DEPARTMENT OF THE INTERIOR

Fish and Wildlife Service

50 CFR Part 17

[Docket No. FWS–R2–ES–2012–0063; 4500030113]

RIN 1018–AY24

Endangered and Threatened Wildlife and Plants; Determination of Endangered Species Status for Jemez Mountains Salamander (Plethodon neomexicanus) Throughout Its Range

AGENCY: Fish and Wildlife Service, Interior.

ACTION: Final rule.

SUMMARY: We, the U.S. Fish and Wildlife Service, determine endangered species status under the Endangered Species Act of 1973 (Act), as amended, for the Jemez Mountains salamander (*Plethodon neomexicanus*). This final rule implements the Federal protections provided by the Act for this species. We have also determined that critical habitat for the Jemez Mountains salamander is prudent and determinable in the proposed rule and will soon publish in the **Federal Register** our final determination designating critical habitat for the Jemez Mountains salamander.

DATES: This rule becomes effective October 10, 2013.

ADDRESSES: This final rule is available on the Internet at *http://www.fws.gov/southwest/es/NewMexico/index.cfm,* and the rule as well as comments and materials received are available at *http://www.regulations.gov* at Docket No. FWS–R2–ES–2012–0063. Comments and materials received, as well as supporting documentation used in the preparation of this rule, will also be available for public inspection, by appointment, during normal business hours at: U.S. Fish and Wildlife Service, New Mexico Ecological Services Field Office, 2105 Osuna NE., Albuquerque, NM 87113; by telephone 505–346–2525; or by facsimile 505–346–2542.

FOR FURTHER INFORMATION CONTACT: Wally Murphy, Field Supervisor, U.S. Fish and Wildlife Service, New Mexico Ecological Services Field Office (see **ADDRESSES** section). If you use a telecommunications device for the deaf (TDD), call the Federal Information Relay Service (FIRS) at 800–877–8339.

SUPPLEMENTARY INFORMATION:

Executive Summary

Why we need to publish a rule. Under the Act, a species or subspecies may warrant protection through listing if it is endangered or threatened throughout all or a significant portion of its range. Listing a species as an endangered or threatened species can only be completed by issuing a rule. On September 12, 2012 (77 FR 56482), we proposed to list the Jemez Mountains salamander (*Plethodon neomexicanus*) under the Act as an endangered species and proposed to designate critical habitat. In that document we explained that the species currently faces numerous threats of high magnitude, and, therefore, qualifies for listing and requested additional information and comments on the proposed listing. This final rule considers all comments received by peer reviewers, tribes, State agencies, Federal agencies, and the public regarding the proposed rule to list the Jemez Mountains salamander. This is our final determination to list the Jemez Mountains salamander as endangered.

The basis for our action. Under the Act, a species may be determined to be an endangered or threatened species based on any of five factors: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; and (E) other natural or manmade factors affecting its continued existence. We have determined that the Jemez Mountains salamander meets the definition of an endangered species due to three of these five factors.

Peer review and public comment. We sought comments from independent specialists to ensure that our designation is based on scientifically sound data, assumptions, and analyses. We invited these peer reviewers to comment on our listing proposal. We also considered all comments and information received during the comment period.

Background

Previous Federal Actions

Please refer to the proposed listing rule for the Jemez Mountains salamander (77 FR 56482; September 12, 2012) for a detailed description of previous Federal actions concerning this species.

We have also determined that critical habitat for the Jemez Mountains salamander is prudent and determinable in the proposed rule and will soon publish in the **Federal Register** our final determination designating critical habitat for the Jemez Mountains salamander.

Species Information

The Jemez Mountains salamander is uniformly dark brown above, with occasional fine gold to brassy coloring with stippling dorsally (on the back and sides) and is sooty gray ventrally (underside). The salamander is slender and elongate, and it possesses foot webbing and a reduced fifth toe. This salamander is a member of the family Plethodontidae, is strictly terrestrial, and does not use standing surface water for any life stage. Respiration (the exchange of oxygen and carbon dioxide) occurs through the skin, which requires a moist microclimate for gas exchange.

Taxonomy and Species Description

The Jemez Mountains salamander was originally reported as *Spelerpes multiplicatus* (=*Eurycea multiplicata*) in 1913 (Degenhardt *et al.* 1996, p. 27); however, it was described and recognized as a new and distinct species (*Plethodon neomexicanus*) in 1950 (Stebbins and Riemer, pp. 73–80). No subspecies of the Jemez Mountains salamander are recognized.

The Jemez Mountains salamander is one of two species of plethodontid salamanders' endemic (native and restricted to a particular region) to New Mexico: the Jemez Mountains salamander and the Sacramento Mountains salamander (*Aneides hardii*). Unlike most other North American plethodontid salamanders, these two species are geographically isolated from all other species of *Plethodon* and *Aneides.*

Genetic studies on plethodontid salamanders in North America suggest that the Jemez Mountains salamander is more closely related to western *Plethodon* species than to eastern *Plethodon* salamanders, and that the Larch Mountain salamander (*P. larselli*) found in Oregon and Washington is no longer considered the most closely related species to the Jemez Mountains salamander (Mahoney 2001, p. 184). In many of the analyses presented by Mahoney 2001 (entire), the Jemez Mountains salamander is basal to all other western *Plethodon* (that is, it maintains the most derived characters, or, that other western *Plethodon* are more closely related to each other than any are to the Jemez Mountains salamander), but still, the relationship of the Jemez Mountains salamander to other western plethodontid salamanders remains partially unresolved. Nonetheless, it has been demonstrated that the Jemez Mountains salamander's closest relatives are western salamanders of the Pacific Northwest of the United States and include Van Dyke's salamander (*P. vandykei*), Larch Mountain salamander (*P. larselli*), Siskiyou Mountains salamander (*P. stormi*), Del Norte salamander (*P. elongatus*), western red-backed salamander (*P. vehiculum*), Dunn's salamander (*P. dunni*), and the green salamander (*Aneides aeneus*) (Mahoney 2001, pp. 178–183). These species, including the Jemez Mountains salamander, are thought to be the result of an old, rapid diversification (Mahoney 2001, p. 185).

Distribution

The distribution of plethodontid salamanders in North America has been highly influenced by past changes in climate and associated Pleistocene glacial cycles. In the Jemez Mountains, the lack of glacial landforms indicates that alpine glaciers may not have developed here, but evidence from exposed rocky areas (felsenmeers) may reflect near-glacial conditions during the Wisconsin Glacial Episode (Allen 1989, p. 11). Conservatively, the salamander has likely occupied the Jemez Mountains for at least 10,000 years, but this could be as long as 1.2 million years, colonizing the area subsequent to volcanic eruption.

The Jemez Mountains salamander is restricted to the Jemez Mountains in northern New Mexico, in Los Alamos, Rio Arriba, and Sandoval Counties, around the rim of the collapsed caldera (large volcanic crater), with some occurrences on topographic features (e.g., resurgent domes) on the interior of the caldera. The majority of salamander habitat is located on federally managed lands, including the U.S. Forest Service (USFS), the National Park Service (Bandelier National Monument), Valles Caldera National Preserve, and Los Alamos National Laboratory, with some habitat located on tribal land and private lands (New Mexico Endemic Salamander Team 2000, p. 1). The Valles Caldera National Preserve is located west of Los Alamos, New Mexico, and is part of the National Forest System (owned by the U.S. Department of Agriculture), but run by a nine-member Board of Trustees: the Supervisor of Bandelier National Monument, the Supervisor of the Santa Fe National Forest, and seven other members appointed by the President of the United States with distinct areas of experience or activity (Valles Caldera Trust 2005, pp. 1–11). Prior to Federal ownership in 2000, the Valles Caldera National Preserve was privately held. The species predominantly occurs at an elevation between 7,200 and 9,500 feet (ft) (2,200 and 2,900 meters (m)) (Degenhardt *et al.* 1996, p. 28), but has been found as low as 6,998 ft (2,133 m) (Ramotnik 1988, p. 78) and as high as 10,990 ft (3,350 m) (Ramotnik 1988, p. 84).

Biology

The Jemez Mountains salamander is strictly terrestrial, does not possess lungs, and does not use standing surface water for any life stage. Respiration (the exchange of oxygen and carbon dioxide) occurs through the skin, which requires a moist microclimate for gas exchange. Substrate moisture through its effect on absorption and loss of water is probably the most important factor in the ecology of this terrestrial salamander, as it is in other strictly terrestrial salamander species (Heatwole and Lim 1961, p. 818). The Jemez Mountains salamander spends much of its life underground, but can be found above ground when relative environmental conditions are warm and wet, which is typically from July through September; but occasional salamander observations have been made in May, June, and October. Relatively warm and wet environmental conditions suitable for salamander aboveground activity are likely influenced by melting snow and summer monsoon rains. When active above ground, the species is usually found under decaying logs, rocks, bark, or moss mats or inside decaying logs or stumps.

Changes in pH (acidity or alkalinity) can affect plethodontid salamander behavioral and physiological responses (Cummer and Painter 2007, p. 34). In one study of the Jemez Mountains salamander, soil pH was the single best indicator of relative abundance of salamanders at a site (Ramotnik 1988, pp. 24–25). Sites with salamanders had a soil pH of 6.6 (± 0.08) and sites without salamanders had a soil pH of 6.2 (± 0.06). In another species of a terrestrial plethodontid salamander, the red-backed salamander (*Plethodon cinereus*), soil pH influences and limits its distribution and occurrence as well as its oxygen consumption rates and growth rates (Wyman and Hawksley-Lescault 1987, p. 1823). Similarly, Frisbie and Wyman (1991, p. 1050) found the disruption of sodium balance by acidic conditions in three species of terrestrial salamanders. A low pH substrate can also reduce salamander body sodium, body water levels, and body mass (Frisbie and Wyman 1991, p. 1050). Significant differences in habitat features (soil pH, litter depth, and log size) were reported between the logged and unlogged sites (Ramotnik 1986, p. 8). We do not know if salamanders actually occupied the logged sites prior to logging, but significant differences in habitat features (soil pH, litter depth, and log size) between the logged and unlogged sites were reported (Ramotnik 1986, p. 8). The type and quantity of vegetation affects soil pH (e.g. pine needles are acidic, decomposed pine needles can increase the soils acidity), and thus could also affect the salamander.

Salamander prey from aboveground foraging is diverse in size and type, with ants (Hymenoptera, Formicidae), mites (Acari), and beetles (Coleoptera) being most important (most numerous, most voluminous, and most frequent) in the salamander's diet (Cummer 2005, p. 43). Cummer (2005, pp. 45–50) found that specialization on invertebrate species was unlikely, but there was likely a preferential selection of prey categories (ants, mites, and beetles).

The aboveground microhabitat (under or inside cover objects) temperature for some Jemez Mountains salamanders ranged from 43 to 63 degrees Fahrenheit (°F) (6.0 to 17.0 degrees Celsius (°C)), with an average of 54.9 °F (12.7 °C) (Williams 1972, p. 18). Significantly more salamanders were observed under logs where temperatures were closest to the average temperature (Williams 1972, p. 19).

Sexual maturity is attained at 3 to 4 years in age for females and 3 years for males (Williams 1976, pp. 31, 35). Reproduction in the wild has not been observed; however, based on observed physiological changes, mating is believed to occur above ground between July and August during the rainy season (Williams 1976, pp. 31–36). Based on examination of 57 female salamanders in the wild and 1 clutch of eggs laid in a laboratory setting, Williams (1978, p. 475) concluded that females likely lay 7 or 8 eggs every 2 to 3 years. Eggs are thought to be laid underground in the spring, about 9 to 10 months after mating occurs (Williams 1978, p. 475). Fully formed Jemez Mountains salamanders hatch from the eggs.

The lifespan of the salamander in the wild is unknown. However, in 2013 a marked salamander was observed at a previous study site where salamanders were uniquely marked with fluorescent elastomer (a colored epoxy injected under the skin) from 1996 through 2000. Based on the colors used, this salamander was likely marked in 1998 or 1999. Juvenile salamanders received a different kind of marking, indicating that this wild salamander is minimally 14 years old, but more likely 15–17 years old.

Movements, Home Range, and Dispersal

Ramotnik (1988, pp. 11–12) used implanted radioactive wires in polyethylene tubing to track nine individual Jemez Mountain salamanders for durations between 2 days and 6 weeks, monitoring their movements every 1 to 3 days, and two salamanders were tracked every 2 hours throughout a 12-hour period. Ramotnik (1988, p. 27) reported that individual distances salamanders moved between consecutive observations ranged from 0 to 108 ft (0 to 33 m) and that 73 percent of recorded movements were less than 3.3 ft (1 m). In 59 of 109 observations, salamanders did not move. When the zero-distance movements were excluded from analysis, the average distance salamanders moved was 7.8 ft (2.4 m), and the greatest total recorded distance of an individual was 144 ft (43.9 m) over 22 days (Ramotnik 1988, p. 28). Ramotnik (1988, p. 32) also estimated the home range of six salamanders with these data and reports the average home range was 86 square feet (ft^2) (8.0 square meters (m^2)); males had a larger home range (137 ft^2 (12.7 m^2)) than females (78 ft^2 (7.2 m^2)). The individuals that had larger home ranges (greater than 54 ft^2 (5.0 m^2)) were often found returning to the same cover object; whereas individuals with home ranges less than 54 ft^2 (5 m^2) rarely returned to the same spot (Ramotnik 1988, p. 32). The smallest estimated home range was 10.7 ft^2 (1 m^2) and the largest 220.7 ft^2 (20.5 m^2) (Ramotnik 1988, p. 28).

In a mark–recapture study conducted by the New Mexico Department of Game and Fish (NMDGF), the average distance of 32 movements measured via recapture either in the same year or from year to year, measured over the course of approximately 10 years within a 164-ft-by-164-ft (50-m-by-50-m) plot, was 19.6 ft (5.98 m), with a maximum distance moved from original capture site of 60.7 ft (18.5 m) (NMDGF 2000, p. 15). In this same study, one salamander was observed near the same log nearly 5 years later (NMDGF 2000, p. 16). The data from this study suggest that Jemez Mountains salamanders generally move very little (NMDGF 2000, p. 16). While the data on Jemez Mountains salamander movements are limited because of small sample size, they provide important information on the relatively small movements made by individuals and their relatively small home range, and show that, occasionally, individuals can make larger movements.

For another well-studied terrestrial salamander, the red-backed salamander (*Plethodon cinereus*), researchers have conflicting evidence regarding dispersal abilities. Some information suggests this salamander exhibits small movements, even across multiple years, consisting primarily of small home ranges and with little movement among cover objects (53–269 ft^2, 5–25 m^2) (Kleeberger and Werner 1982, p. 411). However, there is other evidence of moderate-distance homing ability (90 m, 295 ft) (Kleeberger and Werner 1982, p. 411). Cabe *et al.* 2007 (pp. 53–60) measured gene flow of red-backed salamanders across a continuous forested habitat as an indicator of the salamander's dispersal. They suggested that gene flow and dispersal frequency were normally low, indicating that red-backed salamanders generally do not move much, but under certain circumstances, they might disperse farther than normal. These unique conditions occur when the population density of red-backed salamanders is so high in a given area that the habitat is saturated with them, resulting in a reduction in breeding success, and other, less densely populated habitat is available (Cabe *et al.* 2007, p. 53). In a more closely related terrestrial salamander, the Siskiyou Mountains salamander, individuals are reported to make daily to seasonal vertical migrations in the ground surface as microclimate conditions change, but not extensive horizontal movements (Olson *et al.* 2009, p. 3). Furthermore, genetic analyses indicate limited gene flow in the Siskiyou Mountains salamander and that populations may have been on isolated evolutionary pathways for a very long time (Olson *et al.* 2009, p. 3).

Because the Jemez Mountains salamander makes very small horizontal movements and has limited potential for long-distance horizontal movements, habitat connectivity limitations could have profound effects on populations. These effects could occur from increased vulnerability to genetic drift (the process where small population size causes chance alterations in the genetic composition of a population by natural selection) and inbreeding, fewer successful breeding opportunities, and increased susceptibility to stochastic events (occurring in a random pattern, such as floods, fires, and tornados). Gene flow and population structure has not been assessed in the Jemez Mountains salamander, but would provide useful information for population management and identification of important areas to protect in order to maintain habitat connectivity.

Habitat

The strictly terrestrial Jemez Mountains salamander predominantly inhabits mixed-conifer forest, consisting primarily of Douglas fir (*Pseudotsuga menziesii*), blue spruce (*Picea pungens*), Engelman spruce (*P. engelmannii*), white fir (*Abies concolor*), limber pine (*Pinus flexilis*), Ponderosa pine (*P. ponderosa*), Rocky Mountain maple (*Acer glabrum*), and aspen (*Populus tremuloides*) (Reagan 1967, p. 17; Degenhardt *et al.* 1996, p. 28). Although pure stands of Ponderosa pine may not be considered ideal habitat, the species has occasionally been found in this habitat. The species has also occasionally been found in spruce-fir and aspen stands, and high-elevation meadows. However, these habitat types have not been adequately surveyed so the extent to which salamanders use these habitats is not fully known. Predominant understory trees include Rocky Mountain maple (*Acer glabrum*), New Mexico locust (*Robinia neomexicana*), oceanspray (*Holodiscus sp.*), and various shrubby oaks (*Quercus* spp.) (Reagan 1967, p. 17; Degenhardt *et al.* 1996, p. 28).

Everett (2003, entire) reported habitat variables for 23 sites where Jemez Mountains salamanders were found. Everett (2003) reported that the salamander occurred on all slope aspects (p. 21) (the average slope ranged from 4 to 40.5 degrees (p. 24)); were within 14.0 to 99.8 percent canopy cover and averaged 58.2 to 94.3 percent canopy cover (p. 24); and were found under logs (35 percent), rocks (34 percent), bark (9 percent), and inside logs (22 percent). Available cover objects included rock (52 percent), coarse woody debris (7 percent), bark (11 percent), and cow pie (i.e., manure, less than 1 percent) (p. 24). There may be high-elevation meadows located within the critical habitat units that are used by the Jemez Mountains salamander. Currently, we do not fully understand how salamanders utilize areas like meadows, where the above ground vegetation component differs from areas where salamanders are more commonly encountered (e.g., forested areas); however, salamanders have been found in high-elevation meadows. Salamanders are generally found in association with decaying coniferous logs (which they use as cover and daytime retreats), and in areas with abundant white fir, Ponderosa pine, and Douglas fir as the predominant tree species (Reagan 1967, pp. 16–17; Ramotnik 1988, p. 17). Salamanders use decaying coniferous logs (particularly Douglas fir logs) considerably more often than deciduous logs, likely due to the physical features (e.g., blocky pieces with cracks and spaces) that form as coniferous logs decay (Ramotnik 1988, p. 53). Still, the species may be found beneath some deciduous logs and excessively decayed coniferous logs, because these can provide aboveground habitat and cover (Ramotnik 1988, p. 53).

Subsurface geology and loose rocky soil structure may be an important attribute of underground salamander habitat (Degenhardt *et al.* 1996, p. 28). Geologic and moisture constraints likely limit the distribution of the species. Soil pH (acidity or alkalinity) may limit distribution as well. However, the composition of this subterranean habitat has not been fully investigated. Everett (2003) reported that the salamander occurred in areas where soil texture was composed of 56 percent sandy clay loam, 36 percent clay loam, 6 percent sandy loam, and 2 percent silty clay loam (p. 28); the overall soil bulk density ranged from 0.2 to 0.98 ounces per cubic inch (oz/in^3) (0.3 to 1.7 grams per cubic centimeter (g/cm^3) (p. 28); and had average soil moisture from 4.85 to 59.7 percent (p. 28). The salamander's subterranean habitat appears to be deep, fractured, subterranean, igneous rock in areas with high soil moisture (New Mexico Endemic Salamander Team 2000, p. 2). Many terrestrial salamanders deposit eggs in well hidden sites, such as underground cavities, decaying logs, and moist rock crevices (Pentranka 1998, p. 6). Because the Jemez Mountain salamander spends the majority of its life below ground, eggs are probably laid and hatch underground. Although no egg clutches have been discovered in the wild, it is believed they are laid in the fractured interstices of subterranean, metamorphic rock.

Jemez Mountain salamanders lack lungs; instead, they are cutaneous respirators (meaning they exchange gases, such as oxygen and carbon dioxide, through their skin). To support cutaneous respiration its skin must be moist and permeable. Jemez Mountain salamanders must address hydration needs above all other life-history needs. The salamander must obtain its water from its habitat. In addition, it has no physiological mechanism to stop dehydration or water loss to the environment. Based on this information, it is likely that substrate moisture through its effect on absorption and loss of water is the most important factor in the ecology of this species (Heatwole and Lim 1961, p. 818). We suspect that these components may be a main driver behind salamander occurrences and distribution. We are aware of two modeling efforts that have been initiated on the relationship of subsurface rock and soil components of salamander habitat that we anticipate will help inform our understanding of the distribution of the salamander, but these are not yet completed. In addition, because microclimates where conditions are moist and cool are important to the species, we also suspect that variables that contribute to or work in concert with one another to provide moist cool microclimates are important to the species. For example, shading on hills provided by topography and mosaic patterns in canopy closure provide shading and allow precipitation to reach the soil.

Status of the Species

A complete overview of the available survey data and protocols for the Jemez Mountains salamander is reported in the 12-month finding for the salamander (75 FR 54822; September 9, 2010). Standardized survey protocols have been used for the salamander since 1987 (NMDGF 2000, p. 2), but the number and location of surveys have been variable and opportunistic. Survey methods involve searching under potential cover objects (e.g., logs, rocks, bark, moss mats) and inside decomposing coniferous logs when environmental conditions are likely best for detecting surface-active salamanders, generally May through September, when summer monsoon rains occur. Unfortunately, methods for determining locations to survey salamanders over the past 20 years have not been systematic, and though we have conducted a comprehensive review, the data have not been consistently available to allow comparison of the status of the salamander over its entire range.

Three survey protocols have been in use since 1987 (NMEST 2000b, pp. 27–29). Protocol A (presence or absence) has been used when attempting to determine whether an area is occupied (NMEST 2000b, p. 27). Following this protocol, surveys cease after 2 ''person-hours'' of effort (e.g., one person searching for 2 hours or two people searching for 1 hour) or when the first salamander is observed, whichever comes first. Because the salamander utilizes underground habitat and an unknown number of individuals may be active at the surface, repeated surveys may be necessary to determine occupancy of a locality (NMEST 2000b, p. 27).

Protocol B (population levels and trends) has been used for comparing plots, monitoring trends through time, or evaluating how salamander localities fluctuate in response to environmental variables (NMEST 2000b, p. 28). For this protocol, a survey is conducted for 2 person-hours, with all salamanders tallied.

Protocol C (detailed environmental data) collects microhabitat data to characterize potential salamander habitat (NMEST 2000b, p. 28). This protocol involves collecting data on important habitat features within a 50 m (160 ft) by 2 m (6.6 ft) transect, in addition to surveying for salamanders under cover objects.

The rangewide population size of the salamander is also unknown. Monitoring the absolute abundance of plethodontid salamanders is inherently difficult because of the natural variation associated with surface activity (Hyde and Simons 2001, p. 624), which ultimately affects the probability of detecting a salamander. The probability of detection varies over space and time and is highly dependent upon the environmental and biological parameters that drive surface activity (Hyde and Simons 2001, p. 624). Given the known bias of detection probabilities and the inconsistent survey effort across years, population size estimates using existing data cannot be made accurately.

In summary, we have approximately 20 years of salamander survey data that provide detection information at specific survey sites for given points in time. The overall rangewide population size of the Jemez Mountains salamander is unknown because surveys tend to be localized (approximately 256-ft-by-256-ft areas, 200-m-by-200-m). Additionally, like most plethodontid salamanders, monitoring population size or trends of the Jemez Mountains salamander is inherently difficult because of the natural variation associated with the species' behavior (Hyde and Simons 2001, p. 624). For example, when the species is underground, they cannot be detected (Hyde and Simons 2001, p. 624). Therefore, the probability of detecting a salamander is highly variable and dependent upon the environmental and biological parameters that drive aboveground and belowground activities ((i.e., moisture, temperature) Hyde and Simons 2001, p. 624). Everett (2003, p. 35) noted that areas with high percentages of area of habitat covered by decaying logs, rocks, bark, moss mats, and stumps are difficult to survey and locate salamanders when present, and may bias the data toward lower percentages of area covered by decaying logs, rocks, bark, moss mats, and stumps. Given the known bias of detection probabilities (i.e., the difficulty in detecting salamanders when present due to being underground, secretive, and sparse numbers) and the inconsistent survey effort across years, as a result of differences in the number of days when surveys occurred, differences in environmental conditions, and different survey methods employed, population trends and population size estimates using existing data cannot be made accurately.

Despite our inability to quantify population size or trends for the salamander, these qualitative data (data that are observable, but not measurable) provide information for potential inferences. Based on these inferences, the persistence of the salamander may vary across the range of the species. For example, in some localities where the salamander was once considered abundant or common, the salamander is now rarely detected or has not been recently detected at all (New Mexico Heritage Program 2010a and b, spreadsheets). The number of areas where salamanders were once present, but have not been observed during more recent surveys, also appears to have increased (New Mexico Heritage Program 2010a and b, spreadsheets). Alternatively, there are two localities on the Valles Caldera National Preserve where the salamander continues to be relatively abundant (Redondo Border located in the central portion of the Valles Caldera National Preserve, and on a slope in the northeast portion of the Valles Caldera National Preserve), compared to most other recent detections at other sites. Still, the number of individuals found at the two above referenced localities in the Valle Caldera National Preserve is far less than historical reports from other areas. For example, 659 individual salamanders were captured outside the Valle Caldera National Preserve at one location in Sandoval County in a single year in 1970, and 394 of the 659 were captured in a single month (Williams 1976, p. 26). The maximum number of salamanders captured rangewide is 68 salamanders (observed in 2005). In other words, the number of salamanders observed during recent surveys is far less than observed in historical surveys. Currently, there is no known location where the number of salamanders observed is similar to that observed in 1970.

Overall, the numbers of salamanders found at some of the localized survey areas appear to be similar from survey to survey and from year to year. Surveys are conducted during the period in which environmental conditions for salamander aboveground activity is warm and wet, which is typically from July through September. However, in other areas when surveys are conducted during optimal environmental conditions, fewer or no salamanders are captured, particularly along the western and southern sides of the range, (New Mexico Heritage Program 2010a and b, spreadsheets). An assessment of population trends using these data would not be appropriate because estimates of detection probabilities were not collected, and repeated surveys within the same year were not regularly conducted. Without specifically accounting for detection probabilities using repeated survey techniques, it is unknown whether a trend in population is an actual trend or is due to a greater or lesser proportion of salamanders present being above ground or below ground, which is driven by environmental conditions such as temperature and moisture. For example, if one year a small proportion of a population was above ground and in the next year a large proportion of the population was above ground, it could be interpreted that the number of individuals increased at that site; however, actual numbers could have been unchanged. We have not fully explored future studies that could make use of the existing data; however, we expect that detecting overall trends will be difficult for this species, given data limitations, the cost of comprehensive surveys and protocols to account for natural, annual, and spatial variation, and the long timeframe needed to detect trends.

In summary, the available data cannot be used to estimate population size or trends in the rangewide abundance of the salamander. Although we lack specific long-term population and trend information, available data and qualitative observations of salamanders at surveyed sites during wet environmental conditions indicate that salamanders are now more difficult to find during most surveys than they were 20 years ago and earlier, and the number of areas with surveys resulting in no salamander detections is increasing. On this basis, which is the best available scientific information, we conclude that the Jemez Mountains salamander is in danger of extinction throughout all of its range.

Summary of Comments and Recommendations

We requested written comments from the public on the proposed rule during two comment periods. The first comment period associated with the publication of the proposed rule opened on September 12, 2012 (77 FR 56482), and closed on November 13, 2012. We also requested comments during a period that opened on February 12, 2013 (78 FR 9876), and closed on March 14, 2013. We also contacted appropriate Federal and State agencies, scientific experts and organizations, and other interested parties and invited them to comment on the proposal. A newspaper notice inviting general public comment was published in the Los Alamos Monitor. We did not receive any requests for a public hearing.

During the first comment period, we received nine comment letters addressing the proposed listing of the Jemez Mountains salamander with endangered status and the proposed critical habitat designation. During the second comment period, we received 11 comment letters addressing the proposed listing of the Jemez Mountains salamander, the proposed critical habitat designation, the draft environmental assessment or the draft economic analysis. All substantive information provided during comment periods has either been incorporated directly into this final determination or addressed below.

Peer Review

In accordance with our peer review policy published on July 1, 1994 (59 FR 34270), we solicited expert opinion from seven knowledgeable individuals with scientific expertise that included familiarity with the species, the geographic region in which the species occurs, and conservation biology principles. We received responses from three of the seven peer reviewers.

We reviewed all comments received from the peer reviewers for substantive issues and new information regarding the listing of Jemez Mountains salamander. All three peer reviewers agreed that the information presented in the proposed rule to list the Jemez Mountains salamander as an endangered species is scientifically sound and well researched; that the assumptions, analyses, and conclusions are well reasoned; and that the information is well formulated and the risks or threats to the species are not undervalued. The peer reviewers provided clarifications and suggestions to improve the final rules to list the Jemez Mountains salamander as endangered and to designate critical habitat. Peer reviewer comments specifically regarding the listing of the Jemez Mountains salamander are addressed in the following summary and incorporated into the final rule as appropriate.

Biology and Background Section

(1) *Comment:* Two peer reviewers and some commenters thought additional information regarding our understanding of the subsurface rock and soil components of salamander habitat should be included in the habitat section. One commenter stated that some factors, including soil pH and soil bulk density, are ignored or too readily dismissed.

Our Response: Subsurface geology and loose rocky soil structure may be an important attribute of salamander habitat (Degenhardt *et al.* 1996, p. 28). However, the composition of this belowground habitat has not been fully investigated, although soils comprised of pumice or tuft generally are not suitable. The salamander's belowground habitat appears to be deep, fractured, subterranean, igneous rock in areas with high soil moisture (New Mexico Endemic Salamander Team 2000, p. 2). Everett (2003) reported that the salamander occurred in areas where soil texture was composed of 56 percent sandy clay loam, 36 percent clay loam, 6 percent sandy loam, and 2 percent silty clay loam (p. 28); the overall soil bulk density ranged from 0.2 to 0.98 ounces per cubic inch (oz/in^3) (0.3 to 1.7 grams per cubic centimeter (g/cm^3) (p. 28); and had average soil moisture from 4.85 to 59.7 percent (p. 28). Sites with salamanders had a soil pH of 6.6 (± 0.08) and sites without salamanders had a soil pH of 6.2 (± 0.06) (Ramotnik 1988, pp. 24–25). We have updated the relevant sections to better describe our current understanding of Jemez Mountains salamander subsurface rock and soil components. We have clarified the language in section ''Biology'' above, and the ''Fire Exclusion, Suppression, and Severe Wildland Fires'' section below. We are not aware of any reliable information that is currently available to us on these topics that was not considered in this determination process.

Threats

(2) *Comment:* One peer reviewer did not agree with the conclusion that fire suppression actions, which include the use of fire retardants, water dropping, backfiring, and fire line construction, are not a threat to the salamander.

Our Response: The best commercial and scientific information available at this time, including the Fire Retardant Biological Assessment submitted by the USFS (2011, entire), does not evaluate impacts to salamanders or their habitat from fire suppression actions. Fire suppression actions, including fire retardants, water dropping, backfiring, and fire line construction, may both protect and negatively impact salamanders and their habitat. The effects from fire suppression on the Jemez Mountains salamander or its habitat are unknown. Fire retardants may affect individual salamanders and their habitat, but based the best available scientific and commercial data does not indicate that it is a threat to the species as a whole.

(3) *Comment:* Two peer reviewers commented on chemical use in salamander habitat. One stated that chemical use may constitute a significant threat to the salamander, implied that the lack of information does not mean that the threat does not affect salamanders, and suggested that effects that some chemicals used may have on the salamander or its habitat should be immediately studied. The other peer reviewer thought insecticides used to control western spruce budworm (*Choristoneura occidentalis*) and bark beetles (*Dendroctonus* spp., *Ips* spp.) should be considered in more detail.

Our Response: We agree with the reviewers that lack of information about impacts to the species does not mean there are no impacts. However, the best available scientific and commercial data does not support the claim that chemical use (including fire retardant chemical) is currently a threat to the species. Currently, we have no information on the effects of chemical impacts on salamanders. We are not aware of any broad-scale use of insecticides in salamander habitat in the past, which allow us to consider in more detail. Further, we are not aware of any broad-scale use of insecticides in salamander habitat or proposed for the future, and have no reason to believe that this could be a threat in the foreseeable future. The best available scientific data does not indicate that chemical use is a threat to the salamander.

(4) *Comment:* The data do not seem strong enough to conclude that changes in vegetative components alone constitute a threat.

Our Response: We consider existing and ongoing changes in vegetation composition and structure to be a threat to the salamander because it is interrelated to changes in fire regimes. In order to reduce the risk of large-scale stand-replacing wildfire, management actions to change the current forest conditions are needed.

(5) *Comment:* One peer reviewer stated that unregulated collection of the Jemez Mountains salamander may be more significant than credited, while another stated that the current absence of salamanders at the type locality is disturbing, yet does not prove that overcollecting is the cause of the decline or disappearance of salamanders in specific areas. A commenter stated that past collection was dismissed too readily. The USFS commented that it was not clear if collections were from the same sites that are used as reference sites for salamander populations, but that historical collections could still be influencing salamander populations because of relatively low fecundity.

Our Response: We believe that the majority of collections were made at and around the general area located on the southwest portion of the range of the salamander, south of New Mexico Highway 4. Based on the number of specimens collected from this area, we believe that the impact from collections here was significant and was no doubt a contributing factor in the lack of persistence of the salamander there. We have reviewed the *Overutilization for Commercial, Recreational, Scientific, or Educational Purposes* in this final rule, below, and made clarifications based on the information available; in some cases, the source material was not clear. As explained in the *Overutilization for Commercial, Recreational, Scientific, or Educational Purposes,* collection of the species is regulated by several State and Federal regulations, and illegal collection is not known or thought to be high. Therefore, the best available scientific and commercial data does not indicate that collection is presently an ongoing or future threat.

(6) *Comment:* One peer reviewer stated that increased coordination efforts on the timing and placement of salvage logging operations could mitigate the threats posed by salvage logging. Santa Clara Pueblo stated that salvage logging after wildfire can help alleviate the hydrophobicity (repelling the absorption of water) of soils through disturbance of the soils in pulling the salvage logs to a landing area, and the Service should be careful not to make too sweeping a statement about the threats posed by salvage logging. Guidelines could be developed for managing salvage logging that would also benefit the salamander. The USFS commented that there are many variables to consider regarding salvage logging, and some measures could be taken that include salvage logging in order to reduce the risk of re-burning in areas that have been burned with wildfire.

Our Response: We agree that some impacts resulting from salvage logging in salamander habitat could be abated through best management practices, and there may be certain management actions regarding some salvage logging that could be of potential benefit to the Jemez Mountains salamander. We can provide technical assistance to develop best management practices with those engaged in salvage logging or timber harvesting in areas that may affect the salamander or its habitat. Furthermore, best management practices for minimizing or eliminating adverse effects to the salamander or its habitat resulting from actions such as salvage logging or timber harvesting that are funded, authorized, or carried out by Federal agencies can be developed through section 7 consultation with the Service.

(7) *Comment:* One peer reviewer stated the assumption that an increase in the number of small-diameter trees would result in increased water demand required for evapotranspiration should be supported with a citation, or if the situation is more complex, further explanation of the complexities and uncertainties should be made.

Our Response: We clarified timber harvest actions and included additional information regarding some timber harvest actions and soil water (moisture) in this final rule under the ''Forest Silvicultural Practices'' section under Factor *A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range,* below. The dynamic between tree density, thinning, and soil water is a key ecological process, which is relevant not only to restoration efforts, but also to salamander physiology. We strongly support research in this area in the Jemez Mountains. We also agree that some impacts resulting from timber harvest and thinning in salamander habitat could be abated through best management practices and could also benefit the salamander. We look forward to developing best management practices with those potentially engaged in timber harvesting in areas that may affect the salamander or its habitat. Furthermore, best management practices for minimizing or eliminating adverse effects to the salamander or its habitat resulting from actions such as timber harvesting that are funded, authorized, or carried out by Federal agencies can be developed through section 7 consultation with the Service.

Comments from the U.S. Forest Service

(8) *Comment:* The USFS commented that there are many variables to consider regarding salvage logging, and some measures could be taken that include salvage logging that reduces the risk of re-burning in areas that have been burned with wildfire.

Our Response: See our response to Comment 6, above.

(9) *Comment:* The USFS commented that there are still many unknowns, which lead to numerous assumptions made throughout the document and provide a clear indication that sufficient data does not exist to understand this species' status and needs. A public commenter stated the scientific record accumulated to date is not sufficiently robust to warrant further regulatory action. Additional data should be collected before listing the species as endangered. The Service should withdraw the proposal to list the Jemez Mountains salamander as endangered because of lack of sound scientific evidence. The proposed rule is flawed because it relies too much on speculation and assumption rather than the best scientific information available as required.

Our Response: As required by the Act, we based our proposal and this final rule on the best available scientific and commercial data. We requested review from seven scientific experts of our technical assumptions, analysis, adherence to regulations, and whether or not we had used the best available information. We received reviews from three, all three peer reviewers confirmed that the information contained within this rule is scientifically sound, based on a combination of reasonable facts, assumptions, and conclusions, and the science is well considered. We requested new information during the open public comment period and reviewed information in our files and other available published and unpublished information, and we consulted with recognized species experts and other Federal, State, and tribal agencies. We must make this determination on the basis of the best scientific and commercial information available at this time, and we may not delay our decision until more information about the species and its habitat are available. *Southwest Center for Biological Diversity* v. *Babbitt,* 215 F.3d 58 (DC Cir. 2000).

(10) *Comment:* In light of the unknowns, the number of assumptions described in the proposed rule, and the difficulty in detecting the salamander, it does not appear that there is evidence to support the conclusion that this species is at risk of extinction (i.e., endangered) or likely to become endangered throughout all or a significant portion of its range within the foreseeable future (i.e., threatened).

Our Response: Please see Our Response to Comment 9 above. We have found that the Jemez Mountains salamander is presently in danger of extinction throughout all of its range based on the severity of threats currently affecting the salamander. The threats are both current and expected to continue in the future, and are significant in that they limit all behavioral and physiological functions, including breathing, feeding, and reproduction and reproductive success, and extend across the entire range of the species (For full discussion, see Summary of Factors Affecting the Species and Determination sections, below).

(11) *Comment:* The proposed rule vastly increases the area of potential salamander habitat through loose description of the habitat and biology. As written, the proposed rule would suggest any mixed conifer, Ponderosa pine, spruce, and aspen, essentially all forested lands and meadows between 7,200 and 9,500 ft (2,194 to 2,895 m) elevation in the Jemez Mountains, to be salamander habitat. Clearly, that is not the case and has not been the view of the New Mexico Endemic Salamander Team Cooperative Management Plan as evident from the conservation area identified in the 2000 Cooperative Management Plan.

Our Response: It is unclear what the commenter is referring to in regard to an increase in the area of potential salamander habitat. We assume they are referring to the area of salamander habitat in the New Mexico Endemic Salamander Team Cooperative Management Plan, but that was not specified. The Service recognizes there are differences in the total areas identified in the New Mexico Endemic Salamander Team Cooperative Management Plan and the proposed listing rule. This difference is due to the different purposes of identifying habitat. The areas identified by the New Mexico Endemic Salamander Team in the Cooperative Management Plan are areas only on National Forest lands that were delineated ''by combining distribution data with on-the-ground knowledge of salamander natural history and habitat potentials'' (New Mexico Endemic Salamander Team 2000, p. 13) with the intended purpose of protecting areas known to be important to the species based on occupancy from actions that might occur there. The Cooperative Management Plan identified 146,890 acres (ac) (59,444 hectares (ha)) of salamander habitat on the Santa Fe National Forest for management and conservation of the species (New Mexico Endemic Salamander Team 2000, p. 14). During our process of determining critical habitat for the Jemez Mountains salamander (77 FR 56482 September 12, 2012; 78 FR 9876

February 12, 2013), we proposed designating 56,897 ac (23,025 ha) on USFS lands on which are found those physical or biological features essential to the conservation of the species and which may require special management considerations or protections. However, the occupancy status of salamander habitat outside of the proposed critical habitat boundaries is not fully determined and may be larger than the area initially identified in the Cooperative Management Plan.

(12) *Comment:* With the exception of the discussion of fire interval, the proposed rule makes little distinction between dry and wet mixed conifer. Therefore, it is unclear how the USFS would manage mixed conifer stands as described in the proposed rule.

Our Response: The proposed rule and this final rule are not intended to prescribe to agencies how to specifically manage any forest type under their purview. However, we are interested in working with land managers to find solutions to minimize adverse effects to threatened or endangered species and their habitat while conducting management actions. In addition, we are interested in collaborating on actions that will help the salamander recover to the point where it is no longer considered to be endangered or threatened.

(13) *Comment:* The Service refers to the number of surveys that resulted in no salamanders being found as the main evidence that the species is in decline. Yet the USFS continues to find salamanders even during poor survey conditions. Recent salamander detection results could be influenced from historical overcollection, previous survey efforts, and drought with low precipitation during the monsoon season. Because of the multiple variables that influence salamander detections, it is unclear how the Service can determine that salamander populations are declining due to current management while new salamander locations are detected annually (four in 2011 and three in 2012).

Our Response: The commenter does not identify a specific survey report for us to reference. We have requested the data, but at the time of this final rule, we have not received the information. However, in the *Status of the Species* section of this final rule, below, we state that, despite our inability to quantify population size or trends for the salamander, the qualitative data (data that are observable, but not measurable) provide information for potential inferences. Based on these inferences, we believe that the persistence of the salamander may vary across the range of the species. For example, in some localities where the salamander was once considered abundant or common, the salamander is now rarely detected or has not been recently detected at all (New Mexico Heritage Program 2010a and b, spreadsheets). The number of areas where salamanders were once present, but have not been observed during more recent surveys, has also increased (New Mexico Heritage Program 2010a and b, spreadsheets).

Alternatively, there are two localities on the Valles Caldera National Preserve where the salamander continues to be relatively abundant (e.g., approximately 30 salamanders observed in a day each at Redondo Border located in the central portion of the Valles Caldera National Preserve and on a slope in the northeast portion of the Valles Caldera National Preserve compared to most other recent detections throughout its range. Still, the number of individuals recently found at the two localities on the Valles Caldera National Preserve is far less than other historical records throughout the species range. For example, in northeastern Sandoval County where the species was first 659 individual Jemez Mountain salamanders were captured in a single year in 1970, 394 of which were captured in a single month (Williams 1976, p. 26). Currently, there is no known location where the number of salamanders observed is similar to that observed in 1970. Finally, all three peer reviewers confirmed that the information contained within this rule is scientifically sound, based on a combination of reasonable facts, assumptions, and conclusions. One peer reviewer specifically stated that assumptions made in the section about population abundances and trends are generally typical for this type of salamander, that the risks or threats to the species are not undervalued, and if the threats are not managed, then the probability for a continued downward trend of this animal with extinction an eventual outcome is foreseeable.

(14) *Comment:* Peer reviewers of the proposed rule should include impartial experts in the fields of herpetology, fire ecology, and forest ecology specific to the southwest to evaluate the multitude of assumptions.

Our Response: Four of the seven peer reviewers we requested information from have expertise in the fields of herpetology, plethodontid salamander biology, fire ecology, and forest ecology.

(15) *Comment:* The use of the Wyman and Hawksley-Lescault (1987) citation does not appear applicable to changes in soil pH from wildfire.

Our Response: The purpose of this citation is to demonstrate that changes in soil pH could be an important factor in plethodontid salamander biology because changes in pH can affect their physiology. We have clarified the language of this final rule in section ''Biology'' above, and ''Fire Exclusion, Suppression, and Severe Wildland Fires'' below.

(16) *Comment:* The example for modifying fire management techniques to include not using flares to ignite large decaying logs or modifying chemical use in salamander habitat would eliminate the use of prescribed fire in salamander habitat. Almost all ignitions require the use of chemicals, whether petroleum fuels in drip torches, or potassium permanganate in balls dropped from a helicopter. These chemicals are mostly consumed in the process of getting fire on the ground and are unlikely to leave residue that could affect the salamander.

Our Response: We are not suggesting that prescribed fire be eliminated in salamander habitat or that fire management techniques be modified in a way that would prevent the use of prescribed fire in salamander habitat. Prescribed fire is clearly a necessary tool for managing forests in the Jemez Mountains and in salamander habitat. Furthermore, some activities, such as prescribed fire, can benefit the salamander and its habitat.

(17) *Comment:* The Service issued a biological opinion for the Fire Retardant Biological Assessment prepared by the USFS and should have all relevant information in their project record concerning whether chemicals in fire retardants or foams are a threat to the salamander.

Our Response: We have reviewed the administrative record for the Fire Retardant consultation between the USFS and the Service and did not find information to assess whether fire retardants or foams impacted the salamander. Measures were put in place to avoid aquatic amphibians, but no analyses were done for any terrestrial amphibian.

(18) *Comment:* The proposed rule gives the widening of State Highway 126 as an example of where the Conservation Agreement failed, yet recommendations from the New Mexico Endemic Salamander Team were considered and efforts were taken to minimize effects to the Jemez Mountains salamander in that area, even though the Federal Highway Administration undertook the project. The proposed rule neglects to mention the coordination between the New Mexico Endemic Salamander Team and the USFS on projects since the signing

of the agreement, even after the agreement expired in 2010.

Our Response: In regard to the realignment of Highway 126, action agencies included the Federal Highway Administration and the USFS. While the project was discussed with the New Mexico Endemic Salamander Team, and some efforts were made (e.g., an experimental salvage and relocation of Jemez Mountains salamanders from the footprint of the realignment and felling trees as future potential cover objects in areas adjacent to the road), the project still resulted in a large impact (permanent and complete fragmentation of the population and destruction of habitat) in a small area with relatively moderate salamander densities. We analyzed the adequacy of existing conservation measures at removing or reducing threats to the salamander across the range of the species such that listing the salamander under the Act is not warranted, and found that existing conservation measures are not adequate. The Highway 126 project is an example of how conservation measures as provided by the Cooperative Management Plan are inadequate to protect the salamander and its habitat. Further, the Cooperative Management Plan and the now expired Conservation Agreement only applied to a portion of the range of the salamander (some portions of USFS lands), applied to management actions that the USFS might take, does not specifically address significant threats (e.g., severe wildland fire, climate change) or actions that could be threats if plans to minimize impacts to the salamander are not considered (e.g., forest management such as thinning, prescribed fire), and do not provide specific mechanisms to protect the species (only that the New Mexico Endemic Salamander Team would provide discretionary recommendations). The Cooperative Management Plan and the expired Conservation Agreement are considered inadequate for providing protection to the salamander or alleviating threats to the salamander or its habitat.

Comment From Other Federal Agencies

(19) *Comment:* A new conservation plan should be created in lieu of listing the salamander as an endangered species.

Our Response: The Act does not provide authority to the Service to delay listing in order to wait for future, speculative conservation plans to be developed and implemented.

Comments From the New Mexico Department of Agriculture (NMDA)

(20) *Comment:* Listing the Jemez Mountains salamander will be counter-productive to solving the problem of poor watershed health in the Jemez Mountains and will slow the pace of ongoing forest restoration work. In addition, listing could alter the State's ability to acquire matching funds.

Our Response: Listing the Jemez Mountains salamander does not preclude forest restoration or management practices, including, but not limited to, prescribed fire and thinning treatments, restoration of the frequency and spatial extent of such disturbances as regeneration treatments, and implementation of prescribed natural fire management plans where feasible. We consider use of such treatments to be compatible with the ecosystem management of habitat mosaics and the best way to reduce the threats of catastrophic wildfire to Jemez Mountains salamander and provide protection for the species. In addition, listing the Jemez Mountains salamander does not preclude adaptive management or the incorporation of new information on the interaction between natural disturbance events and forest ecology. We continue to support sound ecosystem management and the maintenance of biodiversity, and we will fully support land management agencies in addressing the management of fire to protect and enhance natural resources under their stewardship.

(21) *Comment:* The Service should partner with ongoing efforts, such as the Southwest Jemez Collaborative Forest Landscape Restoration Project, to effectively improve the watershed health of the Jemez Mountains, thus benefiting the salamander.

Our Response: The Service recognizes the importance of forming and supporting partnerships to achieve mutually identified goals and objectives, and agrees that strong partnerships and collaborations are necessary for the restoration and conservation of our natural resources. We appreciate the ongoing efforts and collaborations with our existing partners, including members of the Southwest Jemez Collaborative Forest Landscape Restoration Project, encourage our partners to work with us to incorporate specific goals and objectives for the protection of the Jemez Mountains salamander and its habitat, and commit to long-term monitoring, without which it is difficult to evaluate the effectiveness of conservation measures intended to benefit salamander. We also look forward to the establishment of new partnerships to improve conservation.

(22) *Comment:* The Service should withdraw its proposal to list the Jemez Mountains salamander as an endangered species, because critical watershed restoration efforts would continue and these efforts could continue without the burdensome regulations associated with the Act.

Our Response: Section 4 of the Act and its implementing regulations (50 CFR 424) set forth the procedures for adding species to the Federal Lists of Endangered and Threatened Wildlife and Plants. A species may be determined to be an endangered or threatened species due to one or more of the five factors described in section 4(a)(1) of the Act: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. Listing actions may be warranted based on any of the above threat factors, singly or in combination. The purpose of the Act is to protect and recover imperiled species and the ecosystems upon which they depend. The regulatory requirements under the Act were determined by Congress to ensure that otherwise lawful actions that affect species listed under the Act are not likely to jeopardize the continued existence of those listed species. The Service will work with Federal agencies during consultation, when required, to develop watershed restoration efforts. The Service can provide technical assistance to non-Federal projects to develop best management practices or alternatives.

Comments From the Santa Clara Pueblo

(23) *Comment:* Santa Clara Pueblo is very interested in restoring, promoting, and sustaining healthy forest lands, which will benefit the Jemez Mountains salamander.

Our Response: The Service appreciates comments received from Santa Clara Pueblo, welcomes continued input on all aspects of restoring, promoting, and sustaining healthy forest lands in the Jemez Mountains, and will continue to be available to provide technical assistance as may be requested by the tribe.

(24) *Comment:* Santa Clara Pueblo stated that salvage logging after wildfire can help alleviate soils repelling water through disturbance of the soils resulting from pulling the salvage logs to a landing area, and the Service

should be careful not to draw the wrong conclusion about the threats posed by salvage logging. Guidelines could be developed for managing coarse woody debris following wildfire that include some salvage logging that would also benefit the salamander.

Our Response: See our response to Comment 6 under Comments from Peer Reviewers, above.

(25) *Comment:* Santa Clara Pueblo commented that responsible timber harvesting can increase available soil moisture because transpiration of vegetation (the process by which plants release moisture into the air) is decreased and more soil moisture becomes available for residual plant growth (and the salamander). Although it is true that reduced shading could increase surface temperatures, that would have little effect at the root level or below where the salamander primarily resides.

Our Response: In the ''Forest Composition and Structure Conversions'' section of this final rule, the Service has clarified how the changes in forest composition and structure impacts the salamander in its habitat.

Public Comments

(26) *Comment:* A public commenter stated that, before the proposed rule is made final, agencies should jointly review the Memorandum of Agreement to determine whether it can be updated or revised in a way that would continue to protect the salamander without allowing it to be listed.

Our Response: It is unclear to what Memorandum of Agreement the commenter is referring. We are assuming the commenter is referring to the New Mexico Endemic Salamander Team Cooperative Management Plan. See our response to Comment 11 under *Comments From the U.S. Forest Service.*

(27) *Comment:* Another commenter could not determine from the text if different logging practices were distinguished, and believe that clear-cut logging would be detrimental to the salamander and its habitat, but that other commercial logging could be conducted in a way that is not. The threat from logging probably is real, but comes from the disruption of the vertical underground passages more than from tree removal. The logging threat is minimal, because industry barely exists in the area.

Our Response: As stated in our proposed rule and this final rule, clear-cutting degrades forest floor microhabitats for salamanders by eliminating shading and leaf litter, increasing soil surface temperature, and reducing moisture (Petranka 1998, p. 16). Significant differences in habitat features (soil pH, litter depth, and log size) were reported between the logged and unlogged sites (Ramotnik 1986, p. 8). On the unlogged sites, salamanders were associated with cover objects that were closer together and more decayed, and that had a higher canopy cover, greater moss and lichen cover, and lower surrounding needle cover, compared to cover objects on logged sites (Ramotnik 1986, p. 8). The best available scientific and commercial data does not indicate that there is an impact to vertical underground passages.

(28) *Comment:* A public commenter stated that the scientific record accumulated to date is not sufficiently robust to warrant further regulatory action. Additional data should be collected before listing the species as endangered. The Service should withdraw the proposal to list the Jemez Mountains salamander as endangered because of lack of sound scientific evidence. The proposed rule is flawed because it relies too much on speculation and assumption rather than the best scientific information available as required.

Our Response: See our response to Comment 9 under *Comments From U.S. Forest Service,* above.

(29) *Comment:* Listing the Jemez Mountains salamander may have the unintended consequences of undermining efforts to reduce the identified principal threat to the salamander, the risk of catastrophic wildfire. Listing the Jemez Mountains salamander as an endangered species may further slow efforts of the Southwest Jemez Mountains Collaborative Forest Landscape Restoration project because of the additional regulatory requirement for section 7 consultation.

Our Response: Listing of the Jemez Mountains salamander does not preclude the proactive treatments necessary to reduce the risk of catastrophic fire or managing forests to restore them to old growth conditions. We recognize that vegetative structural and landscape changes may require proactive management to restore an appropriate distribution of age classes, control regeneration densities, and reintroduce some measure of natural disturbance processes such as fire events, and will need adaptive management and the incorporation of new information as it becomes available. We continue to support sound ecosystem management, and we will fully support land management agencies in addressing the management of fire to protect and enhance natural resources under their stewardship. We recognize the importance of implementing restoration projects such as the Southwest Jemez Mountains Collaborative Forest Landscape Restoration project. We do not anticipate significant delays resulting from consultation, as there is overlap between salamander habitat and Mexican spotted owl habitat, which will also require consultation under section 7. Nonetheless, we will work to minimize any potential additional delays that may result from the requirement for consultation under section 7.

(30) *Comment:* No evidence is presented that time above ground is necessary for the salamander life cycle. Fallen logs are considered important in the rule; however, fallen logs only seem to be convenient places searched by the biologists when looking for the salamander rather than places important to the salamander's life cycle.

Our Response: Aboveground surface activity during wet surface conditions is a documented characteristic of the natural history of the Jemez Mountains salamander. Also, because stomach contents consist primarily of aboveground, ground-dwelling invertebrates, and plethodontid salamanders store fat reserves in their tails for energetic use when foraging opportunities are reduced or do not exist (e.g., underground), we conclude that aboveground activity is important for feeding. Additionally, based on reproductive studies (see Biology section of this rule), this species mates in July and August, which coincides with the salamander's aboveground activity period. We, therefore, conclude that time aboveground is necessary for foraging and mating. Cover objects, including logs, are used by salamanders when aboveground. As explained in the proposed and final rules, these cover objects provide shelter and high moisture retreats while salamanders are aboveground and are necessary for hydration, because overall surface activity usually dehydrates animals. In addition, fallen logs may be relatively more important to the species than rocks because they are able to hold moisture for longer periods, and can be a buffer to the increased temperatures resulting from habitat alterations or climate change.

(31) *Comment:* Thinning to reduce the risk of catastrophic wildfire could impact the vertical underground passages through use of machinery. Forest restoration treatments that minimize impacts and maximize benefits to the salamander need to be tested. The Service's call for research

into thinning techniques and their effects on the salamander is strongly endorsed.

Our Response: We agree that methods for forest restoration treatments that have the potential to significantly affect the salamander and its habitat should be tested to identify options that could minimize impacts and maximize benefits to the salamander. The Service is collaborating with the USFS, The Nature Conservancy, NMDGF, and others on a project to measure effects of prescribed fire to large downed log habitat components. We believe collaborations such as this will provide information on maintaining important salamander habitat features while conducting forest restoration.

Summary of Changes From the Proposed Rule

During the open comment periods, we were asked to add information to provide clarifications in some areas. We added clarifying language regarding our understanding of habitat variables including subsurface rock and geology; hillshading; canopy closure as it relates to microclimates; population connectivity; the disease Ranavirus; the current Forest Planning Rule; and timber harvest and soil moisture relationships. Some information we had not previously considered was provided by the USFS. This additional information did not alter our threats assessment.

Summary of Factors Affecting the Species

Section 4 of the Act and its implementing regulations (50 CFR part 424) set forth the procedures for adding species to the Federal Lists of Endangered and Threatened Wildlife and Plants. A species may be determined to be an endangered or threatened species due to one or more of the five factors described in section 4(a)(1) of the Act: (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) overutilization for commercial, recreational, scientific, or educational purposes; (C) disease or predation; (D) the inadequacy of existing regulatory mechanisms; or (E) other natural or manmade factors affecting its continued existence. Listing actions may be warranted based on any of the above threat factors, singly or in combination. Each of these factors is discussed below.

A. The Present or Threatened Destruction, Modification, or Curtailment of Its Habitat or Range

The principal threats to the habitat of the Jemez Mountains salamander include historical fire exclusion (the act of preventing fire) and suppression (the act of putting out fire) and severe wildland fires; forest composition and structure conversions; post-fire rehabilitation; forest and fire management; roads, trails, and habitat fragmentation; and recreation.

Fire Exclusion, Suppression, and Severe Wildland Fires

In the Jemez Mountains, over 100 years of fire suppression and fire exclusion (along with livestock grazing and other stressors) have altered forest composition and structure, and increased the threat of wildfire in Ponderosa pine and mixed-conifer forests (Belsky and Blumenthal 1997, p. 318). Fire has been an important process in the Jemez Mountains for at least several thousand years (Allen 1989, p. 69), indicating that the salamander coexisted with historical fire regimes. Frequent, low-intensity surface fires; and patchy, small-scale (hundreds of acres instead of thousands of acres), high-intensity fires in the Jemez Mountains historically maintained salamander habitat. These fires spread widely through grassy understory fuels, or erupted on very small scales (a couple of hundred acres compared to several hundreds or thousands of acres). The natural fire intervals prior to the 1900s ranged from 5 to 25 years across the Jemez Mountains (Allen 2001, p. 4). Dry mixed-conifer forests burned on average every 12 years, whereas wet mixed-conifer forests burned on average every 20 years. Historically, patchy surface fires within mixed-conifer forests would have thinned stands and created natural fuel breaks that would limit the extent of fires. Still, in very dry years, there is evidence of historical fires occurring across entire watersheds, but they did not burn with high severity over entire mountain sides (Jemez Mountains Adaptive Planning Workshop Session II Final Notes 2010, p. 7). Aspen stands are evidence of historical patchy crown fires that represent the relatively small-scale, stand-replacing fires that have historically occurred in the Jemez Mountains, which are also associated with significantly dry years (Margolis *et al.* 2007, p. 2236).

These historical fire patterns were interrupted in the late 1800s through the elimination of fine fuels, as a result of livestock overgrazing and historical managed fire suppression. This interruption and exclusion of fire promoted the development of high forest stand densities with heavy accumulations of dead and downed fuel, and growth of ladder fuels (the dense mid-story trees that favor development of crown fires) (Allen 2001, pp. 5–6). In fact, past fire exclusion activities in this area converted historically low- to moderate-severity fire regimes with small, patchy fires to high-severity, large-scale, stand-replacing fires that have the potential to significantly destroy or degrade salamander habitat (USFS 2009a, pp. 8–9). The disruption of the natural cycle of fire and subsequent accumulation of continuous fuels within the coniferous forests on south- and north-facing slopes has increased the chances of a severe wildfire affecting large areas of salamander habitat within the Jemez Mountains (USFS 2009a, 2009b).

In recent years, prescribed fire at Valles Caldera National Preserve has been limited, with only one burn in 2004 that was described as creating a positive vegetation response (ENTRIX 2009, p. 97). A prescribed fire plan is expected to be developed (ENTRIX 2009, p. 97) because of concern for severe wildland fires to occur (Parmenter 2009, cited in Service 2010). The planned Scooter Peak prescribed burn between the Valles Caldera National Preserve and Bandelier National Monument is a fuel-reduction project in occupied salamander habitat, but is small in scale (approximately 960 ac (390 ha)) (ENTRIX 2009, p. 2). Although future thinning of secondary growth may partially reduce the risk of severe wildland fires in areas, these efforts are not likely at a sufficient geographical scale to lessen the overall threat to the salamander.

The frequency of large-scale, high-severity, stand-replacing wildland fires has increased in the latter part of the 20th century in the Jemez Mountains. This increase is due to landscape-wide buildup of woody fuels associated with removal of grassy fuels from extreme year-round livestock overgrazing in the late 1800s, and subsequent fire suppression (Allen 1989, pp. 94–97; 2001, pp. 5–6). The majority of wildfires over the past 20 years have exhibited crown fire behavior and burned in the direction of the prevailing south or southwest winds (USFS 2009a, p. 17). The first severe wildland fire in the Jemez Mountains was the La Mesa Fire in 1977, burning 15,400 ac (6,250 ha). Subsequent fires included the Buchanon Fire in 1993 (11,543 ac (4,671 ha)), the Dome Fire in 1996 (16,516 ac (6,684 ha)), the Oso Fire in 1997 (6,508 ac (2,634 ha)), the Cerro Grande Fire in 2000 (42,970 ac (17,390 ha)), and the Lakes Fire Complex (Lakes and BMG Fires) in 2002 (4,026 ac (1,629 ha)) (Cummer 2005, pp. 3–4). Between 1995 and 2010, severe wildland fires have burned about 36 percent of modeled or known salamander habitat on USFS lands (USFS 2009, p. 1). Following the Cerro Grande Fire, the General Accounting Office reported that these conditions are common in much of the western part of the United States turning areas into a ''virtual tinderbox'' (General Accounting Office 2000, p. 15).

In 2011, the Las Conchas Fire burned 150,590 ac (60,942 ha) in the Jemez Mountains, and, until the 2012 Whitewater Complex Fire in southwestern New Mexico, Las Conchas was New Mexico's largest wildfire to date (USFS 2011a, p. 1). The Las Conchas Fire burned approximately 17,780 ac (7,195 ha) of modeled or known salamander habitat in the east, south, and southeastern part of its range. In the eastern portion of the salamander's range, the Thompson Ridge Fire burned a total of 23,965 ac (9,698 ha) in 2013. This demonstrates that the majority of salamander habitat has either recently burned with uncharacteristic wildfire or that the threat of severe wildland fires to salamander habitat remains high, due to tons of dead and down fuel, overcrowded tree conditions leading to poor forest health, and dense thickets of small-diameter trees. There is a 36 percent probability of having at least one large fire of 4,000 ac (over 1,600 ha) every year for the next 20 years in the southwest Jemez Mountains (USFS 2009a, p. 19). Moreover, the probability of exceeding this estimated threshold of 4,000 ac (1,600 ha) burned in the same time period is 65 percent (USFS 2009a, p. 19). The canyon topography in the western portion of the salamander's range aligns with south winds and steep slopes, making this area highly susceptible to crown fire (USFS 2009a, pp. 24–25). Moreover, we found that the risk of burning is not eliminated following severe wildfires. Some areas that previously burned during the 2000 Cerro Grande Fire burned again during the 2011 Las Conchas Fire burning the remaining forested mosaic areas and dead trees left after the Cerro Grande Fire.

Increases in soil and microhabitat (immediate localized environment that has a unique set of ecological conditions within a larger habitat) temperatures, which generally increase with increasing burn severity, can have profound effects on salamander behavior and physiology and can, therefore, influence their ability to persist subsequent to severe wildland fires. Following the Cerro Grande Fire, soil temperatures were recorded under potential salamander cover objects in geographic areas occupied by the salamander (Cummer and Painter 2007, pp. 26–37). Soil temperatures in areas of high-severity burn exceeded the salamander's thermal tolerance (the temperature that causes death) (Spotila 1972, p. 97; Cummer and Painter 2007, pp. 28–31). Because widespread dry conditions are an important factor contributing to the occurrence of severe wildfire, when severe wildfire occurs, most salamanders are likely protected in subterranean habitat and are not killed directly from wildfire. However, even in moderate and high-severity burned areas where fires did not result in the death of salamanders, the microhabitat conditions, such as those resulting from the Cerro Grande Wildfire, would limit the timing and duration that the salamanders could be active above ground (feeding and mating). Moreover, elevated temperatures lead to increases in oxygen consumption, heart rate, and metabolic rate, resulting in decreased body water (the percentage of water in the body) and body mass (Whitford 1968, pp. 247–251). Physiological stress from elevated temperatures may also increase susceptibility to disease and parasites. Effects from temperature increases are discussed in greater detail under Factor E, below.

As discussed in the Biology section above, soil pH may affect salamanders. Severe wildland fires typically increase soil pH, which could affect the salamander. Changes in soil pH following wildfire could impact the salamander, either by making the habitat less suitable, or through physiological stress. The existing risk of wildfire on the Valles Caldera National Preserve and surrounding areas, including the Santa Fe National Forest, is uncharacteristically high and is a significant departure from historical conditions over 100 years ago (Valles Caldera National Preserve 2010, p. 3.1; Allen 1989, pp. ii–346; 2001, pp. 1–10). Several regulatory attempts have been made to address and correct the altered ecological balance of New Mexico's forests resulting from a century of fire suppression, logging, and livestock grazing. Congress enacted the Community Forest Restoration Act to promote healthy watersheds and reduce the threat of large, high-intensity wildfires, insect infestation, and disease in the forests in New Mexico (H.R. 2389, Pub. L. 106–393). The subsequent Omnibus Public Land Management Act, also called the ''Forest Landscape Restoration Act'' (Title IV, Pub. L. III–II, 2009), established a national program that encourages ecological, economic, and social sustainability and utilization of forest restoration byproducts to benefit local rural economies and improve forest health. As a result, the Santa Fe National Forest and partners prepared the Southwest Jemez Mountains Landscape Assessment designed to reduce the threat of severe wildland fire in the western and southern part of the salamander's range over the next 10 years (USFS 2009, p. 2).

In 2011, this Collaborative Forest Landscape Restoration project was selected and is eligible for up to $4 million per year to restore approximately 210,000 ac (85,000 ha) of forest in the southwestern Jemez Mountains (USFS 2011b, pp. 1–2), but a lack of matching funds may limit the geographical extent of this project. Moreover, this project will not effectively address the short-term risk of severe wildland fire to the species because treatments are anticipated to be implemented slowly, over the next decade or more. Finally, it is unknown whether the proposed treatments will effectively reduce the risk of severe wildfire to the salamander or its habitat without causing additional harm to the species, because measures to minimize impacts will be experimental and have not yet been developed. We believe that this risk of wildfire is one of the most significant threats facing this species, and projects attempting to reduce the threat of wildland fire will need to be implemented over a large part of the landscape before significant risk reduction for the salamander is achieved. For these reasons, we conclude that the overall risk of severe wildland fire will not be significantly reduced or eliminated on USFS lands, National Park Service lands, the Valles Caldera National Preserve, or surrounding lands in the future.

Since 1977, these severe wildland fires have significantly degraded important features of salamander habitat, including removal of tree canopy and shading, increases of soil temperature, decreases of soil moisture, increased pH, loss or reduction of soil organic matter, and reduced soil porosity. It also results in short-term creation of hydrophobic (water-repelling) soils because the burning of the leaf litter, the intensity and speed of the fire and the soil type affect the ability of soils to absorb water. These and other effects limit the amount of available aboveground habitat, and the timing and duration when salamanders can be active above ground, which negatively impacts salamander behavior (e.g., movement to water balance, foraging, and mating) and physiology (e.g., increased dehydration, heart rate and oxygen consumption, and increased energy demands). These negative impacts are greater for hatchlings and juvenile salamanders because, relative to their body mass size, they have a greater skin surface area than larger salamanders, and thus have greater rates of water and gas exchange over their skin surface. Survivorship of hatchlings and juveniles is likely reduced from the effects of extensive stand-replacing wildland fires.

For these reasons, severe wildland fires have led to a reduction in the quality and quantity of the available salamander habitat rangewide, reducing the survivorship and fecundity of the salamander rangewide. The USFS concludes, and we concur, that habitat loss from extensive, stand-replacing wildland fire is a threat to the salamander (USFS 2009c, p. 1), and these effects will likely continue into the future, because areas that have not burned in the past 15 years are still at extremely high risk, and areas that have experienced severe wildfires in the last 15 years have degraded habitat that continues to adversely affect the salamander. We consider the reduction in the quality and quantity of habitat from extensive stand-replacing wildland fire to be a significant threat to the species, because this threat is rangewide and directly kills salamanders or otherwise harms living salamanders by affecting salamander behavior, physiology, and reproductive success. Therefore, we believe that severe wildland fire has substantially impacted the salamander and its habitat, and this trend is expected to continue throughout its range in the future, unless and until projects attempting to reduce the threat of wildland fire are effectively implemented over the large part of the landscape in the Jemez Mountains which includes the habitat of the salamander.

Forest Composition and Structure Conversions

Changes in forest composition and structure exacerbate severe wildland fires and are, therefore, considered an interrelated threat to the salamander. In addition, changes in forest composition and structure may threaten the salamander by directly altering microhabitat conditions such as soil moisture, soil temperature, soil pH, relative humidity, and air temperature. In an area nearby to salamander habitat, but in piñon-juniper woodland (*Pinus edulis* and *Juniperus monosperma*) at 7,021 ft (2,140 m) elevation in the Jemez Mountains, soil moisture conditions can vary spatially between the ground under tree canopy and the ground without tree canopy resulting from the interrelated processes among soil evaporation, leaf interception, runoff generation and redistribution, and plant water use (Breshears *et al.* 1998, p. 1015). Relative to the ground without tree canopy, the ground beneath the canopy receives reduced precipitation input due to the interception of the precipitation from leaves. This also influences soil evaporation rates (Breshears *et al.* 1998, p. 1010). In a study measuring spatial variations in soil evaporation caused by tree shading for a water-limited pine forest in Israel, the authors report that the spatial variability in soil evaporation correlated with solar radiation, which was up to 92 percent higher in exposed compared to shaded sites, and with water content, which was higher in exposed areas during the wetting season, but higher in the shaded areas during the drying season (Raz-Yaseef and Yakir 2010, p. 454). The specific results of this study are not applicable to the Jemez Mountains, but generally support the findings of Breshears *et al.* (entire) and highlight the importance of the correlated factor of seasonality to all processes. Without specific studies measuring these processes in salamander habitat, we are not able to determine how the changes in vegetation composition and structure may have altered soil moisture, evaporation, and temperature processes, but we do understand that vegetation structure can directly influence hydrological processes that are correlated to solar radiation, precipitation, and seasonality, as well as other abiotic factors, such as soil type, slope, and topography. Furthermore, these complex interactions should be considered when forest restoration treatments that alter canopy cover are conducted in salamander habitat.

Reduced soil moisture disrupts other aboveground activities of salamanders (e.g., foraging and mating), because salamanders must first address moisture needs above all other life functions (Heatwole and Lim 196, p. 818). Additionally, ecological changes resulting from forest composition changes could result in altered prey availability; however, we do not know if such changes would affect the salamander. The type and quantity of vegetation affects soil pH (e.g., pine needles are acidic, decomposed pine needles can increase the soils acidity), and thus could also affect the salamander. Overall, the degree of cascading ecological impacts from shifts in forest composition and structure is currently unknown; however, alteration of forest composition and structure contribute to increased risk of forest die-offs from disease and insect infestation throughout the range of the salamander (USFS 2002, pp. 11–13; 2009d, p. 1; 2009a, pp. 8–9; 2010, pp. 1–11; Allen 2001, p. 6). Forest die-offs from disease or insect infestation would have similar effects to the salamander by reducing canopy closure and warming and drying the habitat. We find that the interrelated contributions from changes in vegetation due to large-scale, high-severity wildfire and forest die-offs are of a significant magnitude across the range of the species (e.g., see ''Fire Exclusion, Suppression, and Severe Wildland Fires'' section, above), and, in addition to continued predicted future changes to forested habitat within the range of the species, are threats to the salamander.

Data collected from the Valles Caldera National Preserve indicates that an increase in the amount of tree canopy cover in an area can decrease the amount of snow that is able to reach the ground, and can ultimately decrease the amount of soil moisture and infiltration (Enquist *et al.* 2009, p. 8). On the Valles Caldera National Preserve, 95 percent of coniferous forests have thick tree canopy cover with heavy understory fuels (Valles Caldera National Preserve 2010, pp. 3.3–3.4; USFS 2009a, p. 9). In these areas, snow accumulates in the tree canopy over winter, and in the spring can quickly evaporate without reaching or infiltrating the soil. Relatively recent increases in tree canopy cover, resulting from changes in forest composition and structure caused by historical management and fire suppression, could be having significant drying effects on salamander habitat. In summary, existing and ongoing changes in forest composition and structure are interrelated to the threat of severe wildland fire and may also directly affect habitat suitability by altering soil moisture, soil temperature, soil pH, relative humidity, and air temperature. Therefore, forest composition and structure conversions resulting in increased canopy cover and denser understory pose threats to the salamander now and are likely to continue in the future.

Post-Fire Rehabilitation

Post-fire management practices are often needed to restore forest dynamics (Beschta *et al.* 2004, p. 957). In 1971, USFS was given formal authority by Congress for Burn Area Emergency Rehabilitation (BAER) (Robichaud *et al.* 2000, p. 1) and integrated the evaluation of fire severity, funding request procedures, and treatment options. Treatment options implemented by USFS and BAER teams include hillslope treatments (grass seeding, contour-felled logs, mulch, and other methods to reduce surface runoff and keep post-fire soil in place, such as tilling, temporary fencing, erosion control fabric, straw wattles, lopping, and scattering of slash) and channel treatments (straw bale check dams, log check dams, rock dams, and rock cage dams (gabions)) (Robichaud *et al.* 2000, pp. 11–21). Rehabilitation actions following the Cerro Grande fire in salamander habitat included heavy equipment and bulldozer operation, felling trees for safety reasons, mulching with straw and placement of straw bales, cutting and trenching trees (contour felling and securing on slope), hand and aerial seeding, and aerial hydromulch (process that broadcasts a slurry of water and mulch over an area) (USFS 2001, p. 1). Rehabilitation actions following the Las Conchas Fire included road protections (removal of culverts, installation of trash racks and drainage dips); hand and aerial seeding; mulching; and removal of trees at Native American ancestral communities (USFS 2011a, pp. 7–9; USFS 2012, pp. 1–3).

In many cases, rehabilitation actions can have further detrimental impacts on the Jemez Mountains salamander and its habitat beyond what was caused by the fire, but the USFS has made efforts to minimize such impacts (USFS 2012, pp. 1–3). For instance, following the Las Conchas Fire, rehabilitation actions in the Jemez Mountains salamander's habitat that are categorized as ''Essential'' according to the Jemez Mountains Salamander Management Plan or categorized as ''Occupied Stands'' of Jemez Mountains salamanders by the USFS were limited to small-scale areas and included an estimated 4.3 ac (1.7 ha) of habitat being impacted for road protections, 7.5 ac (3.0 ha) that were seeded and mulched (for archeological site protection and Nordic ski trail protection), 150 ac (60.7) disturbed for hazard tree removal (cutting trees that could be dangerous by falling onto a roadway), and 3.25 ac (1.3 ha) of bulldozer line that was rehabilitated with slash placement or seeding (USFS 2011a, pp. 7–9; USFS 2012, pp. 1–3).

Some post-fire rehabilitation actions may be beneficial for the salamander. For example, contour felling can slow erosion and, in cases where aboveground rocks are not present or present in low numbers, the felled logs can also provide immediate aboveground cover. Following the Cerro Grande Fire, the BAER Team recommended felling large-diameter Douglas fir logs and cutting four disks off each log (rounds) to provide immediate cover for salamanders before summer rains (Interagency BAER Team 2000, p. 87; USFS 2001, p. 1). Similar recommendations were made after the Las Conchas Fire (BAER Survey Specialist Report 2011, p. 3). We believe these actions would benefit the salamander immediately post-fire, but neither of these actions have been implemented or tested. Still, some post-fire treatments (e.g., grass seeding, heavy equipment operation, bulldozing, tilling, hydromulching (process that broadcasts a slurry of water and mulch with seed and fertilizer over an area), mulching, erosion control fabrics, and removal of aboveground rocks to build rock dams) likely negatively impacted the salamander.

The most common BAER treatment has been grass seeding dropped from aircraft (Robichaud *et al.* 2000, p. 11; Peppin *et al.* 2010, p. 574). Nonnative grasses have typically been seeded because they are fast-growing and have extensive fibrous roots (Robichaud *et al.* 2000, p. 11); however, in more recent years, efforts have been made to use native plant species, but their use is often limited by high cost and inadequate availability (Peppin *et al.* 2010, p. 574). Overall, seeding with grass is relatively inexpensive, and has been reported to rapidly increase water infiltration and stabilize soil (Robichaud *et al.* 2000, p. 11). However, Peppin *et al.* (2010, p. 573) concluded that post-wildfire seeding in western U.S. forests does little to protect soil in the short term, has equivocal effect on invasion of nonnative species, and can have negative effects on native vegetation recovery. Nevertheless, nonnative grasses from post-fire rehabilitation efforts have created thick mats that are impenetrable to the salamander, because the species has short legs and cannot dig tunnels. The existing spaces in the soil fill with extensive roots, altering the subterranean habitat in a manner that is unusable to the salamander. We are aware of areas that burned with moderate and high severities in the Dome Fire (eastern and southeastern part of its range), where these thick mats of grass resulting from rehabilitation still persist, and salamanders are no longer found there. It is possible that native grasses could have the same effect, because the goal of the rehabilitation effort is to stabilize the soil with quick-growing fibrous roots.

Additionally, grass seed mixtures can also contain fertilizer that is broadcast over large areas of habitat (e.g., hydromulch used in post-fire treatments for the Cerro Grande Fire). Fertilizers can contain nitrate, which is toxic to amphibians at certain levels (Rouse *et al.* 1999, p. 799). Finally, how mulching with straw post-fire affects the salamander remains unknown, but this practice could have significant adverse effects if there is widespread use and the mulch creates an impenetrable layer or alters the microecology in the upper layers of the soil and at the soil's surface. While the effects to salamanders from seeding with nonnative grasses, use of fertilizers, or mulch application have not been specifically studied, these actions, alone or in combination, have likely caused widespread adverse impacts to the salamander. To reduce adverse effects to the salamander resulting from post-fire rehabilitation efforts following the Las Conchas Fire, efforts were made to avoid seeding in most salamander areas (USFS 2011c, p. 9) and avoiding salamander habitat was a specific criterion for grass seeding and mulching actions (USFS 2012, p. 3). Because many common post-fire treatment actions have the potential to have significant, widespread adverse effects, we anticipate habitat alterations from wildfire and post-fire rehabilitation will continue to be a threat to the salamander localities from both past and future treatments.

In summary, some post-fire treatments, such as contour felling of logs and cutting and scattering rounds, may reduce some of the short-term effects of fire to the salamander and its habitat. However, other post-fire treatments negatively impact the salamander and its habitat in the long term. Small-scale impacts could occur from removing rocks from habitat to build rock dams, and large-scale impacts include grass seeding and associated chemicals, and possibly mulching. We conclude that, while the effects of high-severity, stand-replacing wildfire are the most significant threat to the salamander and its habitat, actions taken following wildfires are also a threat to the salamander's habitat and are expected to continue in the future.

Fire Use

Fire use includes the combination of wildland fire use (the management of naturally ignited wildland fires to accomplish specific resource management objectives) and prescribed fire (any fire ignited by management actions to meet specific objectives) applications to meet natural resource objectives (USFS 2010b, p. 1). Fire use can benefit the salamander in the long term by reducing the risk of severe wildland fires and by returning the natural fire cycle to the ecosystem. Other fire practices, such as broadcast burning (i.e., conducting prescribed fires over large areas), consume ground litter (leaves, dead plants, etc.) that helps to create moist conditions and stabilize soil and rocky slopes. Depending on time of year, fire use can also negatively impact the salamander when the species is active above ground (typically from July to September). However, the wet conditions required for salamander aboveground activity are often not conducive to fire. Prescribed fire in the Jemez Mountains is often planned for the fall (when the salamanders are not active above ground), because low wind and increased moisture during this time allow more control, lowering chances of the fire's escape. Because fire historically occurred prior to July (i.e., premonsoon rains), the majority of fires likely preceded the salamander's aboveground activity. Prescribed fires conducted after September, when salamanders typically return to their subterranean retreats, would be similar to a natural fire regime in the spring with low direct impacts because most salamanders are subterranean at that time. However, the indirect impacts of altering the time of year when fire is present on the landscape on the salamander and its habitat are unknown.

Other activities related to fire use that may have negative impacts to the salamander and its habitat include digging fire lines, targeting the reduction of large decaying logs, and using flares and fire-retardant chemicals in salamander habitat. Some impacts or stressors to the salamander can be avoided through seasonal timing of prescribed burns and modifying objectives (e.g., leaving large-diameter logs and mixed canopy cover) and by modifying fire management techniques (e.g., not using flares or chemicals) in salamander habitat (Cummer 2005, pp. 2–7).

As part of the Southwest Jemez Restoration Project proposal, the Santa Fe National Forest has set specific goals pertaining to salamander habitat, including reduction of the risk of high-intensity wildfire in salamander habitat, and retention of a moisture regime that will sustain high-quality salamander habitat (USFS 2009a, p. 11). The Santa Fe National Forest intends to minimize impacts to salamander habitat and to work toward recovery of the salamander (USFS 2009, p. 4), but specific actions or recommendations to accomplish this goal have not yet been determined. If the salamander's needs are not considered, fire use could make its habitat less suitable (warmer; drier; fewer large, decaying logs), and kill or injure salamanders that are active above ground. Alternatively, the salamander's habitat may benefit if seasonal restrictions and maintaining key habitat features (e.g., large logs and sufficient canopy cover to maintain moist microhabitats) are part of managing fire.

Given the current condition of forest composition and structure, the risks of severe wildland fire on a large geographic scale will take a long-term planning strategy. Fire use is critical to the long-term protection of the salamander's habitat, although some practices are not beneficial to the species and may be a threat to the salamander.

Fire Suppression Activities

Similarly, fire suppression activities may both protect and negatively impact the salamander and its habitat. For example, fire suppression actions that occurred in salamander habitat during the Cerro Grande Fire included hand line construction and bulldozer line construction (digging firebreaks down to bare mineral soil), backfiring (burning off heavy ground cover before the main fire reached that fuel source), and fire retardant drops (USFS 2001, p. 1). Fire suppression actions in modeled salamander habitat on the Santa Fe National Forest following the Las Conchas Fire included 1.2 miles (mi) (1.9 kilometers (km)) of bulldozer line, 0.6 mi (0.9 km) of hand line, 1.2 mi (1.9 km) of fire retardant drop, and 1.5 ac (0.6 ha) of areas cleared for three drop points and one Medivac area (USFS 2011d, pp. 1–2). Water dropping from helicopters is another fire suppression technique used in the Jemez Mountains, where water is collected from accessible streams, ponds, or stock tanks. Dropping surface water into terrestrial habitat significantly increases the risk of spreading aquatic pathogens into terrestrial habitats (see *C. Disease and Predation,* below).

The impacts of fire retardants and firefighting foams to the salamander are discussed under *E. Other Natural or Manmade Factors Affecting Its Continued Existence,* below. Fire suppression actions, including the use of fire retardants, water dropping, backfiring, and fire line construction, likely impact the salamander's habitat; however, the effects of habitat impacts from fire suppression on the salamander remain unknown, and, based on the information available at this time, we determine that fire suppression actions do not appear to be a threat to the salamander's habitat. These activities improve the chances of quick fire suppression, and thus fires would be relatively smaller in scale and could have fewer impacts than a severe wildland fire. Therefore, we do not find that fire suppression activities are a threat to the salamander's habitat, nor do we expect them to become a threat in the future.

Mechanical Treatment of Hazardous Fuels

Mechanical treatment of hazardous fuels refers to the process of grinding or chipping vegetation (trees and shrubs) to meet forest management objectives. When these treatments are used, resprouting vegetation often grows back in a few years and subsequent treatment is needed. Mechanical treatment is a fuel-reduction technique that may be used alone or in combination with prescribed fire. Mechanical treatment may include the use of heavy equipment or manual equipment to cut vegetation (trees and shrubs) and to scrape slash and other debris into piles for burning or mastication. Mastication equipment uses a cutting head attached to an overhead boom to grind, chip, or crush wood into smaller pieces, and is able to treat vegetation on slopes up to 35 to 45 percent, while generally having little ground impact (soil compaction or disturbance). The debris is left on the ground where it decomposes and provides erosion protection, or it is burned after drying out.

Mechanical treatment of hazardous fuels, such as manual or machine thinning (chipping and mastication), may cause localized disturbances to the forest structure or alter ecological interactions at the soil surface that can impact the salamander and its habitat. For example, removal of overstory tree canopy or ground cover within salamander habitat may cause desiccation of soil or rocky substrates. Also, a layer of masticated material could change microhabitat conditions making it unsuitable for salamanders (e.g., altering fungal communities or physically making it difficult for salamanders to move through). Additionally, tree-felling or use of heavy equipment has the potential to disturb the substrate, resulting in destabilization of rocky slopes and compaction of soil, which may reduce subterranean interstices (spaces) used by salamanders for refuges or movement.

Activities that compact soil, alter ecological interactions at the soil surface, remove excessive canopy cover, or are conducted while salamanders are aboveground active would be detrimental to the salamander and its habitat. A masticator is one type of heavy machinery that can be used for mechanical treatment of fuels that could potentially compact the soil and leave debris altering the soil surface ecology. In one study at a different location, a masticator was operated on existing skid trails (temporary trails used to transport trees, logs, or other forest products) and did not increase soil compaction, because the machinery traveled on existing trails covered with masticated materials (wood chips, etc.), which more evenly distributed the weight of the machinery and reduced soil compaction (Moghaddas and Stephens 2008, p. 3,104). However, studies in the Jemez Mountains and effects to soils there have not been conducted.

At this time, we do not have any specific information whether mechanical treatments, including mastication, negatively impact the salamander either through altering aboveground habitat or soil compaction. We encourage research on these techniques if they are to be implemented in salamander habitat. If mechanical treatment and hazardous fuels activities are conducted in a manner that minimizes impacts to the salamander and its habitat, while reducing the risk of severe wildland fire, the salamander could ultimately benefit from the reduction in the threat of severe wildland fire and the improvement in the structure and composition of the forest. However, mechanical treatments could also pose a threat to the salamander and its habitat if conducted in a manner that degrades habitat or makes it unusable to the salamander. Finally, if salamanders are active above ground, any of these activities could crush any salamanders present. We are not aware of any specific large-scale mechanical treatments in salamander habitat; however, mastication is an option for treatments in the Southwest Jemez Restoration Project area. We do not have information indicating that mechanical treatments pose a threat to the salamander.

Forest Silvicultural Practices

Many areas of the landscape in the Jemez Mountains have been fragmented by past silvicultural practices (the care and cultivation of forest trees) including commercial (trees greater than 9 inches (in) (23 centimeteres (cm)) in diameter at breast height (dbh)) and precommercial (trees less than 9 in (23 cm) dbh) timber harvesting. Much of the forests of the Jemez Mountains lack large-diameter trees and have become overgrown with small-diameter trees. While salamanders still occupy areas where timber harvesting has occurred, the effects of past silvicultural practices continue to adversely affect the salamander and its habitat through the absence of large-diameter trees that, when they fall and decompose, provide high-quality aboveground habitat, through the contribution of high fuels increasing the risk of large-scale stand-replacing wildfire, and cascading effects on soil moisture and temperature.

From 1935 to 1972, logging (particularly clear-cut logging) was conducted on Valles Caldera National Preserve (ENTRIX 2009, p. 164). These timber activities resulted in about 50 percent of Valles Caldera National Preserve being logged, with over 1,000 mi (1,600 km) of 1960s-era logging roads (ENTRIX 2009, p. 164) being built in winding and spiraling patterns around hills (ENTRIX 2009, pp. 59–60). On the Valles Caldera National Preserve, 95 percent of forest stands contain dense thickets of small-diameter trees, creating a multi-tiered forest structure (Valles Caldera National Preserve 2010, pp. 3.3–3.4). This multi-tiered forest structure is similar to surrounding areas, and provides ladder fuels that favor the development of crown fires (as opposed to high-intensity, habitat-destroying ground fires) (Allen 2001, pp. 5–6; USFS 2009a, p. 10). Additionally, all forest types on the Valles Caldera National Preserve contain very few late-stage mature trees greater than 16 in (41 cm) dbh (less than 10 percent of the overall cover) (Valles Caldera National Preserve 2010, pp. 3.4, 3.6–3.23). The lack of large trees is an artifact of intense logging, mostly from clear-cutting practices in the 1960s (Valles Caldera National Preserve 2010, p. 3.4). Clear-cutting degrades forest floor microhabitats for salamanders by eliminating shading and leaf litter, increasing soil surface temperature, and reducing moisture (Petranka 1998, p. 16).

In a study comparing four logged sites and five unlogged sites in Jemez Mountains salamander habitat, Ramotnik (1986, p. 8) reports that a total of 47 salamanders were observed at four of the five unlogged sites, while no salamanders were observed on any of the logged sites. We do not know if salamanders actually occupied the logged sites prior to logging, but significant differences in habitat features (soil pH, litter depth, and log size) between the logged and unlogged sites were reported (Ramotnik 1986, p. 8). On the unlogged sites, salamanders were associated with cover objects that were closer together and more decayed, and that had a higher canopy cover, greater moss and lichen cover, and lower surrounding needle cover, compared to cover objects on logged sites (Ramotnik 1986, p. 8). Cover objects on logged sites were less decomposed and accessible by the salamanders, had a shallower surrounding litter depth, and were associated with a more acidic soil than were cover objects on the unlogged sites (Ramotnik 1986, p. 8). Based on the differences between logged and unlogged sites, we believe that logging can destroy or modify the Jemez Mountains salamander's habitat in such a way that it becomes uninhabitable or less suitable for the species.

Consistent with the findings of Ramotnik (1986, p. 8), deMaynadier and Hunter (1995; in Olson *et al.* 2009, p. 6) reviewed 18 studies and found that salamander abundance after timber harvest was 3.5 times greater on control (unlogged) areas than in clear-cut areas. Furthermore, Petranka *et al.* (1993; in Olson *et al.* 2009, p. 6) found that *Plethodon* abundance and richness in mature forest were five times higher than in recent clear-cut areas, and they estimated that it would take as much as 50 to 70 years for clear-cut populations to return to pre-clearcut levels. We do not know the amount of time it might take for Jemez Mountains salamanders to recover from habitat alterations resulting from clear-cut logging, particularly because of concurrent and ongoing factors affecting forest stand conditions (e.g., fire suppression, livestock grazing, changes in vegetation composition and structure).

The majority of Jemez Mountains salamander habitat has been heavily logged, which has resulted in changes in stand structure, including a paucity of large-diameter trees. This lack of large-diameter trees means that there is a limited source for future large, decaying logs that provide high-quality (e.g., relatively cool, high-moisture diurnal retreats) aboveground habitat. Ramotnik (1986, p. 12) reported that logs with salamanders were significantly larger and wetter than those logs without salamanders, and most salamanders were found in well-decomposed logs. In a similar plethodontid salamander, downed logs provide refuge from warmer temperatures and resiliency from impacts that can warm and dry habitat (Kluber *et al.* 2009, p. 31). In summary, areas where large-diameter trees have been removed have less high-quality salamander habitat features and no material for future high-quality salamander habitat features.

On the Valles Caldera National Preserve, only minor selective logging has occurred since 1972, and it is expected that some thinning of secondary growth forests will continue to occur to prevent severe wildfires. However, no commercial logging is proposed or likely in the foreseeable future (Parmenter 2009b, cited in Service 2010). Although commercial timber harvest on the Santa Fe National Forest has declined appreciably since 1988 (Fink 2008, pp. 9, 19), the effects from historical logging and associated roads (see Roads, Trails, and Habitat Fragmentation below) will continue to be a threat to the salamander.

The historical clear-cut logging practices in the Jemez Mountains have likely led to significant habitat loss for the salamander. The cutting has contributed to current stand conditions (high fuels), and the forest lacks large-diameter trees for future high-quality aboveground cover objects. We believe that the effects from historical, clear-cut logging are currently affecting the salamander and its habitat, and will continue to do so in the future.

Salvage cutting (logging) removes dead, dying, damaged, or deteriorating trees while the wood is still merchantable (Wegner 1984, p. 421). Sanitation cutting, similar to salvage, removes the same kinds of trees, as well as those susceptible to attack from biotic pests (Wegner 1984, p. 421). Both types of cutting occur in the Jemez Mountains salamander's habitat, and are referred to as ''salvage logging.'' Salvage logging is a common management response to forest disturbance (Lindenmayer *et al.* 2008, p. 4) and, in the salamander's habitat, is most likely to occur after a forest die-off resulting from fire, disease, insects, or drought. The purposes for salvage logging in the Jemez Mountains have included firewood for local use, timber for small and large mills, salvage before decay reduces the economic value of the trees, creation of diverse healthy and productive timber stands, management of stands to minimize insect and disease losses (USFS 1996, p. 4), and recovery of the timber value of fire-killed trees (USFS 2003, p. 1). When conducted in the salamander's habitat, salvage logging can further reduce the quality of the salamander's habitat remaining after the initial disturbance, by removing or reducing the shading afforded by dead standing trees (Moeur and Guthrie 1984, p. 140) and future salamander cover objects (removal of trees precludes their recruitment to the forest floor), and by interfering with habitat recovery (Lindenmayer *et al.* 2008, p. 13).

Recent salvage logging within the range of the Jemez Mountains salamander occurred following the 2002 Lakes and BMG Wildfire. The USFS stated that mitigation measures for the Lakes and BMG Wildfire Timber Salvage Project would further protect the salamander and enhance salamander habitat by immediately providing slash and fallen logs (USFS 2003, pp. 4–5). Mitigation for the salvage logging project included conducting activities during winter to avoid soil compaction (as the ground is more likely to be frozen and hard at that time), and providing for higher snag retention (by leaving all Douglas fir trees (16 percent fire-killed trees) and 10 percent of other large snags) to provide future fallen log habitat (USFS 2003, p. 29). These mitigation measures were developed in consultation with the New Mexico Endemic Salamander Team in an effort to minimize impacts to the Jemez Mountains salamander from salvage logging; however, the New Mexico Endemic Salamander Team recommended that salvage logging be excluded from occupied salamander habitat because it was not clear that, even with the additional mitigations, it would meet the conservation objectives of the Cooperative Management Plan (New Mexico Endemic Salamander Team 2003, p. 1).

The mitigation measures would likely benefit the salamander in the short term if conducted without salvage logging, or possibly with some salvage logging. It is not known if mitigation measures offset the impacts of salvage logging in salamander habitat; however, Lindenmayer *et al.* (2008, p. 13) reports that salvage logging interferes with natural ecological recovery and may increase the likelihood and intensity of subsequent fires. We believe that removal of trees limits the amount of future cover and allows additional warming and drying of habitat. The potential for large-scale forest die-offs from wildfire, insect outbreak, disease, or drought is high in the Jemez Mountains, which may result in future salvage logging in salamander habitat. We believe that if the needs of the salamander are not considered and provided for during salvage logging actions in salamander habitat, then salvage logging would further diminish habitat quality and may be a determining factor of salamander persistence subsequent to forest die-off.

Some timber harvest activities likely pose no threat to the continued existence of the Jemez Mountains salamander. For example, removal of trees that may pose a safety hazard may have minimal disturbance to surrounding soils or substrates, especially if removal is conducted when the species is not active above ground (i.e., seasonal restrictions). This type of localized impact may affect a few individuals, but it is not likely to affect a population or be considered a threat. Likewise, precommercial thinning (removal of trees less than 9 in (23 cm) dbh) or shrub and brush removal (without the use of herbicides) to control vegetation, and without disturbing or compacting large areas of the surrounding soils, likely could be conducted without adverse effects to the salamander or its habitat.

Similarly, some fuels treatment actions, such as thinning in areas around at-risk human communities could be conducted in a manner that would pose no threat to the salamander. For example, Clayton *et al.* (2009, entire) provides specific guidelines on fuels treatments to manage for the persistence and protection on the Siskiyou Mountains salamander that include maintaining certain habitat features and address specific activity mitigations. We anticipate implementation of similar guidelines for the Jemez Mountains salamander will alleviate any potential threat from fuels treatment action around at-risk communities.

In summary of forest silvicultural practices, impacts from past commercial clear-cut logging activities continue to have detrimental effects to the salamander and its habitat. These past activities removed large-diameter trees, altered forest canopy structure, created roads, compacted soil, and disturbed other important habitat features. These effects of historical clear-cutting logging include the warming and drying of habitat, and a paucity of large cover objects (decaying logs) that would have contributed to habitat complexity and resiliency. Salvage logging further diminishes salamander habitat subsequent to disturbance. Therefore, we conclude that the salamander continues to face threats from current forest silvicultural practices, including salvage logging. These actions are smaller in scale relative to the range of the species, and we are not aware of any proposals to salvage-log the large area of the Las Conchas burn area. However, the habitat-warming and drying effect of these actions may cause additional detrimental disturbance to habitat in areas burned by severe wildfire. We also conclude that the salamander continues to face threats resulting from the habitat-related effects of historical logging activities because high-quality, high-moisture retreats are presently fewer, and future opportunities for high-quality, high-moisture retreats will be extremely rare. Because all salamander life functions and activities are based on the individual's water balance, limiting opportunities for hydration affects all other aspects of survival and reproduction, greatly contributing to the risk of extinction. This significant threat is occurring now and will continue into the future.

Dams

Following the 2000 Cerro Grande Fire, water retention dams were constructed within potential salamander habitat to minimize soil erosion within burned areas (NMDGF 2001, p. 1; New Mexico Endemic Salamander Team 2002, pp. 1–2; Kutz 2002, p. 1). Because these types of structures were installed to slow erosion subsequent to wildfire, additional dams or flood control features could be constructed within salamander habitat in the future following severe wildland fires. Some individual salamanders may be killed or injured by this activity; however, the impact to the species and habitat from construction of retention dams would be relatively minor. For this reason, we do not consider the construction of dams to currently be a significant threat to the salamander, nor do we expect dam construction to be a threat to the species in the future.

Mining

Pumice mining activities (e.g., Copar Pumice Company, the Copar South Pit Pumice Mine, and the El Cajete Pumice Mine) have been evaluated for impacts to the salamander (USFS 1995, pp. 1–14; 1996, pp. 1–3). Pumice mines are located within areas of volcanic substrate that are unlikely to support salamanders (USFS 2009c, p. 2). However, associated infrastructure from expansion of the El Cajete Mine, such as access roads and heavy equipment staging areas, may have the potential to be located in potential salamander habitat. Although no decision on authorizing the extension to the El Cajete Mine has been made (USFS 2009, p. 2), these activities would be small in scale and not likely considered a threat to the species, either currently or in the future.

Private (Residential) Development

In our 12-month finding (75 FR 54822; September 9, 2010), we found that residential development was a threat to the salamander, because we visually assessed salamander occurrences on a map and it appeared that private lands contained substantially sized, contiguous areas of salamander habitat, with the potential for future development. However, after conducting a GIS (Geographical Information System) analysis for the final critical habitat determination to be published soon in the **Federal Register**, we found that only 3 percent (2,817 ac (1,140 ha) of the total modeled habitat are private lands, of which 719 ac (291 ha) include the Pajarito Ski area, where the habitat is already developed and unlikely to be suitable for the salamander in the long term (see Recreation, below). The remaining areas of private lands occur as noncontiguous scattered parcels. However, some private lands, as well as areas with salamander habitat on the Santa Fe National Forest, could be developed for private use (USFS 1997, pp. 1–4; USFS 1998, pp. 1–2).

Development can destroy and fragment the salamander's habitat through the construction of homes and associated infrastructure (e.g., roads, driveways, and buildings), making those areas unusable to salamanders and likely resulting in mortalities to salamanders within those areas. Furthermore, as the human population continues to increase in the Jemez Mountains, we believe development will likely continue to directly affect the salamander and its habitat in the future. These activities will likely be in the form of new housing and associated roads and infrastructure. Although we anticipate some loss and degradation of habitat from these activities, salamander habitat on private lands is smaller and more isolated than we thought prior to our GIS analysis. Moreover, we found very few salamander occurrences on private lands. For these reasons, we believe that private residential development has the potential to impact the salamander and its habitat, but does not constitute a significant threat to the species.

Geothermal Development

A large volcanic complex in the Jemez Mountains is the only known high-temperature geothermal resource in New Mexico (Fleischmann 2006, p. 27). Geothermal energy was explored for possible development on the Valles Caldera National Preserve between 1959 and 1983 (USFS 2007, p. 126). In July 1978, the U.S. Department of Energy, Union Oil Company of California (Unocal), and the Public Service Company of New Mexico began a cooperative geothermal energy project (USFS 2007, p. 126). The demonstration project drilled 20 exploratory wells over the next 4 years. One of the geothermal development locations was south of Redondo Peak on the Valles Caldera National Preserve, and the canyon in this area was occupied by the salamander (Sabo 1980, pp. 2–4). An Environmental Impact Statement analyzed a variety of alternatives, including placement of transmission towers and lines (U.S. Department of Energy cited in Sabo 1980, pp. 2–5). Nevertheless, the project ended in January 1982, because Unocal's predictions concerning the size of geothermal resources were not met. Out of the 40 wells drilled in the Valles Caldera National Preserve in the Redondo Creek and Sulphur Springs areas, only a few yielded sufficient resources to be considered production wells (USFS 2007, p. 126). In some cases, these wells were drilled in the salamander's habitat and concrete well pads were built.

Although the geothermal resources are found within the range of the salamander in the Jemez Mountains, extraction of large quantities of hot fluids from these rocks has proven difficult and not commercially viable (USFS 2007, p. 127). As such, we are not aware of any current or future plans to construct large or small-scale geothermal power production projects within salamander habitat. Moreover, in 2006, the mineral rights on the Valles Caldera National Preserve were condemned, including geothermal resources (VallesCaldera.com 2010, p. 1). For these reasons, geothermal development does not present a current or future threat to the salamander.

Roads, Trails, and Habitat Fragmentation

Construction of roads and trails has historically eliminated or reduced the quality or quantity of salamander habitat, reducing blocks of native vegetation to isolated fragments, and creating a matrix of native habitat islands that have been altered by varying degrees from their natural state. Allen (1989, pp. 46, 54, 163, 216–242, and 302) collected and analyzed changes in road networks (railroads, paved roads, improved roads, dirt roads, and primitive roads) in the Jemez Mountains from 1935 to 1981. Landscape-wide road density increased 11.75 times, from 0.24 mi (0.38 km) of road per mi^2 (2.6 km^2) in 1935, to 2.8 mi (4.5 km) of road per mi^2 (2.6 km^2) in 1981, and in surface area of from 0.13 percent (610 ac; 247 ha) to 1.7 percent (7,739 ac; 3,132 ha) (Allen 1989, pp. 236–240). Allen (1989, p. 240) reports that, of 5,246 mi (8,443 km) of roads in the Jemez Mountains in 1981, 74 percent were mapped on USFS lands (2,241 mi; 3,607 km) and private lands (1,646 mi; 2,649 km). These roads generally indicate past logging activity of USFS and private lands (Allen 1989 p. 236).

Ongoing effects of roads and their construction on the Valles Caldera National Preserve may exceed the effects of the timber harvests for which the roads were constructed (Balmat and Kupfer 2004, p. 46). The majority of roads within the range of the salamander are unpaved, and the compacted soil typically has very low infiltration rates that generate large amounts of surface runoff (Robichaud *et al.* 2010, p. 80). Increasing runoff, decreasing infiltration, and increasing edge effects (open areas along roads) has led to the drying of adjacent areas of salamander habitat.

The construction of roads and trails (motorized vehicle, bicycle, and foot trails) degrades habitat by compacting soil and eliminating interstitial spaces above and below ground. Roads are known to fragment terrestrial salamander habitat and act as partial barriers to movement (deMaynadier and Hunter 2000, p. 56; Marsh *et al.* 2005, p. 2004). Furthermore, roads and trails reduce or eliminate important habitat features (e.g., lowering canopy cover or drying of soil) and prevent gene flow (Saunders *et al.* 1991, p. 25; Burkey 1995, pp. 527, 528; Frankham *et al.* 2002, p. 310; Noss *et al.* 2006, p. 219). Vehicular and off-highway vehicle (OHV) use of roads and trails can kill or injure salamanders. We consider the establishment of roads and trails to be a threat that will likely continue to impact the salamander and its habitat, increasing the risk of extirpation of some localities.

Road clearing and maintenance activities can also cause localized adverse impacts to the salamander from scraping and widening roads and shoulders or maintaining drainage ditches or replacing culverts. These activities may kill or injure individuals through crushing by heavy equipment. Existing and newly constructed roads or trails fragment habitat, increasing the chances of extirpation of isolated populations, especially when movement between suitable habitats is not possible (Burkey 1995, p. 540; Frankham *et al.* 2002, p. 314). Isolated populations or patches are vulnerable to random events, which could easily destroy part of or an entire isolated population, or decrease a locality to such a low number of individuals that the risk of extirpation from human disturbance, natural catastrophic events, or genetic and demographic problems (e.g., loss of genetic diversity, uneven male to female ratios) would increase greatly (Shaffer 1987, p. 71; Burkey 1995, pp. 527, 528; Frankham *et al.* 2002, pp. 310–324).

Terrestrial salamanders are impacted by edge effects, typically adjacent to roads and areas of timber harvest, because microclimate conditions within forest edges often exhibit higher air and soil temperatures, lower soil moisture, and lower humidity, compared to interior forested areas (Moseley *et al.* 2009, p. 426). Moreover, by creating edge effects, roads can reduce the quality of adjacent habitat by increasing light and wind penetration, exposure to pollutants, and the spread of invasive species (Marsh *et al.* 2005, pp. 2004–2005). Due to the physiological nature of terrestrial salamanders, they are sensitive to these types of microclimate alterations, particularly to changes to temperature and moisture (Moseley *et al.* 2009, p. 426). Generally, more salamanders are observed with increasing distance from some edge types, which is attributed to reduced moisture and microhabitat quality (Moseley *et al.* 2009, p. 426).

On the western part of the species' range, road construction on New Mexico State Highway 126 around the town of Seven Springs occurred in occupied salamander habitat in 2007 and 2008. Measures were implemented by the USFS to reduce the impact of these road construction activities on salamanders, including limiting construction to times when salamanders would not be active above ground (October through June) and felling of approximately 300 trees in the project area to replace large woody debris that was being used by the salamander but removed by the road construction. However, these measures only offered some protection for salamanders and their habitat outside the project footprint. The rerouting and construction of Highway 126 went through the middle of a large salamander population where 24 ac (9.7 ha) of salamander habitat were directly impacted by this project (USFS 2009c, p. 2). This project destroyed and made unusable the 24 ac (9.7 ha). Also, the project fragmented the occupied salamander habitat remaining outside of the 24-ac (9.7-ha) footprint, because the new road has a nearly vertical cut bank and salamanders will not be able to cross it. Continued maintenance of State Highway 126 in the future will likely involve the use of salts for road de-icing, and increase the exposure of adjacent areas to chemicals and pollution from vehicular traffic. Habitat fragmentation of and subsequent edge effects due to this road construction project have reduced the quality and quantity of salamander habitat in this part of its range.

In 2007, the New Mexico Endemic Salamander Team concluded that impacts from OHVs and motorcycles were variable depending on their location relative to the salamander's habitat. Because the width of a trail is generally smaller than a road, canopy cover typically remains over trails. In some cases (e.g., flat areas without deeply cut erosion), the trails do not likely impede salamander movement. Alternatively, severe erosion caused by heavy trail use by motorcycles or OHVs in some places formed trenches approximately 2 ft wide by 2 to 3 ft deep (0.6 m wide by 0.6 to 0.9 m deep), which would likely prevent salamander movement, fragment local populations, and trap salamanders that fall into the trenches. Therefore, OHVs and motorcycles could severely impact the salamander's habitat.

On November 9, 2005 (70 FR 68264), the USFS issued the Travel Management Rule that requires designation of a system of roads, trails, and areas for motor vehicle use by vehicle class and, if appropriate, by time of year. As part of this effort, the USFS inventoried and mapped roads and motorized trails, and is currently completing a Final Environmental Impact Statement to change the usage of some of the current system within the range of the salamander. The Santa Fe National Forest is attempting to minimize the amount of authorized roads or trails in known occupied salamander habitat and will likely prohibit the majority of motorized cross-country travel within the range of the species (USFS 2009c, p. 2; USFS 2010c p. 95). Nevertheless, by closing some areas to OHV use, the magnitude of impacts in areas open to OHV use in salamander habitat will be greater (New Mexico Endemic Salamander Team 2008, p. 2). We acknowledge that some individual salamanders may be killed or injured by vehicles and OHVs, and that OHV use impacts salamander habitat. However, we believe the Santa Fe National Forest is attempting to minimize impacts to the salamander and its habitat. Furthermore, we believe that the revised travel management regulations will reduce the impact of motorized vehicles on the salamander and its habitat by providing a consistent policy that can be applied to all classes of motor vehicles, including OHVs. We consider unmanaged OHV and motorcycle use to be a threat to the salamander, but with the implementation of the forthcoming management of motorized trails on the Santa Fe National Forest, the threat will be greatly reduced.

In summary, the extensive roads that currently exist in the Jemez Mountains have significantly impacted the salamander and its habitat due to the possible death and injury of salamanders; fragmentation and population isolation; habitat loss; habitat modification near road edges; and in some cases, increased exposure to chemicals, salts, and pollution. Roads associated with private development are most likely to be constructed or expanded in the future in the southern and eastern portions of the species' range, because this part of the species' range has the most private land. Also, new roads may also be constructed through Federal lands within the salamander's range, but such construction is unlikely because the Santa Fe National Forest is attempting to reduce roads and road usage in the Jemez Mountains. Roads and trails have significantly fragmented habitat and likely reduced persistence of existing salamander localities. Therefore, we consider roads, trails, and the resulting habitat fragmentation to be a threat to the Jemez Mountains salamander and its habitat now and in the future.

Recreation

The Jemez Mountains are heavily used for recreational activities that impact the species, including camping, hiking, mountain biking, hunting, and skiing; OHV use is addressed above. Located in the southwestern Jemez Mountains is the Jemez National Recreation Area. The Jemez National Recreation Area comprises 57,650 ac (23,330 ha) and is managed by the USFS for the promotion of fishing, camping, rock climbing, hunting, and hiking. Nearly 1.6 million people visit the Jemez National Recreation Area for recreational opportunities each year (Jemez National Recreation Area 2002, p. 2). Despite an existing average road density of approximately 2.5 mi (4.0 km) of road per mi^2 (2.6 km^2) on the Jemez National Recreation Area, off-road use continues to occur, resulting in new roads being created or decommissioned roads being reopened (Jemez National Recreation Area 2002, pp. 10–11).

Using current population and travel trends, the potential visitation demand on the Valles Caldera National Preserve is between 250,000 and 400,000 visits per year (ENTRIX 2009, p. 93). Of this projection, the Valles Caldera National Preserve is expected to realize 120,000 visitors per year by the year 2020 (ENTRIX 2009, p. 94). To put this in context, from 2002 to 2007 the Valles Caldera National Preserve averaged about 7,600 visitors per year (ENTRIX 2009, p. 13). Bandelier National Monument, which has a smaller proportion of salamander habitat relative to the Santa Fe National Forest or Valles Caldera National Preserve, attracts an average annual visitation of more than 250,000 people (ENTRIX 2009, p. 92). Fenton Lake State Park in the western part of the species' range also contains salamander habitat. The park received more than 120,000 visitors on its 70 ac (28 ha) containing hiking trails and a fishing lake (ENTRIX 2009, p. 92).

Campgrounds and associated parking lots and structures have likely impacted the salamander's habitat through modification of small areas by soil compaction and vegetation removal. Similarly, compaction of soil from hiking or mountain biking trails has modified a relatively small amount of habitat. The majority of these trails likely do not act as barriers to movement or create edge effects similar to roads, because they are narrow and do not reduce canopy cover. However, similar to OHV trails, deeply eroded mountain bike trails could act as barriers and entrap salamanders.

The Pajarito Ski Area in Los Alamos County was established in 1957 and expanded through 1994. Ski runs were constructed within salamander habitat. A significant amount of high-quality habitat (north-facing mountain slopes with mixed-conifer forests and many salamander observations (New Mexico Heritage Program 2010a and b, spreadsheets) was destroyed with construction of the ski areas, and the runs and roads have fragmented and created a high proportion of edge areas. Nevertheless, surveys conducted in 2001 in two small patches of forested areas between ski runs detected salamanders (Cummer *et al.* 2001, pp. 1–2). Most areas between runs remain unsurveyed. However, because of the large amount of habitat destroyed, the extremely small patch sizes that remain, and relatively high degree of edge effects and fragmentation, the salamander will likely not persist in these areas in the long term.

Adjacent to the downhill ski runs are cross country ski trails. These trails are on USFS land, but maintained by a private group. In 2001, trail maintenance and construction with a bulldozer was conducted by the group in salamander habitat during salamander aboveground activity period (New Mexico Endemic Salamander Team 2001, p. 1). Trail maintenance was reported as leveling all existing ski trails with a bulldozer, which involved substantial soil disturbance, cutting into slopes as much as 2 ft (0.6 m), filling other areas in excess of 2 ft (0.6 m), widening trails, and downing some large trees (greater than 10 in (25 cm) dbh), ultimately disturbing approximately 2 to 5 ac (1 to 2 ha) of occupied salamander habitat (Sangre de Christo Audubon Society 2001, pp. 2–3). This type of trail maintenance, while salamanders were active above ground, may have resulted in direct impacts to salamanders, and further fragmented and dried habitat. We do not know if there are future plans to modify or expand the existing ski area.

The Jemez Mountains are currently heavily used for recreational activities, and, as human populations in New Mexico continue to expand, demand for recreational opportunities in the Jemez Mountains will likely increase. Individually, recreational activities that are small in scale, such as hunting, hiking, fishing, or dispersed camping are not considered as threats; however, the additive nature of recreational activities that include or contribute to activities that are larger in scale, such as off-road use and ski area expansions, are considered a threat to the species. Therefore, we conclude that recreational activities are currently a threat to the salamander, and will continue to be a threat in the future.

Livestock Grazing

Historical livestock grazing contributed to changes in the Jemez Mountains ecosystem by removing understory grasses, contributing to altered fire regimes and vegetation composition and structure, and increasing soil erosion. Livestock grazing generally does not occur within salamander habitat, because cattle concentrate outside of forested areas where grass and water are more abundant. We have no information that indicates livestock grazing is a direct or indirect threat to the salamander or its habitat. However, small-scale habitat modification, such as livestock trail establishment or trampling in occupied salamander habitat, is possible. The USFS and Valles Caldera National Preserve manage livestock to maintain fine grassy fuels, and should not limit low-intensity fires in the future. Although some small-scale habitat modification is possible, livestock are managed to maintain a grassy forest understory. Therefore, we do not consider livestock grazing to be a current threat to the salamander's habitat, nor do we anticipate that it will be in the future.

Conservation Plans Designed To Protect Salamander Habitat

The New Mexico Endemic Salamander Cooperative Management Plan and Conservation Agreement were completed in 2000 (see *Previous Federal Actions* section in the proposed listing rule for the Jemez Mountains salamander (77 FR 56482; September 12, 2012). These are nonregulatory documents and were intended to be a mechanism to provide for conservation and protection and preclude listing the Jemez Mountains salamander under the Endangered Species Act, as amended, (U.S. General Accounting Office 1993, p. 9). The goal of these documents was to ''. . . provide guidance for the conservation and management of sufficient habitat to maintain viable populations of the species'' (New Mexico Endemic Salamander 2000, p. i.). The intent of the agreement was to protect the salamander and its habitat on lands administered by the USFS; however, they have been ineffective in preventing the ongoing loss of salamander habitat, and they are not expected to prevent further declines of the species. The Conservation Agreement and the Cooperative Management Plan do not meet the criteria of the Policy for Evaluation of Conservation Efforts policy because the Cooperative Management Plan covers only a portion of the range of the salamander, the Agreement is expired, and the Cooperative Management Plan lacks specificity for conservation actions, and lacks certainty that conservation measures will be implemented or effective.

Nonetheless, the New Mexico Endemic Salamander Team continues to meet to discuss management actions in salamander habitat, mitigation recommendations for actions occurring in salamander habitat, and research needs. Inadequate personnel and financial resources appear to be the greatest limiting factor in salamander conservation efforts.

Also, Los Alamos National Laboratory has a Best Management Practices document whereby they have committed to, whenever possible, retaining trees in order to maintain greater than 80 percent canopy cover, and avoiding activities that either compact soils or dry habitat (Los Alamos National Laboratory 2010, p. 7).

Summary

In summary of Factor A, the Jemez Mountains salamander and its habitat experience threats from historical and current fire management practices; severe wildland fire; forest composition and structure conversions; post-fire rehabilitation; forest management (including silvicultural practices); roads, trails, and habitat fragmentation; and recreation. Because these threats warm and dry habitat, they affect all behavioral and physiological functions of the species, and ultimately reduce the survivorship and reproductive success of salamanders across the entire range of the species, greatly impacting the salamander and its habitat. Further, these significant threats are occurring now and are expected to continue in the future. While conservation plans and agreements have the goal of conserving and managing the salamander, these efforts have been ineffective in preventing ongoing loss and they are not sufficient to ameliorate or remove this threat. We, therefore, determine that the present or threatened destruction, modification, or curtailment of habitat and range represents a current significant threat to the salamander, and will continue to do so in the future.

B. Overutilization for Commercial, Recreational, Scientific, or Educational Purposes

Between 1960 and 1999, nearly 1,000 salamanders were collected from the wild for scientific or educational purposes (Painter 1999, p. 1). The majority (738 salamanders) were collected between 1960 and 1979 (Painter 1999, p. 1). Since 1999, very few salamanders have been collected, and all were collected under a valid permit, issued by either NMDGF or USFS. This species is difficult to maintain in captivity, and we know of no salamanders in the pet trade or in captivity for educational or scientific purposes.

In 1967, salamanders were only known from seven localities (Reagan 1967, p. 13). Only one of these localities (the ''Type Locality'' in the southern portion of the salamanders range) was described as having an ''abundant salamander population'' (Reagan 1967, p. 8). The species was originally described using specimens collected from this population, which is located in the southern portion of the species' range (Stebbins and Reimer 1950, pp. 73–80). Many researchers went to this site for collections and studies. Reagan (1967, p. 11) collected 165 salamanders from this locality between 1965 and 1967, whereas Williams collected an additional 67 of 659 salamanders found at this locality in 1970 (1972, p. 11). The information regarding the disposition of the 659 salamanders in this study is unclear, and it is possible more of these individuals were collected. Nonetheless, an unspecified but ''large percentage'' of the nearly 1,000 collected salamanders were reported from the ''Type Locality'' (Painter 1999, p. 1) and deposited as museum specimens around the country. Although surveys have been conducted at this locality since the 1990s, no salamanders have been found, suggesting that salamanders in the area may have been extirpated from overcollection. We are not aware of any other localities where the species has been extirpated from overcollection. Nevertheless, it is possible that repeated collections of individuals can lead to extirpation. We believe this is no longer a threat, because collections are stringently regulated through permits issued by NMDGF and the USFS (see Factor D, below). Due to these measures, we do not believe that collection will be a threat in the future.

Survey techniques associated with scientific inquiries and monitoring the salamander can alter salamander habitat by disturbing and drying the areas underneath the objects that provide cover, and by destroying decaying logs as a result of searching inside them. Beginning in 2011, the Service, NMDGF, and other partners are hosting annual training workshops to train surveyors on techniques that will minimize adverse effects to salamanders and their habitat, including replacing cover objects as they were found and leaving part of every log intact; however, impacts will still occur. When surveys are dispersed over multiple intervening years, impacts are likely lessened; however, when a location is repeatedly surveyed, habitat quality is diminished. We are aware of a few locations that have received impacts from repeated surveys for demographic studies conducted by NMDGF, but those studies have since concluded (NMDGF 2000, p. 1). We are currently working with the NMDGF, the USFS, and other partners on a survey protocol testing the efficacy of artificial cover objects to further minimize impacts to the salamander and its habitat.

We do not have any recent evidence of threats to the salamander from overutilization for commercial, recreational, scientific, or educational purposes, and we have no reason to believe this factor will become a threat to the species in the future. Therefore, based on a review of the available information, we do not consider overutilization for commercial, recreational, scientific, or educational purposes to be a threat to the salamander now or in the future.

C. Disease or Predation

The amphibian pathogenic fungus *Batrachochytrium dendrobatidis* (*Bd*) was found in a wild-caught Jemez Mountains salamander in 2003 on the east side of the species' range and again in another Jemez Mountains salamander in 2010 on the west side of the species' range (Cummer *et al.* 2005, p. 248; Pisces Molecular 2010, p. 3). *Batrachochytrium dendrobatidis* causes the disease chytridiomycosis, whereby the *Bd* fungus attacks keratin in amphibians. In adult amphibians, keratin primarily occurs in the skin. The symptoms of chytridiomycosis can include sloughing of skin, lethargy, morbidity, and death. Chytridiomycosis has been linked with worldwide amphibian declines, die-offs, and extinctions, possibly in association with climate change (Pounds *et al.* 2006, p. 161).

In New Mexico, *Bd* has caused significant population declines and local extirpations in the federally threatened Chiricahua leopard frog (*Lithobates chiricahuensis*) (USFWS 2007, p. 14). It is also implicated in the decline of other leopard frogs and the disappearance of the boreal toad (*Bufo boreas*) from the State (NMDGF 2006, p. 13). Prior to the detection of *Bd* in the Jemez Mountains salamander, *Bd* was considered an aquatic pathogen (Longcore *et al.* 1999, p. 221; Cummer *et al.* 2005, p. 248). The salamander does not have an aquatic life stage and is strictly terrestrial; thus, the mode of transmission of *Bd* remains unknown. It is possible that the fungus was transported by other amphibian species that utilize the same terrestrial habitat. Both the tiger salamander (*Ambystoma tigrinum*) and the boreal chorus frog (*Pseudacris maculata*) are amphibians that have aquatic life stages and share terrestrial habitat with the Jemez Mountains salamander. In California, *Bd* has been present in wild populations of another strictly terrestrial salamander since 1973, without apparent population declines (Weinstein 2009, p. 653).

Cummer (2006, p. 2) reported that noninvasive skin swabs from 66 Jemez Mountains salamanders, 14 boreal chorus frogs, and 24 tiger salamanders from the Jemez Mountains were all negative for *Bd.* Approximately 30 additional Jemez Mountains salamanders have been tested through 2010, resulting in the second observation of *Bd* in the salamander. Overall, sampling for *Bd* from Jemez Mountains salamanders has been limited and only observed on two salamanders. The observation of *Bd* in the salamander indicates that the species is exposed to the pathogen and could acquire infection; however, whether the salamander will get or is susceptible to chytridiomycosis remains unknown. Although *Bd* can be highly infectious and can lead to disease and death, the pathogenicity of *Bd* and amphibians varies greatly among and within amphibian species.

Bd may be a threat to the Jemez Mountains salamander, because we know that this disease is a threat to many other species of amphibians, and the pathogen has been detected in the salamander. Currently, there is a lack of sufficient sampling to definitely conclude that *Bd* is a threat, but the best available information indicates that it could be a threat, and additional sampling and studies are needed. We intend to continue monitoring for the prevalence of *Bd* in the salamander to determine if disease rises to a level of a threat to the salamander now or in the future.

Ranavirus is another emerging infectious disease of potential concern for the Jemez Mountains salamander. Pathogens belonging to the genus *Ranavirus* are multi-host (Schock *et al.* 2008, p. 133) and in conjunction with *Bd* are considered the two dominant disease factors in global amphibian declines (Muths *et al.* 2012, p. 2). Like *Bd,* ranaviruses are effectively transmitted in water, and infection and disease varies among host species and developmental stages, ranavirus isolate types, co-evolution factors, and environmental factors (Miller *et al.* 2011, p. 2351). In a targeted study in Great Smokey Mountains National Park, Tennessee, the prevalence of *Ranavirus* in lungless salamanders of the family Plethodontidae was assessed. *Ranavirus* was found in all 10 species tested, including one species of *Plethodon.* While the Jemez Mountains salamander has not been tested for the presence of *Ranavirus,* and the pathogenicity of ranaviruses to plethodontid salamanders remains unknown (Gray *et al.* 2009, p. 318), this pathogen may pose a threat to the Jemez Mountains salamander. Similar to *Bd,* however, is a lack of sufficient sampling to definitely conclude that *Ranavirus* is a threat; additional sampling and studies are needed. Finally, because both *Bd* and *Ranavirus* have the potential to be significant threats to the salamander, biosecurity measures should be strictly followed by field personnel to prevent transmission of the pathogens among populations.

Indirect effects from livestock activities may include the risk of aquatic disease transmission from earthen stock ponds that create areas of standing surface water. Earthen stock tanks are often utilized by tiger salamanders, which are known to be vectors for disease (i.e., they can carry and spread disease) (Davidson *et al.* 2003, pp. 601–607). Earthen stock tanks can also concentrate tiger salamanders, increasing chances of disease dispersal to other amphibian species. Some tiger salamanders use adjacent upland areas and may transmit disease to Jemez Mountains salamanders in areas where they co-occur. However, we do not have enough information to draw conclusions on the extent or role tiger salamanders may play in disease transmission. The connection between earthen stock tanks for livestock and aquatic disease transmission to Jemez Mountains salamanders is unclear.

We are not aware of any unusual predation outside of what may normally occur to the species by predators such as snakes (Squamata) (Painter *et al.* 1999, p. 48), shrews (Soricidae), skunks (Mephitidae), black bears (*Ursus americanus*), and owls (Strigiformes).

In summary, we have no information indicating that predation is a threat to the Jemez Mountains salamander now or in the future. Also, the best available information does not indicate that disease is a threat to the salamander's continued existence now, but it could be a threat in the future. However, additional sampling and studies are needed.

D. The Inadequacy of Existing Regulatory Mechanisms

State Regulations

New Mexico State law provides some protection to the salamander. The salamander was reclassified by the State of New Mexico from threatened to endangered in 2005 (NMDGF 2005, p. 2). This designation provides protection under the New Mexico Wildlife Conservation Act of 1974 (i.e., State Endangered Species Act) (19 NMAC 33.6.8) by prohibiting direct take of the species without a permit issued from the State. The New Mexico Wildlife Conservation Act defines ''take'' or ''taking'' as harass, hunt, capture, or kill any wildlife or attempt to do so (17 NMAC 17.2.38). In other words, New Mexico's classification as an endangered species only conveys protection from collection or harm to the animals themselves without a permit. New Mexico's statutes are not designed to address habitat protection, indirect effects, or other threats to these species, and one of the primary threats to the salamander is the loss, degradation, and fragmentation of habitat, as discussed in Factor A. There is no provision for formal consultation process to address the habitat requirements of the species or how a proposed action may affect the needs of the species. Because most of the threats to the species are from effects to habitat, protecting individuals, without addressing habitat threats, will not ensure the salamander's long-term conservation and survival.

Although the New Mexico State statutes require the NMDGF to develop a recovery plan that will restore and maintain habitat for the species, the Jemez Mountains salamander does not have a finalized recovery plan. The Wildlife Conservation Act (N.M. Stat. Ann. §§ 17–2–37–46 (1995)) states that, to the extent practicable, recovery plans shall be developed for species listed by the State as threatened or endangered. While the species does not have a finalized recovery plan, NMDGF has the authority to consider and recommend actions to mitigate potential adverse effects to the salamander during its review of development proposals. However, there is no requirement to follow the State's recommendations, as was demonstrated during the construction and realignment of Highway 126, when NMDGF made recommendations to limit impacts to the salamander and its habitat, but none of the measures recommended were incorporated into the project design (New Mexico Game Commission 2006, pp. 12–13) (see *A. Present or Threatened Destruction, Modification, or Curtailment of the Species' Habitat or Range* section, above).

Federal Regulations

Under the Federal Land Policy and Management Act of 1976 (43 U.S.C. 1701 et seq.) and the National Forest Management Act of 1976 (16 U.S.C. 1600 et seq.), the USFS is directed to prepare programmatic-level management plans to guide long-term resource management decisions. However, in practice, the provisions of these statutes that require consideration of rare species have not been able to address the threats to the Jemez Mountains salamander.

The Jemez Mountains salamander has been on the Regional Forester's Sensitive Species List since 1990 (USFS 1990, 1999, p. 14; 2007, p. 1), the same time period when the species was being reviewed for listing under the Act, as amended (See *Previous Federal Actions* above). The Regional Forester's Sensitive Species List policy is applied to projects implemented under the 1982 National Forest Management Act Planning Rule (49 FR 43026, September 30, 1982).

All existing plans continue to operate under the 1982 Planning Rule and all of its associated implementing regulations and policies; however, all new plans and plan revisions must conform to the new 2012 planning requirements (68 FR 21162; April 9, 2012). As Forest Plans are revised under this new planning requirement, National Forests will develop coarse-filter plan components, and fine-filter plan components where necessary, to contribute to the recovery of listed species and conserve proposed and candidate species (68 FR 21162; April 9, 2012). National Forests will also provide the desired ecological conditions necessary to maintain viable populations of species of conservation concern within the plan area, or to contribute to maintaining a viable population of a species of conservation concern across its range where it is not within the USFS's authority or is beyond the inherent capability of the plan area (68 FR 21162; April 9, 2012). We do not have a schedule for the Forest Plan revisions on the Santa Fe National Forest. As the Forest Plan is revised, it is unclear whether the 2012 planning requirements will provide adequate protection of the salamander on National Forest System lands. In the interim, the Forest Plans will continue to operate under the 1982 planning rule. The Santa Fe National Forest will continue developing biological evaluation reports and conducting analyses under the National Environmental Policy Act (42 U.S.C. 4321 *et seq.*) for each project that will affect the salamander or its habitat. As noted above, the Santa Fe National Forest may implement treatments under the Collaborative Forest Landscape Restoration project that, if funded and effective, have the potential to reduce the threat of severe wildland fire in the southern and western part of the salamander's range over the next 10 years (USFS 2009c, p. 2). At this time, matching funding for the full implementation of the project is not certain, nor is it likely to address short-term risk of severe wildland fire. While the Regional Forester's sensitive species designation provides for consideration of the salamander during planning of activities, it does not preclude activities that may harm salamanders or their habitats on the Santa Fe National Forest.

In summary, while the New Mexico Wildlife Conservation Act provides some protections for the Jemez Mountains salamander, specifically against take, it is not designed nor intended to protect the salamander's habitat, and one of the primary threats to the salamander is the loss, degradation, and fragmentation of habitat. Further, while NMDGF has the authority to consider and recommend actions to mitigate potential adverse effects to the salamander during review of development proposals, there is no requirement to follow these recommendations. With respect to Federal protections, the salamander has been on the Regional Forester's Sensitive Species List since 1990 (USFS 1990), but while this designation provides for consideration of the salamander during planning of activities, it does not prevent activities that may harm salamanders or their habitats on the Santa Fe National Forest.

E. Other Natural or Manmade Factors Affecting Its Continued Existence

Chemical Use

The salamander has the potential to be impacted by chemical use. Chemicals are used to suppress wildfire and for noxious weed control. Because the salamander has permeable skin, and respiration occurs through the skin and physiological functions are carried out with its skin, it may be susceptible if it comes in contact with fire retardants or herbicides. Chemicals may impact individual salamanders and their habitat, but based the best available scientific and commercial data does not indicate that it is a threat to the species as a whole. Many of these chemicals have not been assessed for effects to amphibians, and none have been assessed for effects to terrestrial amphibians. We do not currently have information that chemical use is a threat to the salamander.

Prior to 2006 (71 FR 42797, July 28, 2006), fire retardant used by the USFS contained sodium ferrocyanide, which is highly toxic to fish and amphibians (Pilliod *et al.* 2003, p. 175), but its impacts on terrestrial salamanders is not known. In 2000, fire retardant was used in salamander habitat for the Cerro Grande Fire, but we have no information on the quantity or location of its use (USFS 2001, p. 1). While sodium ferrocyanide is no longer used by USFS to suppress wildfire, similar retardants and foams may still contain ingredients that are toxic to the salamander. Beginning in 2010, the USFS began phasing out the use of ammonium sulfate because of its toxicity to fish and replacing it with ammonium phosphate (USFS 2009e, p. 1), which may have adverse effects to the salamander. We do not have any scientific reports indicating whether the chemicals currently used in fire retardants or foams adversely impact terrestrial salamanders, but it is possible.

The USFS is in the process of completing an Environmental Impact Statement regarding the use of herbicides to manage noxious or invasive plants (Orr 2010, p. 2). Chemicals that could be used include 2,4,D; Clopyralid; Chorsulfuron; Dicamba; Glyphosate; Hexazinone; Imazapic; Imazapyr; Metasulfuron Methyl; Sulfometuron Methyl; Picloram; and Triclopyr (Orr 2010, p. 2). We reviewed the ecological risk assessments for these chemicals at *http://www.fs.fed.us/foresthealth/pesticide/risk.shtml,* but found few studies and data relative to amphibians. We found a single study for Sulfometuron Methyl conducted on the African clawed frog (*Xenopus laevis*) (an aquatic frog not native to the United States). This study resulted in alterations in limb and organ development and metamorphosis (Klotzbach and Durkin 2004, pp. 4–6, 4–7). The use of chemicals listed above by hand-held spot treatments or roadside spraying (Orr 2010, p. 2) in occupied salamander habitat could result in impacts to the salamander. Because of the lack of toxicological studies of these chemicals, we do not have information indicating that these chemicals pose a threat to the salamander. However, we will continue to evaluate whether these chemicals are a threat to the salamander.

Climate Change

Our analyses under the Endangered Species Act include consideration of ongoing and projected changes in climate. The terms ''climate'' and ''climate change'' are defined by the Intergovernmental Panel on Climate Change (IPCC). ''Climate'' refers to the average and variability of different types of weather conditions over time, with 30 years being a typical period for such measurements, although shorter or longer periods also may be used (International Panel on Climate Change 2007, p. 78). The term ''climate change'' thus refers to a change in the average or variability of one or more measures of climate (e.g., temperature or precipitation) that persists for an extended period, typically decades or longer, whether the change is due to natural variability, human activity, or both (International Panel on Climate Change 2007, p. 78). Various types of changes in climate can have direct or indirect effects on species. These effects may be positive, neutral, or negative and they may change over time, depending on the species and other relevant considerations, such as the effects of interactions of climate with other variables (e.g., habitat fragmentation) (International Panel on Climate Change 2007, pp. 8–14, 18–19). In our analyses, we use our expert judgment to weigh relevant information, including uncertainty, in our consideration of various aspects of climate change.

Habitat drying affects salamander physiology, behavior, and viability; will affect the occurrence of natural events such as fire, drought, and forest die-off; and will increase the risk of disease and infection. Trends in climate change and drought conditions have contributed to temperature increases in the Jemez Mountains, with a corresponding decrease in precipitation. Because the salamander is terrestrial, constrained in range, and isolated to the higher elevations of the Jemez Mountains, continued temperature increases and precipitation decreases could threaten the viability of the species over its entire range.

Climate simulations of the Palmer Drought Severity Index (PSDI) (a calculation of the cumulative effects of precipitation and temperature on surface moisture balance) for the Southwest for the periods of 2006–2030 and 2035–2060 show an increase in drought severity with surface warming. Additionally, drought still increases during wetter simulations because of the effect of heat-related moisture loss (Hoerling and Eicheid 2007, p. 19). Annual average precipitation is likely to decrease in the Southwest as well as the length of snow season and snow depth (International Panel on Climate Change (2007b, p. 887). Most models project a widespread decrease in snow depth in the Rocky Mountains and earlier snowmelt (International Panel on Climate Change 2007b, p. 891). Exactly how climate change will affect precipitation is less certain, because precipitation predictions are based on continental-scale general circulation models that do not yet account for land use and land cover change effects on climate or regional phenomena. Consistent with recent observations in climate changes, the outlook presented for the Southwest and New Mexico predict warmer, drier, drought-like conditions (Seager *et al.* 2007, p. 1181; Hoerling and Eischeid 2007, p. 19).

McKenzie *et al.* (2004, p. 893) suggest, based on models, that the length of the fire season will likely increase further and that fires in the western United States will be more frequent and more severe. In particular, they found that fire in New Mexico appears to be acutely sensitive to summer climate and temperature changes and may respond dramatically to climate warming.

Plethodontid salamanders have a low metabolic rate and relatively large energy stores (in tails) that provide the potential to survive long periods between unpredictable bouts of feeding (Feder 1983, p. 291). Despite these specializations, terrestrial salamanders must have sufficient opportunities to forage and build energy reserves for use during periods of inactivity. As salamander habitat warms and dries, the quality and quantity of habitat decreases along with the amount of time that salamanders could be active above ground. Wiltenmuth (1997, pp. ii–122) concluded that the Jemez Mountains salamanders likely persist by utilizing moist microhabitats and they may be near their physiological limits relative to water balance and moist skin. During field evaluations, the species appeared to be in a dehydrated state. If the species has difficulty maintaining adequate skin moisture (e.g., see Wiltenmuth 1997, pp. ii–122), it will likely spend less time being active. As a result, energy storage, reproduction, and long-term persistence would be reduced.

Wiltenmuth (1997, p. 77) reported rates of dehydration and rehydration were greatest for the Jemez Mountains salamander compared to the other salamanders, and suggested greater skin permeability. While the adaptation to relatively quickly rehydrate and dehydrate may allow the salamander to more quickly rehydrate when moisture becomes available, it may also make it more susceptible and less resistant to longer dry times because it also quickly dehydrates. Dehydration affects the salamander by increasing heart rate, oxygen consumption, and metabolic rate (Whitford 1968, p. 249), thus increasing energy demand, limiting movements (Wiltenmuth 1997, p. 77), increasing concentration and storage of waste products (Duellman and Trueb 1986, p. 207), decreasing burst locomotion (stride length, stride frequency, and speed) (Wiltenmuth 1997, p. 45), and sometimes causing death. Moisture-stressed salamanders prioritize hydration over all else, thereby reducing salamander survival and persistence. Additional impacts from dehydration could include increased predation because burst locomotion is impaired (which reduces ability to escape) and increased susceptibility to pathogens resulting from depressed immunity from physiological stress of dehydration. Any of these factors, alone or in combination, could lead either to the reduction or extirpation of salamander localities, especially in combination with the threats of habitat-altering activities, as discussed under Factor A.

The International Panel on Climate Change (2007, pp. 12–13) predicts that changes in the global climate system during the 21st century will very likely be larger than those observed during the 20th century. For the next two decades, a warming of about 0.4 degrees Fahrenheit (°F) (0.2 degrees Celsius (°C)) (per decade is projected (International Panel on Climate Change 2007, p. 12). The Nature Conservancy of New Mexico analyzed recent changes in New Mexico's climate. Parts I and II of a three-part series have been completed. In Part I, the time period 1961–1990 was used as the reference condition for analysis of recent departures (1991–2005; 2000–2005). This time period is consistent with the baseline used by the National Oceanic and Atmospheric Administration and the International

Panel on Climate Change for presenting 20th-century climate anomalies and generating future projections (Enquist and Gori 2008, p. 9). In Part II, trends in climate water deficit (an indicator of biological moisture stress, or drying), snowpack, and timing of peak stream flows were assessed for the period of 1970–2006 (Enquist *et al.* 2008, p. iv). The Nature Conservancy of New Mexico concludes the following regarding climate conditions in New Mexico and the Jemez Mountains:

(1) Over 95 percent of New Mexico has experienced average temperature increases; warming has been greatest in the Jemez Mountains (Enquist and Gori 2008, p. 16).

(2) Ninety-three percent of New Mexico's watersheds experienced increasing annual trends in moisture stress during 1970–2006, that is, they have become relatively drier (Enquist *et al.* 2008, p. iv).

(3) Snowpack has declined in 98 percent of sites analyzed in New Mexico; the Jemez Mountains has experienced significant declines in snowpack (Enquist *et al.* 2008, p. iv).

(4) In the period 1980–2006, the timing of peak runoff from snowmelt occurred 2 days earlier than in the 1951–1980 period (Enquist *et al.* 2008, pp. 9, 25).

(5) The Jemez Mountains have experienced warmer and drier conditions during the 1991–2005 time period (Enquist and Gori 2008, pp. 16, 17, 23).

(6) The Jemez Mountains ranked highest of 248 sites analyzed in New Mexico in climate exposure—a measure of average temperature and average precipitation departures (Enquist and Gori 2008, pp. 10, 22, 51–58).

Although the extent of warming likely to occur is not known with certainty at this time, the International Panel on Climate Change (2007a, p. 5) has concluded that the summer season will experience the greatest increase in warming in the Southwest (International Panel on Climate Change 2007b, p. 887). Temperature has strong effects on amphibian immune systems and may be an important factor influencing susceptibility of amphibians to pathogens (e.g., see Raffel *et al.* 2006, p. 819); thus, increases in temperature in the Jemez Mountains have the potential to increase the salamander's susceptibility to disease and pathogens. As noted, we have no information that indicates disease is a threat to the species, but we intend to evaluate this issue further.

Climate Change Summary

In summary, we find that current and future effects from warmer climate conditions in the Jemez Mountains could reduce the amount of suitable salamander habitat, reduce the time period when the species can be active above ground, and increase the moisture demands and subsequent physiological stress on salamanders. Warming and drying trends in the Jemez Mountains currently are threats to the species, and these threats are projected to continue into the future.

Determination

Section 4 of the Act (16 U.S.C. 1533), and its implementing regulations at 50 CFR part 424, set forth the procedures for adding species to the Federal Lists of Endangered and Threatened Wildlife and Plants. Under section 4(a)(1) of the Act, we may list a species based on (A) The present or threatened destruction, modification, or curtailment of its habitat or range; (B) Overutilization for commercial, recreational, scientific, or educational purposes; (C) Disease or predation; (D) The inadequacy of existing regulatory mechanisms; or (E) Other natural or manmade factors affecting its continued existence. Listing actions may be warranted based on any of the above threat factors, singly or in combination.

We have carefully assessed the best scientific and commercial information available regarding the past, present, and future threats to the Jemez Mountains salamander. Habitat loss, degradation, and modification through the interrelated effects from severe wildland fire, historical and current fire management practices, forest composition and structure conversions, and climate change have impacted the salamander by curtailing its range and affecting its behavioral and physiological functions. Because the salamander has highly permeable skin used for gas exchange and respiration, it must stay moist at all times or it will die. Salamanders have little control in maintaining water balance except through physically changing where they are in the environment, seeking high-moisture areas to hydrate and avoiding warm, dry areas where they would otherwise dehydrate. Warmer temperatures increase water use and dehydration, as well as increase metabolic processes, which then in turn require additional energy for the salamander. These life-history traits make hydration maintenance the most important activity of the salamander life functions. Therefore, any action or factor that warms and dries its habitat adversely affects the Jemez Mountains salamander and its ability to carry out normal behavior (foraging and reproduction).

Furthermore, historical silvicultural practices removed most of the large-diameter Douglas fir trees from the Jemez Mountains, and this change affects the salamander now and will continue to do so in the future, because a lack of these trees results in a lack of the highest quality cover objects available to Jemez Mountains salamanders now and in the future. For other related plethodontid salamanders, these types of cover objects were an important component in providing resiliency from the effects of factors that warm and dry habitat, such as climate change (See Factor A).

Finally, this species has a restricted range within one small mountain range in northern New Mexico, with no movement or expansion potential to other areas outside of its current range. This species is not able to tolerate the hot dry conditions at lower elevations that completely surround the Jemez Mountains and occupies habitat to the highest elevations in this mountain range. Within its occupied habitat where habitat features are continuous, Jemez Mountains salamander observations are often isolated. Within the restricted habitat of the Jemez Mountains, this species likely makes only very small movements. We are aware of only three populations, the two in Valles Caldera National Preserve mentioned earlier and one in Alamo Canyon, that have higher relative densities compared to all other known Jemez Mountains salamander occurrences (and even these areas are not considered as densely populated as reported from the 1970's). Combined, this information suggests recolonization or expansion opportunities, particularly after habitat alteration, and genetic exchange among populations may be limited.

On the basis of this information, we find that the threats to the Jemez Mountains salamander most significantly result from habitat loss, habitat degradation, and habitat modification, including severe wildland fire, but also alterations to habitat of varying magnitude from fire suppression, forest composition and structure conversions, post-fire rehabilitation, forest and fire management, roads, trails, habitat fragmentation, and recreation (see Factor A). Some of these threats may be exacerbated by the current and projected effects of climate change, and we have determined that the current and projected effects from climate change are a direct threat to the Jemez Mountains salamander. Habitat drying affects salamander physiology, behavior, and viability; will affect the occurrence of natural events such as fire, drought, and forest die-off; and will increase the risk of disease and infection. Trends in climate change and drought conditions have contributed to temperature increases in the Jemez Mountains, with a corresponding decrease in precipitation. Because the salamander is terrestrial, constrained in range, and isolated to the higher elevations of the Jemez Mountains, continued temperature increases and precipitation decreases, exacerbated by climate change, could threaten the viability of the species over its entire range.

The Act defines an endangered species as any species that is ''in danger of extinction throughout all or a significant portion of its range'' and a threatened species as any species ''that is likely to become endangered throughout all or a significant portion of its range within the foreseeable future.'' We evaluated whether the Jemez Mountains salamander is in danger of extinction now (i.e., an endangered species) or is likely to become in danger of extinction in the foreseeable future (i.e., a threatened species). The foreseeable future refers to the extent to which the Secretary can reasonably rely on predictions about the future in making determinations about the future conservation status of the species. A key statutory difference between a threatened species and an endangered species is the timing of when a species may be in danger of extinction (i.e., currently at a high risk of extinction), either now (endangered species) or in the foreseeable future (threatened species). A species that is in danger of extinction at some point beyond the foreseeable future does not meet the definition of either an endangered species or a threatened species.

Because of the fact-specific nature of listing determinations, there is no single metric for determining if a species is ''in danger of extinction'' now. In the case of the Jemez Mountains salamander, the best available information indicates that a major range reduction has not happened. However large-scale habitat destruction or modification within the highly restricted habitat for the salamander has significantly affected the behavior and physiology of the species (including increased oxygen use, increased metabolism, increased desiccation, increased need to hydrate, and reduced opportunities to forage and mate) and has likely resulted in reductions in populations and in total numbers of individuals within its range. These losses are ongoing as habitat conditions necessary for Jemez Mountains salamander survival continue to deteriorate by become warmer and drier. Without substantial conservation efforts, this trend of habitat and population loss is expected to continue and result in an elevated risk of extinction of the species.

Many of the threats faced by the species would not have historically been significant (such as wildfire), but because the entire ecological system in which this species occurs has been significantly altered, and many of the threats are interrelated, when wildfire occurs, it leaves behind a landscape-sized scar of highly modified, possibly unusable habitat for the Jemez Mountains salamander. The Jemez Mountains salamander completely relies on its environment and habitat to maintain physiological functions and to stay alive. All habitat for the Jemez Mountains salamander has been modified to its existing condition, and either has been burned with large-scale high-severity wildfire or is at risk of doing so. Effects from climate change are also resulting in warming and drying of all Jemez Mountains salamander habitat. Because Jemez Mountains salamanders are reliant on their habitat for survival, and all habitat is currently warming, drying, and either at risk of burning in wildfire, or has burned in wildfire, all extant Jemez Mountains salamanders are vulnerable. Since, part of the life-history requirements (including mating, foraging, and dispersal) necessitate the use of above ground habitat and the above ground habitat is impacted by one or more threats, no resilient populations currently exist to support persistence of the Jemez Mountains salamander. Consequently, it is in danger of extinction throughout all of its range now, and appropriately meets the definition of an endangered species (i.e., in danger of extinction).

In conclusion, after a review of the best available scientific and commercial information as it relates to the status of the species and the five listing factors, we find that the Jemez Mountains salamander is presently in danger of extinction now based on the severity of threats currently impacting the salamander. The threats are both current and expected to continue in the future, and are significant in that they limit all behavioral and physiological functions, including breathing, feeding, and reproduction and reproductive success, and extend across the entire range of the species. This meets the definition of endangered. Therefore, on the basis of the best available scientific and commercial information, we are listing the Jemez Mountains salamander as an endangered species, in accordance with sections 3(6) and 4(a)(1) of the Act.

Under the Act and our implementing regulations, a species may warrant listing if it is endangered or threatened throughout all or a significant portion of its range. The Jemez Mountains is highly restricted in its range, and the threats to its survival occur throughout its range and are not restricted to any particular significant portion of their range. The salamander is in danger of extinction now, and thus meets the definition of endangered, and not threatened. Accordingly, our assessment and determination applies to the species throughout its entire range.

Available Conservation Measures

Conservation measures provided to species listed as endangered or threatened species under the Act include recognition, recovery actions, requirements for Federal protection, and prohibitions against certain practices. Recognition through listing results in public awareness and conservation by Federal, State, Tribal, and local agencies, private organizations, and individuals. The Act encourages cooperation with the States and requires that recovery actions be carried out for all listed species. The protection required by Federal agencies and the prohibitions against certain activities are discussed, in part, below.

The primary purpose of the Act is the conservation of endangered and threatened species and the ecosystems upon which they depend. The ultimate goal of such conservation efforts is the recovery of these listed species, so that they no longer need the protective measures of the Act. Subsection 4(f) of the Act requires the Service to develop and implement recovery plans for the conservation of endangered and threatened species. The recovery planning process involves the identification of actions that are necessary to halt or reverse the species' decline by addressing the threats to its survival and recovery. The goal of this process is to restore listed species to a point where they are secure, self-sustaining, and functioning components of their ecosystems.

Recovery planning includes the development of a recovery outline shortly after a species is listed and preparation of a draft and final recovery plan. The recovery outline guides the immediate implementation of urgent recovery actions and describes the process to be used to develop a recovery plan. Revisions of the plan may be done to address continuing or new threats to the species, as new substantive information becomes available. The recovery plan identifies site-specific management actions that set a trigger for review of the five factors that control whether a species remains endangered or may be downlisted or delisted, and methods for monitoring recovery progress. Recovery plans also establish a framework for agencies to coordinate their recovery efforts and provide estimates of the cost of implementing recovery tasks. Recovery teams (composed of species experts, Federal and State agencies, nongovernmental organizations, and stakeholders) are often established to develop recovery plans. When completed, the recovery outline, draft recovery plan, and the final recovery plan will be available on our Web site (*http://www.fws.gov/endangered*), or from our New Mexico Ecological Services Field Office (see **FOR FURTHER INFORMATION CONTACT**).

Implementation of recovery actions generally requires the participation of a broad range of partners, including other Federal agencies, States, tribal, nongovernmental organizations, businesses, and private landowners. Examples of recovery actions include habitat restoration (e.g., restoration of native vegetation), research, captive propagation and reintroduction, and outreach and education. The recovery of many listed species cannot be accomplished solely on Federal lands because their range may occur primarily or solely on non-Federal lands. To achieve recovery of these species requires cooperative conservation efforts on private, State, and tribal lands.

Once this species is listed, funding for recovery actions will be available from a variety of sources, including Federal budgets, State programs, and cost share grants for non-Federal landowners, the academic community, and non-governmental organizations. In addition, pursuant to section 6 of the Act, the State of New Mexico would be eligible for Federal funds to implement management actions that promote the protection or recovery of the Jemez Mountains salamander. Information on our grant programs that are available to aid species recovery can be found at *http://www.fws.gov/grants.*

Please let us know if you are interested in participating in recovery efforts for the Jemez Mountains salamander. Additionally, we invite you to submit any new information on this species whenever it becomes available and any information you may have for recovery planning purposes (see **FOR FURTHER INFORMATION CONTACT**).

Section 7(a) of the Act requires Federal agencies to evaluate their actions with respect to any species that is proposed or listed as endangered or threatened and with respect to its critical habitat, if any is designated. Regulations implementing this interagency cooperation provision of the Act are codified at 50 CFR part 402. Section 7(a)(4) of the Act requires Federal agencies to confer with the Service on any action that is likely to jeopardize the continued existence of a species proposed for listing or result in destruction or adverse modification of proposed critical habitat. If a species is listed subsequently, section 7(a)(2) of the Act requires Federal agencies to ensure that activities they authorize, fund, or carry out are not likely to jeopardize the continued existence of the species or destroy or adversely modify its critical habitat. If a Federal action may affect a listed species or its critical habitat, the responsible Federal agency must enter into formal consultation with the Service.

Federal agency actions within the species habitat that may require conference or consultation or both as described in the preceding paragraph include landscape restoration projects (e.g., forest thinning); prescribed burns, wildland-urban-interface projects; forest silvicultural practices; other forest management or landscape-altering activities on Federal lands administered by the National Park Service (Bandelier National Monument), Valles Caldera National Preserve, and the Department of Energy (Los Alamos National Laboratory), and USFS; issuance of section 404 Clean Water Act permits by the Army Corps of Engineers; and construction and maintenance of roads or highways by the Federal Highway Administration.

The Act and its implementing regulations set forth a series of general prohibitions and exceptions that apply to all endangered wildlife. The prohibitions of section 9(a)(2) of the Act, codified at 50 CFR 17.21 for endangered wildlife, in part, make it illegal for any person subject to the jurisdiction of the United States to take (includes harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect; or to attempt any of these), import, export, ship in interstate commerce in the course of commercial activity, or sell or offer for sale in interstate or foreign commerce any listed species. Under the Lacey Act (18 U.S.C 42–43; 16 U.S.C 3371–3378), it is also illegal to possess, sell, deliver, carry, transport, or ship any such wildlife that has been taken illegally. Certain exceptions apply to agents of the Service and State conservation agencies.

We may issue permits to carry out otherwise prohibited activities involving endangered and threatened wildlife species under certain circumstances. Regulations governing permits are codified at 50 CFR 17.62 for endangered plants, and at 17.72 for threatened plants. With regard to endangered wildlife, a permit must be issued for the following purposes: for scientific purposes, to enhance the propagation or survival of the species and for incidental take in connection with otherwise lawful activities.

Required Determinations

National Environmental Policy Act (42 U.S.C. 4321 et seq.)

We have determined that environmental assessments and environmental impact statements, as defined under the authority of the National Environmental Policy Act (NEPA; 42 U.S.C. 4321 *et seq.*), need not be prepared in connection with listing a species as an endangered or threatened species under the Endangered Species Act. We published a notice outlining our reasons for this determination in the **Federal Register** on October 25, 1983 (48 FR 49244).

Government-to-Government Relationship with Tribes

In accordance with the President's memorandum of April 29, 1994 (Government-to-Government Relations with Native American Tribal Governments; 59 FR 22951), Executive Order 13175 (Consultation and Coordination With Indian Tribal Governments), and the Department of the Interior's manual at 512 DM 2, we readily acknowledge our responsibility to communicate meaningfully with recognized Federal Tribes on a government-to-government basis. In accordance with Secretarial Order 3206 of June 5, 1997 (American Indian Tribal Rights, Federal-Tribal Trust Responsibilities, and the Endangered Species Act), we readily acknowledge our responsibilities to work directly with tribes in developing programs for healthy ecosystems, to acknowledge that tribal lands are not subject to the same controls as Federal public lands, to remain sensitive to Indian culture, and to make information available to tribes.

References Cited

A complete list of all references cited in this rule is available on the Internet at *http://www.regulations.gov* or upon request from the Field Supervisor, New Mexico Ecological Services Field Office (see **ADDRESSES** section).

Authors

The primary authors of this document are the staff from members of the New

Mexico Ecological Services Field Office (see **ADDRESSES**).

List of Subjects in 50 CFR Part 17

Endangered and threatened species, Exports, Imports, Reporting and recordkeeping requirements, Transportation.

Regulation Promulgation

Accordingly, we amend part 17, subchapter B of chapter I, title 50 of the Code of Federal Regulations, as follows:

PART 17—[AMENDED]

■ 1. The authority citation for part 17 continues to read as follows:

Authority: 16 U.S.C. 1361–1407; 1531–1544; 4201–4245; unless otherwise noted.

■ 2. In § 17.11(h), add an entry for ''Salamander, Jemez Mountains'' in alphabetical order under Amphibians to the List of Endangered and Threatened Wildlife, to read as follows:

§ 17.11 Endangered and threatened wildlife.

* * * * *

(h) * * *

Species		Historic range	Vertebrate population where endangered or threatened	Status	When listed	Critical habitat	Special rules
Common name	Scientific name						
*	*	*	*	*	*	*	
AMPHIBIANS							
*	*	*	*	*	*	*	
Salamander, Jemez Mountains.	*Plethodon neomexicanus*.	U.S. (NM)	U.S. (NM)	E	819	NA	NA
*	*	*	*	*	*	*	

Dated: August 26, 2013.

Rowan W. Gould,

Acting Director, U.S. Fish and Wildlife Service.

[FR Doc. 2013–21583 Filed 9–9–13; 8:45 am]

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