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Los Alamos NATIONAL LABORATORY

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Status of Federally Listed Threatened and Endangered Species at Los Alamos National Laboratory

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Acronyms

Acronym	Definition
AEI	area of environmental interest
ARU	autonomous recording units
Bd	*Batrachochytrium dendrobatidis*
ESA	Endangered Species Act
GPS	global positioning system
HMP	*LANL Threatened and Endangered Species Habitat Management Plan*
LANL	Los Alamos National Laboratory
PDSI	Palmer Drought Severity Index
USFWS	U.S. Fish and Wildlife Service

1 INTRODUCTION

Los Alamos National Laboratory (LANL) contains suitable habitat for three species protected under the Endangered Species Act (ESA): Mexican spotted owl (*Strix occidentalis lucida*), Jemez Mountains salamander (*Plethodon neomexicanus*), and southwestern willow flycatcher (*Empidonax traillii extimus*). LANL biologists have documented two other species nearby and manage them for any potential impacts. These species are the western distinct population segment of the yellow-billed cuckoo (*Coccyzus americanus*) and the New Mexico meadow jumping mouse (*Zapus hudsonius luteus*).

LANL biologists perform annual surveys for the three species that have suitable habitats. These federally permitted biologists follow the required federal survey protocols for each species. This 2025 biennial report details survey results and other actions related to endangered species management at LANL.

2 HABITAT MANAGEMENT PLAN

LANL achieves compliance with the ESA through the implementation of the "LANL Threatened and Endangered Species Habitat Management Plan" (HMP; LANL 2022a). This plan is a formal agreement between the U.S. Department of Energy/National Nuclear Security Administration and the U.S. Fish and Wildlife Service (USFWS) for the management of endangered species and their habitats at LANL (Cons. #2-22-98-I-336 and Cons. #2-22-95-I-108). LANL biologists review all actions and activities for compliance with the HMP; if the actions and activities meet the requirements in the HMP, then the work may proceed. Actions or activities that cannot follow the HMP requirements must go through individual Section 7 consultations under the Endangered Species Act (ESA) (Endangered Species Act of 1973, 16 U.S.C. § 153616). LANL staff incorporate the controls for ESA compliance into an internal project review process through which LANL reviews all projects for environmental compliance (LANL 2024a).

LANL is revising the HMP as of winter 2025. Anticipated revisions include updates to threatened and endangered species areas of interest and refinements to wildland fire management concepts, among other subjects. We expect to complete this revision by the end of 2026.

3 COMPLIANCE ACTIONS

Since the last version of this report in 2023 (LANL 2023), we completed five biological assessments for actions not covered in the HMP.

- "Biological Assessment for a Multi-Use Path along Los Alamos Canyon on Federally Listed Threatened and Endangered Species at Los Alamos National Laboratory" (LANL 2024b). This consultation addresses the potential direct, indirect, and cumulative effects on federally listed threatened and endangered species caused by disturbance from construction and following us of a bicycling and hiking path with year-round access along the mesa top of Los Alamos Canyon.
- "Biological Assessment for the Los Alamos Canyon Fuels Mitigation Treatments, Los Alamos National Laboratory" (LANL 2024c). The goal of this consultation and eventual biological opinion is to address the potential direct, indirect, and cumulative effects on federally listed threatened and endangered species caused by disturbance and habitat alteration from fuels

mitigation treatment in and along Los Alamos Canyon. The biological opinion was granted in August 2025.

- "Biological Assessment for the Potential Effects from TA-41 Tunnel Access and Maintenance, Los Alamos Canyon, Los Alamos National Laboratory" (LANL 2024d). This biological assessment addresses the potential direct, indirect, and cumulative effects on federally listed threatened and endangered species caused by disturbance from periodic access to and maintenance around an existing tunnel in Technical Area 41 in Los Alamos Canyon.
- "Biological Assessment for the Technical Area 53 Light Manufacturing Lab at Los Alamos National Laboratory" (LANL 2024e). This biological assessment addresses the potential direct, indirect, and cumulative effects on federally listed threatened and endangered species of the proposed U.S. Department of Energy National Nuclear Security Administration project within Technical Area 53 at Los Alamos National Laboratory, referred to as the Light Manufacturing Laboratory.
- "Biological Assessment of the Potential Effects of TA-61 Asphalt Millings Staging Area at Los Alamos National Laboratory" (LANL 2024f). This biological assessment addresses the direct, indirect, and cumulative effects on federally listed threatened and endangered species caused by noise disturbance from a construction project in developed and undeveloped core habitat for the Mexican spotted owl in the Sandia/Mortandad Canyon Area of Environmental Interest (AEI).

The HMP does not require projects to make in-kind remediation of habitat for the impacted species; therefore, mitigations that benefit any of the three federally listed species that occur at LANL are acceptable.

Mitigation actions resulted from the consultations. A collaborative research project is currently in the planning phase (as of winter 2025) to use global positioning system (GPS) tags by a network of government agencies in the Jemez Mountains to assess habitat use and movement ecology of the Mexican spotted owl in the greater Jemez Mountains. Little data currently exist on the site-specific ecology of northern New Mexico, where owls are strongly associated with canyon microclimates, riparian inclusions, and structurally complex forests.

4 SPECIES INTRODUCTION

The LANL HMP includes species that are federally protected under the ESA that are present on or near LANL property. The HMP requires annual (or as needed) surveys depending on the species and the presence of suitable habitat.

4.1 MEXICAN SPOTTED OWL

4.1.1 General Biology

The Mexican spotted owl is one of three subspecies of spotted owl found in North America. The Mexican spotted owl is a pale gray–chestnut brown color with white and brown spots on the abdomen, back, and head. Its tail is brown with thin white bands, and its ears lack tufts. The Mexican spotted owl is one of only a few owl species in the United States that has dark eyes. Owls younger than 5 months have a downy appearance. Females are larger than males (USFWS 2012a).

The Mexican spotted owl is found in northern Arizona, southeastern Utah, southwestern Colorado, New Mexico, west Texas, and into Mexico. It is the only subspecies of spotted owl recognized in New Mexico (USFWS 2012a). The Mexican spotted owl generally inhabits mixed conifer and ponderosa pine (*Pinus ponderosa Lawson & C. Lawson*) and Gambel oak (*Quercus gambelii nutt.*) forests in mountains and canyons. Characteristics of Mexican spotted owl habitat include high canopy closure, high stand diversity, and multi-layered canopy resulting from an uneven-aged stand, large mature trees, downed logs, snags, and stand decadence, as indicated by the presence of mistletoe (*Arceuthobium spp.*).

Some Mexican spotted owls have been found in second-growth forests—younger forests that have been logged; however, these areas were found to contain characteristics typical of old-growth forests. No Mexican spotted owls were found in forests less than 36 years of age (USFWS 2012a). Mexican spotted owls in the Jemez Mountains seem to prefer cliff faces in canyons for their nest sites (Johnson and Johnson 1985). The young leave the nest at 32 to 36 days old to perch on surrounding branches and can fly short distances at 40 to 45 days. Survival rate for the young is low. The recovery plan for the Mexican spotted owl recommends that mixed conifer and pine-oak woodland types on slopes greater than 40 percent be protected for the conservation of this owl (USFWS 2012a). Although seasonal movements vary among owls, adults commonly remain within their summer home ranges throughout the year.

Under the HMP, we modeled Mexican spotted owl habitat at LANL based on a combination of topographical features and macro-level vegetation classifications. During the development of the HMP in 1998, we delineated areas determined as suitable Mexican spotted owl habitat into AEIs. We have since developed a Mexican spotted owl habitat model that incorporates finer-scale vegetation characteristics into the current model (Hathcock and Haarmann 2008). We used a version of this model to update the AEIs at LANL, and the proposed changes received concurrence from the USFWS in 2005 (LANL 2005). The current Mexican spotted owl AEI inventory spans seven canyons at LANL.

4.1.2 Conservation History and Current Status

On December 30, 1982, a USFWS status review of vertebrate taxa led to the consideration of adding the Mexican or "Southern" spotted owl to the ESA list of threatened or endangered species (USFWS 1982). On November 3, 1991, the USFWS proposed listing the Mexican spotted owl as a threatened species under the ESA (USFWS 1991). The Mexican spotted owl was listed as a threatened species under the ESA on March 16, 1993 (USFWS 1993). Critical habitat was established on August 31, 2004 (USFWS 2004). The first recovery plan for the Mexican spotted owl was approved in 1995 (USFWS 1995a) and updated in 2012 (USFWS 2012a). A 5-year status review was initiated in February 2013 (USFWS 2013a) and another in 2023 (USFWS 2023). Both reviews found no change to the Mexican spotted owl status.

4.1.3 Survey Methods

Surveyors must obtain federal permits before conducting surveys using three primary calling techniques for the Mexican spotted owl: point, continuous, and leapfrog. The choice of calling technique is based on the best way to cover all suitable habitats. LANL biologists use the point-method survey technique.

In the point-method survey technique, surveyors play an electronic recording of a male or female owl call using a handheld game caller (or a surveyor may imitate vocal calls of the owl) at a fixed point. The observer spends at least 15 minutes at a point and alternates between playing the recording of the owl and listening for a response. In canyon habitat, surveyors spend a minimum of 20 minutes at each station. The primary four-note location call of the Mexican spotted owl is the major call played during surveys. Points are approximately 0.5 mi (0.8 km) apart and cover all AEIs.

LANL biologists conduct surveys annually in all Mexican spotted owl AEI core areas on LANL property. We conduct four surveys in each AEI between late March and August 31 of any given year unless we find a Mexican spotted owl. We conduct no more than one survey in March of any given year, and we complete at least two surveys before July 1 of any given year. We schedule surveys at least 5 days apart and initiate them either before sunrise or 2 hours after sunset. We do not conduct field surveys during existing or predicted wind >15 mph (>24.1 km) or during stormy weather, nor do we conduct surveys when access problems occur due to snow or poor road conditions. Surveyors also opportunistically monitor canyons of interest for Mexican spotted owls using autonomous recording units (ARUs), which are self-contained audio recording devices deployed for noninvasive bioacoustical monitoring.

4.1.4 History of Results

Biologists have conducted surveys for Mexican spotted owls on LANL property since 1994. In 1995, a pair of Mexican spotted owls and their nest were located in Cañon de Valle. They occupied the nesting territory from 1995 through 2011, and young fledged in multiple years. Between 2004 and 2006, at least one Mexican spotted owl occupied a territory in Mortandad Canyon. This area was reoccupied in 2013 and continues to support a resident pair to date. In 2007, LANL biologists located a pair of Mexican spotted owls and their nest in Threemile Canyon. They occupied this site annually until 2023, with successful fledging documented in multiple years. Most recently, in 2025, LANL biologists identified a pair of Mexican spotted owls and their nest in Pajarito Canyon. A summary of the Mexican spotted owl surveys and results on LANL property since surveys began in 1994 is shown in Table 4-1.

Table 4-1. Mexican Spotted Owl Survey Results at LANL

Year	Cañon de Valle	Water Canyon	Threemile Canyon	Pajarito Canyon	Mortandad Canyon	Sandia Canyon	Los Alamos Canyon
1993	–	–	–	N	–	–	–
1994	–	–	–	–	–	–	N
1995	P+(2)	N	N	N	–	–	N
1996	P+(2)	N	N	N	–	–	N
1997	P	N	–	–	–	–	N
1998	P+(2)	N	–	–	N	N	N
1999	P+(2)	N	N	N	N	N	N
2000	P	N	N	N	N	N	N
2001	P	N	N	N	N	N	N
2002	P	N	N	N	N	N	N
2003	P	N	N	N	N	N	N
2004	P	N	N	N	P*	N	N
2005	P+(3)	N	N	N	P*	N	N
2006	P	N	N	N	P*	N	N
2007	P	N	P+(3)	N	N	N	N
2008	P	N	P	N	N	N	N
2009	P+(2)	N	P+(1)	N	N	N	N
2010	P	N	P	N	N	N	N
2011	P	N	P	N	N	N	N

Year	Cañon de Valle	Water Canyon	Threemile Canyon	Pajarito Canyon	Mortandad Canyon	Sandia Canyon	Los Alamos Canyon
2012	N	N	P+(1)	N	N	N	N
2013	N	N	P+	N	P+	N	N
2014	N	N	P	N	P	N	N
2015	N	N	P+(4)	N	P+(3)	N	N
2016	N	N	P	N	P+(2)	N	N
2017	N	N	P+(2)	N	P	N	N
2018	N	N	P	N	P	N	N
2019	N	N	P+(3)	N	P+(1)	N	N
2020	N	N	P+(3)	N	P+(2)	N	N
2021	N	N	P	N	P	N	N
2022	N	N	P	N	P	N	N
2023	N	N	P+(3)	N	P+(3)	N	N
2024	P*	N	P*	P*	P+(2)	N	P*
2025	P*	N	P*	P+(3)	P+(2)	N	N

– = No data; N = Negative survey; P = Positive survey; + = Breeding confirmed (of young seen); * = A single owl

Local citizen scientists have also observed spotted owls within Acid Canyon (a canyon within the township of Los Alamos not on LANL property) after hearing reports that local bird enthusiasts were observing Mexican spotted owls in that area. Surveys conducted in 2016 and 2017 determined that the Mexican spotted owls in Acid Canyon were not breeding and that the owls were thought to possibly be siblings. One Mexican spotted owl was found dead in nearby Pueblo Canyon in 2017, likely the result of depredation by a great horned owl (*Bubo virginianus*). The dead owl was transferred to the USFWS species lead, Shaula Hedwall, in September 2017. In January 2018, a second Mexican spotted owl was found dead in Pueblo Canyon near the confluence with Acid Canyon. This owl carcass was also transferred to Shaula Hedwall (February 2018). Birders have reported additional sightings in Acid Canyon and Pueblo Canyon annually from 2020 through 2025. Of these years of occupation, only 2024 documented a single fledged young.

In addition to our annual surveys, biologists have begun using ARUs in all Mexican spotted owl AEIs to supplement field season surveys and to understand owl use year-round. In 2021, we deployed a single ARU on the southern canyon rim of Cañon de Valle to assess effectiveness of these units. At that time, we recorded a single Mexican spotted owl within the canyon. Subsequent deployment followed from 2022 to 2025.

In 2022, we placed units in Los Alamos Canyon, Threemile Canyon, and Mortandad Canyon. We experienced positive detections—of males primarily—in each location. We followed up on positive recordings with on-the-ground annual surveys to verify the presence of owls. Due to the success of positive detections—initially without the call-playback survey methodology—we continued deployment of ARUs in all canyons of interest.

The effectiveness of owl detections with ARUs alone has led biologists to expand the use of ARUs into other canyons at LANL. In 2025, before the breeding season, a detector recorded both male and female owls in the previously unoccupied Pajarito Canyon. We verified this detection in the annual survey route, followed by verification of breeding owls and three nestlings in the canyon in July 2025. As part of our 2026 update of the HMP, we plan to expand our ARU monitoring efforts for Mexican spotted owl by designating ARUs to each suspected occupied canyon. We will leave detectors in place year-round, with delayed recording set for December of each year, allowing biologists to determine presence ahead of usual breeding time and ensure that call-playback surveys are indeed effective.

4.1.5 Mexican Spotted Owl Analytical Methods

To assess the effectiveness of the HMP on Mexican spotted owl productivity measured by the number of young fledged over time, we compiled survey data and the documented number of owls fledged from 1994 to 2025. Using a generalized linear modeling approach, we assessed if Mexican spotted owl productivity—measured as the number of young fledged per year—changed over time. Before model fitting, we evaluated data for normality and homogeneity of variances using Shapiro-Wilk and Levene's tests, respectively. Productivity data were not normally distributed and exhibited zero inflation; therefore, we used a Poisson regression model with a log link function to model productivity as a function of year. We checked model assumptions, and diagnostic tests indicated an appropriate model fit. We performed visualization of observed and predicted values over time using the ggplot2 package to illustrate productivity trends. We used R statistical software version 4.5.1 for all data analyses (R Core Team 2025).

4.1.6 Results

The Poisson regression model indicated that Mexican spotted owl productivity—measured as the number of young fledged—did not change significantly over time ($\beta = 0.0267 \pm 0.0168$, $z = 1.59$, $p = 0.11$). Although the fitted model suggested a slight positive trend in productivity across years, this relationship was not statistically significant at the $\alpha = 0.05$ level and therefore indicates a stable population trend for Mexican spotted owls onsite (Figure 4-1).

Figure 4-2 visualizes the data by illustrating the annual productivity—measured as the number of young fledged—from 1995 through 2025 across five monitoring sites: Pajarito, Mortandad-1, Mortandad-2, Cañon de Valle, and Threemile. The stacked bars represent the total number of fledged young per year, with contributions from each site distinguished by color. A vertical dashed line marks the year 2000, indicating the implementation of LANL's HMP. The data suggest variations in productivity over time and across sites, with notable increases following the introduction of the HMP.

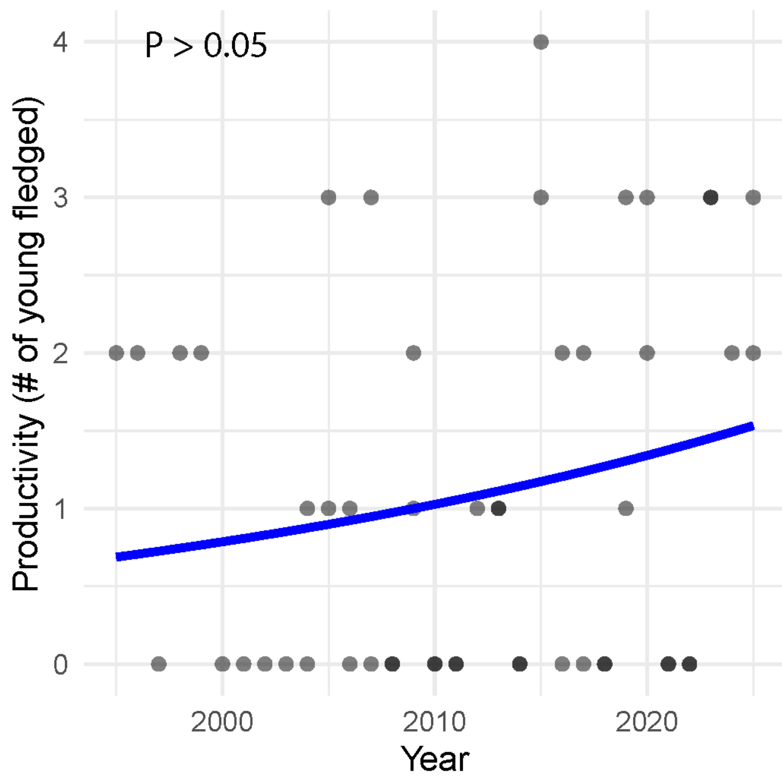

Figure 4-1. Scatter plot showing the number of fledged young each year. A Poisson regression fitted line in blue suggests a slight positive trend over time, but the relationship was not significant at the α = 0.05 level.

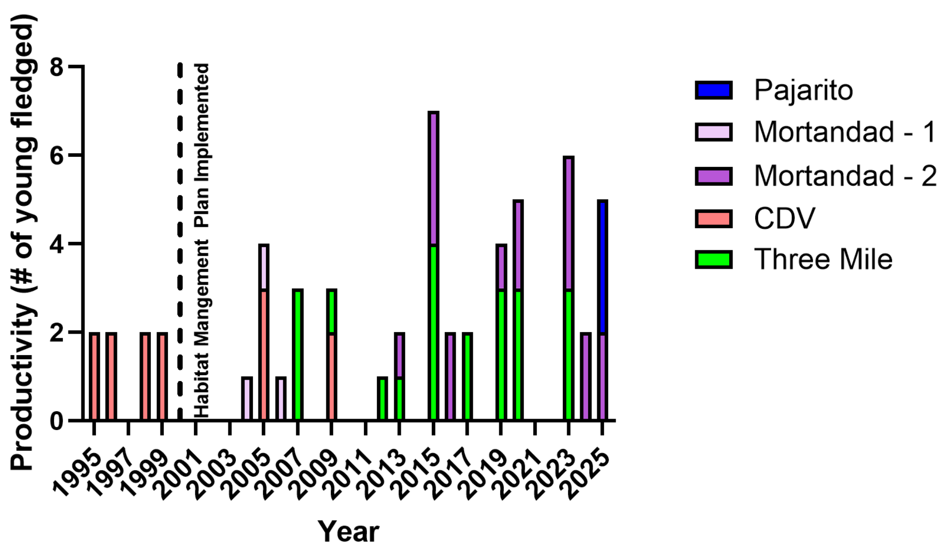

Figure 4-2. A stacked bar graph of fledged young from 1995 to 2025 by site, with the year of LANL's Habitat Management Plan implementation (2000) shown as a dashed line.

4.1.7 Additional Analysis

Increases in the frequency, duration, and severity of drought could have cascading effects on bird productivity (Saracco et al. 2018). In our region of the country, Saracco et al. (2018) documented avian productivity declines as a function of relative spring drought severity; therefore, we anticipated a negative relationship between indicators of drought and the number of young fledged for Mexican spotted owl pairs at occupied locations. To assess the influence of drought on Mexican spotted owl productivity, we investigated if regional climatic conditions were correlated with successful breeding of Mexican spotted owls at LANL. We theorized that spring drought severity would influence reproductive productivity.

The Palmer Drought Severity Index (PDSI) uses readily available temperature and precipitation data to estimate relative dryness (Dai et al. 2019, NOAA 2024). This standardized index spans −10 (dry) to 10 (wet) and has been reasonably successful at quantifying long-term drought. Drought categories include no drought (greater than −1.0) abnormally dry (−1.0 to −1.9), moderate drought (−2.0 to −2.9), severe drought (−3.0 to −3.9), extreme drought (−4.0 to −4.9), and exceptional drought (−5.0 and less). For analyses, we used PDSI monthly data from the United States Climate Division 2 of north central New Mexico (NOAA 2024) and averaged the monthly index (December through May) for each year. We speculated that this period would best reflect the conditions to which Mexican spotted owls respond during the breeding season. Because productivity data were count-based and exhibited zero inflation, we used a generalized linear mixed model with a Poisson error distribution and a log link function. We used a mixed-effects Poisson regression model to test the influence of drought (PDSI index values) on productivity (the number of young fledged). We included pair identity as a random effect to account for repeated measures and potential nonindependence among observations because Mexican spotted owls, in general, show high mate and site fidelity (Bond et al. 2002).

The model (Figure 4-3) showed that Mexican spotted owl productivity increased significantly with higher PDSI values, indicating that wetter conditions were associated with greater reproductive success ($\beta = 0.229 \pm 0.070$, $z = 3.28$, $p = 0.001$). The model explained approximately 28 percent of the variation in productivity ($R^2 = 0.28$). Visualization of the fitted model showed a positive relationship between PDSI and the number of young fledged, with confidence intervals indicating a robust effect across the observed range of PDSI values. These results support the hypothesis that wetter environmental conditions positively influence Mexican spotted owl productivity.

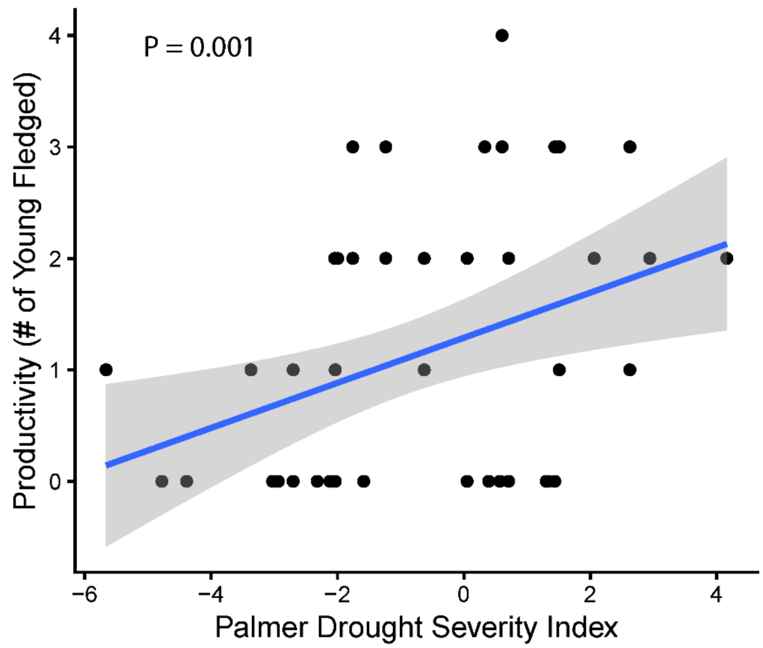

Figure 4-3. Scatter plot that shows the number of fledged young relative to the Palmer Drought Severity Index; 95 percent confidence intervals appear as shaded areas. Productivity increased significantly with higher PDSI values, indicating that wetter conditions were associated with greater reproductive success ($\beta = 0.229 \pm 0.070$, $z = 3.28$, $p = 0.001$).

4.1.8 Discussion

Our findings suggest that the implementation of LANL's HMP in 2000 contributed to maintaining stable or slightly improved productivity in subsequent years. Before 2000, productivity remained low but relatively consistent; however, following implementation of the HMP, one additional breeding pair reflected a modest increase in more-frequent successful fledging events. Although overall productivity has shown no significant change over time, higher PDSI values (wetter conditions) were associated with notably greater productivity. This pattern suggests that habitat protection under the HMP has sustained population stability, but drought intensity continues to exert a dominant influence on reproductive success.

Looking ahead, management efforts should incorporate adaptive strategies such as maintaining riparian and canopy cover and enhancing water availability in occupied habitats to buffer owls and their prey from the increasing drought variability expected under changing climate conditions. Equally important is the integration of wildland fire mitigation treatments that reduce fire risk while preserving critical habitat components and structure. As LANL prepares to update the HMP in the coming years, building on the HMP's demonstrated successes will be essential to ensure continued effective management of this species on site by balancing habitat protection with the growing need for proactive fire management.

4.2 JEMEZ MOUNTAINS SALAMANDER

4.2.1 General Biology

The Jemez Mountains salamander is one of two species of plethodontid (lungless) salamanders endemic to New Mexico. The species exists in the Jemez Mountains in north-central New Mexico in Los Alamos, Rio Arriba, and Sandoval counties (Stebbins and Riemer 1950). The Jemez Mountains salamander occurs at elevations between 6,988 and 11,254 feet (2,130 to 3,430 m) in mixed-conifer forest that consists primarily of Douglas fir (*Pseudotsuga menziesii Mirb.*), blue spruce (*Picea pungens Engelm.*), Engelmann spruce (*Picea engelmannii Parry*), white fir (*Abies concolor Gord.*), limber pine (*Pinus flexilis E. James*), ponderosa pine, Rocky Mountain maple (*Acer glabrum Torr.*), and aspen (*Populus tremuloides Michx.*; Degenhardt et al. 1996). Although pure stands of ponderosa pine might not be considered ideal habitat, the species has been found occasionally in this forest type. The species has also been found occasionally in spruce-fir and aspen stands and high-elevation meadows.

The Jemez Mountains salamander spends most of its life underground but can be found at the surface when conditions are warm and wet, typically from July through September. Occasional salamander observations have been made during May, June, and October (USFWS 2013b). When on the surface, the species usually is found under decaying logs, rocks, bark or moss mats, or inside decaying logs or stumps. The salamander is strictly terrestrial and does not use standing surface water for any life stage. Respiration occurs through the skin, which requires a moist microclimate for gas exchange. The Jemez Mountains salamander is uniformly grayish dark brown above (dorsal side), with occasional gold stippling and sooty gray below (ventral side). The salamander is slender and elongate, and it possesses foot webbing and a reduced fifth toe. The average Jemez Mountains salamander is approximately 3.2 in. (82 mm) in total length; eats invertebrates including ants, mites, and beetles; and is thought to lay its eggs underground (USFWS 2013b).

4.2.2 Conservation History and Current Status

The Jemez Mountains salamander was listed in New Mexico as endangered under the Wildlife Conservation Act of New Mexico in 2006 (NMDGF 2006). In September 2012, USFWS proposed the Jemez Mountains salamander as endangered under the ESA (USFWS 2012b). The final listing of the Jemez Mountains salamander as federally endangered under the ESA was issued September 10, 2013 (USFWS 2013b). On November 20, 2013, the USFWS issued the designation of critical habitat for the Jemez Mountains salamander (USFWS 2013c).

4.2.3 Survey Methods

The New Mexico Department of Game and Fish and the USFWS collaborated on the development of survey techniques for the Jemez Mountains salamander. Federal and state law requires permits before conducting surveys. The Jemez Mountains salamander visual encounter surveys consist of three-person-hour surveys or until first detection of the species. We perform a moisture assessment of the survey area before all surveys to determine if conditions are suitable for salamander surface activity. Surveyors should look under 10 cover objects to assess moisture levels. If soil is dry to the touch, do not survey. If soil is moist to the touch, then proceed with the survey.

We collect current weather, soil moisture, soil pH, and soil temperature data before the salamander survey begins. Once conditions are determined to be suitable for a salamander survey, the three-person-hour survey begins. One individual is the center point and lead for the survey and is responsible for tracking time; the remaining surveyors stand approximately 30 ft (9 m) apart in a line. We collect GPS coordinates for the initial survey point, midpoint, and conclusion of the area surveyed. We turn over all cover objects and then place them back into their former position. If a surveyor finds a salamander, the person who captures the salamander shouts “salamander!” to notify the remaining survey crew to stop surveying. They immediately place the salamander into a plastic bag with a small amount of water. A small spray bottle of distilled water can be useful for moistening the salamander. We record morphological measurements (snout-vent-length, total length, and tail condition) and microhabitat data (i.e., cover object type and size, soil temperature, soil pH, and current weather conditions). We swab all salamanders on their ventral (bottom) side approximately 30 times, making sure to swab the cloaca (vent) area well and the bottom of the feet approximately 10 times for *Batrachochytrium dendrobatidis* (Bd) pathogen sampling. We document GPS coordinates at the salamander location. The USFWS recommends that biologists conduct repeat salamander surveys at the same site within a survey season. To prevent inadvertent movement of disease or parasitic organisms among sites, we must clean and disinfect field equipment and boots in accordance with the disinfection protocols provided by the USFWS.

4.2.4 History of Results

Before being listed as endangered under the ESA in 2013, biologists documented two Jemez Mountains salamander locations at LANL. They conducted surveys in 1985 and began again in 2007. Ramotnik (1986) documented the salamander in Los Alamos Canyon—east of the Omega Bridge—by and west of the bridge by Hathcock (LANL 2008). In 2014, biologists conducted surveys in Los Alamos Canyon, Cañon de Valle, and around the Fenton Hill facility; they detected no salamanders. In 2015, biologists conducted Jemez Mountains salamander surveys in Los Alamos Canyon, Twomile Canyon, and around the Fenton Hill facility; they found two salamanders in Los Alamos Canyon. Surveys in 2016 focused on U.S. Forest Service property west of LANL for a LANL's Paleoseismic Trenching Project. We have detailed the history of Jemez Mountains salamander survey results in Table 4-2.

Table 4-4-2. Jemez Mountains Salamander Survey Results at LANL

Year	Los Alamos Canyon	Pajarito Canyon	Twomile Canyon	Cañon de Valle	Fenton Hill
1985	P	—	N	N	N
2008	P	—	—	—	—
2009	—	—	—	—	—
2010	—	—	N	—	—
2011	—	—	—	—	—
2012	—	—	—	—	N
2013	—	—	—	—	N
2014	N	—	—	N	—
2015	P	N	N	—	N
2016	—	—	—	—	—
2017	—	—	—	—	—
2018	—	—	—	—	—
2019	N	—	—	—	—
2020	—	—	—	—	—
2021	N	—	—	—	—
2022	N	—	—	—	—
2023	N	—	—	—	—
2025	N	—	—	—	—

— = No data; N = Negative survey; P = Positive survey

In 2024 and 2025, biologists conducted surveys within and surrounding the proposed footprint of a wildland fire thinning project in Los Alamos Canyon. Jemez Mountains salamanders have historically occupied some areas within the project footprint, so we focused surveys within those areas. The project underwent formal section 7 consultation and received a Biological Opinion in 2025 (see Section 3). We found no salamanders during surveys in these areas in 2024 or 2025, but we will continue to survey historically occupied habitat in the project area before and after project implementation.

4.2.5 Disease

One of the factors in the federal listing (USFWS 2013b) was risk to the Jemez Mountains salamander from disease. In 2003, biologists found the amphibian pathogenic fungus Bd in a Jemez Mountains salamander (Cummer et al. 2005) on the east side of the species' range and again in another salamander in 2010 on the west side of the species' range (USFWS 2013b). Because biologists seldom achieve suitable conditions for conducting surveys for the Jemez Mountains salamander, a proxy for assessing quality habitat available to Jemez Mountains salamander might be to test for prevalence of Bd in other amphibian species in the Jemez Mountains. Therefore, LANL biologists have proactively been monitoring for Bd since 2007. In 2010, 2015, and 2016, we swabbed four Jemez Mountains salamanders found on or near LANL for Bd, and test results from Pisces Molecular, LLC, laboratory were negative. Since 2007, we have swabbed various other amphibians, and all were negative for Bd.

In a separate study in 2015, we collected, anesthetized, and euthanized 10 larval-stage (neotenic adult and juvenile) tiger salamanders (*Ambystoma tigrinum*) from the Milagro Pond at Technical Area 57. We took swab samples on the outer dermis and on all mouth parts to examine if larval stage tiger salamanders have enough keratin in their outer dermis (compared with keratinized mouth parts) to be able to detect Bd. All 20 swabs were negative for Bd. We also collected tissue samples from all 10 tiger salamanders and tested the samples for ranavirus, another amphibian pathogen; these results were also negative. We collected one swab sample from a canyon tree frog (*Hyla arenicolor*) in 2018; it was negative. We analyzed swabs collected from tiger salamanders in 2019, and all results were negative for the presence of Bd, as were results from one Jemez Mountains salamander caught in 2021. We have sent 97 samples collected from around the greater Jemez Mountains area for analysis, and all were negative for Bd and ranavirus. We need continued and more extensive sampling to monitor for Bd at LANL.

4.3 SOUTHWESTERN WILLOW FLYCATCHER

4.3.1 General Biology

The southwestern willow flycatcher is a small migratory bird about 6 in. (15 cm) long with gray-green back and wings, white throat, gray-olive breast, and pale-yellow belly. It also has two obvious pale wing-bars but lacks the conspicuous pale eye-ring of many similar *Empidonax* species. While perched, the southwestern willow flycatcher characteristically flicks its tail slightly upward. It is best identified by vocalizations or genetic analyses. The primary song, "fitz-bew," can be interspersed with britt notes (USFWS 2002). The southwestern willow flycatcher is found in close association with dense stands of willows (*Salix L.*), arrowweed (*Pluchea spp.*), buttonbush (*Cephalanthus occidentalis L.*), tamarisk (*Tamarix L.*), Russian olive (*Elaeagnus angustifolia L.*), and other riparian vegetation, often with a scattered overstory of cottonwood (*Populus L.*; USFWS 2002). The size of vegetation patches or habitat mosaics used by the southwestern willow flycatcher varies considerably and ranges from as small as 2 ac (0.8 ha) to several hundred acres. The southwestern willow flycatcher nests in thickets of trees and shrubs approximately 6.5 to 50 ft (2 to 15 m) tall, with a high percentage of canopy cover and dense foliage from 0 to 13 ft (0 to 4 m) above ground. Regardless of the plant species composition or height, occupied sites always have dense vegetation in the patch interior (Sogge et al. 2010).

4.3.2 Conservation History and Current Status

The southwestern willow flycatcher was given a status review and possible listing as an endangered or threatened species on September 1, 1992 (USFWS 1992). The review was proposed due to serious population declines, historical and present habitat destruction, and inadequate regulatory protections. The southwestern willow flycatcher was given full protection under the ESA as endangered on February 27, 1995 (USFWS 1995b). The listing also received revisions to critical habitat on January 3, 2013 (USFWS 2013d). The southwestern willow flycatcher is known to have breeding territories in all states of its historical range except Texas; however, its continued existence is in jeopardy due to continued riparian habitat reduction, degradation, and elimination caused by land and water management actions associated with agricultural and urban development. Other threats include predation, cowbird (*Molothrus spp.*) brood parasitism, and naturally occurring fires and floods that have become more frequent and intense as a result of the proliferation of exotic vegetation and degraded watersheds (USFWS 2002).

4.3.3 Survey Methods

Federal permits are required before conducting surveys. The survey methods for documenting the presence/absence of southwestern willow flycatchers rely on broadcast call-playback technique. Surveyors play an electronic recording of a willow flycatcher to elicit a response from a territorial bird, thereby increasing the detectability of a resident bird. Surveys should be initiated in the pre-dawn hours and continue until all suitable habitat has been covered or until environmental factors or adverse anthropogenic sources hinder conducting a full and adequate survey. Additionally, one way to determine if flycatchers found at a particular site are migrants or territorial breeders is to find them present during the "non-migrant" period, which generally is from about June 15 through July 20. A willow flycatcher found during this time probably is a territorial bird, although a small chance exists that it could be a non-territorial floater (Sogge et al. 2010). Differing numbers of visits must be conducted for general surveys versus project-related surveys, with a minimum of one survey within each of the three survey periods for general surveys. For project-related surveys, one survey within the first survey period must be conducted, and the second and third survey periods must each have two surveys conducted. Surveys must be conducted with at least 5 days between surveys. Survey periods are as follows: Survey Period 1 occurs May 15 through May 31, Survey Period 2 occurs June 1 through June 24, and Survey Period 3 occurs June 25 through July 17.

4.3.4 History of Results

LANL biologists conduct surveys annually in the Sandia and Pajarito wetlands following linear transects. Pajarito wetlands is the only AEI for the southwestern willow flycatcher at LANL in the HMP. The Sandia wetlands is not listed as an AEI for the flycatcher, and surveys in this area are not required but are conducted when time is available. We have conducted call-playback surveys annually since 1995 in the Pajarito wetlands and since 2014 in the Sandia wetlands, and no southwestern willow flycatchers have been found to be breeding in these areas. A monitoring avian productivity and survivorship banding station operated in the Sandia wetlands since 2014 has captured multiple willow flycatchers of unknown subspecies during the spring migration period. A fall banding station operated since 2010 within the Pajarito wetlands has captured multiple willow flycatchers of unknown subspecies during the fall migration period.

Biologists defined AEIs by the presence of riparian habitat and suitable wetland vegetation—wetlands with stands of dense willows at least 2 m (7 ft) tall and 30 m (98 ft) wide—including a buffer area within

100 m (328 ft) of the core areas (LANL 2022b). However, over the past 30 years, the Pajarito wetlands has undergone drastic vegetation changes due to ongoing drought conditions and changes in water flows in Pajarito Canyon. Although we still manage the AEI as southwestern willow flycatcher habitat under the current HMP, we have discontinued annual surveys due to the condition of the habitat. In 2025, we hosted a site visit with the USFWS species lead during which we collectively determined that there is no need to continue surveys. In the 2026 update of the LANL HMP, we will remove the Pajarito wetlands as a southwestern willow flycatcher AEI. We also use ARUs to opportunistically monitor for the willow flycatcher along the Rio Grande.

4.4 YELLOW-BILLED CUCKOO

4.4.1 General Biology

The yellow-billed cuckoo is a neotropical migrant bird with a mostly yellow bill, brownish back, rufous wings, and all white underneath. In flight and when perched, large white spots and edging to tail feathers are prominent. The yellow-billed cuckoo is a riparian obligate species; therefore, it nests almost exclusively in low-mid elevation riparian/riverine habitat typically dominated by a cottonwood-willow matrix (Halterman et al. 2015). It is a late spring migrant and therefore has one of the shortest nesting phases of any bird species. The cuckoo tends to time its breeding to coincide with locally abundant food supplies (Hughes 2015).

4.4.2 Conservation History and Current Status

The yellow-billed cuckoo was noted as declining in California as early as 1944 (Grinnell and Miller 1944). The yellow-billed cuckoo was first posted to the Federal Register for review of possible listing as an endangered or threatened species on December 30, 1982 (USFWS 1982). On October 3, 2013, USFWS proposed listing the western distinct population segment of the yellow-billed cuckoo as threatened. Following multiple public comment periods and a proposal to designate critical habitat for the yellow-billed cuckoo, the USFWS designated it as a threatened species within the western United States, Canada, and Mexico (USFWS 2014a). The species is no longer thought to breed in western Canada or the northwestern continental United States areas of Washington, Oregon, and Montana (USFWS 2014a). On April 21, 2021, the USFWS issued the designation of critical habitat for the yellow-billed cuckoo (USFWS 2021).

4.4.3 Survey Methods

Permitted biologists conduct surveys along the Rio Grande on LANL's southeastern boundary following a continuous linear transect with a broadcast call-playback technique. They must conduct at least one survey per survey period, with no fewer than 12 days and no more than 15 days between surveys in survey periods 1 and 3: survey period 1 occurs June 15 through July 1, and survey period 3 occurs July 31 through August 15. They must conduct at least two surveys in survey period 2 (July 1 through July 31). They start the surveys at first light and continue until they cover all points or suitable habitat. They should make a special effort to complete the survey route before 11:00 a.m. because activity levels decrease significantly after this time (Halterman et al. 2015). The survey protocol should consist of five contact calls, (e.g., "kowlp") spaced 1 minute apart with an initial minute of listening for calls when arriving at survey points. Survey points should be approximately 328 ft (100 m) apart; however, if they identify a cuckoo at a survey point, the biologist should move at least 984 ft (300 m) away so an individual is not recounted. We also use ARUs to opportunistically monitor for the yellow-billed cuckoo along the Rio Grande.

4.4.4 History of Results

In 2016, LANL biologists surveyed a stretch of potential habitat along LANL's southern boundary; those surveys were negative for the cuckoo. Biologists conducted no surveys during 2017 through 2021 due to the lack of a programmatic need for surveys. Between 2022 and 2025, LANL biologists conducted surveys and monitoring for the yellow-billed cuckoo in White Rock Canyon to assess potential habitat impacts from upcoming utility projects that will cross the Rio Grande. These efforts were prompted by earlier guidance (Keller 2015) that required review of any LANL activities that could affect the species' habitat and by ongoing degradation of riparian areas from feral cattle. In 2022, biologists detected one yellow-billed cuckoo who was likely using the area as stopover habitat during migration. Biologists recorded no detections during subsequent surveys or ARU monitoring in 2023 and 2024. Although they conducted no formal surveys in 2025, a breeding pair was observed in Upper Water Canyon, approximately half a mile from LANL property, from June 3 through 13, with evidence of breeding (copulation observed) but no confirmed nesting or fledglings.

4.5 NEW MEXICO MEADOW JUMPING MOUSE

4.5.1 General Biology

The New Mexico meadow jumping mouse (*Zapus hudsonius luteus*) is endemic to the states of New Mexico, Arizona, and portions of southern Colorado (Hafner et al. 1981). The mouse is grayish-brown on the back, yellowish-brown on the sides, and white underneath. The species is about 7 to 10 in. (187 to 255 mm) in total length, with elongated feet and an extremely long, bicolored tail. It nests in dry soils but uses moist, streamside, and dense riparian/wetland vegetation up to elevations of about 8,000 ft (2,438 m; Frey 2006). The mouse appears to use only riparian community types that consist of persistent, emergent herbaceous wetlands such as beaked sedge (*Carex rostrata Stokes*) and reed canarygrass (*Phalaris arundinacea L.*) alliances and scrub-shrub wetlands such as riparian areas composed of willow and alder along perennial streams (*Alnus spp.*; Frey 2005). The mouse is generally nocturnal and occasionally diurnal. It is active only during the growing season of the grasses and forbs on which it depends, when the mouse accumulates fat reserves by consuming seeds and insects to sustain it through hibernation.

4.5.2 Conservation History and Current Status

The USFWS first proposed adding the mouse as a threatened or endangered animal on September 18, 1985 (USFWS 1985). On July 10, 2014, the New Mexico meadow jumping mouse was given protection under the ESA as an endangered species, with a final determination of critical habitat designated on March 15, 2016 (USFWS 2016).

4.5.3 Survey Methods

No formal survey methods approved by the USFWS exist at the time of this report.

4.5.4 History of Results

No records exist of the meadow jumping mouse from within the LANL boundary of Los Alamos County (BISON-M 2021, LANL 2009).

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