (MESC), United States Geological Survey, Los Alamos National Laboratory, and Bandelier National Monument, a three-year project to determine the occurrence, distribution, and habitat use of bat species in the Jemez Mountains, Sandoval and Los Alamos Counties, New Mexico, was initiated in late summer 1995 and continued in 1996 and 1997. Considerable progress has been made toward assessing the current status of the bat

species inhabiting the eastern portion of the Jemez Mountains. This report summarizes captures of bats for the three years. A more detailed analysis will be found in a final report.

## 2.0 Methods

During the three-year study, bats were captured in mist nets as they foraged over and drank from water sources. Sometimes nets were set up at the base of cliffs away from water sources. Selected individuals, usually reproductive females, were instrumented with miniaturized radios that were used to track them to day roosts. Capture, handling, and radio-tagging of bats followed a written protocol approved by the Animal Care and Use Committee at MESC. All personnel associated with the project and actively handling bats were vaccinated against rabies before field work. We followed netting methods outlined by Kunz and Kurta (1988). Mist nets were deployed shortly after sunset and attended continuously until closure. Time of net closure varied for numerous reasons, such as inclement weather or radio-transmitter attachment and tracking, but most often we netted until bat activity diminished significantly (30 to 45 min after the last bat was captured).

For each netting episode we recorded investigator' names, site location, date, number and size of nets, times nets were opened and closed, starting and ending temperature, cloud cover, wind speed, and brief habitat description. We removed bats upon capture and promptly processed them before release. We recorded the species, sex, age (adult or young-of-the-year based on epiphyseal fusion; Anthony 1988), reproductive condition (testes or *cauda epididymides* visible in males, females pregnant, lactating, postlactating, or non-reproductive; Racey 1988), and time of capture for all bats. Additional comments on parasites, wing damage, and the like were made as necessary. All data were recorded on standardized data sheets; completed data sheets are on file at the Albuquerque office of the MESC.

## 3.0 Results

Tables 1 and 2 and Figures 1 and 2 summarize the bat captures in the Jemez Mountains in 1995, 1996, and 1997. Table 1 and Figure 1 summarize total captures for the Jemez Mountains. Table 2 and Figure 2 summarize the total captures at LANL. Bat species of concern are marked with an asterisk on the tables. The (E) next to *Euderma* on Table 1 means that it is a state listed species.

As can be seen from the tables and figures, we captured moderate to large numbers of all species of concern in the mountains and reproduction was noted in most of them. In addition, roosting locations of most species of concern were found by following instrumented animals. Roosting locations were identified on LANL for the state listed species (spotted bat).

A full analysis of the data collected will be in the final report entitled "Status and Trends of Bat Populations at Los Alamos National Laboratory and Bandelier National Monument, Jemez Mountains, New Mexico."

Table 1. Total captures of bats in the Jemez Mountains, 1995–1997.

| Species | 1995 | | | 1996 | | | 1997 | | | Totals | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Female | Male | Subtotal | Female | Male | Subtotal | Female | Male | Subtotal | Female | Male | Total |
| California myotis *M. californicus* | 0 | 2 | 2 | 5 | 4 | 9 | 0 | 0 | 0 | 5 | 6 | 11 |
| *Western small-footed myotis *M. ciliolabrum* | 2 | 4 | 6 | 7 | 30 | 37 | 9 | 34 | 43 | 18 | 68 | 86 |
| *Long-eared myotis *M. evotis* | 4 | 40 | 44 | 11 | 24 | 35 | 8 | 19 | 27 | 23 | 83 | 106 |
| Fringed myotis *M. thysanodes* | 8 | 8 | 16 | 13 | 13 | 26 | 16 | 11 | 27 | 37 | 32 | 69 |
| *Long-legged myotis *M. volans* | 5 | 18 | 23 | 12 | 29 | 41 | 25 | 12 | 37 | 42 | 59 | 101 |
| *Yuma myotis *M. yumanensis* | 3 | 5 | 8 | 2 | 0 | 2 | 1 | 2 | 3 | 6 | 7 | 13 |
| Hoary bat *L. cinereus* | 0 | 2 | 2 | 0 | 19 | 19 | 7 | 92 | 99 | 7 | 113 | 120 |
| Silver-haired bat *L. noctivagans* | 0 | 91 | 91 | 6 | 314 | 320 | 5 | 329 | 334 | 11 | 734 | 745 |
| Western pipistrelle *P. hesperus* | 0 | 0 | 0 | 0 | 3 | 3 | 0 | 7 | 7 | 0 | 10 | 10 |
| Big brown bat *E. fuscus* | 2 | 5 | 7 | 33 | 34 | 67 | 45 | 37 | 82 | 80 | 76 | 156 |
| (E) *Spotted bat *E. maculatum* | 3 | 0 | 3 | 2 | 0 | 2 | 4 | 3 | 7 | 9 | 3 | 12 |
| *Townsend's big-eared bat *C. townsendii* | 2 | 0 | 2 | 0 | 45 | 45 | 2 | 18 | 20 | 3 | 64 | 67 |
| Pallid bat *A. pallidus* | 1 | 1 | 2 | 0 | 45 | 45 | 2 | 18 | 20 | 3 | 64 | 67 |
| *Brazilian free-tailed bat *T. brasiliensis* | 1 | 4 | 5 | 0 | 1 | 1 | 1 | 7 | 8 | 2 | 12 | 14 |
| Big free-tailed bat *N. macrotis* | 0 | 0 | 0 | 7 | 0 | 7 | 8 | 0 | 8 | 15 | 0 | 15 |

Table 2. Total captures of bats on LANL, 1995–1997.

| Species | Male | Female | Total | % Male | % Frequency |
|---|---|---|---|---|---|
| California myotis *M. californicus* | 4 | 4 | 8 | 50 | 1.32 |
| Western small-footed myotis *M. ciliolabrum* | 51 | 16 | 67 | 76 | 10.98 |
| Long-eared myotis *M. evotis* | 19 | 19 | 38 | 50 | 6.23 |
| Fringed myotis *M. thysanodes* | 13 | 12 | 25 | 52 | 4.10 |
| Long-legged myotis *M. volans* | 26 | 16 | 42 | 62 | 6.89 |
| Yuma myotis *M. yumanensis* | 0 | 1 | 1 | 0 | 0.16 |
| Hoary bat *L. cinereus* | 34 | 0 | 34 | 100 | 5.57 |
| Silver-haired bat *L. noctivagans* | 216 | 5 | 221 | 98 | 36.23 |
| Western pipistrelle *P. hesperus* | 10 | 0 | 10 | 100 | 1.64 |
| Big brown bat *E. fuscus* | 40 | 62 | 102 | 39 | 16.72 |
| Spotted bat *E. maculatum* | 0 | 2 | 2 | 0 | 0.33 |
| Townsend's big-eared bat *C. townsendii* | 5 | 0 | 5 | 100 | 0.82 |
| Pallid bat *A. pallidus* | 52 | 2 | 54 | 96 | 8.85 |
| Brazilian free-tailed bat *T. brasiliensis* | 1 | 0 | 1 | 100 | 0.16 |
| Big free-tailed bat *N. macrotis* | 0 | 0 | 0 | 0 | 0.00 |
| **Total** | 471 | 139 | 610 | 77 | 100.00 |

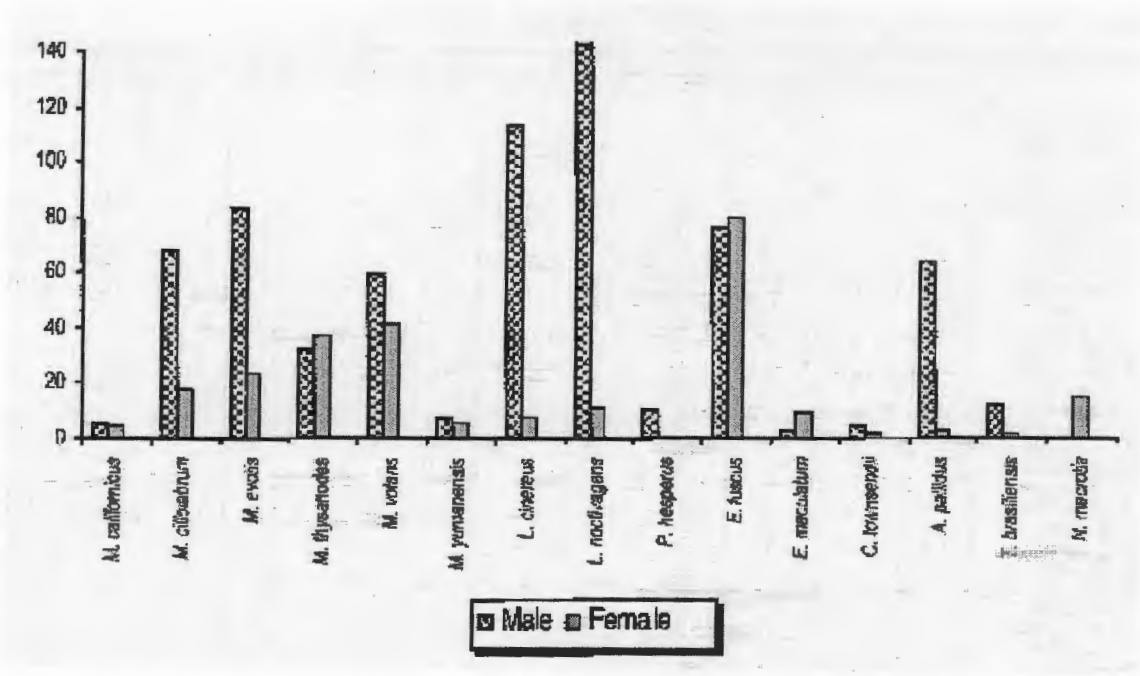


Figure 1. Total captures of bats in the Jemez Mountains, 1995–1997.

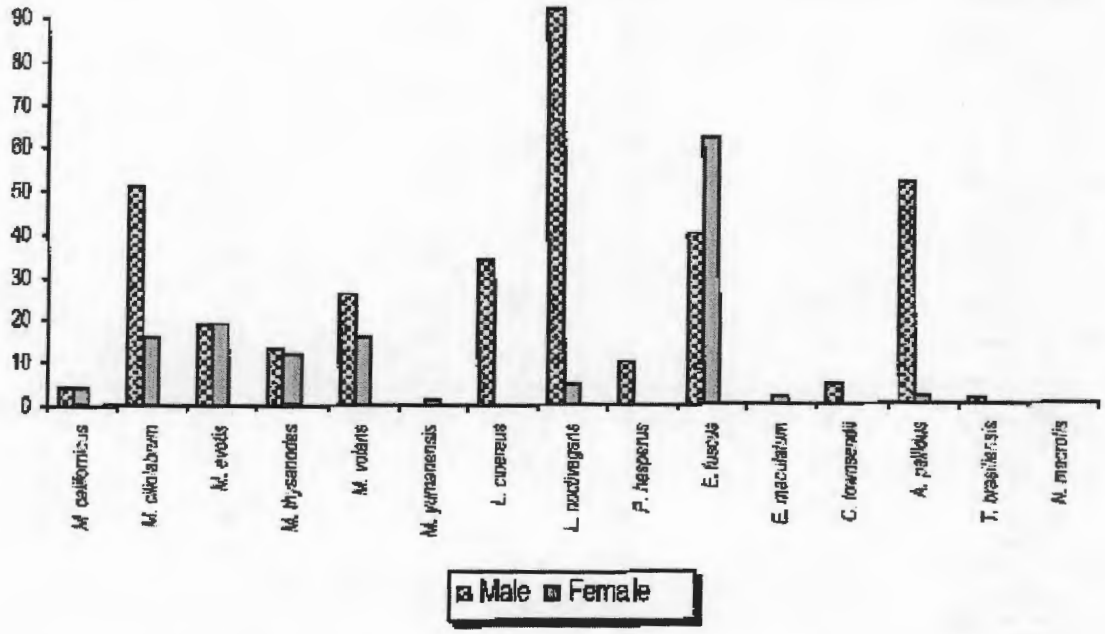


Figure 2. Total captures of bats on LANL, 1995–1997.

## 4.0 Conclusion

A total of 1532 bats representing 15 species were collected in the Jemez Mountains during the three-year study. At LANL, we netted for a total of 56 nights at 16 different sites where we captured 610 bats representing 14 species. The captures included 8 species of concern and one state-listed species (spotted bat). On LANL, the most frequently captured species were silver-haired bat (46% of LANL captures), western small-footed myotis (11%), pallid bat (11%), big brown bat (8%), and hoary bat (7%). One species, big free-tailed bat, was found in the Jemez but not on LANL.

**Acknowledgements**

Several people have been instrumental in assisting our studies of bats in the Jemez Mountains; at LANL, Terry Foxx and David Keller; at BNM, Steve Fettig and Chris Judson; and on Santa Fe National Forest, Buck Sanchez.

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# Monitoring Reptiles and Amphibians at Los Alamos National Laboratory

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**Abstract**

Baseline studies of reptiles and amphibians of the Pajarito wetlands at Los Alamos National Laboratory have been conducted by the Ecology Group (ESH-20) since 1990. ESH-20 implemented a pioneer mark-recapture study in 1996, using a passive integrated transponder (PIT), and also toe clipping, which was put to use in 1997. When animals are over eight grams in mass, PIT tagging is utilized, and when less than eight grams, toe clipping is used. The pioneer study is to investigate the feasibility for using permanent marking methods in the future. With the gathered data, we will develop a monitoring plan and use the information to interpret population dynamics over time.

## 1.0 Introduction

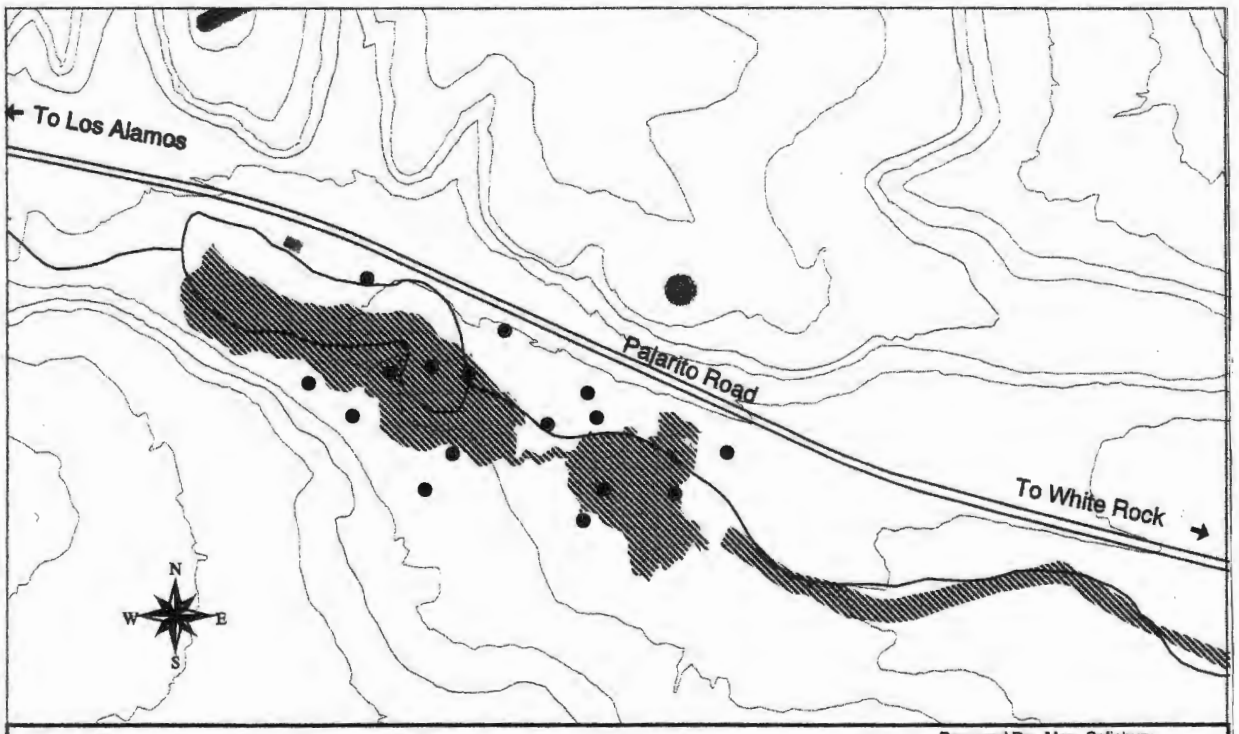
Research has demonstrated the importance of these animals in natural ecosystems. Reptiles and amphibians are indicators of general environmental health while aquatic amphibians and snakes are good indicators of the health of aquatic systems. These animals are especially sensitive to pollution and loss of aquatic habitat (Hall 1980). Amphibians and reptiles are also important in food chains, and they make up large proportions of vertebrates in certain ecosystems (Bury and Raphael 1983). Because of recent concern for non-game wildlife, biologists and land managers find themselves faced with studies and management needs for a group of animals they know little about (Jones 1986).

The Ecology Group (ESH-20) at Los Alamos National Laboratory (LANL) has been monitoring reptiles and amphibians since 1990. This will allow the Biology Team of ESH-20 to provide pertinent information for LANL management decisions as they pertain to reptiles and amphibians.

## 2.0 Study Area

The traps are located within LANL's Technical Area 36, known as the Pajarito wetlands. The wetlands are located 804 m (2655 ft) west of White Rock on Pajarito Road (Figure 1). The study site is 127 m (419 ft) wide by 356 m (1175 ft) long.

This area is classified as both a riparian association (Degenhart et al. 1996) and a dry upland. The major vegetation in the upland area is Apache plume (*Fallugia paradoxa*), rabbitbrush (*Chrysothamnus nauseosus*), big sage (*Artemisia tridentata*), white sweet clover (*Melilotus albus*), one-seed juniper (*Juniperus monosperma*), blue grama (*Bouteloua gracilis*), mutton grass (*Poa fendleriana*), and mullein (*Verbascum thapsus*). Vegetation in the wetland area is rush (*Juncus* spp), willows (*Salix* spp.), broad-leaved cattail (*Typha latifolia*), redtop (*Agrostis gigantea*), and mutton grass (*Poa fendleriana*). Pitfall traps are located by both upland and riparian vegetation types. Approximately 16 pitfall trap arrays are located within the study site. The study site is divided into two areas—denoted as north and south—by an ephemeral stream. Seven ponds are located adjacent to the north side of the stream.




Buildings
Roads
Trap Locations
Piestrine Wetland
Riverine Wetlands
20 ft Contours
100 ft Contours

0 90 Feet
0 30 Meters

Prepared By: Mary Salisbury
Date: 11/07/97
Biological Data Managed By ESH-20
Facilities Data Managed By FIMAD

Figure 1: Pitfall Trap Array Locations within Pajarito Wetlands

## 3.0 Materials and Methods

Studies of reptiles and amphibians have been conducted via pitfall trapping at LANL since 1990. Drift fences (aluminum flashing) with pitfall traps (large buckets) are used commonly to inventory and monitor populations of amphibians and reptiles (Heyer et al. 1994). Aluminum flashing is placed in the ground and used to intercept and direct animals into pitfall traps. Lids are elevated above the traps to provide overhead protection by attaching uniformly shaped wooden blocks underneath the corners. The entire trap system, including the aluminum flashing and buckets, will be referred to as a pitfall trap array. Nine pitfall trap arrays were placed in the wetland area in 1990. In 1993, seven pitfall trap arrays were added to the study site at the wetland area. The total number of pitfall traps (one-gal. buckets) in the arrays was 72. The 72 1-gal. buckets were placed side by side with the drift fence intersecting the very edge of the buckets. In 1997, all pitfall traps were replaced with 5-gal. buckets to reduce the potential for escape by larger animals. The total number of traps was also reduced from 72 to 40. Although the number has changed, the actual traps are in the same location and encompass the previously occupied space.

Traps were checked daily Monday through Friday and closed on the weekends. Trapping days for all years are similar. Field technicians responsible for checking the traps changed on a yearly basis. Because data collected from 1992 are incomplete, we excluded them from our analysis.

Once animals were captured, they were brought back to the laboratory to be measured. The mass of the animal was measured in grams with a Mettler electronic scale. Then the distance from the tip of the rostrum to the vent (snout-vent length) was measured in millimeters with Mitytoyo electronic calipers. Total tail length is measured from the vent to the tip of the tail. If the tail had been damaged or showed regeneration, then the regenerated portion of the tail was measured from the anterior portion of where the tail was broken off to the most posterior portion of the tail. The data were recorded with date, trap number, and comments.

ESH-20 implemented a pioneer mark-recapture study in 1996 to study the feasibility of using mark-recapture methods for future use. A permanent marking system known as the passive integrated transponder (PIT) was implemented for the purpose of gathering mark and recapture data. In 1997 another permanent marking system, toe clipping, was used in addition to PIT tagging. Both methods are used independently of one another. PIT tagging is used only for animals that are eight grams or more in mass. Toe clipping is implemented if an animal is less than eight grams in mass. PIT tags are only used when the tag is less than 10% of the body mass of the animal.

When animals are caught in a pitfall trap, it can be determined if the animal is a recapture by counting the number of toes, or scanning the individual with the PIT wand for an implanted PIT tag. This method is used in mark-recapture studies where long-term monitoring is desirable.

## 4.0 Results

All reptiles and amphibians caught at the Pajarito wetlands since 1990 (excluding 1992) have been recorded and are included in Table 1. The population dynamics of these animals are to be studied in the future. With the mark-recapture study underway, we wish to calculate survival rates and monitor

populations as well. Only five animals were recaptured in 1996, where 17 were implanted with PIT tags. In 1997, 100 animals were marked with either toe clips or PIT tags. Eighteen animals were recaptured, which includes one animal PIT tagged from 1996. Animals marked and recaptured are shown in Table 2.

**5.0 Conclusion**

Pitfall trapping has been employed widely for surveys of amphibian and reptile diversity and abundance in different habitat types. Traps can be operated continuously, so that variation in activity due to weather can be detected (Bury and Corn 1987).

Reptiles and amphibians have been trapped at the Pajarito wetlands using pitfall traps since 1990 (excluding 1992). The project was initiated to monitor these species as they are affected greatly by environmental changes. Through the years we have modified our sampling design and implemented new techniques to help us better understand the population dynamics of these animals. With the data collected, we will develop a monitoring plan to identify if any significant changes have occurred within the populations over time. Monitoring generally requires sampling over several years so that species and community health can be more accurately evaluated. This is especially needed in sampling amphibians and reptiles because populations fluctuate greatly from year to year with environmental changes, with respect to precipitation. Data collected over several years allows biologists to determine if population trends are due to naturally fluctuating environmental conditions or to other causes (Jones 1986).

With the implementation of these studies we are in the process of evaluating population dynamics such as survival rates and species composition as compared to annual and seasonal fluctuations in precipitation and temperature. In addition, issues of contamination effects on reptiles and amphibians may be evaluated.

In the future the mark-recapture methods in the pioneer study will be incorporated into our sampling methodology.

**Acknowledgements**

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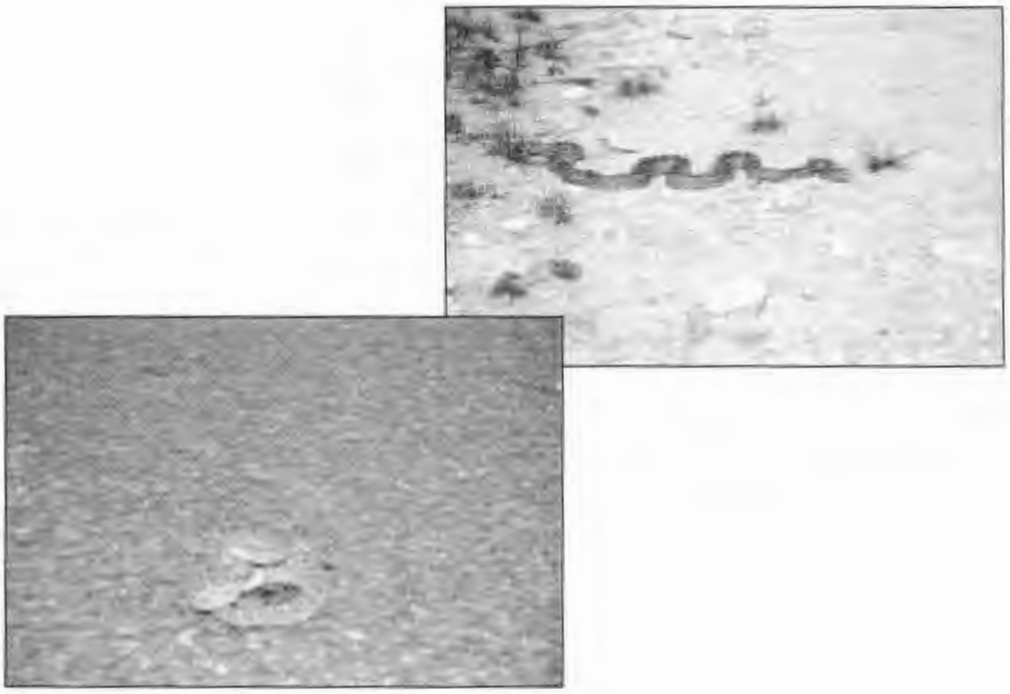
Table 1. Reptiles and Amphibians caught at Pajarito Wetlands.

| **Species** | **1997** | **1996** | **1995** | **1994** | **1993** | **1991** | **1990** |
|---|---|---|---|---|---|---|---|
| Tiger salamander (*Ambystoma tigrinum*) | 1 | 7 | 1 | 0 | 5 | 29 | 5 |
| New Mexico spadefoot toad (*Spea multiplicata*) | 2 | 7 | 0 | 1 | 0 | 878 | 1 |
| Couch's spadefoot toad (*Scaphiopus couchii*) | 0 | 0 | 0 | 2 | 1 | 1 | 0 |
| Woodhouse's toad (*Bufo woodhousii*) | 27 | 1 | 2 | 2 | 9 | 4 | 1 |
| Canyon treefrog (*Hyla arenicolor*) | 0 | 0 | 0 | 0 | 1 | 1 | 0 |
| Western chorus frog (*Psuedacris triseriata*) | 55 | 15 | 4 | 12 | 21 | 26 | 28 |
| Short-horned lizard (*Phrynosoma douglasii*) | 5 | 0 | 0 | 1 | 1 | 0 | 2 |
| Prairie lizard* (*Sceloporus undulatus*) | 5 | 12 | 3 | 6 | 13 | 2 | 9 |
| Plateau striped whiptail lizard (*Cnemidophorus velox*) | 83 | 101 | 42 | 73 | 23 | 30 | 48 |
| Many-lined skink (*Eumeces multivirgatus*) | 33 | 37 | 21 | 31 | 48 | 22 | 46 |
| Great plains skink (*Eumeces obsoletus*) | 0 | 1 | 0 | 1 | 1 | 0 | 24 |
| Night snake (*Hypsiglina torquata*) | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| Smooth green snake (*Liochlorophis vernalis*) | 0 | 0 | 0 | 0 | 1 | 0 | 0 |
| Western terrestrial garter snake (*Thamnophis elegans*) | 5 | 3 | 1 | 8 | 10 | 2 | 4 |
| Prairie rattlesnake (*Crotalus viridis*) | 1 | 0 | 0 | 0 | 0 | 0 | 0 |

* Prairie lizard was formerly known as eastern fence lizard (Degenhart et al. 1996).

Table 2. Reptiles and Amphibians PIT Tagged or Toe Clipped. (Recaptures are in parentheses.)

| Species | PIT tagged | | Toe clipped |
|---|---|---|---|
| | 1996 | 1997 | 1997 |
| New Mexico spadefoot toad | 0 | 1 | 0 |
| Tiger salamander | 1 | 0 | 0 |
| Woodhouse's toad | 0 | 4 (1) | 0 |
| Western chorus frog | 0 | 0 | 5 |
| Short-horned lizard | 0 | 1 | 3 (1) |
| Prairie lizard* | 0 | 0 | 2 (1) |
| Plateau striped whiptail | 15 (5) | 18 (3) | 41(10) |
| Many-lined skink | 0 | 0 | 21 (2) |
| Western terrestrial garter snake | 1 | 3 | 0 |

*Prairie lizard was formerly known as eastern fence lizard (Degenhart et al. 1996).