BEFORE THE SECRETARY OF THE INTERIOR

Petition to List the Siskiyou Mountains Salamander (*Plethodon stormi)* as Threatened or Endangered under the Endangered Species Act

March 12, 2018

Petitioners:

Center for Biological Diversity
Klamath-Siskiyou Wildlands Center
Environmental Protection Information Center
Cascadia Wildlands

Notice of Petition: March 12, 2018

Pursuant to Section 4(b) of the Endangered Species Act, 16 U.S.C. § 1533(b); section 553(e) of the Administrative Procedure Act, 5 U.S.C. § 553(e); and 50 C.F.R. § 424.14(a), the Center for Biological Diversity, Klamath Siskiyou Wildlands Center, Environmental Protection Information Center and Cascadia Wildlands ("Petitioners") hereby formally petition the U.S. Fish and Wildlife Service ("USFWS") to list the Siskiyou Mountains salamander (*Plethodon stormi*) as a threatened or endangered species.

The USFWS has jurisdiction over this petition. This petition sets in motion a specific process, placing definite response requirements on the USFWS. Specifically, the USFWS must issue an initial finding as to whether the petition "presents substantial scientific or commercial information indicating that the petitioned action may be warranted" and the USFWS must make this initial finding "[t]o the maximum extent practicable, within 90 days after receiving the petition." 16 U.S.C. § 1533(b)(3)(A).

The USFWS has several options for listing the Siskiyou Mountains salamander. The entire species can be listed because it is threatened or endangered in all of its range, or because it is threatened or endangered in a significant portion of its range. The USFWS could alternatively list two identified distinct population segments ("DPS") of the species. Information presented in this petition indicates that both the northern and southern DPS of Siskiyou Mountains salamander warrant listing as either threatened or endangered.

Petitioners request that the USFWS designate critical habitat for the Siskiyou Mountains salamander concurrent with listing, as required by 16 U.S.C. 1533(b)(6)(C) and 50 CFR 424.12, and pursuant to the Administrative Procedures Act (5 U.S.C. 553).

Petitioners are conservation organizations with an interest in protecting the Siskiyou Mountains salamander and its habitat. Failure to grant the requested petition will adversely affect the aesthetic, recreational, commercial, research, and scientific interests of the petitioning organizations' members and of the citizens of the United States.

Center for Biological Diversity is a nonprofit, public interest environmental organization dedicated to the protection of imperiled species and their habitat, through science, policy, law and creative media. The Center is supported by more than 1.6 million members and activists throughout the country.

Klamath Siskiyou Wildlands Center is a non-profit organization with a mission to protect and restore the biodiversity and wild areas of the Klamath-Siskiyou region of southwest Oregon and northwest California. KS Wild promotes science-based land and water conservation through policy and community action.

Cascadia Wildlands envisions vast old-growth forests, rivers full of salmon, wolves howling in the backcountry, and vibrant communities sustained by the unique landscapes of the Cascadia bioregion. Cascadia Wildlands defends and restores Cascadia's wild ecosystems and is sustained by the support of 10,000 members and supporters across the country.

Environmental Protection Information Center is a community-based, nonprofit organization dedicated to the protection and restoration of the watersheds, biodiversity, native species, and natural ecosystems of the North Coast of California. EPIC uses an integrated science-based approach, combining public education, citizen advocacy, and strategic litigation.

EXECUTIVE SUMMARY

The Siskiyou Mountains salamander (*Plethodon stormi*) is a long-bodied, short-limbed terrestrial salamander, brown in color with a sprinkling of white flecks. The species only occurs in the Klamath-Siskiyou region of southern Oregon and Northern California, and has the second smallest range of any western Plethodontid salamander.

The Siskiyou Mountains salamander represents millions of years of evolution and is a distinct part of the ecological heritage of the Klamath-Siskiyou region. Plethodontid salamanders play a vital role in healthy forest ecosystems. They regulate the composition and abundance of soil invertebrates, and assist forest nutrient flow by converting smaller prey items into a food source for reptiles, birds, and mammals. Plethodontid salamanders serve as indicator species of forest ecosystem integrity.

Optimal Siskiyou Mountains salamander habitat is stabilized rock talus in old-growth forest, especially areas covered with thick moss. These salamanders require mature forest canopy to help maintain a cool and stable moist microclimate. Logging is thus a primary threat to the survival of the salamander.

Suitable mature forest habitat for the Siskiyou Mountains salamander is patchily distributed in the Klamath-Siskiyou region and the species only occurs in a portion of available habitat. Because the Siskiyou Mountains salamander has limited dispersal capabilities and a slow reproductive rate, its persistence depends upon the preservation of interconnected stands of mature forests. This increases the salamander's sensitivity to logging and other forest disturbances.

Although the Siskiyou Mountains salamander evolved in an environment with frequent fires, fire suppression has increased fuel loads in portions of the landscape, potentially threatening salamander habitat through stand-replacing fires. This risk is heightened by rising temperatures and increased drought associated with climate change. Other threats include gravel mining and road development.

There are two distinct populations of the Siskiyou Mountains salamander separated by the Siskiyou Mountains crest: a larger northern (Applegate) population in the Applegate River drainage in Oregon; and a small southern (Grider) population in northern California in the Klamath River drainage, immediately east of Happy Camp and west of Grider Ridge. Most of the known Siskiyou Mountains salamander locations are on U.S. Forest Service and U.S. Bureau of Land Management lands.

In 2004, conservation groups petitioned for protection of the Siskiyou Mountains salamander under the Endangered Species Act. The 2006 U.S. Fish and Wildlife Service finding denying the petition was overturned by a court, and the agency initiated a status review. In an effort to avoid impending listing of the salamander, a conservation strategy was developed for BLM lands in southern Oregon. In 2007 a conservation agreement was signed by the BLM and the Fish and Wildlife Service based on this strategy. The agreement was intended to protect habitat for 110 salamander sub-populations considered high-priority salamander management areas on federal lands in the Applegate River watershed. In 2008, the Fish and Wildlife Service again denied ESA protection for the salamander, in large part based on "Survey and Manage" protections provided by the Northwest Forest Plan and the newly signed conservation agreement.

Survey and Manage protections under the Northwest Forest Plan required the BLM and Forest Service to conduct pre-disturbance surveys for Siskiyou Mountain salamanders and to designate protected buffers from logging and other disturbance where salamanders were found. However in 2016, the Western Oregon Plan Revision (WOPR) was adopted by the BLM for the express purpose of substantially increasing logging in western Oregon. The WOPR removed key protections for old-growth forests within the Oregon range of the salamander and for many high priority salamander conservation sites.

The WOPR undermines key elements of the 2007 conservation strategy that were deemed necessary in order to maintain well-distributed salamander populations and avoid a trend towards listing under the Endangered Species Act. The WOPR allows increased timber harvest in late-successional areas, decreases optimal salamander habitat, increases habitat fragmentation, eliminates requirements to conduct pre-disturbance surveys in salamander habitat, and allows logging of previously identified known, occupied salamander sites. The WOPR removes protections for salamander populations formerly included in species protection buffers on Oregon BLM lands. The Forest Service still implements the Survey and Manage program, but most Siskiyou Mountains salamander locations are on BLM lands.

The Siskiyou Mountains salamander is particularly vulnerable to human impacts due to its narrow range, specific habitat requirements and low reproductive rate. Given that parts of the conservation agreement (such as monitoring and reassessment with land-use planning changes) have not been implemented, in combination with the undermining of key habitat protections formerly provided by the Northwest Forest Plan, immediate protection of the salamander under the Endangered Species Act is needed.

Because of their rarity, uniqueness, and ecological importance, Siskiyou Mountains salamanders deserve full protection under the Endangered Species Act. Protecting the Siskiyou Mountains salamander as a threatened or endangered species will ensure that it continues to inhabit the forested ecosystems of the Klamath-Siskiyou region and will help to preserve the natural heritage of this biologically rich area.

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NATURAL HISTORY AND STATUS OF THE SISKIYOU MOUNTAINS SALAMANDER

Description

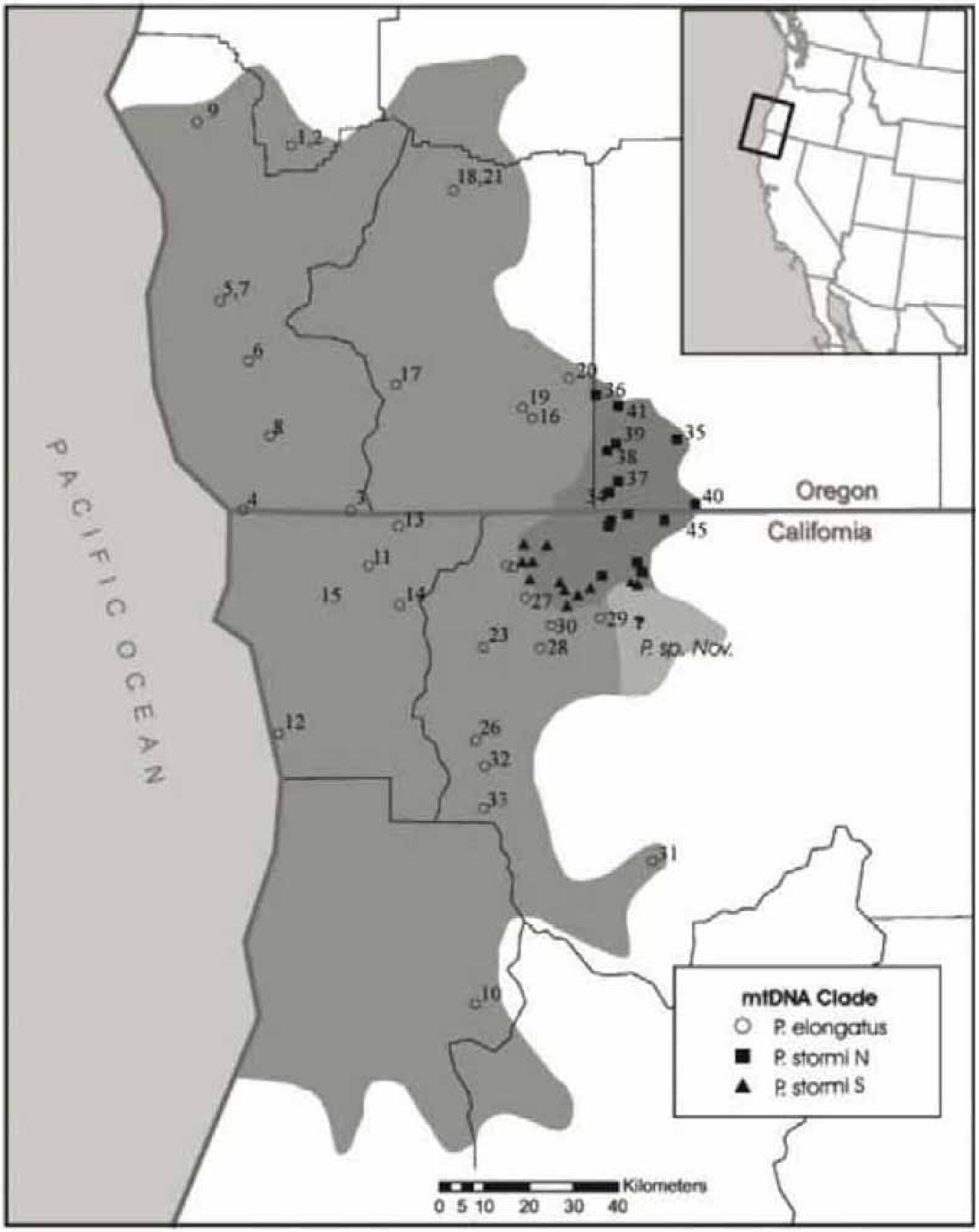
The Siskiyou Mountains salamander is a slim, long-bodied, short-limbed terrestrial salamander with a broad, short head. The dorsal color of adults is chocolate-brown to light purplish-brown (also described as pink-tan or pink-gray to light brown), with varying amounts of light flecking on the head, sides and limbs (Nussbaum et al. 1983; Olson et al. 2007). The ventral color of adults is grayish-purple. Adults may also have a faint lighter brown dorsal stripe, with pinkish or golden-tan dots. In adults the tail is about as long as the head and body (shorter in females) and lacks constriction at the base (Brodie 1970). Toes are short and round and the outer (fifth) toe on the hind foot is about one-third the length of the fourth toe (Nussbaum et al. 1983). Adults may reach a total length of 102-152 cm (4-6 inches) (Nussbaum et al. 1983). Juveniles tend to be black or very dark brown with a heavy sprinkling of white flecks, especially on the head and sides. Juveniles are gray ventrally and can often exhibit a light brown or tan dorsal stripe.

Adults can be distinguished from their close relatives the Del Norte salamander (*Plethodon elongates*); Siskiyou Mountains salamanders have a modal number of 17 costal grooves and 4 to 5.5 intercostal folds between adpressed limbs, while Del Norte salamanders have 18 costal grooves and 5.5-7.5 intercostal folds (Nussbaum et al. 1983; Leonard et al. 1993; Jones et al. 2004). Del Norte salamanders may also have a reddish dorsal stripe rather than the light brown stripe of the Siskiyou Mountains salamander. Juvenile Del Norte salamanders differ by usually having a bright, coppery dorsal stripe that can fade with age. However, within the contact zone of these two species and the Scott Bar salamander (*P. asupak*), morphological characteristics such as dorsal stripe and intercostal folds may not readily identify species.

Taxonomy and Population Structure

The Siskiyou Mountains salamander is a member of the family Plethodontidae (lungless salamanders) and the genus Plethodon (woodland salamanders). The Siskiyou Mountains salamander was first discovered in 1963 and described as a separate species (*Plethodon stormi*) in 1965 (Highton and Brame 1965). Based on apparent clinal variation in color and morphology, Bury (1973) questioned the recognition of *P. stormi* as a full species and suggested that it be considered a "distinct group" of the closely related Del Norte salamander (*P. elongatus*). Stebbins (1985) subsequently considered the Siskiyou Mountains salamander to be a subspecies of the Del Norte salamander (*P. e. stormi*), but provided no further information. Others continued to recognize *P. stormi* as a separate species (e.g. Nussbaum et al. 1983; Leonard et al. 1993).

Subsequent studies (Pfrender and Titus 2002; DeGross 2004; Mahoney 2004; Mead et al. 2005; Vieites et al. 2011) have postulated and then confirmed that the Siskiyou Mountains salamander is morphologically and genetically distinct from both the Del Norte salamander and the recently discovered Scott Bar salamander (*Plethodon asupak*), and is a separate species. For example, Mahoney (2004) analyzed mitochondrial protein-coding genes of 81 salamander populations from throughout the range of *P. elongatus* and *P. stormi*, and reaffirmed that the two species are monophyletic sister taxa. Mahoney (2004) concluded that "morphological boundaries between *P. elongatus* and *P. stormi* are largely congruent with mitochondrial DNA breaks and continued treatment as sister taxa is supported." DeGross (2004) concluded that "multivariate analyses of the 11 microsatellite loci lend strong support to the view that *P. elongatus* and *P. stormi* are distinct species." Mead et al. (2005) provided genetic and morphological evidence that Scott River populations are distinct from *P. stormi*. The best available science from recent studies (DeGross 2004; Mahoney 2004; Mead et al. 2005) identifies *P. stormi* as a distinct species.



Map from DeGross (2004) delineating northern (dark squares) and southern (dark triangles) populations of Siskiyou Mountains salamander. The map also shows the species range for Siskiyou Mountains salamander (dark gray), Del Norte salamander (medium gray) and Scott Bar salamander (light gray).

Together the Siskiyou Mountains and Del Norte salamanders seem to be descended from a single common ancestral form that is a sister taxa to the basal Scott Bar salamander (Mahoney 2004; Mead et al. 2005). Because its status was uncertain until recently, localities of the Scott Bar salamander have been treated as Siskiyou Mountains salamanders by land management and regulatory agencies, though it is now formally recognized as a distinct species. The Scott Bar salamander occurs in a small area only in northern California, south of the Klamath River and east of Grider Ridge. The Scott Bar salamander occurs in California in the Scott River drainage, south of the Klamath River.

Two Distinct Population Segments ("DPS") of the Siskiyou Mountains salamander have been identified, with adjacent but not significantly overlapping northern and southern clades or populations. The northern, or Applegate DPS, and southern, or Grider DPS, are separated by the Siskiyou Mountains crest, and are distinct in their mtDNA and microsatellite loci (Pfrender and Titus 2001; DeGross 2004; Mahoney 2004). Pfrender and Titus (2001) found three distinct genetic groups within *P. stormi*, one of which has subsequently been identified as a separate species, the Scott Bar salamander, the other two being the northern Applegate and southern Grider DPS of the Siskiyou Mountains salamander. These populations have also been identified as Group I *P. stormi* (Applegate) and Group II *P. stormi* (Grider) (USDA and USDI 2004).

The northern DPS occupies the Applegate River drainage in Oregon and represents the majority of the range of the Siskiyou Mountains salamander; the southern DPS is limited to a small area in northern California both north and south of the Klamath River, immediately east of Happy Camp and west of Grider Ridge. Work with nuclear markers indicates that some limited gene flow may have recently occurred or may be ongoing along the contact between the two clades in California but not in Oregon (DeGross 2004). Because the two clades of the Siskiyou Mountains salamander meet the criteria outlined by Moritz (1994; reciprocally monophyletic mtDNA haplotypes and significant differences in allele frequencies at nuclear genes), DeGross (2004) suggested that they be managed as separate Evolutionarily Significant Units, the equivalent of DPSs. A full discussion of how these northern and southern populations of Siskiyou Mountains salamander meet the Endangered Species Act criteria for Distinct Population Segments can be found on page 24 below.

DeGross (2004) studied the contact zones between the northern and southern populations of *P. stormi*, finding clear microsatellite evidence for distinct population segments:

> "The canonical discriminant analysis revealed strong separation of the two P. stormi clades on the second canonical variable. This multivariate analysis lends support to the separation of the two *P. stormi* clades as distinct, differentiated lineages, as well as additional support for *P. elongatus* and *P. stormi* as separate species. The data presented here, support the presence of two differentiated groups within *P. stormi*, which further support the mtDNA analysis from Mead et al. (2004). Although these two groups may not be biological species these two units should receive recognition because of their ecological and evolutionary significance. Distinct differentiation of these two clades in their mtDNA and microsatellite loci warrants the designation of Evolutionary Significant Units (ESUs) (Moritz 1994)."

Another significant finding by Pfrender and Titus (2002) was that the northern population of *P. stormi* in the Applegate River, comprising a majority of known sites of the species, has very low genetic variability:

> “The most striking feature of our study is the almost complete lack of genetic variation observed within and among populations of the Siskiyou Mountains salamander in the Applegate drainage… While it is not uncommon for specific populations to have low levels of genetic diversity, it is very rare indeed for multiple populations comprising the bulk of the range of a species to show such lack of variation.”

Pfrender and Titus (2002) reasoned that the most likely cause for the low level of genetic variation in the northern population of *P. stormi* is recent expansion of the Siskiyou Mountains salamander into the Applegate River watershed by a small number of individuals, causing a genetic bottleneck. Regardless of the cause, the low genetic variation found in the northern population of the Siskiyou Mountains salamander is of substantial conservation concern because it indicates the species may have a limited capacity to adapt to environmental change related to climate change or other factors. This further highlights the need to ensure the survival of all distinct population segments of the Siskiyou Mountains salamander.

Habitat Requirements

Species of the genus Plethodon have fairly rigid physiological requirements (DeGross and Bury 2007). Plethodon salamanders in general and *P. stormi* in particular breathe through their skin. Water loss from dry conditions can be lethal to Plethodon salamanders, and evidence from the Del Norte salamander (*P. elongatus*) indicates sensitivity to these conditions (Ray 1958). This would infer limited utilization of habitats or microclimatic environments that occur outside their zone of tolerance (Welsh et al. 2007).

Nussbaum (1974) broadly characterized the habitat of *P. stormi* as stabilized talus in old-growth stands on north, northeast or northwest facing slopes. Siskiyou Mountains salamanders are exclusively found in association with rocky substrates (Nussbaum et al. 1983). These substrates may range from gravelly soils to talus but there is always some component of rock. Although exceptions exist, most known sites consist of forested areas. Individuals are found by searching under rocks, bark, logs or other debris on the forest floor during wet weather (Petranka 1998). To facilitate respiration, the skin of Plethodon salamanders must be in contact with moist substrate or individuals begin to dehydrate (Spotila 1972; Feder 1983). These physiological requirements largely explain the species requirements for talus slopes, shaded by late-seral forests that maintain a cooler and more stable microclimate (Feder 1983; Chen et al. 1993).

Factors that create a cool, moist microclimate appear to strongly influence the distribution and abundance of the Siskiyou Mountains salamander. Shading provided by vegetation, aspect and topography appear to play a significant role in creating the conditions associated with presence of Plethodon salamanders. Forested stands with high canopy closure and larger conifers, when associated with rocky soils, often harbor abundant populations of Siskiyou Mountains salamander (Nussbaum et al. 1983; Ollivier et al. 2001; Welsh et al. 2007). Such stands are most common on north-facing slopes where this species reaches its highest abundances (Nussbaum et al. 1983) and where it is most commonly encountered (Farber et al. 2001). Welsh et al. (2007) considered mature to late-seral forest stands to provide optimal conditions for this species. Although *P. stormi* have been found in other seral stages and aspects (Farber et al. 2001; Ollivier et al. 2001), in younger stands and more southerly aspects micro-site topography may provide shading allowing salamanders to exist in areas that otherwise would be inhospitable.

Precipitation also has been associated with the presence of Siskiyou Mountain salamanders (Ollivier et al 2001; Welsh et al. 2007). Dry conditions likely limit the eastward extent of the species. In one study conducted in California, Siskiyou Mountains salamanders were encountered at a greater proportion of sample points and in greater abundances in the wet western side of the range when compared to the much drier eastern side of the range (Nauman and Olson 2004). Siskiyou Mountains salamanders require a moist, relatively cool habitat. Precipitation, canopy cover, aspect, and topographic shading directly affect salamanders by creating the conditions necessary for persistence. The abundance of moss and ferns, deep litter, the number of hardwood trees and years since disturbance (Ollivier et al. 2001; Welsh et al. 2007) are associated with salamanders because they likely reflect the stable existence of cool, moist conditions over longer periods of time.

Extensive research by the U.S. Forest Service (Ollivier et al. 2001) confirmed that the Siskiyou Mountains Salamander is closely associated with late-successional forest. Using a systematic, stratified, random sampling design that focused on sites with suitable substrates, Ollivier et al. (2001) sampled 239 sites both north and south of the Siskiyou crest for salamander presence. Ollivier et al. (2001) used discriminant and regression analyses to determine habitat characteristics predictive of salamander presence at landscape, macro-habitat and micro-habitat scales. Ollivier et al. (2001) concluded:

> "Overall, our results indicated a significant association of the Siskiyou Mountains salamander with conditions found in older, undisturbed forest with a closed canopy, moist microclimate, and rocky substrates dominated by cobble-sized pieces. These habitat attributes appear optimal for reproductive success and longterm survival throughout the range of this species. The Siskiyou Mountains salamander may require those ecological conditions found primarily in late-seral forest."

At the landscape scale, Ollivier et al. (2001) found that latitude, elevation, years since disturbance and average annual precipitation best predicted *P. stormi* presence in California and that longitude and aspect best predicted *P. stormi* presence in Oregon. Sites in California occurred more in the southern and eastern portion of the species range, were lower in elevation, had greater time since disturbance (disturbance was related to logging in all instances), and had higher mean precipitation than sites where salamanders were not found. In Oregon, sites with salamanders occurred more in the northern portion of the species' range and were more likely to occur on a north aspect than sites without salamanders. Ollivier et al. (2001) believed these characteristics reflected interactions between the prevailing climate, the distribution of habitats on the landscape and the physiological requirements of the Siskiyou Mountains salamander:

> "The condition of the landscape as a mosaic of varyingly suitable habitats and the relationship between those habitats and the prevailing weather, determines the various microclimates available to organisms which inhabit a landscape. The length of time that equable surface microclimatic conditions are within the tolerance limits of terrestrial salamanders is probably the single most important aspect of their biology, because it can affect both the density of individuals within a site and the density of occupied sites on the landscape. Shortened periods of surface conditions appropriate for feeding and breeding activities can limit both survivorship and recruitment… It is likely that salamanders living at sites with microclimatic conditions limiting the duration of surface activity will take longer to achieve the body mass and fat reserves necessary for reproduction. Most

> recently disturbed sites we sampled appeared to lack the microclimatic conditions necessary for persistence of the species over time."

The findings by Ollivier et al. (2001) indicate that the Siskiyou Mountains salamander is a narrow habitat specialist that is severely impacted by disturbances that influence microclimate, including logging. At the macro-habitat scale, Ollivier et al. (2001) found that sites in California had greater minimum Douglas-fir diameter, more small decayed conifer logs, greater proportional area of rock, less gravel, lower solar index, greater canopy cover and greater average subsurface soil temp than sites where salamanders were absent. In Oregon, sites with salamanders had more hardwood trees, large conifers, decayed hardwood logs, sword fern, moss, leaf litter, rock, and cobble, fewer small conifers and small decayed conifer logs, greater conifer diameter, less poison oak and grass, a lower solar index and greater relative humidity than unoccupied sites.

Of the above variables, several are characteristic of late-seral forest, including high canopy cover, large tree size and presence of decayed conifer and hardwood logs. California sites with salamanders had a mean canopy cover of 80.6% (95% confidence interval, 68.0-93.3%), indicating to Ollivier et al. (2001) that Siskiyou Mountains salamanders in the southern portion of their range have "even less tolerance for canopy openings" than the Del Norte salamander (Ollivier et al. 2001). Canopy closure was found to be less significant for Siskiyou Mountain salamanders in Oregon, but sites with salamanders in Oregon had "a dominant canopy of large conifers" and "greater average conifer diameter." Ollivier et al. (2001) reasoned that larger tree size on occupied sites compared to unoccupied sites in both Oregon and California suggests a requirement for stand structures that have not been disturbed by logging, have higher canopy closure and more stable microclimates.

Ollivier et al. (2001) found that greater cover of rock and cobble and lower levels of "intermixed gravel" was a significant predictor of salamander presence in both Oregon and California, demonstrating the importance of substrate to the Siskiyou Mountains salamander, which moves vertically through talus to find the appropriate microclimate. At the micro-habitat scale, sites with salamanders in California had fewer bracken ferns, greater area of leaf litter and boulder cover, and higher canopy closure and subsurface soil temperature than unoccupied sites (Ollivier et al. 2001). Sites with salamanders in Oregon had more understory hardwoods, leaf litter, sword fern, moss and rock, and less sand and soil than sites where salamanders were absent (Ollivier et al. 2001). These results largely mirror findings at coarser scales, demonstrating that substrate, canopy cover, and microclimate are important predictors of salamander presence. For example, salamanders were found to be negatively associated with bracken fern, which is a species that typically occurs in dry forest openings. Ollivier et al. (2001) concluded:

> "Thus, we consider this salamander to be a mature to old-growth forest associated species that exists at its biological optimum under conditions found primarily in later seral stages of mixed conifer-hardwood forests in northwestern California and southwestern Oregon. It is important to use caution when interpreting correlative studies in the absence of accompanying data that demonstrate a cause and effect relationship. However, we believe that our study clearly links this salamander species with conditions that are found more consistently and reliably in later successional forests. This work therefore demonstrates an ecological dependence (Ruggiero et al. 1988) by the Siskiyou Mountains salamander on attributes and conditions found primarily in these mature to late seral forests."

In sum, the most comprehensive study of Siskiyou Mountains salamander habitat use indicates the species is dependent on mature and late successional forests for its continued survival. This does not mean that Siskiyou Mountains salamanders only occur in late-successional forests; on sites with deep talus on north facing slopes in wetter portions of their range, Siskiyou Mountains salamanders can be found in open areas. However, optimum habitat is in late-successional forests, and in portions of their range Siskiyou Mountains salamanders are primarily limited to such forests.

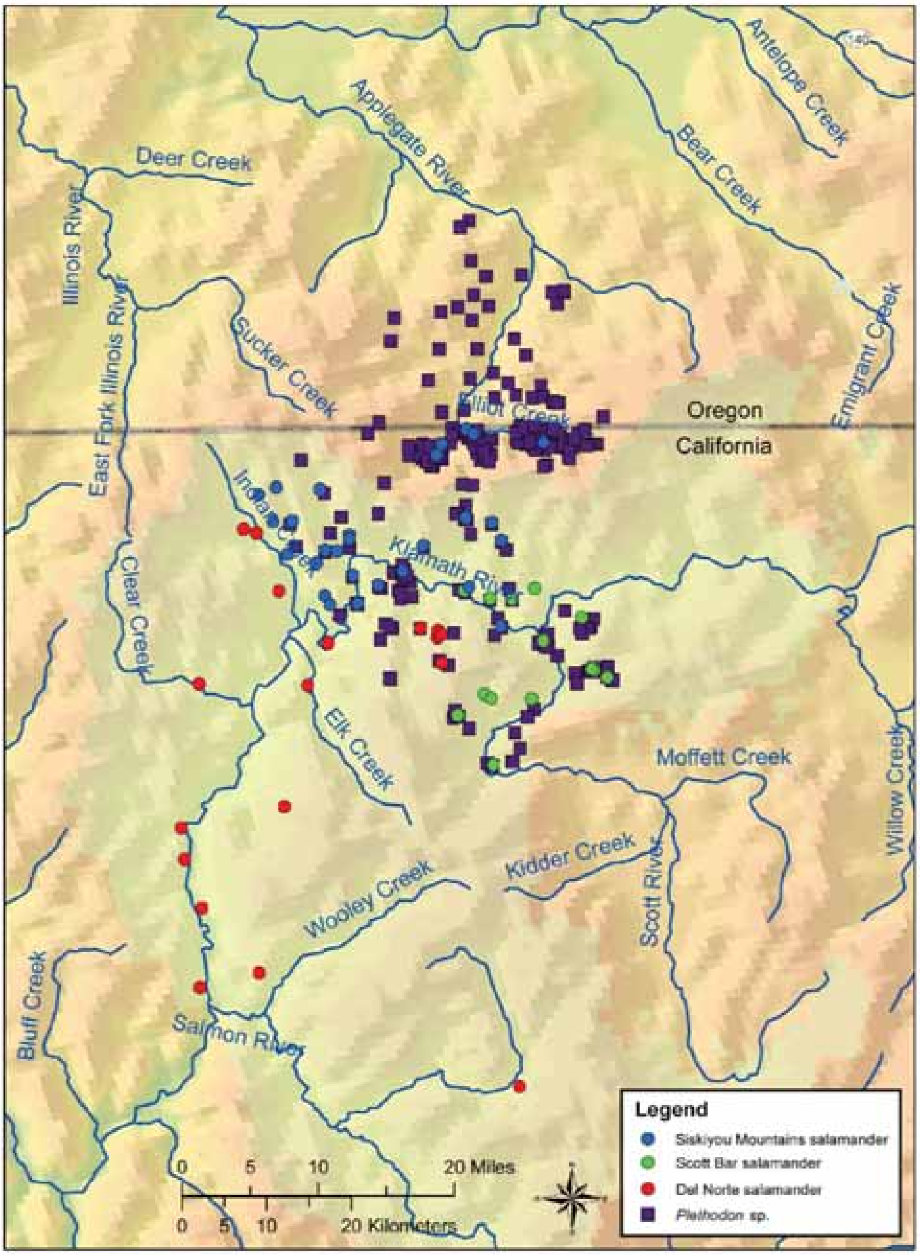
These conclusions are supported by Welsh et al. (2007a), who similarly found these salamanders are closely associated with old-growth forests:

> "The best models of salamander presence consisted of combined landscape, macro- and micro-environmental scale variables; included linear, quadratic, and pseudo-threshold (i.e., log) forms, and included interactions between variables. These models showed positive relationships of salamander presence with site conditions and plant assemblages characterizing old, less disturbed forest with closed canopy, moist, relatively warm microclimates, deep litter, and cobble and boulder-sized rock substrates. Our results suggest that mature to late-seral-forest attributes provide optimal habitat for the Siskiyou Mountains salamander. Stands of mature and older forests evenly distributed and interconnected across the geographical range of this species would likely best insure its long-term viability."

Building on these results, Welsh et al. (2008) evaluated population-level responses of Siskiyou Mountains salamanders to forest disturbance by examining salamander occupancy, relative abundance, demographic structure and body condition in four forest age classes: pre-canopy, young, mature, and old-growth. Welsh et al. (2008) compared these data with those collected from reference stands in mature forest containing robust salamander populations. Both occupancy and salamander counts were lowest at pre-canopy sites. Welsh et al. (2008) detected the related Del Norte salamander (*P. elongatus*) in young forests, but higher proportions of Del Norte salamanders were juveniles and sub-adults when compared to populations in late-seral forests. Welsh et al. (2008) found a negative relationship between the proportion of immature salamanders and total counts at a site, indicating that the high proportion of young salamanders in young forest stands is likely due to dispersal of young salamanders from nearby source populations and/or low survival of adult animals in young forests. Welsh et al. (2008) also found reduced body condition of *P. stormi* populations in young forests. The results of Welsh et al. (2008) suggest that there are costs to salamander populations occupying early seral forests, such as skewed age class structure and reduced body condition, which are indicative of sink populations.

Suzuki et al. (2007) used GIS data and logistic regression analysis to determine habitat associations of the Siskiyou Mountains salamander in the Applegate River watershed at the Oregon-California border. They developed habitat suitability models at fine, medium and broad spatial scales, noting that habitat associations could be better explained at fine and moderate spatial scales due to the sedentary nature of the species and its predisposition to associate with fine-scale habitat features. Suzuki et al. (2007) found that the best habitat model showed salamanders are more likely to be found with increasing amounts of rocky soils and decreasing abundance of white-fir and Oregon white oak. High abundance of white fir generally indicates cold dry environments at high elevations. Salamanders were positively correlated with higher abundance of Pacific madrone at lower elevations, perhaps because madrone can grow in rocky soils. Although Siskiyou Mountains salamanders tend to occur in low elevation habitats, Suzuki et al. (2007) found that elevation was not as effective at predicting salamander occurrence as models with tree species abundance (with changes in tree species abundance generally occurring along the elevation gradient). Suzuki et al. (2007) found that structural habitat features such as tree canopy cover and conifer DBH were not as effective at predicting salamander occurrence, likely due to their associations with tree species abundances. Suzuki et al. (2007) cautioned that their modeling relied on limited GIS and climatic data, and lacked home range and movement information for salamanders.

Range



Locations of Siskiyou Mountains Salamander, Scott Bar Salamander, and Del Norte Salamander in Northern California and Southern Oregon, from Vinikour et al. (2006). Note that Applegate River drainage salamanders labeled as Plethodon sp. have subsequently been shown to be the northern population of Siskiyou Mountains Salamander.

The Siskiyou Mountains salamander has the second smallest range of any western *Plethodon* salamander. The species occupies suitable portions of a known range of roughly 150,000 hectares; it is found only in portions of Jackson and Josephine counties in extreme southwestern Oregon and in Siskiyou County in northwestern California (Nauman and Olson 1999; USDA and USDI 2002). Its distribution includes the southern portion of the Applegate River drainage in southern Oregon and drainages in the Klamath River in northern California. It is bounded on the northeast by the Rogue River valley and in the east by the distribution of the Del Norte salamander. *Plethodon* salamanders found in a few drainages south of the Klamath River, in the Scott River and Grider Creek drainages, are the recently described Scott Bar salamander (Mead et al. 2005). *P. stormi* is known from sites ranging from 488 m (1,488 ft) to about 1,800 m (6,000 ft) (Nussbaum et al. 1983; Clayton 1999; Nauman and Olson 2004a, 2004b).

Over time, the Siskiyou Mountains salamander has been found to have a wider distribution than previously known. This is not surprising, given that the species was first described in 1963 and extensive surveys were not conducted until the 1980s. The species range is estimated at about 337,000 acres (Vinikour et al. 2006). Salamander locales in an estimated 68,000-80,000 acres of the Klamath River basin which were formerly presumed to belong to the Siskiyou Mountains salamander have been shown to represent a distinct species, the Scott Bar salamander. The fact that new locations have been found for the species does not mean that is no longer rare: the Siskiyou Mountains salamander has a small overall range, only a small portion of this narrow range contains suitable habitat, and this habitat is patchily distributed across the landscape. Recent information that the Siskiyou Mountains salamander is genetically subdivided into two distinct populations means that each population has a much smaller range.

Reproduction and Growth

Siskiyou Mountains salamanders are fully terrestrial. The species has completely abandoned the aquatic larval stage, thus does not require standing or flowing water at any stage of its life cycle. Siskiyou Mountains salamanders manage this by depositing eggs deep in moist, protected subterranean sites such as cracks in rock rubble or talus slopes. Courtship probably occurs during the spring rainy season on the talus surface (Nussbaum et al. 1983). In the early spring, females retreat down into the talus and establish nests. Limited data suggests that females lay eggs every other year, beginning at 5 years old (Nussbaum 1974). In captured females, the clutch has averaged 9 eggs, ranging from 2-18 eggs (Nussbaum 1974; Nussbaum et al. 1983). The eggs are laid in a grape-like cluster and are tended by the female through the summer until hatching in the fall. Juveniles emerge in late fall and early spring. Welsh and Lind (1992) reported that juveniles captured in mid-spring were significantly larger than would be expected if newly hatched. When juvenile salamanders hatch, they are already metamorphosed into fully terrestrial salamanders. Siskiyou Mountains salamanders mature at 5-6 years, and appear to be relatively long-lived (up to 15 years).

The low reproductive rate of the Siskiyou mountains salamander makes it particularly vulnerable to stochastic and anthropogenic events that reduce breeding success or individual survival, placing the species at additional risk of extinction.

Movement

Mobility of *P. elongatus* appears to be extremely low (Welsh and Lind 1992). Siskiyou Mountains salamanders complete their life cycles in an area less than 2.5 acres and have not been observed migrating between subpopulations (Nussbaum 1974). In a study of the closely related *P. elongatus*, Welsh and Lind (1992) found that of a total of 54 captured salamanders, the majority (66% of males and 80% of females) remained in the same 7.5 x 7.5 m^2 plot over the course of a two year study. The remainder of salamanders were found in adjacent squares, except one male that moved across two squares for a total distance of 36.2 m over six months. Mead et al. (2005) found genetic differences between Siskiyou Mountains salamander individuals separated only by the Seiad Valley, indicating that they had evolved separately for as long as 3-4 million years. These results indicate that Siskiyou Mountains salamanders complete their life cycle in a very small area and have a limited ability to disperse between populations or habitat, making them particularly vulnerable to local population extirpation from habitat disturbance or other factors, and offer little hope for natural recolonization of habitats.

P. stormi's movements are highly dependent on moist microhabitats. Hence, fully terrestrial salamanders such as *P. stormi* are usually only active during fall or spring rainy seasons or at night when temperatures are low and humidity high. During the day they hide under surface objects, in cracks, or buried in talus and soil, often in burrows made by other animals. In spring and fall when the soil is wet they are often close to the surface, but during the summer and winter they retreat to considerable depth to escape heat and drought in the former and freezing in the latter seasons (Nussbaum 1974).

Feeding

No systematic studies of diet have been conducted, but Siskiyou Mountains salamanders are thought to prey on a variety of small terrestrial invertebrates, including spiders, pseudo-scorpions, mites, ants, collembolans and beetles (Nussbaum et al. 1983). Ants may be an important dietary component in the spring, while millipedes appear to be eaten by larger adults in the fall (Nussbaum 1974). *P. stormi* searches for its food on damp soil and underground debris, or conceals itself under small cover objects or at burrow mouths. This foraging behavior requires adequate burrow systems and cover objects to be successful. Siskiyou Mountains salamanders are active on the ground surface primarily at night when it is cool and moist. Peak active periods occur during the wet season, with periods of inactivity during freezing temperatures. They may also forage at the surface during the dry summer (Nussbaum et al. 1983).

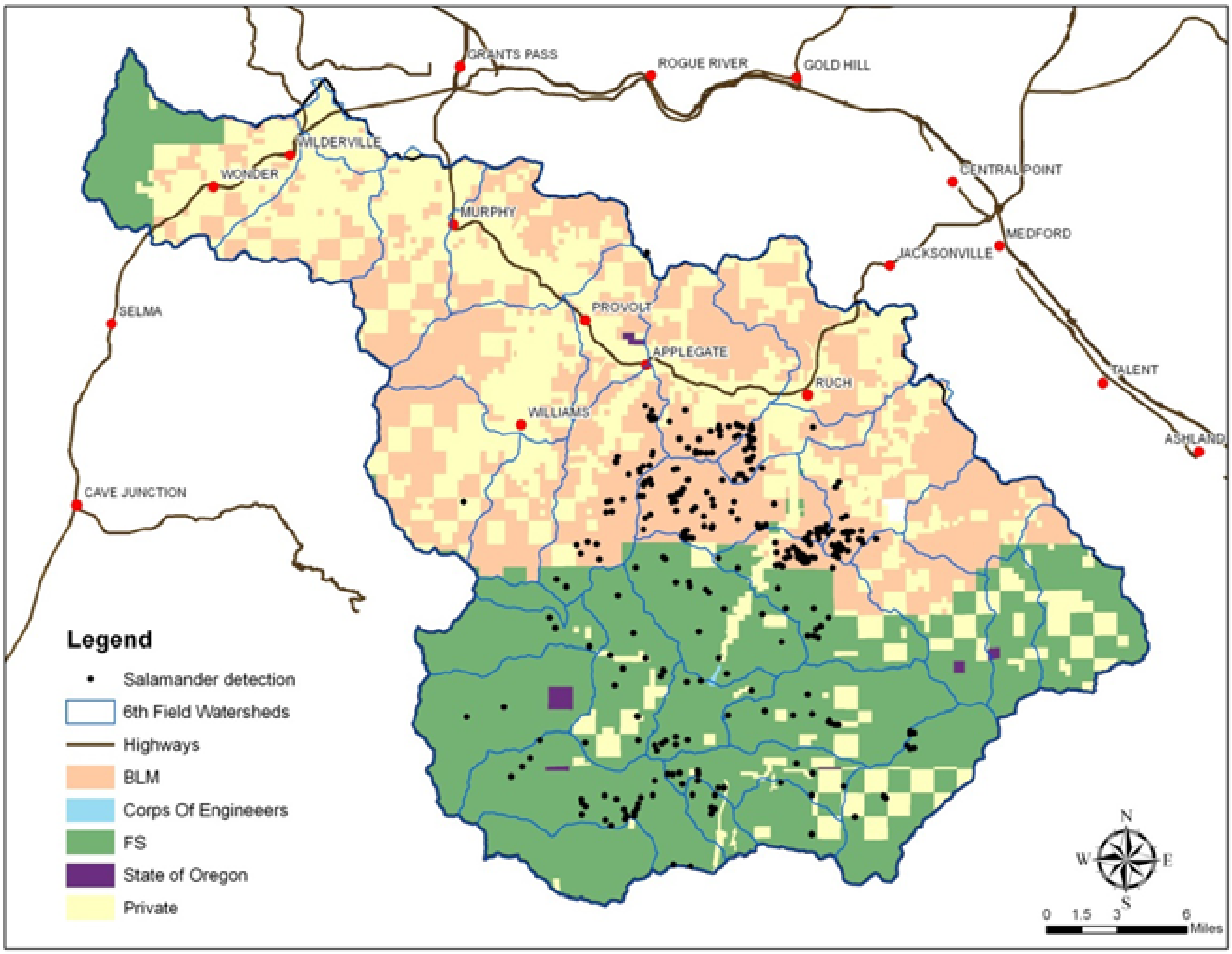
Predators

Salamanders are an important component of the food web in many forest ecosystems and evidence indicates that they constitute the single most important vertebrates whose size enables them to exploit prey too small and inaccessible to be used by most birds and mammals; thus salamanders convert small prey into biomass that is available to larger vertebrates (Pough 1983). Specific predators of Siskiyou Mountains salamanders are largely unknown but may include sympatric snake and shrew species. Potential competitors may include ensatina and black salamanders, which also occur in similar habitat. Nothing is known of parasites and diseases, nor of symbiotic or mutualistic interactions with other species.

DISTRIBUTION AND ABUNDANCE

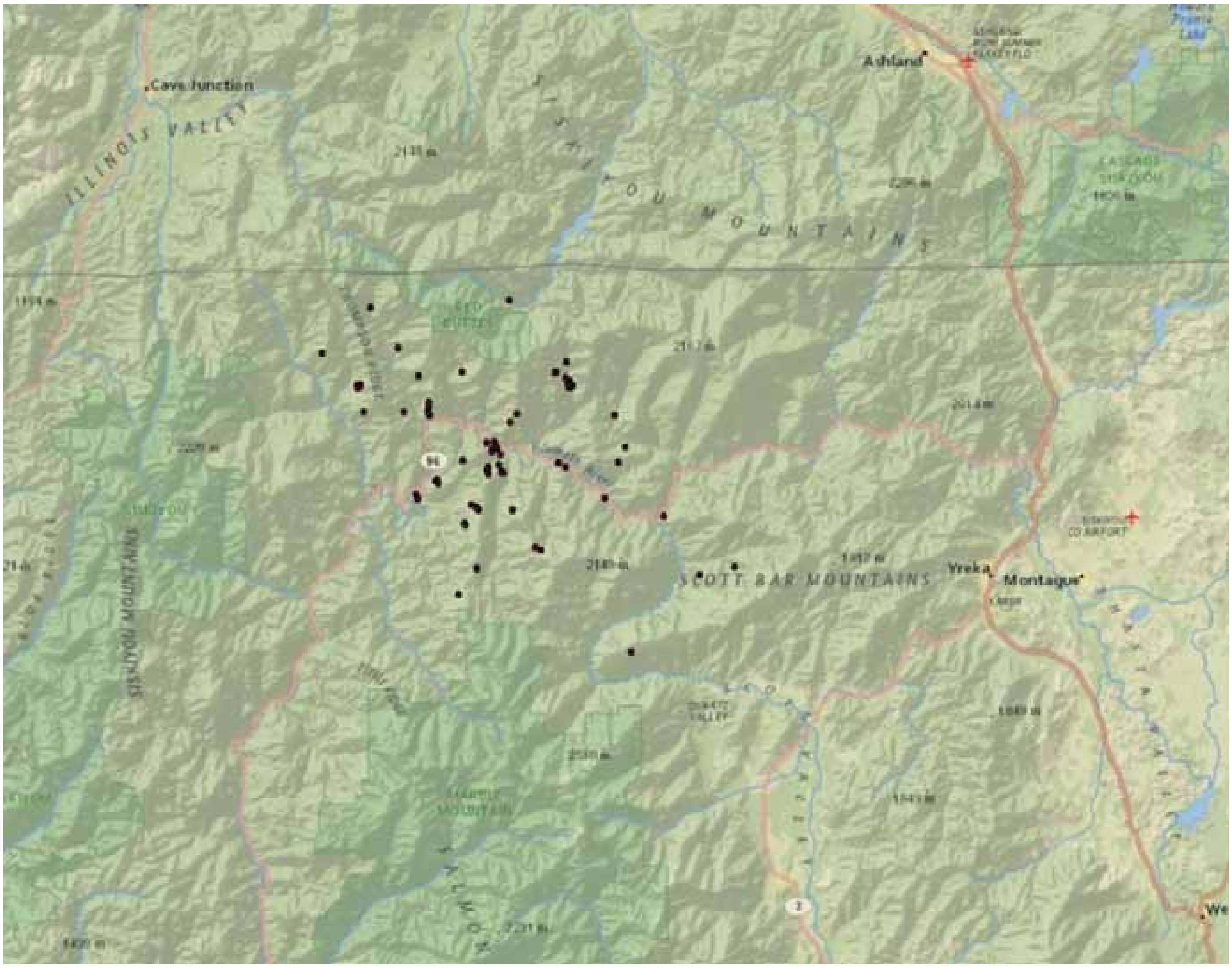
Given that the Siskiyou Mountains salamander was only described in 1965, little is known about its historic distribution. Former Siskiyou Mountains salamander populations were known to have been inundated by 1980 (including the type locality) when Applegate Dam was constructed; other former sites have likely been lost because of logging, mining, road construction and other factors (USDA and USDI 2001), but the extent of such loss is unknown.

The northern population of the Siskiyou Mountains salamander is within the Applegate River watershed in southwestern Oregon. Siskiyou Mountains salamander detections are in the southern portion of the Applegate River drainage in the upper watershed, above Thompson Creek.



Distribution of Siskiyou Mountains salamander sites in the Applegate watershed, from Medford USBLM 2007, and Plate 1 in Olson et al. 2009

The southern population of the Siskiyou Mountains salamander is within a small area in extreme northern California, both north and south of the Klamath River, immediately east of Happy Camp and west of Grider Ridge. Genetic analyses indicate the southern population range is bounded to the west by the Indian Creek drainage and to the east by the Horse Creek drainage (DeGross 2004; Mahoney 2004; Mead et al. 2005; Mead 2006). The southern population is physically and genetically separated from the northern population by the Siskiyou Mountains crest. Salamanders found in a few drainages to the southeast, in the Scott River and Grider Creek drainages, are Scott Bar salamanders; and salamanders in the Klamath drainage downstream of Indian Creek and Happy Camp are Del Norte salamanders.



Siskiyou Mountains Salamander detections in Klamath National Forest, 1974-2015, from USFS

Within its narrow range, suitable habitat for the Siskiyou Mountains salamander comprises a small fraction of the total landscape, further restricting the species' distribution. Nussbaum (1974) estimated that only 3% of the species' known range was suitable habitat. Forest Service and BLM pre-disturbance surveys for the Siskiyou Mountains salamander found that suitable habitat occupied only 3-14% of planning areas in the northern portion of *P. stormi's* range (USDA and USDI 2001). A preliminary habitat model developed by the Forest Service and BLM for *P. stormi* in the Applegate River predicted that suitable habitat occupies 30% of the species northern range (USDA and USDI 2002). Similar estimates have not been made for the southern portion of the species' range.

The distribution of Siskiyou Mountains salamanders is even further restricted because the species is only found in a portion of suitable habitat. For example, Ollivier et al. (2001) sampled

239 randomly selected sites within the range of the species, in forested habitat containing suitable substrates for the Siskiyou Mountains salamander, and found that only 30% of Oregon sites and 20% of California sites were occupied by the species, due to microclimate and canopy requirements for suitable habitat. Using a more refined habitat definition and a different survey approach, Nauman and Olson (2004a) similarly found *P. stormi* in only 26% of randomly selected suitable habitat sites on federal lands in California. Nauman and Olson (2004b) found *P. stormi* at 65% of "optimal" habitat sites on federal lands in the Applegate drainage, where the species appears to occur more commonly.

According to data collected by the Forest Service as part of the Survey and Manage Program, as of 2004 there were approximately 173 known Siskiyou Mountain salamander sites range wide (USDA and USDI 2004). Known sites as of 2004 were unevenly distributed among the northern and southern populations with the majority (143 of 170) found in the Applegate River watershed in Oregon and 27 sites the Klamath River watershed in California (USDA and USDI 2004). Of these sites, nearly a third (51) had not been surveyed since 1994 or before and thus it was unknown if they were still extant (USDA and USDI 2001). Sites were defined as an occurrence location entered into the Forest Service's database and may represent multiple records from the same population. Often the capture of an individual animal was entered into the database as a "site." The Forest Service estimated that there were 6-10 Siskiyou Mountain salamander population centers, based on habitat contiguity and site clusters, with occupied "localities" ranging in size from "very small inclusions of rock to entire hillsides" (USDA and USDI 2001). As of 2007 there were approximately 380 "localities" known for the Siskiyou Mountains salamander (Nauman and Olson 1999; USDA and USDI 2006; Olson et al. 2007).

Because Siskiyou Mountain salamanders spend considerable amounts of time underground and have a highly patchy distribution, abundance at both local and landscape scales is difficult to estimate. Populations likely range in size from a few individuals to thousands of individuals in some cases (Nussbaum 1974; Welsh and Lind 1992). Based on numbers of salamanders captured on three 60 m^2 plots, Nussbaum (1974) guessed that in optimal habitat Siskiyou Mountain salamanders could reach a density of 0.53 salamanders/m^2. This figure was not based on marked individuals and thus no confidence intervals or estimate of standard error were provided.

Using more reliable methods, including mark and recapture of salamanders and the Lincoln-Peterson estimator, Welsh and Lind (1992) estimated that in optimal habitat, which produced the greatest capture rate in a metapopulation study, the closely related salamander *P. elongatus* had a mean density of 0.9 (0.3 SE) salamanders/m^2 and an estimated abundance for the entire 4,500 m^2 study area of 4,034.7 salamanders (1,382 SE). Welsh and Lind (1992) however, cautioned that their study area was likely the exception for salamander density rather than the rule, since they used the site with the highest capture rate from the metapopulation study. Based in part on results from a separate study that captured salamanders from across the range of *P. elongatus*, Welsh and Lind (1992) concluded:

> "This species can occur at high local abundance, but such sites appear to be the exception, and probably represent 'hot spots' or potential source populations deserving of special protection. The site with the highest capture rate from the metapopulation study yielded 30 captures in 49 m^2; the next highest site yielded 13 captures/49 m^2, and most sites produced one to five animals/49 m^2."

P. elongatus has similar habitat requirements and a similarly patchy distribution as *P. stormi*, although a larger range, and thus it is likely safe to assume that large populations of the

Siskiyou Mountains salamander such as those observed by Nussbaum (1974) in optimum habitat, are rare. These conclusions caution against using site specific densities to estimate rangewide abundance of the salamander.

An inventory of all known Siskiyou Mountains salamander sites on the Applegate Ranger District in 1992 yielded abundances of salamanders ranging from 0.3 to 11 captures per person-hour (Olson et al. 2007). A habitat associations study from 1994 to 1997 (Ollivier et al. 2001) yielded densities of salamanders ranging from 1 to 16 animals per 49 m^2 search plot (i.e., 0.02-0.33 animals/m^2). Nauman and Olson (2004) reported an average of 0.01 salamanders/m^2 and 2.39 salamanders/person-hour in California, with lower elevations having higher capture rates. In comparison, other plethodontid capture rates in the western United States can be much higher (Nussbaum et al. 1984).

The limited and highly fragmented distribution of the Siskiyou Mountains salamander in combination with its limited dispersal ability, places the species at further risk of extinction, especially in California.

Population Trends

In 1993 the Forest Service and BLM (USDA and USDI 1993) gave the Siskiyou Mountains salamander only a 50% likelihood of having habitat that “is of sufficient quality, distribution, and abundance to allow the species population to stabilize, well distributed across federal lands.” Although additional localities for the species have been discovered since this rating was assigned, factors such as the species’ association with late-successional forests and agency abandonment of promised habitat protections are reasons for continued concern for the Siskiyou Mountains salamanders’ viability. The identification of two distinct population segments, each with their own management concerns, exacerbates the risk.

It is important to note that crude rules of thumb for minimum viable population size, such as those proposed by Gilpin and Soulé (1986) and others for long-term persistence, don’t apply to populations that can be extirpated by catastrophic disturbance. Probability of persistence is independent of population size if the population can be eliminated in a single event. It doesn’t matter if there are 500 or 5,000 salamanders on a hillside if a large fire or logging destroys the entire habitat. Indeed, numerous studies have documented complete elimination of salamander populations by logging (see pages 28-29 below). Nussbaum (1974) reached much the same conclusion:

> “If a species of salamander totaled 10,000 individuals, this may at first thought seem like a lot, but one fairly large talus slope of optimal quality habitat could conceivably contain 10,000 individuals and hence the entire species. In this hypothetical case the fate of one talus slope could determine the fate of the species.”

The probability of persistence in the Siskiyou Mountains salamander is thus determined less by overall abundance than it is by numbers of populations and the security of the habitat where those populations are found. As discussed in the section on threats below, very few populations are secure from habitat destruction and alteration.

LEGAL REQUIREMENTS FOR DETERMINING WHETHER THE SISKIYOU MOUNTAINS SALAMANDER WARRANTS LISTING

The Endangered Species Act ("ESA") was enacted in order to protect species faced with the threat of extinction. [Babbitt v. Sweet Home Chapter of Communities for a Great Oregon (Babbitt), 515 U.S. 687, 698-99 (1995)] Species protection may conflict with other policies, such as development or natural resource extraction; however Congress struck a balance in favor of imperiled species when it adopted the ESA. [TVA v. Hill, 437 U.S. 153, 194 (1978)] The U.S. Fish and Wildlife Service must give the benefit of the doubt to the Siskiyou Mountains salamander when faced with scientific uncertainty.

The ESA requires the government to provide protective measures to imperiled species as soon as possible. [Defenders of Wildlife v. Babbitt (Defenders of Wildlife), 958 F.Supp. 670, 680 (D.D.C. 1997)] A precautionary approach underlies the ESA. [TVA, 437 U.S. at 178, 194; H.R. Rep. No. 93-412, 5 (1973)] Under this principle of institutionalized caution, the listing agency must list a species facing a threat of extinction even if the scientific data does not definitively and conclusively indicate that the species is threatened or endangered. [Defenders of Wildlife, 958 F.Supp. at 680]

The ESA intends to provide protection to imperiled species before conclusive evidence indicates imminent danger of significant population declines. [Id at 679-680] If a species is not listed because the listing agency claims the data is inconclusive, and later data shows that the species' numbers were actually fewer than initially believed, the damage done may be irreparable. An endangered species may face extinction, and an extinct species can never be brought back. This is the precise harm Congress enacted the statute to avoid. [Babbitt, 515 U.S. 687, 698 (1995)] The purpose of the ESA is to "halt and reverse the trend toward species extinction, whatever the cost." [Id. at 699 (quoting TVA, 437 U.S. at 184)] Delaying listing of a species certainly will not halt any downward trends, and by the time a downward trend can be conclusively confirmed with scientific data, it may be too late for mankind to ever reverse the trend. Congress recognized that the extinction of a species is an irreplaceable loss of incalculable value. [TVA, 437 U.S. 153, 177-78 (1978); H.R. Rep. No. 93-412, 4 (1973)]

Given the significance of such a loss, Congress chose to adopt the ESA to mandate a policy of "institutionalized caution." [TVA, 437 U.S. at 194] "Sheer self-interest impels us to be cautious. The institutionalization of that caution lies at the heart of [the ESA bill]." [TVA, 437 U.S. at 178 (quoting H.R. Rep. No. 93-412 at 5)] The listing agency must err on the side of caution when science cannot provide a conclusive answer. Doubt as to a species' status may exist, but Congress's intent under the best available standard was to "give the benefit of the doubt to the species" when faced with any data gaps. [Conner, 848 F.2d 1441, 1454 (9th Cir. 1998) (quoting H.R. Conf. Rep. No. 96-697, reprinted in 1979 U.S.C.C.A.N. 2572, 2576); Defenders of Wildlife, 958 F.Supp. at 680; FWS & NMFS, Final Endangered Species Act Consultation Handbook, I-6 (1998)] When a listing decision "is a close call" the listing agency must "err on the side of the species." [Endangered Species Act Oversight; Hearing on S. 321, Before the Senate Comm. On Environment and Public Works, 97th Cong. 37 (1982) (remarks of Senator Chafee)]

The ESA's policy of institutionalized caution requires the listing agency to list as threatened a species if any of the five statutory factors "are sufficiently implicated," even if a decline in species' numbers has not been conclusively established. [Southwest Center for Biological Diversity, 215 F.3d 58, 60 (D.C. Cir. 2000)] Threats from the five statutory factors can be far more indicative that a species is threatened than established population declines. [See Endangered and Threatened Wildlife and Plants; Re-opening of Comment Period on the

Sacramento Splittail Final Rule, 67 Fed. Reg. 13095, 13095, 13097 (March 21, 2002)] Certain species are inherently difficulty to survey, and fish and wildlife abundance date has an “inherent high variability.” [Id. at 13097] This may cause scientific uncertainty regarding the species' status. Nevertheless, given the “intrinsically precautionary nature of section 4,” the species should be listed because the risk to the species outweighs the lack of scientifically certain data. [Id.]

Congress intended listing a species as threatened to be a “preventive measure…before a species is ‘conclusively’ headed for extinction.” [Defenders of Wildlife, 958 F.Supp. 670, 680 (D.D.C. 1997)] “The purpose of creating a separate designation for species which are ‘threatened’. . . was to try to regulate these animals before . . .danger becomes imminent.” [Id., quoting S. Rep. 93-307 at 3 (1973)] The Fish and Wildlife Service itself has indicated that “detection of a [statistically significant] decline should not be a necessary criterion for enacting conservation measures.” [67 Fed. Reg. At 13097, quoting Taylor and Gerrodette (1993)] Indeed with some species, if the listing agency “were to wait for a statistically significant decline before instituting stronger protective measures, the [species] would probably go extinct first.” [Id., quoting Taylor and Gerrodette (1993)] Listing the species as threatened is critical to ensuring stronger protective measures are instituted.

Petition History

In June 2004, conservation groups submitted a petition to the U.S. Fish and Wildlife Service to list the Siskiyou Mountains salamander as threatened or endangered under the Endangered Species Act (CBD et al. 2004). In July 2004 the Service responded that it had reviewed the petition but because of inadequate funds it would not be able to address the petition at that time. In 2005 the conservation groups sued the Service for its failure to respond to the petition. In April 2006 the Service published a 90-day finding that the petition to list the salamanders did not present substantial information to indicate that listing may be warranted (USFWS 2006). In July 2006 the conservation groups filed suit challenging the negative 90-day finding. In January 2007 a federal court determined that the Service's 90-day finding was arbitrary and capricious, due in part to the finding ignoring “substantial information presented by various scientists that logging and other activity threatened the salamanders.” The court ordered the Service to make a new finding.

In March 2007 the Service issued a new finding that listing the Siskiyou Mountains salamander might be warranted, and initiated a status review (USFWS 2007b). In January 2008 the Service published a final rule announcing that listing the Siskiyou Mountains salamander was not warranted (USFWS 2008). The 2008 finding admitted that the only peer-reviewed science on the habitat requirements of the Siskiyou Mountains salamander demonstrates that the species is closely associated with old-growth forests, that mature to late-seral-forest attributes provide optimal habitat for the species, and that stands of mature and older forests evenly distributed and interconnected across the geographical range of the species would likely best insure its long-term viability. In order to conclude the salamander did not need protection despite these findings, the 2008 negative finding relied on the Northwest Forest Plan and the new conservation agreement. Given that portions of this agreement appear to have not been implemented (such as monitoring and reassessment with land-use planning changes) and the BLM has now eliminated key protections formerly provided by the Northwest Forest Plan (as discussed below in the section on inadequacy of existing regulatory mechanisms), we are again petitioning for the salamander.

Best Available Science

The ESA requires that the listing agency decide whether to list a species based upon the "best scientific data . . . available." [16 U.S.C. § 1533(b)]. The USFWS' 2008 determination (USFWS 2008) that listing the Siskiyou Mountains salamander was not warranted arbitrarily relied heavily on un-reviewed, unpublished and self-serving interpretations in timber industry reports (e.g. Farber et al. 2001; Farber 2007) and other unpublished reports (Bull et al. 2006). These reports postulated that limited and incidental detections of salamanders in early seral and disturbed areas demonstrated that these salamanders are habitat generalists which are not dependent on late seral forests. Rather than giving primacy to the findings of a peer reviewed published article, the USFWS (2008) arbitrarily accepted the timber company and CDFG interpretation, despite the fact that their random salamander observations were not based on systematic, unbiased sampling, and their habitat conclusions were never peer reviewed.

A U.S. Geological Survey science review that evaluated the biology and habitat associations of the Siskiyou Mountains salamander (DeGross and Bury 2007) found that these timber industry assumptions and interpretations were dubious at best. These unpublished reports were of *P. stormi* at areas with little natural canopy cover or pre-canopy sites where past disturbance had removed the majority of or all of the overhead forest structure, habitats which are not representative of or the most optimal for the species, and for which inferences should not be made about habitat use across the range of the salamander (DeGross and Bury 2007). The unpublished timber industry studies merely noted occupancy (e.g., presence of few animals); although it is possible that timber harvest may not be lethal to all members of a salamander population at a logging site, random documentation of occupancy does not evaluate the effects of logging disturbance on densities, survivorship, reproduction, or altered demographics of salamander populations (DeGross and Bury 2007). Welsh et al. (2008) demonstrated that *P. stormi* living in early seral stages of harvested forests have reduced body condition and skewed age distributions, indicative of sink populations (DeGross and Bury 2007).

Conservation scientist and Siskiyou Mountains salamander expert Richard S. Nauman (Nauman 2008) detailed the U.S. Fish and Wildlife Service's factual errors, misrepresentations of scientific consensus, and failure to use the best available science in its flawed 2008 determination (USFWS 2008) that listing the Siskiyou Mountains salamander was not warranted:

> "The 12-month finding falsely reports the level of disagreement among scientists and managers regarding the habitat of P. stormi and P. asupak, mischaracterizes the type locality of P. asupak, dismisses the best available science regarding habitat based on flawed assumptions, and instead arbitrarily relies on biased conclusions drawn unpublished anecdotal observations of salamanders in marginal habitats despite considerable scientific information that indicates the conclusions drawn from these observations are not reasonable." (Nauman 2008, p. 3)

Nauman (2008) noted that there is little or no disagreement among the scientific and land management communities regarding habitat associations of these species. Nauman (2008) asserted that the best available science regarding Siskiyou Mountains salamander habitat was the peer reviewed work provided by Welsh et al. (2007), whose sampling design and analysis methods were "robust and powerful tools using standard statistical methods to detect relationships in their large sample… and the methodology and data have been found by the reviewers to support the author's conclusions."

Nauman (2008) noted that the USFWS failed to consider several important papers (Welsh and Droege 2001; Welsh et al. 2004; Davic and Welsh 2004) that provided information regarding the biology of Plethodon, reviewed the published information regarding the strong relationship between woodland salamanders and late seral forests, and reflected the scientific consensus regarding the habitat associations of woodland salamanders.

Nauman (2008) also noted that the USFWS finding (USFWS 2008) appeared to ignore the important analysis and discussion of salamander observations in young stands by Welsh et al. (2007):

> "Most of the recently disturbed sites we sampled on the South Slope appeared to be "sink" habitat for populations (Pulliam 1988, 2000). This was suggested by the age class distribution of the few animals we found on recently disturbed sites both slopes combined, pre-canopy and young sites; N=15 salamanders), which were mostly juveniles and sub-adults (73.0% of detections), with fewer adults present compared with mature and old-growth sites (H. Welsh, unpublished data). Overall, juveniles and sub-adults together comprised only 50.0% of captures on mature and old growth sites (both slopes combined, N=20). Further, body condition of salamanders (see Karraker and Welsh 2006) on young sites (both slopes combined) was significantly lower than it was on mature sites (H=8.90, df=2, P=0.01, H. Welsh et al., unpublished manuscript). The higher proportions of young salamanders on recently disturbed sites may have consisted largely of animals from more suitable nearby habitats that were displaced by competition with adults on established territories (i.e. despotic dispersal) (see Jaeger and Forester 1993, Gabor 1995, Maerz and Madison 2000)."

In its attempt to improperly remove California Endangered Species Act protection for the Siskiyou Mountains salamander, the California Department of Fish and Game (CDFG 2005) contended that the salamanders could survive in "diverse forest conditions" based on a re-sampling of the clearcut sites in the Ollivier et al. (2001) study. Noted herpetologist and Siskiyou Mountains salamander expert Dr. Hartwell Welsh, in a 2005 letter to CDFG (Welsh 2005), challenged this conclusion that logged areas provide suitable habitat for the salamanders:

> "The details of this misinterpretation lie with the effort, results, and interpretation of the Department of Fish and Game (CDF&G) re-sampling of the clear-cut sites that were part of the Ollivier et al. (2001) study on habitat associations for this salamander that was conducted under my direction (Ollivier et al. 2001. Habitat correlates of the Siskiyou Mountains salamander, Plethodon stormi [Caudata: Plethodontidae]. USDA Forest Service, Redwood Science Laboratory). The Ollivier et al. (2001) study, which documented an association of this salamander with interior, mature forest conditions, employed a proven random systematic study design, employed across the entire forest seral continuum, to address the question of what habitat attributes are important for this salamander. The subsequent re-sampling of just the clear-cut sites from Ollivier et al. (2001), by CDF&G personnel, was conducted without a study design, in an unusually wet year, and used a completely different sampling method than that employed in the original study. The result of these differences is that the two sampling efforts actually addressed two different questions relative to salamander detections at these sites" (Welsh 2005, p.1).

Significantly, Welsh concluded that the methods employed by CDFG (2005), which focused on determining presence or absence of any salamanders rather than self-sustaining populations, were more likely to detect dispersing individuals:

> "This marked difference between methods greatly increasing the chances of detections by TCS compared with the ACS method. However, the TCS method is also more likely to detect migrating individuals that may be crossing areas of generally unsuitable habitat in search of better conditions (see Marsh et al. 2004. Dispersal and colonization through open fields by a terrestrial woodland salamander. Ecology 85:3396-3405)…Evidence that the interpretation of migrant detections is correct is found in the age classes of the animals detected by the CDF&G crews in the clear cut sites. This sample consisted primarily of juveniles and sub-adults (75.9% as reviewed in my earlier letter). In fact, we re-visited three of these clear-cut sites this spring, and using the TCS method, were able to locate one juvenile and one sub-adult at two of the sites where we had no detections with ACS (Welsh and Clayton, unpublished data). However, it is not accurate to assume that the presence of younger animals at a site constitutes a reproducing population, and it is an even greater mistake to assume that these detections in fact mean that the species as a whole does not require interior forest conditions for its long-term well-being. If that were indeed the case, it would be the first plethodontid salamander species ever to liberate itself from forest-associated micro-habitats (see review in Davic and Welsh. 2004. On the ecological roles of salamanders. Annual Review of Ecology, Evolution, and Systematics 35:405-434)" (Welsh 2005, p. 2)

In fact, the Siskiyou Mountains salamander has not liberated itself from forest-associated micro-habitats. Neither the USFWS 2008 listing determination (USFWS 2008) nor the California Department of Fish and Game attempt to remove California Endangered Species Act protection (CDFG 2005; Bull et al. 2006) followed the ESA's best available science standard.

Distinct Population Segments

The ESA provides for the listing of distinct population segments (DPS) of vertebrate species. The U.S. Fish and Wildlife Service will consider a population a DPS if it is "discrete" in "relation to the remainder of the species to which it belongs" and it is "significant" to the species to which it belongs. According to the Service's policy regarding recognition of distinct vertebrate populations (Federal Register V. 61, No. 26, February 7, 1996), a species is considered discrete if it is "markedly separated from other populations" because of "physical, physiological, ecological, or behavioral factors;" or it is "delimited by international governmental boundaries within which differences in control of exploitation, management of habitat, conservation status, or regulatory mechanisms exist that are significant in light of section 4 (a) (1) (D)." The policy further clarifies that a population need not have "absolute reproductive isolation" to be recognized as discrete. A population is considered significant based on, but not limited to, the following factors: 1) "persistence of the discrete population in an unusual or unique ecological setting;" 2) "loss of the discrete population would result in a significant gap in range;" 3) the population "represents the only surviving natural occurrence of an otherwise widespread population that was introduced;" or 4) the population "differs markedly in its genetic characteristics" (Federal Register V. 61, No. 26, February 7, 1996).

The genetic and distribution information in this petition, as well as previous analysis by the USFWS (2008), indicates that the northern (Applegate) and southern (Grider) populations of the Siskiyou Mountains salamander meet the U.S. Fish and Wildlife Service's criteria for consideration as distinct population segments, being both discrete and significant.

The USFWS (2008) determined that the Siskiyou Mountains salamander consists of two distinct genetic lineages: North, or Applegate, Clade (populations within the Applegate River drainage and on the crest of the Siskiyou Mountain Range); and South, or Grider, Clade (populations south of the Siskiyou Mountain Range crest and adjacent to the Klamath River). The USFWS (2008) identified the Applegate and Grider clades as two separate, valid DPSs. The USFWS (2008) found that "the Applegate and Grider salamanders are markedly separated as a consequence of physical (geographic) features, and as a consequence exhibit genetic divergence as well," and concluded that the two clades are both discrete and significant, as defined under the USFWS' DPS policy. The USFWS (2008) determined that Applegate and Grider salamanders warrant recognition as separate DPSs under the Endangered Species Act.

A combination of observed genetic differences (Pfrender and Titus 2002; DeGross 2004; Mahoney 2004; Mead et al. 2005) and the low ability for the Siskiyou Mountains salamander to migrate suggests the northern and southern populations are reproductively isolated and thus discrete. Although populations in the Applegate River watershed in Oregon cross the Siskiyou Crest into the Klamath River watershed, genetic studies show little to no gene flow between populations (DeGross 2004; Mead et al. 2005). Mead et al. (2005) found that the northern and southern populations of Siskiyou Mountains salamanders separated more than 4 million years ago. Most populations in the Applegate River watershed are in fact isolated by the Siskiyou Crest. Observed marked genetic differences between the northern and southern populations indicate they are significant (Pfrender and Titus 2002; DeGross 2004; Mahoney 2004; Mead et al. 2005).

Pfrender and Titus (2002) stated:

> "The levels of genetic variation and relationships among genetic groups indicate that *P. stormi* comprises three distinct population segments. These segments should be given independent management consideration." [the third population being the Scott Bar salamander]

DeGross (2004) concluded:

> "Although these two groups may not be biological species these two units should receive recognition because of their ecological and evolutionary significance. Distinct differentiation of these two clades in their mtDNA and microsatellite loci warrants the designation of Evolutionary Significant Units (ESUs) (Moritz 1994)."

Olson et al. (2007) stated:

> "Because the 2 mtDNA groups of the Siskiyou Mountains salamander meet the criteria outlined by Moritz (1994; reciprocally monophyletic mtDNA haplotypes and significant differences in allele frequencies at nuclear genes) DeGross (2004) suggested that they be managed as separate Evolutionarily Significant Units [ESU]. One ESU occupies the majority of the range of the Siskiyou Mountains salamander while the other is limited specifically to California, in a

small area north and south of the Klamath River immediately east of Happy Camp"

The case for significance is strengthened by information indicating differences in habitat use by Siskiyou Mountains salamanders in California and Oregon. Siskiyou Mountains salamander populations in the southern portion of the species range are exposed to warmer and drier conditions for longer periods than those in the northern portion of the species range and thus may harbor unique behavioral and genetic adaptations that allow them to survive in a harsher environment. Ollivier et al. (2001) found that salamander sites in Oregon received more rainfall and had a longer rainy period than sites in California. These differences translated into distinct differences in vegetation and other habitat characteristics between Siskiyou Mountains salamander sites. Ollivier et al. (2001) concluded:

> "The plant assemblage and structure at the California sites are indicative of a warmer, drier climate and therefore, may be less suitable habitat for the Siskiyou Mountains salamander than the cooler, moister Oregon sites."

These differences make Siskiyou Mountains salamanders in California potentially more sensitive to logging. According to Ollivier et al. (2001):

> "The most notable difference in landscape-scale habitat models for the two versants was the addition of the years since disturbance variable in the model for the California sites. Disturbance in all instances was related to timber harvest activities, which was prevalent on both versants and occurs throughout the range of this salamander."

The best available information thus indicates that there are two DPSs of the Siskiyou Mountains salamander. Ultimately, it is up to the Service to decide whether to list individual DPSs of the Siskiyou Mountains salamander. Information presented in this petition indicates the Siskiyou Mountains salamander is threatened or endangered in all or significant portion of its range. To avoid complicating recovery processes, we recommend listing the species as a whole.

Significant Portion of Range

The Service can list the Siskiyou Mountains salamander either because it is threatened or endangered in all of its range or because it is threatened or endangered in a significant portion of its range. Populations south of the Siskiyou Crest in California are arguably more imperiled than those north of the Crest, and are comprised of far fewer populations and occur in a less hospitable environment, potentially making them more vulnerable to logging (Ollivier et al. 2001; USDA and USDI 2001, 2002). Populations in the north of the species range, however, face increased threat from logging on the many sites found on lands managed by the BLM. In either case, the salamander is threatened or endangered in a significant portion of its range.

PRESENT OR THREATENED DESTRUCTION, MODIFICATION, OR CURTAILMENT OF HABITAT OR RANGE

Numerous factors place the Siskiyou Mountains salamander at risk of extinction now or in the foreseeable future. These factors relate to the biology of the species and its specific habitat requirements. The Siskiyou Mountains salamander has a low reproductive rate, with individuals not reaching maturity until 5-6 years of age, clutch sizes of only from 3-12 eggs, and most individuals only breeding every other year (Nussbaum 1974, pp. 21-22). This means the species has a limited ability to recover from disturbances that impact either reproduction or survival, such as loss or degradation of habitat from logging.

Siskiyou Mountain salamanders occupy a narrow habitat niche that combines aspects of regional climate, topography, stand structure, substrate and microclimate. The conditions in which *P. stormi* are able to forage on the surface are highly limited and influenced by climate variation and habitat quality; with *P. stormi* in particular and salamanders in general exhibiting extreme sensitivity to habitat perturbations, including logging (e.g. Welsh 1990; Dupuis et al. 1995, p. 651; deMaynadier et al. 1995, pp. 234-246; Herbeck and Larsen 1999, pp. 628-631; Ollivier et al. 2001, pp. 35-42; USDA and USDI 2001, pp. 4-6; USDA and USDI 2002, p. 1, 5). The Siskiyou Mountains salamander is thus highly susceptible to local extirpation in response to logging or other forms of habitat disturbance.

Many amphibian populations may be unable to recolonize areas after local extinction (Blaustein et al. 1994). Siskiyou Mountain salamanders have the second smallest range of any western Plethodon. Habitat is naturally fragmented across the landscape and the species' distribution in this habitat is spotty. Siskiyou Mountain salamanders have low ability to move about freely and migrate, with individuals completing their life-cycle in small areas of forest. Migration of Siskiyou Mountain salamanders between different populations occurs very rarely. Because of this combination of factors, when local populations are extirpated due to habitat disturbance or demographic or environmental stochasticity, there is little chance habitat will be re-colonized. This places the species at risk of range reduction and ultimately extinction.

Olson et al. (2007a, pp. 3-4) summarized known threats to Siskiyou Mountain salamanders:

> "Habitat loss, degradation, and additional fragmentation of discrete populations are all potential threats to this species. Activities that may pose threats are those that disturb the surface microhabitats and/or microclimate conditions. Typically these involve actions that remove canopy and/or disturb the substrate. Removal of canopy overstory may cause desiccation of the rocky substrates and loss of the moss ground cover, a microhabitat feature of Siskiyou Mountain salamander sites. Disturbing the substrate can result in substrate compaction and deconsolidation of the stabilized talus, which reduces or eliminates substrate interstices used by salamanders as refuges and for their movements up and down through the substrate. Examples of the types of activities that may cause impacts include: certain types of timber harvest such as regeneration harvest with associated road construction and ground-based harvest systems. Other types of activities such as recreation projects, rock quarry management and construction, and prescribed as well as wildland fire may pose somewhat lesser potential threats to the species. As the majority of known sites occur on Federal lands, Federal land management activities have the highest likelihood to adversely impact the species."

Logging

Logging is the primary threat to the habitat of the Siskiyou Mountains salamander, and timber harvest is the primary land "management" activity in forested ecosystems in the range of the salamander. Several disturbances of salamander habitat conditions can result from timber harvest practices: removal of overstory may cause desiccation of rocky substrates and loss of moss ground cover, a microhabitat feature of Siskiyou Mountain salamander sites; tree-felling and ground-based logging systems disturb substrate which can result in substrate compaction and deconsolidation of stabilized talus, reducing or eliminating substrate interstices used by salamanders as refugia and for their movements up and down through the substrate; and logging site preparation practices such as broadcast burning remove the moss covering that helps to stabilize talus (Olson et al. 2007a, pp. 3-4).

Because Siskiyou Mountains salamanders and other Plethodons breathe through their skin and can be exposed to water loss and desiccation, they are only active on the surface for short periods of the year when moisture conditions are suitable (Feder 1983, pp. 295-299). The majority of Siskiyou Mountains salamander foraging and reproductive activities take place during these short forays. Removal of the canopy and disruption of the surface layer from logging alters forest stand microclimate in ways that harm salamanders. For example, Chen et al. (1993, p. 234) found that the interior of old-growth Douglas-fir stands was cooler and moister than forest edges or clearcuts. Such microclimate changes from logging can result in conditions unsuitable for salamander surface activity and the loss or sharp decline in salamander populations, particularly for a species such as the Siskiyou Mountains salamander that occurs in a region with a relatively warm, dry climate.

Although replicated studies examining the effects of logging or other disturbances on the Siskiyou Mountains salamander have not been conducted, several lines of evidence demonstrate that logging harms this salamander's habitat and populations, including information about the Siskiyou Mountains salamander habitat needs and observational data, as well as studies of closely related species.

The Siskiyou Mountains salamander is closely associated with old-growth forests, typically with very high canopy closure (Ollivier et al. 2001, pp. 37-39). In California, sites with Siskiyou Mountains salamanders had a narrow and relatively high confidence interval (68.0-93.3%) for mean canopy closure (Ollivier et al. 2001, p. 21). The forest canopy conserves surface moisture and helps to maintain a high relative humidity for periods of salamander surface activity. These results strongly suggest that *P. stormi* is sensitive to canopy removal either in whole from clearcutting, or in part from thinning. Welsh and Ollivier (1995, pp. 8-9) posited that tractor logging may harm Siskiyou Mountains salamander habitat by compacting, breaking and realigning talus used by salamanders for thermal regulation and foraging cover.

Clayton (2000) sampled for Siskiyou Mountains salamanders at a site with high-grade logging (near Hutton Guard Station) and a clearcut logging site just above this station, from 1992-1994 (see CDFG 2005, p. 20). Salamander numbers were consistent in the high-graded site from 1992-1994 (CDFG 2005, p. 20). In the clearcut, salamanders were abundant immediately following cutting in April 1993, but appeared to have been eliminated from the site by April 1994 (CDFG 2005, p. 20). Surveys in 1995 and 1998 similarly failed to find salamanders at this site (CDFG 2004). A single salamander was found in 1999 and several were found on the site in 2003 (CDFG 2004), suggesting some salamanders may have moved back onto the site from adjacent habitat. It is unknown whether salamanders have returned to their former abundance prior to cutting. These results suggest that Siskiyou Mountains salamanders are eliminated by overstory removal.

Studies from across North America demonstrate that logging harms salamander populations and Plethodontids in particular (Dupuis et al. 1994, p. 651; Ash 1997, pp. 986-988; DeMaynadier and Hunter 1998, pp. 348-350; Herbeck and Larsen 1999, pp. 628-630; Grialou et al. 2000, pp. 110-111). DeMaynadier and Hunter (1995, pp. 234-235) reviewed 18 studies of salamander abundance after clearcut timber harvest and found median abundance of amphibians was 3.5 times greater on controls over clearcuts. Petranka et al. (1993) found that Plethodon abundance and richness in mature forest were 5 times higher than those in recent clearcuts (p. 366), conservatively estimated that about 75-80% of salamanders in mature stands are lost following timber harvesting by clearcutting (p. 367), and estimated that it would take as much as 50-70 years for clearcut populations to return to pre-clearcut levels (pp. 366-367). A comparison by Petranka et al. (1994) of recent regeneration harvest units (<5 years) and mature forests (120 years) also suggested salamanders are eliminated or reduced to very low numbers when mature forests are clearcut.

Tilghman et al. (2012) conducted a meta-analysis of published studies of the effects of timber harvesting and canopy removal on terrestrial salamander abundance, looking at 108 salamander species/treatment combinations from 24 studies. Tilghman et al. (2012, pp. 4-8) found that: salamander numbers almost always declined following timber removal; clearcutting has a greater impact on salamander populations than partial harvest; and salamander decreases following harvest are more pronounced at sites with warmer summer high temperatures. Tilghman et al. (2012, p. 4) found the greatest salamander reductions with timber harvest are seen in the Plethodon salamanders, including *P. stormi*. Tilghman et al. (2012, pp. 4-6) noted that active sampling of salamanders (e.g., surface counts) leads to greater apparent effects of timber harvest than passive sampling (e.g., cover boards or pitfall traps), suggesting that sampling methodology influences the perceived effects of timber harvest.

Specific to the Pacific Northwest, a number of studies have documented greater salamander abundance in old-growth compared to clearcuts or second growth (Bury and Corn 1988, pp. 18-19; Raphael 1988, p.p. 26-29; Welsh and Lind 1988, pp. 443-444, 447-448; Welsh 1990, p. 314; Welsh and Lind 1991, pp. 400-409; Corn and Bury 1991, pp. 309-316; Dupuis et al. 1995, pp. 648-652; Ollivier et al. 2001, pp. 36-42). Of these studies, those which evaluated species most closely related to the Siskiyou Mountains salamander and species in similar climactic settings consistently found logging to negatively affect salamander populations.

Using a variety of sampling techniques, Raphael (1988, p. 23) sampled 166 sites, representing clearcuts through old-growth in northwestern California. Three salamander species were found to be closely associated with late seral forests, including the closely related Del Norte salamander (*P. elongatus*); no salamanders were associated with early seral forests (Raphael 1988, p. 26).

Welsh and Lind (1988) used pitfall traps and time constrained searches in stands ranging from 40-450 years old in southwestern Oregon and northwestern California to measure differences in herpetofauna, concluding that: "amphibians were significantly more abundant in old than in young stands and significantly less abundant in dry than in moist stands: (p. 452); and that older forests support both a richer and more abundant salamander fauna (p. 448). Welsh and Lind (1988, p. 445) found that closely related *P. elongatus* was more abundant in old forest compared to young forest. Welsh and Lind (1988, p. 439) concluded that "changes in forest structure due to forest practices results in reduced species diversity and abundance among the herpetofauna."

Similarly, Welsh (1990, p. 314) and Welsh and Lind (1995, pp. 201-208) found closely related *P. elongatus* to be more abundant in old-growth stands compared to young or mid-seral forest. Welsh (1990, p. 314) concluded: "During this study, 91 percent of 406 Del Norte salamanders were found on old growth forest sites. The remaining salamanders were from two mature sites, or from two young sites both adjacent to older forest."

In contrast, Diller and Wallace (1994) found *P. elongatus* to be common in managed young stands in northwestern California and found no relationship of salamander presence to forest age. However, Diller and Wallace (1994) sampled stands that were from zero to 90 years old, and the areas surveyed were also in the coastal redwoods that have a milder, wetter climate than interior sites sampled by others (Welsh and Lind 1991; Ollivier et al. 2001) that are dryer, hotter and more interior and are similar to areas where the Siskiyou Mountains salamander is found. Diller and Wallace (1994) agree that differences in their findings relate to differences in prevailing climate in the study areas.

Dupuis et al. (1995, p. 648) found that clearcutting reduced western redback salamander (*Plethodon vehiculum*) abundance by 70% and that the species was six times more abundant in old-growth than in managed stands, concluding that: "old-growth forests support more salamanders than second growth managed stands, particularly young stands. These findings agree with other surveys conducted in the Pacific Northwest and in eastern North America" (p. 650).

Karraker and Welsh (2006, p. 132) found clearcutting affected Plethodontid numbers up to 25 years post-harvest in northwestern California. Karraker and Welsh (2006, p. 136, 138) also found similar abundances of Plethodontid salamanders in thinned and unthinned forests, but body condition of most species was lower in thinned stands.

Rundio and Olson (2007, pp. 323-329) found reduced abundances of Plethodontid salamanders following thinning at one of two study sites, and suggested site conditions (e.g., down wood, substrate) may have ameliorated the effects of canopy reduction at one site.

Welsh et al. (2008, p. 1149) noted that investigations to determine stable or source-sink animal population dynamics are challenging and often infeasible for most species due to the time and expense of mark-recapture studies and the challenge of life histories attributes that result in low detectability and low recapture probabilities. Welsh et al. (2008, p. 1149) cautioned that land managers should not rely solely on occupancy or relative abundance patterns to assess a species' sensitivity to environmental changes, but that greater insight into population-level responses to environmental change can be gained by consideration of a combination of readily obtainable metrics, including occupancy, relative abundance, demographic structure and body condition.

Welsh et al. (2008, pp. 1151-1155) examined and compared these population metrics for the Del Norte salamander (*P. elongatus*) and the Siskiyou Mountains salamander (*P. stormi*) across the seral continuum represented by four forest age classes: pre-canopy, young, mature, and old-growth. Welsh et al. (2008, pp. 1151-1152) compared these data with those collected from reference stands in mature (*P. stormi*) or old-growth (*P. elongatus*) forest containing robust populations. Welsh et al. (2008, pp. 1153-1155) found that both occupancy and salamander counts were lowest at pre-canopy sites for both species; and although there were numerous *P.*

elongatus detections in young forests, higher proportions of these individuals were juveniles and sub-adults when compared to populations in late-seral forests. Welsh et al. (2008, pp. 1156-1157) found a negative relationship between the proportion of immature animals and total counts at a site, indicating that the high proportion of young animals in young forest stands is likely due to dispersal of young salamanders from nearby source populations and/or low survival of adult animals in young forests. Welsh et al. (2008, p. 1157) also found reduced body condition of *P. stormi* populations in young forests. Welsh et al. (2008, p. 1149) suggest that there are costs to populations occupying early seral forests, such as skewed age class structure and reduced body condition that are indicative of sink populations.

Welsh and Hodgson (2013, p. 1) evaluated Plethodontid salamanders (*Batrachoseps attenuatus*, *Ensatina eschscholtzii*, and *Plethodon elongatus*) in northern California as metrics of seral recovery, and found that that the increased structural complexity in late-seral forest stands supported larger salamander populations that appeared to be competing for limited resources and, thus, likely have greater population fitness than those in younger forests.

Overall, many species of salamanders are sensitive to disturbance from logging, but the results are species- and range-specific. Notably, all of the studies that considered species closely related to the Siskiyou Mountains salamander and species occurring in similar habitat found them highly sensitive to logging. This was particularly well documented for the Del Norte salamander in dryer portions of its range (Raphael 1988, p. 26; Welsh and Lind 1988, p. 443; Welsh 1990, p. 314). This sensitivity of related salamanders to logging disturbance, along with information indicating that Siskiyou Mountains salamanders require old-growth habitats across much of their range (Ollivier et al. 2001) infer that the Siskiyou Mountains salamander is highly sensitive to logging.

The Siskiyou Mountains salamander range has been fragmented by logging and fire into a patchwork of stands of different seral stages, from early seral to mature forests (Olson et al. 2007a, p. 15). Although the extent of logging in Siskiyou Mountains salamander habitat has not been quantified, it is likely that the species has experienced substantial habitat loss from logging. For example, using soil mapping as a basis for projecting potential habitat loss, 10% of the total potential Siskiyou Mountain salamander habitat on the Applegate Ranger District, Rogue River National Forest (10,000 acres, 4,047 ha), was logged in just one decade, between 1984 and 1994 (USDA and USDI 2001, p. 10; Olson et al. 2007a, p. 15). Surveys in timber sale units after harvest have shown marked reductions in Siskiyou Mountains salamander capture rates. A site adjacent to the type locality was surveyed in 1993 immediately after a clearcut harvest and broadcast burn, and a high number of individuals (10+captures/person-hour) were found (Olson et al. 2007a, p. 16). Subsequent surveys showed a rapid loss of individuals detected at the site, and since 1995, no salamanders were found at the site until 1999 when one was found (CDFG 2005, p. 20; Olson et al. 2007a, p. 16). In 2003, two searches conducted by the California Department of Fish and Game yielded 3 salamanders in 17 minutes and 5 salamanders in 75 minutes (CDFG 2005, p. 20). These data are inconclusive but may indicate some recolonization of the site or a sink habitat into which individuals are dispersing from a nearby source habitat and may not subsequently survive.

Siskiyou Mountains salamander habitat loss has likely been more severe on private lands, where there are fewer restrictions on logging. The Forest Service concluded that private lands within the range of the Siskiyou Mountains salamander are “not expected to provide much, if any, suitable habitat for the species” (USDA and USDI 2001, p. 7).

As some federal timber management practices changed over time, it was presumed that "clear-cut logging" would no longer be carried out on Forest Service or BLM lands within the range of this species (Olson et al. 2007a, p. 17). Logging under "regeneration harvests" was supposed to maintain large down logs, large snags, and 15% of the original stand as green retention trees (Olson et al. 2007a, p. 17). However, these regeneration harvest retention standards were not carried forward in the BLM's 2016 Resource Management Plan (USBLM 2016). On Forest Service lands, substrate impacts are still likely under regeneration harvests and it is unknown at what level canopy reduction is significant enough to render an area unsuitable for salamanders. Based on scatter plot data from the Ollivier et al. work (2001, pp. 21, 29, 37-38), salamander capture rates declined significantly when canopy closures were below approximately 70 percent.

As discussed below (in the section on inadequacy of existing regulatory mechanisms), the BLM's recent land-use planning change through the Western Oregon Plan Revisions has potentially altered the foundation upon which the salamander Conservation Agreement and Strategy was designed for the salamander in the Applegate Valley, where the majority of Siskiyou Mountains salamander sites occur. The BLM has recently proposed substantially increasing logging within the range of the salamander and removing protections for many high priority conservation sites for the salamander (USBLM 2016). The BLM will now allow new logging projects in known occupied Siskiyou Mountains salamander sites without surveys or buffers (USBLM 2016). Projected logging under WOPR places the salamander at risk, necessitating protection under the Endangered Species Act.

Timber harvest projects within the range of the Siskiyou Mountains salamander since 2007, such as the Applegate Plantation Thinning Project on the Rogue River-Siskiyou National Forest, appear to have followed the Conservation Agreement and avoided all high priority salamander sites.

The Nedsbar timber sale, which would allow logging of 3.4 million board feet in the Applegate watershed, had known Siskiyou Mountains salamander sites in a 5-acre patch of talus habitat, adjacent to a high-priority management site. The BLM approved helicopter logging of talus habitats at Nedsbar, but promised to protect talus habitat from ground disturbing activities "to the extent feasible." The sale allowed no post-harvest under-burning, no activities during the wet season when salamander are active, and was supposed to retain a minimum 40% canopy cover. The sale required felling of trees away from talus "where possible." Up to 15% of talus habitat areas could be compacted from cable yarding. This timber sale was withdrawn by the BLM in September 2016, but will be renewed to make it more "economically viable."

Road Development, Mining and Recreational Development

Other federal land actions may result in loss of Siskiyou Mountains salamander habitat, including road construction, mining and recreational development (Olson et al. 2007a, p. 15). The Forest Service noted that timber harvest is perceived to be the primary threat to the species, "but road building, quarry development, and recreational developments are also known to impact the species" (USDA and USDI 2001).

<u>Roads</u>

Many roads have been constructed in the Siskiyou Mountains salamander range to access timber harvest operations and for easy access to existing rock sources to use as road-surfacing material (Olson et al. 2007a, p. 17). Road construction in suitable salamander habitat directly removes overstory and compacts the substrate (Olson et al. 2007a, p. 17). The intensity of road impacts are more intense and longer lasting than timber harvest (Olson et al. 2007a, p. 17). Road construction likely causes direct mortality to individual salamanders and some amount of habitat loss (Olson et al. 2007a, p. 17). However, due to the scale of impact and the linear nature of the action, Olson et al. (2007a, p. 17) considered road impacts to the species to be significantly less than timber harvest or stand-replacement fire. Olson et al. (2007a, p. 17) noted that roads are not generally known to be barriers to plethodontid salamanders, *P. stormi* has been found in road cuts, and road kill is not well documented for this species.

DeMaynadier and Hunter (2000, pp. 59-62) found that Plethodon salamander abundance in Maine was 2.3 times higher at forest control sites than at roadside sites, and salamander captures in roadside traps (road crossings) were approximately 26 percent of similarly oriented captures in paired forested controls. Plethodontids, as species where natal dispersal and migratory movements are limited, were found to be particularly sensitive to population fragmentation by logging roads (DeMaynadier and Hunter 2000, pp. 62-64). The total area of land converted to road surface and shoulder clearance for permanent logging roads represents a significant loss of former habitat in densely roaded regions (DeMaynadier and Hunter 2000, pp. 63-64). Further observations of *P. stormi* need to be made to determine their specific ability to cross roads and more generally to disperse between habitats and populations. In the interim, a conservative approach is to assume that roads do lead to population fragmentation.

<u>Mining</u>

Rockpit mining operations remove large amounts of material far back into a hillside or mountain, and both overstory and substrate may be removed. Such operations undoubtedly remove both surface and subsurface refugia for salamanders permanently, and likely have impacted local populations (Olson et al. 2007a, p. 17). However, due to the small scale of rockpit mining across the range of this species, Olson et al. (2007a, p. 17) did not consider such mining to be a primary threat.

However, much of the Klamath River drainage in the vicinity of Seiad Valley and Happy Camp, California has been hydraulically mined, evidenced by tailings that now make up the majority of the banks of the river (DeGross and Bury 2007, p. 8). Much like road building or road cuts, mining removes and undermines the integrity of salamander habitat and then exposes the remaining underlying rock and talus of an area, creating exposure of the remaining substrate to the surface and reducing the complexity of the habitat.

The Forest Service (Region 6) and USEPA began planning in 2010 to remove hazardous substances from the Blue Ledge Mine in the Rogue River-Siskiyou National Forest, in Siskiyou County, California. Surface runoff from the mine containing sulfuric acid, dissolved copper, zinc, iron, cadmium, and other heavy metals has migrated onto public and private land, and the mine has contaminated surface waters, stream sediments, riparian soil, and groundwater. The Siskiyou Mountains salamander occurs at the mine site and there is abundant habitat for the salamander in the talus slopes surrounding the site (USFS 2010, p. 4, 10).

<u>Developed Recreation</u>

Construction of camping areas, access roads, boat ramps, and other developed recreation sites have likely impacted Siskiyou Mountains salamanders, by the direct alteration of substrate as well as canopy loss due to overstory vegetation removal (Olson et al. 2007a, p. 17). This impact is particularly known around Applegate Lake (Olson et al. 2007a, p. 17). Dispersed campsites may also have had an impact on Siskiyou Mountains salamander habitat from soil compaction and vegetation alteration, although the impact is expected to be somewhat limited (Olson et al. 2007a, p. 17).

INADEQUACY OF EXISTING REGULATORY MECHANISMS

Federal Protections

The majority of the Siskiyou Mountains salamander range occurs on federal lands managed under the Northwest Forest Plan (Olson et al. 2007a). The species has been documented to occur on the Medford District Bureau of Land Management, Ashland Resource Area; the Applegate Ranger District of the Rogue River-Siskiyou National Forest; and the Happy Camp and Scott River Ranger Districts of the Klamath National Forest.

The Northwest Forest Plan established a system of federal reserves interspersed with matrix forestlands where timber harvest and other commodity production are given priority. Reserves were designed to provide large blocks of habitat for northern spotted owls and management on reserved lands generally attempted to protect species associated with older forests. However, the reserves may not provide adequate protection to older-forest associated species such as the Siskiyou Mountains salamander, whose range has limited overlap with those owl reserves and whose life history traits occur at a different scale than the spotted owl (Nauman and Olson 2008). Only 27% of salamander sites occur in "late-successional reserves," where timber harvest and other ground-disturbing activities are restricted and salamanders are expected to receive adequate protection (Olson et al. 2007a). Because many reserved lands occur at higher elevations, many of the sites that are found in reserves may provide sub-optimal habitat for *P. stormi*, with potentially lower abundance. Thus less than 10% of the suspected high quality habitat for the Siskiyou Mountains salamander is in Northwest Forest Plan reserves (Clayton et al. 2002; USDA and USDI 2004).

Distributions of salamander sites within the Applegate watershed portion of the range are primarily (67%) in "Adaptive Management Areas" [a designation which has since been eliminated on BLM lands by the Western Oregon Plan Revisions (see USBLM 2016), but still exists on Forest Service lands], late-successional reserves (18%), and private lands (16%) (Nauman and Olson 1999).

In the southern portion of the range in California, site distribution is primarily (67%) on reserve lands, with 31% of sites on Matrix land. Nauman and Olson (2008) conducted a stratified random survey for terrestrial salamanders on federal lands in the southern portion of the range of the Siskiyou Mountains salamander and compared occupancy rates and abundances between reserve and matrix land allocations. They found that at low elevations, the proportion of sample points with captures of Plethodon spp. was significantly higher in matrix lands than on reserved lands.

Nauman and Olson (2008) reported that matrix land mitigations may be essential to provide protection for Siskiyou Mountains salamanders. The Forest Service (USDA and USDI 2001) also concluded "it is likely that non-protected land allocations will be required in order to ensure persistence for the species, both in the northern and southern portions of the range." In recognition that reserves did not adequately protect the Siskiyou Mountains salamander, it was originally protected under the "Survey and Manage" program and then a conservation agreement.

<u>Survey and Manage Program</u>

The Siskiyou Mountains Salamander was formerly afforded some protection on federal BLM lands under the "Survey and Manage" program of the Northwest Forest Plan. The Survey and

Manage program required the BLM to conduct pre-disturbance surveys for Siskiyou Mountain salamanders and to designate protected buffers from logging and other disturbance where salamanders were found. However these protections were eliminated for Siskiyou Mountains salamander populations on BLM lands in Oregon in 2016 (see USBLM 2016, p. 28). The Forest Service still implements the Survey and Manage program.

An example of protections for the Siskiyou Mountains salamander from the Survey and Manage program was a Forest Service biological evaluation for the Carberry Creek timber sale on the Rogue River National Forest (USFS 1997), which concluded that because of mitigations provided by the Survey and Manage program the timber sale would have no effect on the salamander:

> "This species is known to occur at various locations within or near the proposed activities and potential habitat occurs within most of these areas. Surveys will be conducted before any activities begin including road construction or reconstruction, logging, or burning. Under the action alternatives, no treatments would take place in known salamander habitat and all known habitat will receive a 100' buffer around the outer periphery and no overstory trees will be removed within this buffer. If these mitigation measures are followed, the proposed action should have no effect on Siskiyou Mountains salamander or their habitat."

Similar conclusions were reached for numerous other timber sales within the range of the Siskiyou Mountains salamander.

The elimination of pre-disturbance surveys and buffers for the salamander on BLM lands in Oregon leaves it vulnerable to timber harvest and other activities on BLM lands outside reserves. Without the mitigations of the Survey and Manage program, it is clear that timber harvest activities will harm these species by allowing the destruction and modification of their habitat. Northwest Forest Plan Standards and Guidelines allow logging that removes substantial portions of the canopy and fails to establish minimum canopy levels. A number of timber sales have been cut in the Siskiyou Mountains salamander's range which reduced canopy closure well below levels required by the species, including the Carberry, Wagner Gap and many others. These timber sales did little direct harm to Siskiyou Mountain salamander populations only because the Survey and Manage program kept them out of areas where the salamanders were found. Such protections will not be carried forward on BLM lands under the 2016 Resource Management Plan that does not require pre-disturbance surveys and which allows for logging of known, occupied SMS sites that were previously protected under the Survey and Manage program of the NW Forest Plan (USBLM 2016, p. 28).

Western Oregon Plan Revision

In the Oregon portion of the salamander's range, a majority of sites (67%) are found on the Applegate Adaptive Management Area, which includes a mix of BLM and Forest Service lands. Management of the AMA did not preclude logging, but many protections of the Northwest Forest Plan did apply. At least for the more than 150,000 acres of the AMA that falls on BLM lands, these protections have now been eliminated.

The Western Oregon Plan Revision (WOPR) which replaces the Northwest Forest Plan, has the express purpose of substantially increasing logging on BLM lands with the range of the salamander and elsewhere (USBLM 2016, p. 20). The WOPR was originally proposed in 2008 and abandoned by the BLM in 2012 after years of litigation. In August 2016 the BLM issued a final Environmental Impact Statement implementing the WOPR (USBLM 2016).

The WOPR presents a substantial new threat to Siskiyou Mountains salamanders in Oregon because it will allow increased timber harvest in late-successional areas, decrease optimal salamander habitat, increase habitat fragmentation, eliminate requirements to conduct pre-disturbance surveys in salamander habitat, and allow logging of previously identified known, occupied salamander sites. The WOPR removes protections for salamander populations formerly included in species protection buffers on BLM lands. Although some of the reserves on BLM lands have been enlarged in the WOPR, timber harvest emphasis areas will often be subject to more intensive logging, and logging of known, occupied Siskiyou Mountains salamander sites is allowed.

The stated purpose and need of the WOPR is to shift the dominant use of BLM lands to timber production in order to increase timber harvest levels:

> "The BLM is proposing to revise existing plans to replace the Northwest Forest Plan land use allocations and management direction because the BLM's plan evaluations found harvest levels have not been achieving the timber harvest levels directed by existing plans" (p. 3). "The BLM has re-focused the goal for management of the BLM-administered lands to the statutory mandates specifically applicable to these lands. The statutory requirements of the O&C Act, which governs most BLM-administered lands in western Oregon, include, but are not limited to, managing the O&C lands for permanent forest production by selling, cutting, and removing timber in conformance with the principles of sustained yield; determining the annual productive capacity of the lands managed under the O&C Act; and offering that determined capacity annually under normal market conditions. The statute states that the purpose of sustained yield management of these lands is to provide a permanent source of timber, contribute to the economic stability of local communities and industries, as well as benefit watersheds, regulate stream flows, and provide recreational use" (USBLM 2016, p. 6).

The WOPR states that the BLM will manage for the Siskiyou Mountains salamander "consistent with the Conservation Agreement for the Siskiyou Mountains Salamander (*Plethodon stormi*) in Jackson and Josephine Counties of Southwest Oregon; and in Siskiyou County of Northern California (August 17, 2007), as amended and as long as in effect" (USBLM 2016, p. 121). However, the WOPR does not have any information about how the removal of formerly protected land designations will be consistent with the Conservation Agreement. The WOPR contains no mention of the Conservation Strategy or the habitat needs and correlates of the Siskiyou Mountains salamander.

The protected status of the old-growth forests on which Siskiyou Mountains salamanders depend is uncertain under the WOPR, and warrants reassessment of salamander protections.

The WOPR replaces the Northwest Forest Plan's late successional reserves (LSRs), with late-successional management areas (LSMAs). Whereas the LSR provision allowed no logging of stands older than 80 years, the LSMA allows logging "to promote the development of suitable habitat" (p. 110). This vague language permits timber harvest activities in former late successional reserves. Elements of the WOPR which threaten *P. stormi* include changing the rotation to emulate the timber industry's short rotation practices (p. 111), and increasing the annual sale quantity of timber from 268 million board feet (under the No Action Alternative) to 727 million board feet under Alternative 2 (p. 112). Harvest acres are increased from 62,000 acres under the No Action alternative to 143,000 acres under Alternative 2 (p. 722). Alternative 2 admittedly "increases the risk of local extirpation for forest floor highly endemic wildlife species" and "decreases suitable wildlife habitat" (p. 112).

Although *P. stormi* is listed as a special status species on BLM lands, the language of the WOPR makes it clear that timber harvest activities take precedence over species protection:

> "The BLM would accord specific protection to BLM sensitive or assessment species on O&C lands *where protection would not conflict with sustained yield forest management in areas dedicated to timber production*" (p. 14 -15, emphasis added).

The WOPR does not detail specific protections for BLM special status species. Chapter 4, Environmental Consequences, divides special status species into five groups based on habitat requirements. The Siskiyou Mountains Salamander is in Group 5, Forest Floor Associates, which the DEIS acknowledges will lose habitat under the WOPR:

> "Species in group 5 are comprised of amphibians and mollusk species associated with mature or structurally complex forests, upland, forest floor communities. These species respond to changes to canopy cover, down wood, and soil moisture. Regeneration harvests and the associated impact to adjacent forests would result in the loss of habitat. This is due to the breakage and movement of existing forest structure during harvest and the decreases in soil and down wood moisture levels due to increased light and wind penetration into adjacent stands" (p. 717).

To evaluate the effects of habitat degradation under the WOPR on forest floor species, BLM produced a model ranking habitat quality in response to increased timber harvest. The DEIS acknowledges that Alternative 2 scores low in terms of habitat quality and does not provide for the retention of legacy structures (downed wood and snags) which provide critical salamander microhabitat:

> "Twenty random watersheds were modeled to evaluate the effects of regeneration harvests and legacy requirements on forest floor species. Structural stages from nonforest and stand establishment to structurally complex stands were scored based on habitat value. Differences between the alternatives in the amount of habitat within habitat quality categories 0 to 3 would occur as a result of legacy retention and the amount of harvesting activities. Since Alternatives 1 and 2 do not have legacy retention requirements, they would have more habitat with a 0 to 3 score compared to the No Action Alternative and Alternative 1. Legacy structures (downed wood and snags) are key habitat features in enabling forest floor species to maintain a presence in a stand when regeneration harvests occur" (p. 720 – 721).

It is clear that the WOPR presents a substantial new threat to *P. stormi* in Oregon because it eliminates late-successional reserves and allows increased timber harvest in known salamander habitat. The WOPR abandons protections for the mature forests that provide optimal habitat for *P. stormi*, especially at important low elevation sites.

Conservation Agreement

Recognizing that Northwest Forest Plan reserves were not adequate to protect the Siskiyou Mountains salamander and to avoid ESA listing, a Siskiyou Mountains salamander Conservation Strategy was developed for the northern portion of the species' range in 2007 (Olson et al. 2007). The U.S. Forest Service (Rogue River-Siskiyou National Forest), U.S. Bureau of Land Management (Medford District) and U.S. Fish and Wildlife Service subsequently signed a Conservation Agreement in 2007 based on this Conservation Strategy, for the northern population of the Siskiyou Mountains salamander in Jackson and Josephine Counties of southwest Oregon (USFWS 2007a). The Conservation Agreement was intended to protect habitat for 110 sub-populations of *P. stormi* considered high-priority salamander management areas on federal lands in the Applegate River watershed in Oregon.

The goal of the Conservation Strategy is "management actions necessary to maintain a high likelihood of well-distributed populations across the northern portion of the species' range, within the Applegate River 4th Field watershed, on federal lands administered by the Rogue River-Siskiyou National Forest, Siskiyou Mountains Ranger District, and the Oregon Bureau of Land Management, Medford District, Ashland Resource Area."

Conservation measures for high priority salamander sites and suitable habitat for Siskiyou Mountain salamanders from the Conservation Strategy include: maintaining >70% canopy closure on at least 80% of a known salamander site and maintaining no less than 40% canopy closure on the remaining 20% of a known site; avoiding ground disturbing activities on 80% of a known site (activities that displace, compact, or otherwise disturb the substrate either by heavy machinery or by yarding of logs or similar activities are only allowed on no more than 20% of a known site); and restricting habitat or ground disturbing activities and burning to when salamanders are not surface-active (late spring through early fall, before 1.5 inches of rain falls, or when environmental conditions are "out of protocol," e.g. in winter after freezing temperatures when animals are unlikely to be near surface) (Olson et al. 2007).

Additional considerations in the Conservation Strategy for reducing direct and indirect impacts on salamanders are: broadcast/understory burning can occur within an entire known salamander site, utilizing "cool" burns with short flame lengths (generally less than 2-4 feet), maintaining at least 50% of the duff layer and all possible large woody-debris post-burn, and leaving areas of suitable habitat within the known site unburned, if possible; avoiding hand piling to the extent that the piles would cover more than 20% of a known site (machine piling is not recommended however, is allowed, limiting ground disturbance to 20% at known sites); pile burning is allowed during mid-winter during freezing events, late spring, or early fall, when salamanders are not surface active (in coastal areas where winter freezing is rare, attempting to burn piles outside of conditions when animals are surface active, e.g. late spring to early fall); within known sites canopy closure mitigations do not apply to manual thinning of suppressed understory trees and ladder fuels (ground-disturbance allowance of 20% of a known site applies to all activities associated with mechanized understory thinning, such as yarding, temporary road construction, landings, etc.); and hand firelines at known sites should be limited to 20% of the known site.

The Forest Service has followed these additional considerations closely in the small amount of suitable salamander habitat where there have been projects since 2007, and none of the activities such as understory burning or handpiling have occurred in high priority salamander sites on Forest Service lands (D. Clayton, pers. comm., 2018). However, the extensive 2017 summer wildfires (and agency fire suppression activities) in the Applegate River watershed did not include mitigation measures for high priority salamander sites.

The Conservation Agreement has now been substantially undermined by the BLM's proposal under the WOPR (USBLM 2016) to eliminate the Survey and Manage program and to allow for logging and ground-disturbing activities in the majority of Siskiyou Mountains salamander sites managed by the BLM. Implementation of the WOPR action alternatives would undermine several key elements of the 2007 Conservation Strategy that were deemed necessary in order to "maintain well-distributed populations" and "avoid a trend towards listing under the ESA."

Limitations of the Conservation Agreement

There were many problems with the Conservation Agreement, including its limited geographic scope, coverage for only a portion of known salamander sites, allowance of further habitat fragmentation, absence of efforts to protect connectivity, ambiguous and voluntary protections, unknown effectiveness, and lack of secure funding, which subjected its implementation to funding and staffing limitations.

Even before the WOPR eliminated protections for many important Siskiyou Mountain salamander sites, not all known sites were protected by the Conservation Agreement. At least half of known salamander sites on federal lands in Oregon and all sites and habitat on private lands in Oregon are not covered by the Conservation Agreement.

The Klamath National Forest is not a signatory to the Conservation Agreement and the Klamath National Forest is outside the scope of the 2007 Conservation Strategy for the northern portion of the range. Therefore all Siskiyou Mountain salamander sites and habitat in California, which includes the entire range of the southern DPS, are not covered by the Conservation Agreement. As of 2016 the Klamath National Forest was working with the USFWS on a conservation strategy for Region 5 Forest Service lands, but the strategy was not complete. The Forest Service states that the Siskiyou Mountains salamander is protected on the Klamath National Forest under the 2001 ROD Survey and Manage, Protection Buffer, and other Mitigation Measures Standards and Guidelines, and the Regional Forester's Sensitive Species – Forest Service, Region 5, and that these mitigations are carried out in each Klamath National Forest project within the Siskiyou Mountains salamander range to minimize impacts.

The Conservation Strategy (Olson et al. 2007) identified 2,824 acres of National Forest land and 1,950 acres of BLM land for salamander management; more than half of these lands are located in Adaptive Management Area land-use allocation, which allows timber harvest and disturbance. These 4,774 acres represent only an estimated 8-11% of the potential salamander habitat on Forest Service and BLM lands (USBLM and USFS 2007).

Of 316 known localities for Siskiyou Mountains salamanders on federal land in the Applegate watershed, only 151 (48%) are covered by the Conservation Agreement. These are designated into 110 high-priority salamander management areas. Two strategies were proposed for managing these sites. Under management strategy 1, no "canopy reduction or heavy equipment use is recommended." Under management strategy 2, forest management is recommended to reduce risk of fire, which is acknowledged to have "some risk to salamanders because the effects of the recommended forest management activities have not been assessed." Of the 110 high-priority areas, only 62 are recommended for management strategy 1, which would potentially limit detrimental activities. Thus, roughly only 20% (62/316) of known salamander sites on federal lands are given the Conservation Agreement's strongest level of protection. The future of the salamander populations at sites not designated as high-priority is uncertain. The Conservation Agreement states, “Long-term effects on the species from federal land management of occupied salamander sites that are not chosen as high priority sites are unknown” (p. 21).

The Conservation Agreement thus allows some habitat loss and fragmentation for the salamander, which will likely only be made considerably worse by WOPR. Allowing additional habitat degradation and fragmentation will likely further isolate populations, could disrupt gene flow, and make the species even more vulnerable to stochastic events and/or inbreeding depression. Pfrender and Titus (2001) noted that the Applegate group of salamanders to which the Conservation Agreement applies already has very low genetic variability:

> “The most striking feature of our study is the almost complete lack of genetic variation observed within and among populations of the Siskiyou Mountains salamander in the Applegate drainage...While it is not uncommon for specific populations to have low levels of genetic diversity, it is very rare indeed for multiple populations comprising the bulk of the range of a species to show such lack of variation.”

The lack of genetic variation within the northern salamander population is a substantial conservation concern because it limits the ability of the species to adapt to environmental change and because without substantial protection, populations are likely to become even more fragmented. The Conservation Agreement states:

> “Non-federal lands fragment some parts of the species range, and consequences of disturbances on non-federal lands for salamander persistence is only addressed by recommendations for management practices on the adjacent federal lands...Both federal and non-federal land management of salamander habitats may fragment the species’ range and disrupt population integrity more than is currently considered in this Strategy” (p. 21).

The issue of population connectivity was not directly addressed in the Conservation Strategy, but there was an average of ~0.8 km between high priority sites. This would be a long distance for an individual salamander to move, so resident salamanders would have to maintain presence between high priority sites to retain gene flow. A closer look at this issue could be warranted during a reassessment of the Conservation Strategy due to the BLM change in land use policy.

The Conservation Agreement may also increase fragmentation because it does nothing to protect areas of optimal habitat where the species has not been detected, which may indicate species absence, but could also mean that the area has not been surveyed, or that the species was undetected during the survey. The Conservation Agreement states:

> “Only known sites of Siskiyou Mountains salamanders were considered for management; optimal habitat areas without known detections of animals were not considered for high priority site selection...It is acknowledged that the detectability of these salamanders may be an issue for determining occupancy patterns. Under appropriate environmental conditions for surveys, there is a chance of not detecting the salamanders when they are present at a site because they are subsurface” (p. 22).

Entire watersheds that could potentially harbor populations of *P. stormi* were excluded from protections:

> “Watersheds with potential habitat but with no known sites (e.g., due to a lack of surveys) were afforded no salamander protection at this time” (p. 32).

Implementation of the Conservation Agreement

The BLM and USFS are required under the Conservation Agreement to: 1) adopt and implement the conservation strategy; 2) prepare a 5-year monitoring plan to address implementation and effectiveness; and 3) review the conservation strategy every 5 years and make revisions if needed for adaptive management. Review of the Conservation Agreement can also be triggered by "significant management direction change on federal lands within the area of the conservation strategy."

A Freedom of Information Act (FOIA) request was sent in February 2017 to the U.S. Bureau of Land Management, Medford District Office, and the USDA Forest Service, Rogue River-Siskiyou National Forest and Klamath National Forest, asking for all information the agencies have regarding the Siskiyou Mountains salamander. The FOIA request specifically asked for: all monitoring reports and/or data regarding distribution and abundance of the Siskiyou Mountains salamander since 2007; all records of agency management actions taken on behalf of the Siskiyou Mountains salamander since 2007; and all records created pursuant to the 2007 Conservation Strategy for the Siskiyou Mountains Salamander and/or the 2007 Conservation Agreement for the Siskiyou Mountains Salamander. Both agencies sent responsive documents in 2017 and 2018.

The BLM responded to the FOIA with e-mails and documents regarding a few individual timber sales, where the agency appeared to attempt to avoid activities in high priority salamander sites. However, none of the documents contained any coherent or comprehensive summary of implementation and effectiveness monitoring done by the agency in the northern range of the salamander. None of the documents contained any post-treatment monitoring or information about relative abundance of salamanders pre- and post-treatment, nor any indication of general population trend for salamanders in the Conservation Agreement area. Although the agency may have generally avoided direct impacts during projects in high priority salamander sites, it is difficult to determine whether BLM projects in the range of the salamander are having an impact on salamanders and their habitat without the required 5-year reviews to determine implementation and effectiveness.

Agency e-mails did show that agency staff in the Medford District BLM working on surveying and permitting timber sales within the range of the Siskiyou Mountains salamander were often unfamiliar with the terms and requirements of the 2007 Conservation Agreement for the salamander.

The Siskiyou Mountains Ranger District of the Rogue River-Siskiyou National Forest, where the smaller Siskiyou Mountains salamander population occurs, has not conducted any timber sales or projects within any high priority salamander sites for many years prior to 2007(D. Clayton, pers. comm., 2018).   A very small amount of suitable salamander habitat in the Siskiyou Mountains Ranger District that was not considered high priority has had some low intensity prescribed under-burning – the Forest Service did site specific field validation to confirm that high priority salamander sites were not entered with fire. The Forest Service was not able to conduct any salamander surveys prior to these low intensity prescribed burns in suitable habitat, but has some anecdotal evidence at high quality sites which burned at low severity during wildfires, where Siskiyou Mountains salamanders were found easily 2 years after the fires (D. Clayton, pers. comm., 2018).

The USBLM and USFS did prepare a Siskiyou Mountains Salamander Implementation and Effectiveness Monitoring Plan in 2007. It calls for delineation of high priority salamander sites where activities might affect those sites, including field validation and site-specific mapping and baseline vegetation data. Activities with potential to affect high priority sites are supposed to have a NEPA analysis of treatments and potential impacts. Any treatments are supposed to be consistent with the Conservation Strategy recommendations for that site. These sites are supposed to be surveyed a minimum of three times pre-treatment for salamanders, per a survey protocol that is included in the monitoring plan. Post-treatment the agencies are supposed to evaluate whether the proposed management strategies occurred within sites, and conduct post-treatment surveys for salamanders for at least two survey seasons per the survey protocol. The agencies are supposed to note relative abundance of salamanders pre- and post-treatment. The agencies are also supposed to do habitat data collections post-treatment in order to compare site conditions pre- and post-treatment. Presumably because no high priority sites were impacted, neither the BLM nor the USFS sent any information in response to the FOIA indicating that any post-treatment surveys or evaluations ever occurred. The Siskiyou Mountains Ranger District stated that it does not yet have funding to write a monitoring plan or do pre- and post-burning salamander surveys to test their assumptions, but plans to try for funding at some point (D. Clayton, pers. comm., 2018).

None of the FOIA documents sent by the BLM or USFS included a 5-year review of the Conservation Strategy. The Forest Service stated that it has not done any review of the Conservation Strategy and has not made any revisions to the Conservation Strategy (D. Clayton, pers. comm., 2018). The BLM did not respond to queries in January 2018 whether it has done any 5-year review of the Conservation Strategy. Although the potential undermining of the Conservation Agreement under WOPR is clearly a "significant management direction change on federal lands within the area of the conservation strategy," neither agency has initiated any review of the Conservation Strategy. The BLM has not fully analyzed the potential effects of the WOPR on the Conservation Strategy, in terms of its likely alteration of canopy and substrate conditions which are known to be suitable habitat for Siskiyou Mountains salamanders. Such a review and reassessment could also address new information about the effects on Siskiyou Mountains salamanders of the recent scope and intensity of wildfires, and new knowledge about the potential effects of disease and climate change.

Undermining of the Conservation Agreement under WOPR

The BLM action alternative under the WOPR may directly contribute to significant habitat loss, degradation and additional fragmentation of discrete salamander populations, the very threats to species persistence called out in the Conservation Agreement (USFWS 2007a, p. 3).

Under the WOPR, the BLM is eliminating the “adaptive management area” land use allocation (see USBLM p. 48, Map 2, land allocations and sub-allocations in the Southwestern Oregon RMP), which removes protections promised in the Conservation Agreement for 67% of known Siskiyou Mountains salamander sites (USFWS 2007a, p. 12). This includes many of the important and supposedly protected sites under the Conservation Agreement. Under the WOPR, the BLM is also significantly reducing the width of some Riparian Reserves that were relied upon as a selection criterion for determining “high priority” Siskiyou Mountains salamander sites.

The Conservation Strategy noted that the location of reserves (including Riparian Reserves) influenced the selection of “high priority” Siskiyou Mountains salamander sites and indicated that an objective of the strategy was to “utilize the existing federal land use allocations as a foundation for providing a high likelihood of continued persistence” (Olson et al. 2007, p. 4, 18). This objective, and the underlying assumptions of the Conservation Strategy, are undermined by BLM plans under the WOPR to change the land-use allocations of the Northwest Forest Plan.

The Conservation Strategy rested on the assumption that “clearcut logging is no longer carried out on Forest Service or BLM lands within the range of this species” (Olson et al. 2007, p. 17). The elimination of protections under land use allocations, reduction of reserves, and increase in logging proposed under the WOPR renders this assumption invalid. The Conservation Strategy indicated that “if intervening lands become highly disturbed and unsuitable habitat conditions predominate, connectivity to retain interacting individuals across the landscape may need to be re-addressed,” and noted “long-term effects on the species from federal land management of occupied salamander habitat sites that are not chosen as high priority sites are unknown” (Olson et al. 2007, p. 21). The WOPR does not disclose or analyze the uncertainties associated with BLM plans for non-high priority Siskiyou Mountains salamander known sites.

Both the Conservation Agreement (USFWS 2007a, p. 5) and the Conservation Strategy (Olson et al. 2007, p. 5, 40) indicate that “significant changes in Forest Service or BLM land-use allocation within the area of the conservation strategy” must trigger “immediate review of the Conservation Agreement.” Such a review is not being done.

The USFWS relied on supposedly stable federal land management designations and protections to deny Endangered Species Act protection for the Siskiyou Mountains salamander in 2008, specifically stating that “given the stability of Federal Land and Resource Management Plans and the Northwest Forest Plan since its establishment in 1994, we assume that significant changes to current land management practices on Federal lands are not likely to occur within 20 years” (USFWS 2008). The WOPR renders that assumption invalid.

The USFWS decision also relied upon the belief that Siskiyou Mountains salamander management would include Northwest Forest Plan “Matrix Standards and Guidelines [that] are designed to provide for important ecological functions such as dispersal of organisms, carryover of some species from one stand to the next, and maintenance of ecologically valuable structural components…” (USFWS 2008, at 4388). The WOPR revisions undermine the Northwest Forest Plan conservation strategy relied upon by the USFWS in its determination that the Siskiyou Mountains salamander does not need to be listed.

The USFWS also presumed that the Survey and Manage guidelines would provide “additional security for salamander populations across the vast majority of the range of the Siskiyou Mountains salamander” (USFWS 2008, at 4390). That security is removed under the WOPR (USBLM 2016, p. 20).

The USFWS determination not to list the Siskiyou Mountains salamander relied on the assumption that under the 2007 Conservation Agreement, “many additional populations will continue to persist in reserved lands and in Matrix where habitat is retained for other reasons” (USFWS 2008, at 4390). Under the WOPR, the BLM is implementing a land management plan to reduce the size of Riparian Reserves and eliminate the Matrix tree retention standards that were relied upon in both the Conservation Agreement and in the USFWS listing assessment.

Evaluation of the Conservation Agreement under the Policy for Evaluation of Conservation Efforts (PECE Policy)

The USFWS has developed a policy for consideration of whether conservation efforts forestall the need for ESA listing, the Policy for Evaluation of Conservation Efforts (PECE Policy) (USFWS 2003). The PECE policy considers two primary factors: (1) "the certainty that the conservation effort will be implemented" and (2) "the certainty that the conservation effort will be effective." Under each of these factors, the USFWS determines whether the agreement is sufficient based on a number of specific criteria. We have evaluated the Conservation Agreement under these criteria and it clearly does not forestall the need for listing. We examine applicable criteria below:

A. The certainty that the conservation agreement will be implemented:

1. The conservation effort, the party(ies) to the agreement or plan that will implement the effort, and the staffing, funding level, funding source, and other resources necessary to implement the effort are identified.

The Conservation Agreement does not specifically identify the staffing, funding level, funding source, and other resources necessary for implementation. The Conservation Agreement states that it is "subject to available funding and staffing" and that "this does not impose financial obligations beyond appropriations." (p. 6).

2. The legal authority of the party(ies) to the agreement or plan to implement the formalized conservation effort, and the commitment to proceed with the conservation effort are described.

Because the Conservation Agreement has not been formally incorporated into forest management plans, it is questionable whether there is legal impetus for its implementation, and whether timber harvest goals in the WOPR can override the terms of the Conservation Agreement. The mandate of the Forest Service and Bureau of Land Management to meet timber quotas, which was a primary justification for the WOPR, presents a serious conflict of interest with protection of salamander habitat, and the Conservation Agreement does not ensure that salamander habitat will be safeguarded from timber harvest activities, as is clearly demonstrated by the WOPR.

3. The legal procedural requirements (e.g. environmental review) necessary to implement the effort are described, and information is provided indicating that fulfillment of these requirements does not preclude commitment to the effort.

The Conservation Agreement does not describe the legal procedural requirements necessary for its implementation.

4. Authorizations (e.g., permits, landowner permission) necessary to implement the conservation effort are identified, and a high level of certainty is provided that the party(ies) to the agreement or plan that will implement the effort will obtain these authorizations.

The authorizations necessary to implement the Conservation Agreement are uncertain given that it has not been formally incorporated into forest management plans and that the protection of salamander habitat conflicts with mandated timber harvest levels and fire reduction activities.

> *5. The type and level of voluntary participation (e.g., number of landowners allowing entry to their land, or number of participants agreeing to change timber management practices and acreage involved) necessary to implement the conservation effort is identified, and a high level of certainty is provided that the party(ies) to the agreement or plan that will implement the conservation effort will obtain that level of voluntary participation (e.g., an explanation of how incentives to be provided will result in the necessary level of voluntary participation).*

The Conservation Agreement is not being implemented on private lands, so does not require volunteers. The Forest Service and BLM have agreed to participate. Because the Conservation Agreement only includes recommendations, however, there is no certainty that these agencies will effectively implement the recommendations.

> *6. Regulatory mechanisms (e.g., laws, regulations, ordinances) necessary to implement the conservation effort are in place.*

Regulatory mechanisms necessary to implement the Conservation Agreement are not in place and the agreement does not create specific regulations prohibiting anthropogenic disturbances in *P. stormi* habitat. Although the parties have signed the Conservation Agreement, it hasn't been formally incorporated into their forest management plans. The Conservation Agreement does not prohibit specific activities in salamander habitat, even in designated high-priority salamander management areas, but rather just recommends avoidance of habitat disturbance and destruction.

> *7. A high level of certainty is provided that the party(ies) to the agreement or plan that will implement the conservation effort will obtain the necessary funding.*

There is not a high level of certainty that the necessary funding will be obtained. The Conservation Agreement states only that funding will be sought each year (p. 6). The implementation of the Conservation Agreement will be subject to annual appropriations, which are subject to political pressures. As discussed above, the Siskiyou Mountains Ranger District of the Forest Service has not been given adequate funding to write a salamander monitoring plan or to conduct pre- and post-burning salamander surveys to test their assumptions about project impacts.

> *B. The certainty that the conservation effort will be effective:*

> *1. The nature and extent of threats being addressed by the conservation effort are described, and how the conservation effort reduces the threats is described.*

The Conservation Agreement identifies threats to the species, including timber harvest, but does not specify how the threats will be reduced. Even for designated high-priority sites, the actual degree of protection afforded to salamanders by the Conservation Agreement is vague. Rather than prohibiting specific activities in specific areas, the Conservation Strategy recommends one of two management strategies for each high-priority site. The Conservation Agreement does not specifically prohibit timber harvest or other activities within the management areas, rather it states only that "no canopy reduction or heavy equipment use is *recommended*" (emphasis added) for Strategy 1 areas (p. 34). Approximately 57% of sites have the first recommended strategy (Appendix 3). The second strategy "allows for greater latitude in activities" by applying the existing Fire Management Recommendations. The second strategy guarantees little actual protections for salamanders:

> "The strategy was developed to allow forest management priorities at the landscape scale to proceed, while *hopefully* improving habitats for salamanders. This strategy has some risk to salamanders because the effects of the recommended forest management activities have not been assessed" (p. 34; emphasis added).

> *2. Explicit incremental objectives for the conservation effort and dates for achieving them are stated.*

The Conservation Agreement does not identify explicit incremental objectives with dates for achievement.

> *3. The steps necessary to implement the conservation effort are identified in detail.*

The steps necessary to implement the Conservation Agreement are not identified in detail.

> *4. Quantifiable, scientifically valid parameters that will demonstrate achievement of objectives, and standards for these parameters by which progress will be measured, are identified.*

The Conservation Agreement does not identify quantifiable, scientifically valid parameters that will demonstrate achievement of objectives, or standards for these parameters by which progress will be measured.

> *5. Provisions for monitoring and reporting progress on implementation (based on compliance with the implementation schedule) and effectiveness (based on evaluation of quantifiable parameters) of the conservation effort are provided.*

The Conservation Agreement does not include provisions for monitoring and reporting progress on implementation and effectiveness. As discussed above, neither the BLM nor the USFS appear to have conducted any of the post-treatment surveys or evaluations promised in the Conservation Agreement. Because the Conservation Agreement does not set forth quantifiable parameters, its effectiveness cannot be evaluated on that basis.

All of the above conclusions are further underscored by the loss of protections for high priority salamander sites under the WOPR. In summary, although it was hoped that the Conservation Agreement would provide protection for many Siskiyou Mountain salamander sites, its scope is limited to a minority portion of sites in Oregon including only one DPS of the species and its implementation and effectiveness are uncertain. As such, the Conservation Agreement cannot form a basis for denying protection for the Siskiyou Mountains salamander under the ESA.

<u>Habitat Conservation Plans</u>

There are no Habitat Conservation Plans under the U.S. Endangered Species Act that cover the Siskiyou Mountains salamander (USFWS 2018).

Fruit Growers Supply Company, which conducts extensive logging on private lands within the range of the Siskiyou Mountains salamander in Siskiyou County in California, chose not to include the Siskiyou Mountains salamander as a covered species in its Habitat Conservation Plan for commercial timberland because the species was not federally listed, and because "little is known about the species' presence and use of the FGS ownership, such that effects of the Covered Activities cannot be evaluated, nor a meaningful conservation program developed for this species" (CH2MHill 2009). 496 acres of Siskiyou Mountains salamander habitat was mapped on Fruit Growers Supply Company lands in 2007 (FGS 2007). This HCP has since been overturned by the courts and is thus no longer in effect. There are no protections or mitigations whatsoever for Siskiyou Mountains salamander populations located in Fruit Growers Supply Company logging units.

National Environmental Policy Act

The National Environmental Policy Act of 1969 (NEPA) (42 U.S.C.4321-4370a) requires federal agencies to consider the environmental impacts of their actions. The NEPA process requires these agencies to describe a proposed action, consider alternatives, identify and disclose potential environmental impacts of each alternative, and involve the public in the decision-making process. Most actions taken by the federal agencies such as the U.S. Forest Service and U.S. Bureau of Land Management that could affect the Siskiyou Mountains salamander are subject to the NEPA process. NEPA does not, however, prohibit these agencies from choosing alternatives that will negatively affect individual salamanders, populations of salamanders, or potential salamander habitat.

Sensitive Species Designation

The U.S. Forest Service (Regions 5 and 6) and the U.S. Bureau of Land Management (in Oregon, the species is not known on BLM lands in California) designate the Siskiyou Mountains salamander as a "sensitive species" for planning purposes. These agency designations as a "sensitive species" offer little protection for individual Siskiyou Mountains salamanders, salamander populations or salamander habitat. The designation merely requires that the impacts to the species be considered, but does not prevent agency actions such as logging or road building which could harm the species or its habitat. Species designated as sensitive cannot be impacted without an analysis of significance of adverse effects on the populations, their habitat, and on the viability of the species as a whole. All Forest Service and BLM planned, funded, executed, or permitted programs and activities are reviewed under NEPA for possible effects on sensitive species, through a Biological Assessment and Evaluation. However, agencies would be able to conclude in a Biological Evaluation that even though individual salamanders or salamander populations would be harmed or destroyed by an action, they could still carry out this action.

A review of 505 biological evaluations for another Forest Service sensitive species, the California spotted owl, revealed a number of short-comings in the Forest Service's implementation of the sensitive species program (Greenwald 2000). For 505 biological evaluations in which the Forest Service concluded a project may affect individual California spotted owls, the Forest Service: routinely did not conduct project specific surveys and instead relied on information from past surveys or research projects; did not track cumulative effects on habitat or individuals of a species by keeping a record of the number of projects approved in a given habitat area or by specifically identifying species or habitat locations in biological evaluations; and routinely did not include mitigation above what is required by their Forest Plans as part of their evaluation of project effects on a species (Greenwald et al. 2000). These results indicate that the Siskiyou Mountains salamander designation as a sensitive species will not result in routine surveys for the species or protection of its habitat from logging.

State Protections

California Threatened Species Designation

In California, the Siskiyou Mountains salamander is listed as a threatened species under the state's California Endangered Species Act (CESA). The CESA listing theoretically provides some substantive protections for populations of the species on private lands in California, but these represent the minority portion of its range in California. However private lands cover a fairly small area of the range of the Siskiyou Mountains salamander that is not sufficient to ensure its viability, and some habitat destruction is allowed under CESA nevertheless.

The CESA threatened status requires consultations with the California Department of Fish and Wildlife (CDFW) for all Timber Harvest Plans (THP) in the range of the Siskiyou Mountains salamander, to ensure logging does not cause "take" of the species. CDFW considers all forested areas with 25% or more talus cover to be suitable habitat for the salamander for the purposes of consultation. To proceed with logging, timber operators must either conduct protocol surveys that determine the species isn't present, obtain an incidental take permit, or protect all suitable habitat from logging, including limiting logging in 50 to 100 foot buffers around suitable habitat to periods when the species is not active. However, the THP review process for logging operations on private lands in California is skewed toward authorizing logging over ecosystem protection. THPs are guided by the California Forest Practice Rules, adopted by the California Board of Forestry and designed to conform to the dictates of the California Forest Practice Act and the California Environmental Quality Act. The California Board of Forestry is a timber industry dominated agency and approves virtually all THPs. Although theoretically the Board of Forestry may not approve a THP if it breaks a specific Forest Practices rule, in practice THPs are approved regardless of what evidence is submitted, unless a Forest Practices breach is glaring or challenged by the public. CDFW may exert some influence on THPs, but not all agency recommendations and mitigations must be accepted. CAL FIRE can approve THPs without mitigations recommended by CDFW or other resource agencies, merely by filing a "letter of non-concurrence."

Additionally, there is not much confidence in CDFW's motivation or willingness to protect the Siskiyou Mountains salamander from take by logging operations, given the agency's active attempts to improperly remove California Endangered Species Act protection for the salamander. CDFW has relied on flawed science to contend that Siskiyou Mountains salamanders could survive in "diverse forest conditions" (CDFG 2005; Bull et al. 2006), despite sharp criticism from leading salamander scientists and agency staff admitting that the single study on which their case is based is "not a scientific study." Also instructive is the agency's attempt to improperly strip protection for the newly discovered Scott Bar salamander. When the even more rare and imperiled Scott Bar salamander was designated as a new species, CDFW decided that because the new name wasn't on its list of threatened species, the Scott Bar salamander did not deserve CESA protection and its habitat could be logged.

Oregon Sensitive Species List

The Siskiyou Mountains salamander is listed as a vulnerable species by the Oregon Department of Fish and Wildlife. This designation does not provide any regulatory protection for the species.

OTHER NATURAL OR MANMADE FACTORS AFFECTING THE CONTINUED EXISTENCE OF THE SISKIYOU MOUNTAINS SALAMANDER

Fire

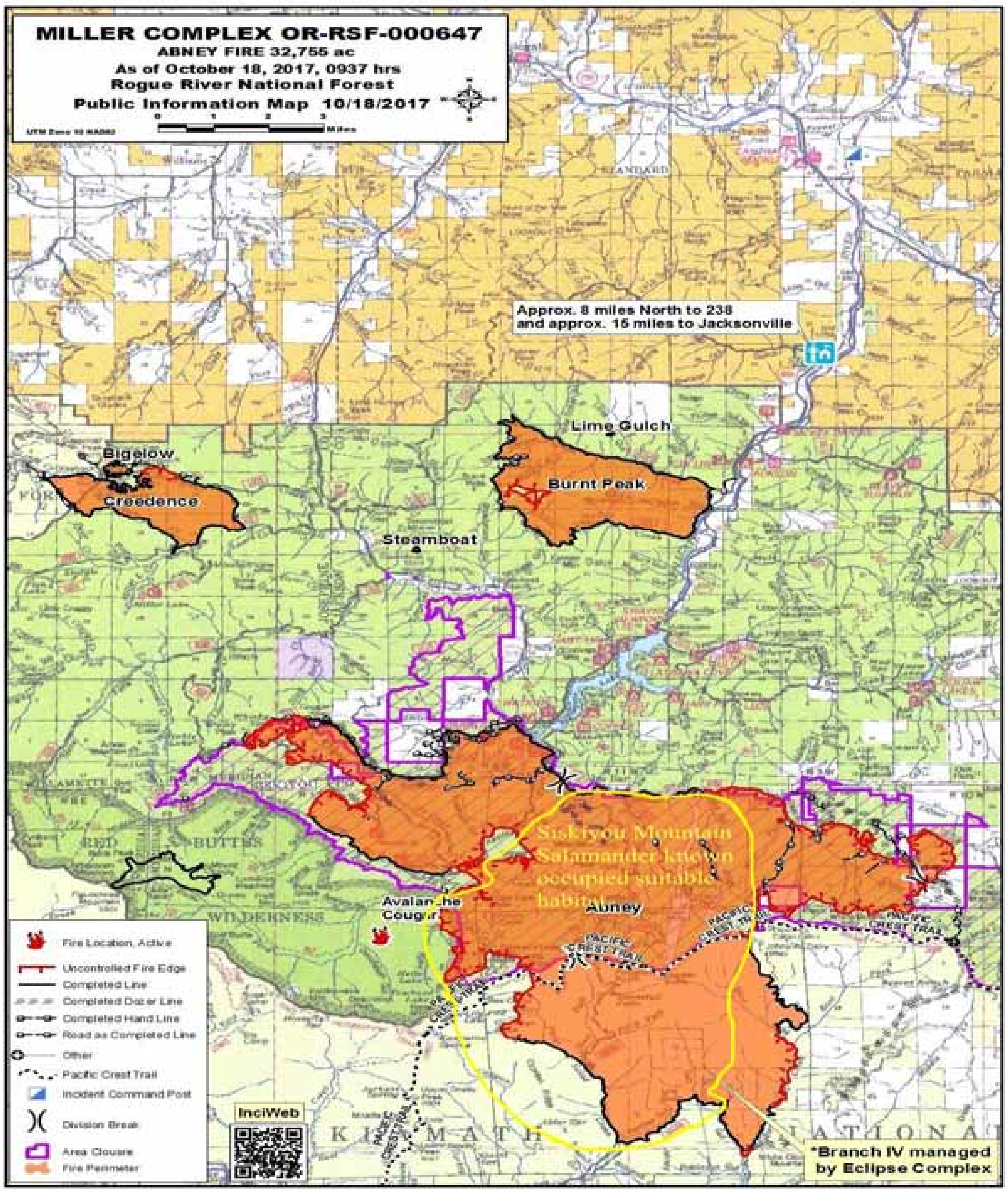
Fire is a natural part of the ecosystem in the range of the Siskiyou Mountains salamander (Agee 1993, pp. 283-285) and the species has survived for eons in the presence of periodic fire. Although the Siskiyou Mountains salamander evolved with high frequency and low intensity fire, it is unknown how the species will respond to high severity fires. Wildfires in the region tend to burn in the late summer and early fall (Pilliod et al. 2003, pp. 166-167). This timeframe does not correspond with the surface activity of the terrestrial salamanders of the region, and therefore was assumed to not have direct impacts on salamander populations (Bury 2004, p. 971). However, in light of recent large stand-replacing fires in the Klamath region there is cause for concern.

However, large-scale wildfires could indirectly impact salamanders by reducing available wood resources and leaf litter for seasonal cover on the forest floor and by removing overhead canopy, decreasing the ability of the forest to retain moisture, at least temporarily (DeGross and Bury 2007, pp. 7-8).

In recent decades, fire suppression has led to increased fuel loadings in some forest stands, possibly increasing fire severity and extent (e.g. Bury et al. 2002, p. 34; Major 2005; Miller et al. 2009; Steel et al. 2015). Impacts to Siskiyou Mountains salamanders from either natural or prescribed fire, and the degree of current fire danger in the species' habitat have not received substantial study (Olson et al. 2007a, p. 18). To the extent that fire has the potential to remove or reduce forest canopy cover in Siskiyou Mountains salamander habitat, there is some risk that future fires will impact populations. Combined with habitat loss from logging, this could pose a significant risk to the species.

The risk of stand-replacing fires in the range of the Siskiyou Mountains salamander has likely increased as a result of intensive forest management that focuses on removing the largest most fire resistant trees, creating stands of young, highly combustible plantations. The number and distribution of plantations resulting from industrial timber management likely has altered fire regimes at both stand and landscape scales (Frost and Sweeny 2000, p. 29). Perry (1995, p. 243) suggested that once a threshold proportion of highly combustible even-age patches are established on a forest landscape, the potential exists for a self-reinforcing cycle of catastrophic fires. A study of the 1987 Klamath Complex fires (Odion et al. 2004, pp. 933-935) affirmed the susceptibility of plantations to high severity fire. Odion et al. (2004, p. 933) found that young tree plantations experienced twice the burn severity of closed canopy forests. The lesser susceptibility of mature and old-growth stands to high severity fire may limit the impact of fire on the salamander in the face of increased fuel loadings and rising temperatures with climate change.

Fire exclusion in recent years has resulted in an increased risk of large stand-replacement fire in the region, so large fires that remove overstory from suitable habitat may be of highest concern for the Siskiyou Mountains salamander (Olson et al. 2007a, p. 18). An example of this was the Biscuit Fire in 2002 (Olson et al. 2007a, p. 18). Although the Siskiyou Mountains salamander has persisted in a landscape with fire, there is concern that the intensity of the local fire regime has changed. The historical fire regime in the area was one of high frequency and low intensity fire, which consisted of very frequent underburning of the forest in the summer and early fall and few stand-replacement events, at least at the lower elevations (Agee 1993, p. 285). At higher elevations, longer fire return intervals and high intensity fires occurred historically and likely resulted in more stand-replacement events (Agee 1993, p. 284). The effects of a more intense level of fire disturbance due to fire suppression and fuel loading is of concern in that stand-replacement fire represents a higher potential for disturbance to flora and fauna. In particular, relative to salamander habitat, it removes overstory canopy that serves to moderate surface microclimates from extremes, such as high temperatures and low moisture (Olson et al. 2007a, p. 18).



2017 Abney Fire overlaid with Siskiyou Mountains salamander habitat (yellow habitat boundary lines are approximate)

The 2017 Abney fire portion of the Miller Fire Complex burned on Rogue River-Siskiyou National Forest, Medford BLM, and Klamath National Forest lands comprising a significant amount of known occupied and suitable Siskiyou Mountains salamander habitat. The Forest Service and BLM have not requested funding or attempted to determine the impacts of this mixed severity fire effects upon Siskiyou Mountains salamander populations or habitat. A large majority of the 32,848-acre Abney Fire burned within known occupied suitable Siskiyou Mountains salamander habitat as illustrated by the map above.

Recent federal management strategies emphasize fuel prescriptions to remove the unnaturally high fuel loading. Fuel reduction practices include various combinations of understory thinning, slashing, piling, and/or prescribed burning. Most prescribed burning occurs in the moister and cooler time of the year to avoid escapement risks and smoke concerns. Spring/winter burning may increase the chance of direct mortality of Siskiyou Mountains salamanders during a time of year when they are active above the surface and vulnerable to fire (Olson et al. 2007a, p. 18). However, fuels reduction activities may contribute to the long-term persistence of the species by reducing the potential for stand-replacement fire, which Olson et al. (2007a, p. 18) concluded likely has a higher potential for adverse effects to the species than the fuels reduction activities.

Climate Change

Climate change is a major threat to Siskiyou Mountains salamanders. Higher average temperatures, varying precipitation patterns, and alterations in disturbance regimes such as fire are already affecting many wildlife species across North America (e.g. Root et al. 2003; Parmesan 2006; Chen et al. 2011; Case et al. 2015). Climate change is particularly problematic for amphibian populations because they are ectothermic. All aspects of amphibians' life history are strongly influenced by the external environment, particularly temperature, precipitation and moisture; their body temperatures and activity cycles are dependent on the presence of optimal environmental conditions (Lind 2008). The unique physiology of Plethodon salamanders, including *P. stormi*, make them particularly sensitive to variations in climate (Feder 1983; Ollivier et al. 2001). Ollivier et al. (2001) documented the importance of regional climate, in particular variation in average precipitation, on the distribution and habitat selection of the Siskiyou Mountains salamander.

Climate change is already causing a rise in temperatures across the United States and an increase in extreme weather events, such as droughts (Parmesan et al. 2000; NSC 2003; CCSP 2008; Karl et al. 2009). Climate change predictions for terrestrial areas in the Northern Hemisphere indicate warmer air temperatures, more intense precipitation events, and increased summer continental drying (Field et al. 1999; Cayan et al. 2005; IPCC 2007). In the United States, the average surface temperature rose by 1.8°F (1.0°C) between 1901 and 2016, with the most rapid warming occurring since 1979 (USGCRP 2017). By mid-century, the average temperature in the United States is expected to increase by 2.5°F (1.4°C) relative to 1976-2005, meaning that record-setting hot years will become commonplace during the next few decades (USGCRP 2017). By late century, much greater warming is projected, ranging from 2.8 to 7.3°F (1.6 to 4.1°C) under a lower emissions scenario and 5.8 to 11.9°F (3.2 to 6.6°C) under a higher emissions scenario (USGCRP 2017). Global carbon emissions over the past 15 to 20 years have tracked the highest emission scenario used in IPCC climate projections, which is projected to lead to devastating impacts (IPCC 2014).

California is likely to see average annual temperatures rise by 1.5 to 4.5°C in the next century, with summer stream flow and soil moisture required for plant growth likely to decrease (Field et al. 1999; Cayan et al. 2008). Since 1895, annual average air temperatures in California have increased by about 1.5 degrees Fahrenheit, with minimum temperatures increasing at a rate almost twice as fast as the increase in maximum temperatures, and warming accelerated over the past three decades in most regions of the state (Kadir et al. 2013). Climate models predict more variable annual precipitation (Smith and Tirpak 1989; USEPA 1997).

Suzuki et al. (2007) found that the response of Siskiyou Mountains salamanders to solar radiation (used as a surrogate for climate variables) differed between the northern and southern populations. Salamanders were more frequently found in areas with low solar illumination in California, where the climate is hotter and drier than in southwestern Oregon. Suzuki et al. (2007) were unable to evaluate the association of Siskiyou Mountains salamanders with climate conditions such as precipitation and minimum and maximum temperatures, because the climate data was too coarse for the spatial scale of their study.

Case et al. (2015) evaluated the relative sensitivity to climate change of species in Northwestern North America, using a combination of scientific literature and expert knowledge to assess 195 plant and animal species. Amphibians and reptiles were, as a group, estimated to be the most sensitive to climate change. Most climate change research that analyzes the impacts on wildlife species have focused on physiological sensitivities, projected range shifts, and changes in phenology, but Case et al. (2015) argue that more emphasis should be placed on ecosystem responses to climate change, thus better understanding how species dependent on those ecosystems may be impacted. Case et al. (2015) determined that out of the four taxonomic groups and 195 species they studied in the Pacific Northwest, amphibians and reptiles were on average the most sensitive to climate change, largely due to the fact that 90 percent of the 20 amphibians and reptiles studied were identified as having at least one highly sensitive habitat upon which they depended. Among studied amphibians was the Siskiyou Mountains salamander, which had a sensitivity score of 79 (out of a potential range of 14-100, with a higher number indicating a higher sensitivity) and an average confidence in that score of 4 out of 5 (Case et al. 2015, Appendix A, p. 6). For context, the overall average sensitivity score for reptiles and amphibians was 76 (Case et al. 2015).

Rapid climate changes could be devastating for the Siskiyou Mountains salamander. Warmer temperatures may result in greater forest fires and the loss of forest canopy to the detriment of the salamander’s habitat. They may also shorten the window in which the species is able to forage and reproduce. It is unlikely the Siskiyou Mountains salamander will simply be able to shift its range in response to rapid climate change. Climate-associated shifts in amphibian ranges can be particularly problematic for restricted range species that have specific habitat requirements and limited options for movement (Li et al. 2013, p. 149).

The potential effects of climate change were not assessed for the Siskiyou Mountains salamander in the 2007 Conservation Strategy (Olson et al. 2007a), so the Forest Service, BLM and the Conservation Agreement do not have a strategy for addressing the effects of rapid climatic changes on the Siskiyou Mountains salamander.

Disease

Although nothing is known of diseases that may impact Siskiyou Mountains salamanders (Olson et al. 2007a, p. 11), the recent emergence and rapid spread of chytrid fungus among amphibian populations in western North America is cause for considerable concern. *Batrachochytrium dendrobatidis* (Bd) is a fungal pathogen that causes the disease chytridiomycosis in amphibians. The rate of infection and mortality it has caused in amphibians worldwide has been described as 'the most spectacular loss of vertebrate biodiversity due to disease in recorded history' (Skerratt et al. 2007; Piovia-Scott et al. 2015). Adult amphibians infected with chytrid exhibit symptoms such as lethargy and reluctance to flee, skin abnormalities, loss of righting reflex, and extended back legs (Fellers et al. 2001). In tadpoles infected with chytrid fungus, jaw sheaths and tooth rows are abnormally formed or lack pigment, and this type of deformity likely inhibits tadpole foraging ability (Fellers et al. 2001). The effect of Bd on individual species, however, is considerably variable and often dependent on other environmental factors, including temperature, other environmental stressors such as predation pressures, pesticide exposure, and UV-B radiation (Pope et al. 2014; Piovia-Scott et al. 2015). Also, the virulence of different Bd strains may vary (Piovia-Scott et al. 2015).

Habitat Fragmentation

Olson et al. (2007a, pp. 21-22) noted that both federal and non-federal land management of Siskiyou Mountains salamander habitats may fragment the species' range and disrupt population integrity more than is currently considered in the Conservation Strategy for the northern portion of the range. Non-federal lands fragment some parts of the species range, and consequences of disturbances on non-federal lands for salamander persistence is only addressed by recommendations for management practices on the adjacent federal lands. Also, long-term effects on the species from federal land management of occupied salamander sites that are not chosen as high priority sites are unknown.

REQUEST FOR CRITICAL HABITAT DESIGNATION

Petitioners request and strongly recommend the designation of critical habitat for the Siskiyou Mountains salamander coincident with its listing. Because the distribution of the primary constituent elements of the salamander's critical habitat is poorly defined (suitable substrates in combination with landscape and stand features necessary to support the species), critical habitat should be designated in the entire range of the species. The primary threat to the Siskiyou Mountains salamander is habitat destruction and thus critical habitat will provide a clear and measurable benefit for the species.

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