STATUS REVIEW OF
SISKIYOU MOUNTAINS SALAMANDER

Report to the California Fish and Game Commission

SEPTEMBER 2006

California Department of Fish and Game
The Resources Agency
State of California

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The Resources Agency
Department of Fish and Game

STATUS REVIEW OF SISKIYOU MOUNTAINS SALAMANDER (*Plethodon stormi*) IN CALIFORNIA

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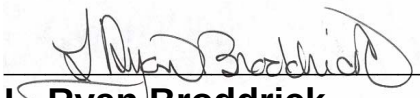

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Front Cover Photograph by: Stu Farber

TABLE OF CONTENTS

List of Acronyms and Abbreviations

BLM	Bureau of Land Management
CCR	California Code of Regulations
CDF	California Department of Forestry and Fire Protection
CEQA	California Environmental Quality Act
CESA	California Endangered Species Act
Commission	Fish and Game Commission
CWHR	California Wildlife Habitat Relationships
dbh	diameter at breast height
Department	California Department of Fish & Game
ESA	Federal Endangered Species Act
GIS	Geographic Information Systems
LMP	Land Management Plan
LSR	Late Successional Reserves
SMS	Siskiyou Mountains salamander
THP	Timber harvesting plan
USDA	US Department of Agriculture
USDI	US Department of the Interior
USFS	US Forest Service
USFWS	US Fish and Wildlife Service

List of Appendices

Siskiyou Mountains Salamander Status Review
EXECUTIVE SUMMARY
September 2006

Petition History

In June 2001, the Department of Fish and Game (Department) commenced a status review of the Siskiyou Mountains salamander (*Plethodon stormi*) (SMS). Based upon the information developed through the status review, peer review comments and the best scientific information available, the Department proceeded with a petition to delist the species. On August 18, 2005, the Fish and Game Commission (Commission) received a petition by the Department to remove SMS from the list of threatened species under the California Endangered Species Act (CESA). The Commission accepted the petition based on the Department's recommendation on September 30, 2005, and published a notice of acceptance and finding that the delisting action may be warranted in the California Regulatory Notice Register on October 4, 2005, and a more detailed status review of the species began.

Following the Commission's action, the Department notified affected and interested parties and solicited data and comments on the petitioned action from as many persons as practicable. The Department then commenced a review of information, searched for any relevant information not considered in the petition and sought any new information generated and available after the Commission's action. This document contains the results of the Department's status review as required by California Fish and Game Code section 2074.6.

Conclusions

The Department recommends delisting of SMS as threatened due primarily to:

1) The substantially larger range and greater number of occurrences than was known when listed as rare in 1971;

2) Recent information indicates that SMS occupy a wide range of sites, including both disturbed and undisturbed sites with low canopy cover. SMS are not primarily associated with late successional forests as previously thought;

3) Populations may be impacted by disturbance, but they are not extirpated from disturbed sites.

SMS is a relatively recently discovered species, first found in 1963, and described in 1965. In 1971, the species was listed as rare due to the limited number of occupied locations known at that time in California and Oregon. At that time, the range of SMS appeared to be very restricted (i.e., 6 square miles)

and little was known about its habitat requirements. All rare animal species were automatically designated as threatened when the California Endangered Species Act (CESA) was enacted in 1985. In July 1987 the Department prepared a "Five Year Status Report" recommending the threatened classification be retained (California Department of Fish and Game, 1987). Current information on SMS shows the species occupies a greater range and more diverse forest conditions than was known at the time of the status review in 1987.

SMS are sedentary, terrestrial salamanders that are lungless and require moist microclimates in order to respire through their skin. These salamanders occupy talus in a wide range of forest types and varied overstory canopy cover. Genetic studies have identified two distinct population segments within the range of SMS.

Population trends have not been evaluated for SMS. Population measurements are problematic because the animals are underground most of the time in talus slopes on steep ground in remote mountainous terrain of Siskiyou County. The number of SMS found at individual sites is highly variable and only a small percentage of the population is likely to be active and accessible at any one time, even during optimal conditions.

Presence/absence surveys are required by the Department in the course of conducting CESA consultations for proposed timber harvesting on private lands; and for the past 10 years under the Survey and Manage provision of the Northwest Forest Plan on Federal lands. These surveys have identified a substantial number of sites where SMS are present and document a larger range for the species than was previously known. The currently documented range for SMS in California covers at least 277 square miles. Within the currently known range there are numerous occupied sites that have been disturbed, either: 1) before SMS was State-listed, 2) by activities on Federal lands not regulated by CESA, 3) on private lands which were not believed to be within the range of SMS at the time of the disturbance, or 4) by fire.

Timber harvesting is considered the biggest threat to the species as it is the most common disturbance within the range of SMS. Fire, road building, quarry development, and recreational developments may also impact the species. Recent data collected on SMS and studies of closely related species indicate that disturbance to habitat may reduce the number of salamanders at an occupied site, but that the species persists and reproduces afterward.

Most (approximately 90%) of the range for this species in California occurs on Federal lands. Approximately 76% of the range is within withdrawn Federal land management types where little or no timber harvesting takes place, while 14% of the range occurs on Federal lands subject to programmed timber harvesting. On private lands, currently no timber harvesting is allowed on SMS habitat, but if allowed, might occur over 10% of the range of SMS except as restricted by other regulatory programs, by private landowner management objectives or by the

distribution of commercial timber stands.

In 2004, the US Fish and Wildlife Service (USFWS) was petitioned to emergency list SMS under the Federal Endangered Species Act (ESA). The USFWS determined that, while threats do exist from private and Federal land management activities, such threats did not constitute an imminent threat warranting emergency listing under the Federal ESA (USFWS 2004). The USFWS was subsequently sued by the petitioners and issued a 90-day finding in the Federal Register on April 25, 2006 (USFWS 2006). The USFWS considered and made five determinations in considering whether listing of SMS under the Federal ESA warranted further review. These threat factors were:

- present or threatened destruction, modification, or curtailment of habitat and range,
- overutilization for commercial, recreational, scientific, or educational purposes,
- disease or predation,
- inadequacy of existing regulatory mechanisms,
- other natural or manmade factors affecting their continued existence.

The USFWS determined that although timber harvesting and wildfire may reduce the suitability of habitat for SMS, these factors do not extirpate SMS populations. Timber harvesting on Federal lands has declined significantly within the range of SMS and the USFWS expects the rate to remain at or near the present rate (USFWS 2006). Based on their review, the USFWS determined that listing of SMS as threatened or endangered under the Federal ESA was not warranted.

In June 2001 the Department commenced work to review the status of SMS by assembling occurrence information, coordinating with the U.S. Forest Service, private landowners and researchers. Additional fieldwork and analysis of available information evolved into several draft status reviews. Field data from DFG surveys was provided for review to researcher Dr. Hartwell Welsh in mid-2003 and comments were provided by Dr. Welsh in August of 2003 (Welsh pers. comm.). A draft SMS status review was provided to multiple reviewers in February 2004 and comments were received from Dr. Lowell Diller (2004a pers. comm.); Stuart Farber (2004a pers. comm.); Richard Nauman, Dave Clayton and Dede Olson (2004 pers. comm.); Dr. David Wake (2004a pers. comm.); Dr. Hartwell Welsh and Don Ashton (2004 pers. comm.); Karen West (2004 pers. comm.); and Sam Cuenca (2004 pers. comm.). In late 2004 the Department determined that the status review should be reformulated as a delisting petition, leading to the current proposal.

The Department concludes that SMS is not rare, as it was originally designated, not likely to become endangered in the foreseeable future nor in serious danger of becoming extinct throughout all or a significant portion of its range. Consequently, the Department recommends that SMS be removed from the list

of threatened species. Subsequent to such action, the Department proposes to enter into an initial five year program in collaboration with private forest landowners to document and report on the response of SMS to timber operations. At, or before, the conclusion of this effort the Department may elect to extend the work further in time if necessary to document longer term response by SMS to disturbance.

In general, the formal process to delist species under CESA is governed by sections 2070 through 2079 of the California Fish and Game Code. Additional detail regarding the process is found in section 670.1 of Title 14 of the California Code of Regulations. With respect to SMS, the current formal process to delist the species under CESA began with the Department's submittal of a petition to the Commission in May 2005. (See Fish & G. Code, § 2072.7.) The Department submitted an amended petition to the Commission in August 2005, and the Commission took formal action acknowledging receipt of the petition at a public meeting on August 18, 2005. (*Ibid.*; see also Cal. Reg. Notice Register 2005, No. 35-Z, p. 1269.) At a public meeting on September 30, 2005, the Commission accepted the petition for further consideration under CESA after finding the proposed delisting may be warranted. (Fish & G. Code, § 2074.2, subd. (b); Cal. Reg. Notice Register 2005, No. 41-Z, p. 1486.)

Following the Commission's acceptance of the petition, the Department has worked to review the status of SMS, including notifying and soliciting data and comments from interested and affected members of the public. (See generally Fish & G. Code, §§ 2074.4, 2074.6.) This status review culminates that effort. The Department's status review will be submitted to the Commission and made available to the public as part of the information the Commission will consider in determining whether delisting is warranted. (*Id.,* 2075, 2075.5.) If the Commission ultimately finds at a public meeting that delisting is warranted, the Commission will initiate a formal rulemaking action under the Administrative Procedure Act (APA) (Gov. Code, § 11340 et seq.) to remove SMS from the list of species designated as threatened under CESA. (Fish & G. Code, § 2075.5(2).)

In addition to CESA, the delisting of SMS is subject to required environmental review under the California Environmental Quality Act (CEQA) (Pub. Resources Code, § 21000 et seq.). CEQA review of the proposed delisting is governed by the Commission's "certified regulatory program," which is found in section 781.5 of Title 14 of the California Code of Regulations. (See generally *Id.*, § 21080.5.) Environmental review of the proposed delisting is also subject to other requirements in CEQA, including various requirements found in sections 21080 through 21098 of the California Public Resources Code.

CEQA review of the proposed delisting is currently underway. Following the Commission's decision to accept the petition for further consideration, the Department prepared an initial study under CEQA. The initial study evaluated

whether and ultimately concluded that the delisting of SMS had the potential to result in significant adverse impacts to the environment. The initial study also identified various impacts associated with the delisting that the Department believes are less than significant. The initial study, along with a notice of preparation of an environmental document that will address the potentially significant impacts in more detail, was submitted to the State Clearinghouse in the Governor's Office of Planning and Research, circulated for public review from March 29, 2006 through June 2, 2006, and addressed at a public scoping meeting held by the Department in Redding on behalf of the Commission on April 6, 2006. The draft environmental document prepared pursuant to the Commission's certified regulatory program, which will serve as a functional equivalent of an environmental impact report under CEQA, will be circulated for public review once completed by the Department. Thereafter, a final environmental document will be prepared, considered and certified by the Commission as required by the certified regulatory program and CEQA generally.

In ideal circumstances, researchers will answer questions about species biology with a high degree of statistical certainty. The hypothetico-deductive scientific method includes the development of hypotheses which are then evaluated by collecting data in an experimental setting. The data are analyzed with statistical methods to determine whether the original hypotheses should be accepted or rejected. A general explanation of this method is made by Pidwirny (2004).

For purposes of CESA, the Department is required to use the best scientific information available when evaluating status of species for listing or delisting petitions. (Fish & G. Code, § 2074.6.) More often than not, the available information does not answer every question which might be asked about the habitat requirements, distribution or abundance of a species. Because wildlife are difficult to study, conclusions based upon the available information have some degree of uncertainty. Even in these cases, decisions can be made by identifying hypotheses and applying relevant observations, including field data, and predictions from ecological theory (Murphy and Noon, 1991; National Research Council, 1995). The Department used this approach to evaluate the status of SMS. Precise estimates of species abundance have not been made nor are there statistically valid experimental data quantifying suitability of various habitat types for SMS. However, there are easily identifiable hypotheses regarding factors affecting SMS distribution including range, elevation, presence in disturbed habitats, aspect, habitat types and ability to persist and reproduce in disturbed locations. All of these bear on whether the species is threatened and sufficient relevant information is available to evaluate these hypotheses.

Status Review of Siskiyou Mountains Salamander in California
Report to the Fish and Game Commission
September 2006

Introduction

Petition History

In June 2001, the Department of Fish and Game (Department) commenced a status review of the Siskiyou Mountains salamander (*Plethodon stormi*) (SMS). Based upon the information developed through the status review, peer review comments and the best scientific information available, the Department proceeded with a petition to delist the species. On August 18, 2005, the Fish and Game Commission (Commission) received a petition from the Department to remove SMS from the list of threatened species under the California Endangered Species Act (CESA). Pursuant to section 2072.7 of the California Fish and Game Code, the Commission accepted the petition based on the Department's recommendation.

At the Commission meeting in Susanville on September 30, 2005, the Commission received the Department's presentation of the findings and recommendation to delist, and public testimony, and the petition was accepted by the Commission. On October 4, 2005, the Commission published a notice of acceptance and finding that the delisting action may be warranted in the California Regulatory Notice Register. SMS shall retain its threatened designation under CESA during the review process.

Department Review

This report, prepared pursuant to California Fish and Game Code section 2074.6, details the Department's review, analysis and recommendations to the Commission regarding the proposed removal of SMS from the list of threatened species under CESA. The discussion and analysis set forth below is based on the best scientific information available. The Department's recommendation whether the petitioned action is warranted is also addressed.

Following the Commission's action, the Department solicited information and undertook an updating of the status review of the species. The Department contacted affected and interested parties, invited comment on the petition, and requested any additional scientific information that may be available, as required by California Fish and Game Code section 2074.4. The Department produced a public notice (Appendix A1) and distributed it by mail on March 28, 2006, to affected and interested parties. Appendix A2 contains a list of individuals, organizations, and agencies contacted. Newspapers that published the public notice on March 28-31, 2006 are shown in Appendix A3. A scoping meeting was held on April 6, 2006, in Redding, California to receive verbal and written comments from the public.

No substantive comments were received on the petition subsequent to the March 28, 2006 public notice.

Population Trends

Very little data exists characterizing either absolute or relative abundance of this species. SMS are rarely present on or near the surface and even then only a small fraction of the total population is accessible. Established survey methodologies are designed to determine presence, not abundance. Even at sites known to support SMS, subsequent surveys are sometimes unsuccessful in finding animals under conditions believed to be suitable. There is no comprehensive, range-wide population estimate and Department concludes that there is currently no basis to generate such an estimate with available information. However, in this, as in select other instances, the Department believes that sufficient scientific information comprised of extensive data on distribution, information on habitat used by the species, application of ecological principles and an assessment of probable risks can be used to support determinations to either add or remove species from the list of threatened and endangered species.

Range and Distribution

Early Estimate of Range

SMS were first discovered in a road cut in Oregon by the Oregon Herpetological Society in 1963 (Kesner 1977) and described in 1965 (Highton and Brame 1965). The species is found in Josephine and Jackson counties in Oregon and northern Siskiyou County, California. When listed as rare[1] by the State of California in 1971, SMS were known only to exist at eight sites in California and seven additional sites in Oregon. At that time the range in California was estimated by the Department to be approximately 15.5 km^2 (6 mi^2).

The Commission kept regulatory files for only four years in the 1970s. The only currently available information pertaining to listing SMS are Commission meeting notes dated April 2 and May 21, 1971[2]. SMS was reclassified on January 1, 1985, when all such animal species previously determined by the Commission to be rare, were designated as “threatened species” in accordance with California Fish and Game Code section 2067.

Currently Known Range

The current documented range of SMS in California is approximately 718 km^2 (277 mi^2) containing approximately 234 sites where the species is known to occur (Figures 1 and 2)[3]. A recently

[1] Former California Fish and Game Code section 2051, subdivision (b), defined "Rare animal" as an animal of a species or subspecies of birds, mammals, fish, amphibian or reptiles that, although not presently threatened with extinction, is in such small numbers throughout its range that it may be endangered if its environment worsens.

[2] Those notes show the Commission directed the Department at that time to publish a notice to amend section 670.5 of Title 14 of the former California Administrative Code, adding SMS to the list of rare and endangered species. The Commission directed the Department to take this action in accordance with CESA as it existed at the time, along with the former California Species Preservation Ac. Commission meeting notes from May 1971 indicate the Commission directed the Department to take similar action with respect to two “endangered” and six “rare” amphibians (including SMS), and that the Commission passed the related motion unanimously.

[3] Due to the fact that the field data underlying this shapefile came from different sources, it is possible that some of the observations were duplicated between data sources. To remove duplicate observations, a comparison between field data was made. If an observation occurred within 100 meters of another observation, and if both observations occurred on the same day, by the same person, then the two observations were counted as one. The observation with the most complete

described related species, the Scott Bar salamander (*Plethodon asupak*), is distributed to the south of SMS. In Oregon, the documented range of SMS is approximately 751 km^2 (290 mi^2) (Mead et al. 2005). This species is distributed between 365 and 1,830 meters (1,200 and 6,000 feet) in elevation (Nauman and Olson 2004). The species is distributed patchily within suitable habitat which is often fragmented across the landscape (USDA, USDI Species Review Panel 2001). Another related species, the Del Norte salamander (*Plethodon elongatus*), is distributed to the west of SMS.

The currently accepted survey protocol for detection of SMS was developed under the Survey and Manage provision of the Federal Northwest Forest Plan to determine the presence of SMS on Federally owned and managed lands (Clayton et al. 1999). This protocol contains a narrow sampling window (Farber et al. 2002b). The conditions required under this protocol are very restrictive and sometimes requires effort over several years before enough days meet necessary criteria for completion. High elevation habitats are frequently inaccessible due to snow (Farber et al. 2001; Klug 2003 pers. comm.; Nauman 2004 pers. comm.). Before concluding that a site is not occupied, three surveys, at least ten days apart are required, with a minimum of one survey conducted in the spring. The soil temperature must be greater than 3.5°C (38.3°F) and air temperature must fall between 4 and 20°C (39.2 and 68°F). Relative humidity must be ≥ 65% and the substrate below the first layer of rock must be moist to the touch. Surveys are time-constrained searches and search effort must be a minimum of four person-hours per 10 acres of suitable habitat. Habitat is searched by turning over cover objects in a timed area-search method. In addition, freezing temperatures must not have occurred at the site within 48 hours prior to the site visit, except at California sites above 1,372 meters (4,500 feet), where it may freeze lightly (approx. -2°C/28.4°F) the night prior to the survey. However, if multiple site visits are necessary, at least one site visit must meet the low elevation freezing criterion (i.e., 48 hours prior to the visit).

Physical Habitats within the Range

SMS occur in the Klamath Mountains province in interior northern California, in areas underlain by metamorphosed marine sediment (chert, marble, slate), metamorphosed sub-marine lava, ultramafic rock (peridotite, serpentine) and granitic rock. The area consists of very steep mountains and mountain valleys (USDA Forest Service 1994a).

Climate conditions in the Klamath Mountains province are characterized by warm, dry summers and cold, moist winters. Average daily air temperatures are about 32°C (90°F) during the summer and near 0°C (32°F) in the winter. Annual precipitation is approximately 50 to 190 cm (20 to 75 inches) and during the winter typically falls as rain below 1,219 m (4,000 feet) and as snow above 1,219 m (4,000 feet) (USDA Forest Service 1994b).

Biological Conditions within the Range

Variations in elevation, soil, bedrock types, local climate and past disturbance create a wide range of vegetation types within the range of SMS. The Klamath-Siskiyou geographic region is widely

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attribute information was deemed the actual location. This process may have inadvertently combined two points which were actually different observations, or in some cases, this process may have deemed two observations as unique when in fact they were one and the same. This does not affect the Department's conclusions and recommendations since the majority of sites are considered to be separate, it does not reduce the known range, and a significant portion of the range has not been surveyed to date. Consequently, it is likely that this number of sites is a conservative estimate.

recognized as supporting a very high diversity of vertebrate, invertebrate and plant species. Dry vegetation types include Mixed Chaparral, Montane Hardwood-Conifer and Montane Hardwood (Mayer and Laudenslayer 1988). Mesic sites include Klamath Mixed Conifer, Douglas fir and ponderosa pine (Mayer and Laudenslayer 1988). Forest management has been practiced on private forestlands in the area for over 80 years and the resulting landscape supports young, intermediate, and mature coniferous forests along with dry climate hardwood and chaparral habitats (Farber et al. 2001).

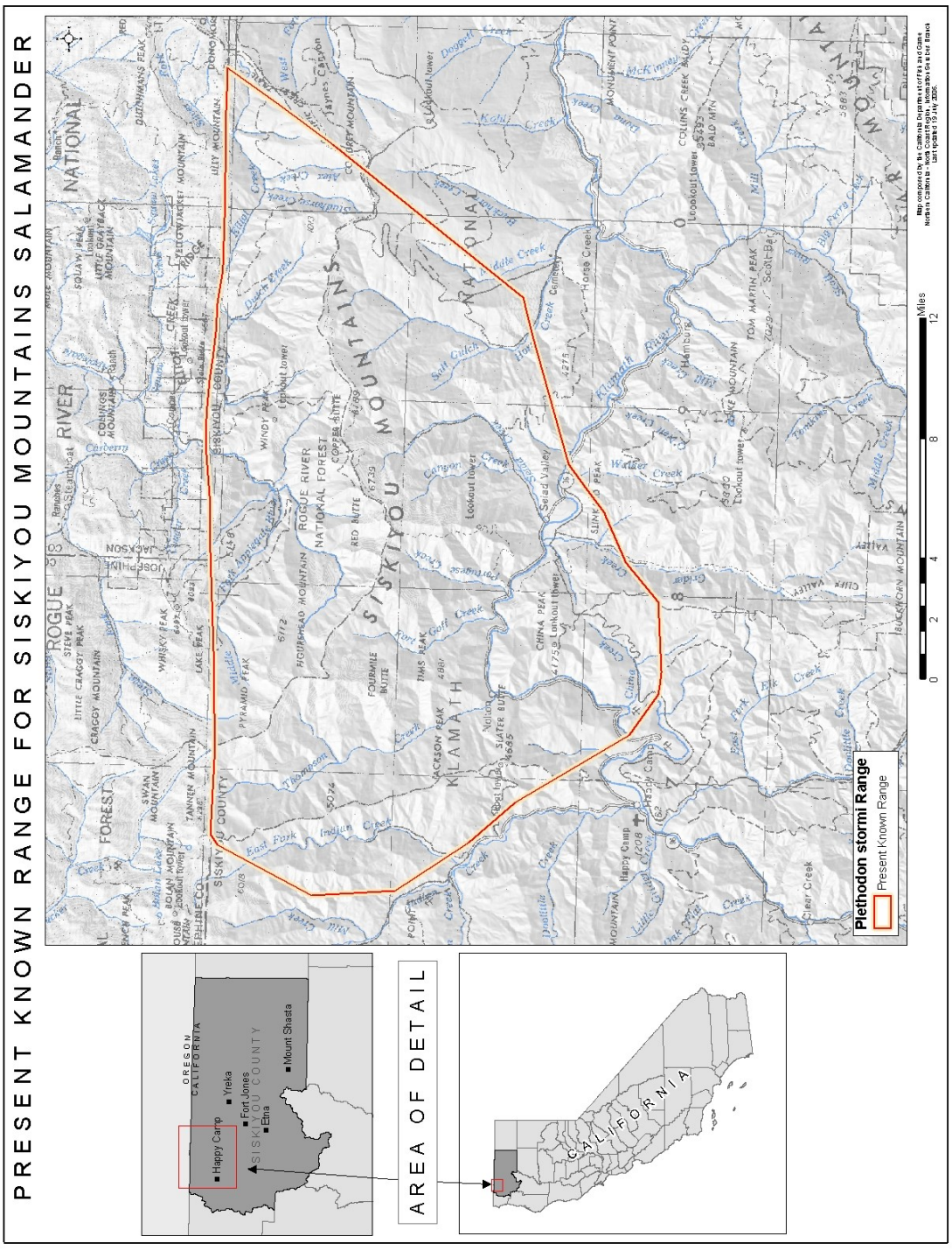
PRESENT KNOWN RANGE FOR SISKIYOU MOUNTAINS SALAMANDER
Plethodon stormi Range
Present Known Range
Miles
0
2
4
8
12
OREGON
CALIFORNIA
Happy Camp
Yreka
Fort Jones
Etna
Mount Shasta
SISKIYOU COUNTY
AREA OF DETAIL
CALIFORNIA
SISKIYOU MOUNTAINS
KLAMATH
ROGUE RIVER NATIONAL FOREST
SISKIYOU NATIONAL FOREST

FIGURE 1.

Abundance

Few attempts have been made to determine abundance of SMS. Relative or absolute abundance studies for this species are problematic since the extent to which salamanders are active on the surface depends on variable climatic conditions such as temperature, rainfall and humidity. On a single sampling occasion only 13% (Bailey et al. 2004) of the total plethodontid salamanders in a given sampling area were estimated to be available for capture near the surface; Taub (1961) estimated between 2 and 32% were available for capture in an earlier study. Some studies measure abundance by counting the number (i.e., density) of individuals per square meter (Diller and Wallace 1994; Ollivier et al. 2001). Studies that employ trapping or time-constrained study designs report results as number of individuals found per unit of survey effort (Grialou et al. 2000; Farber et al. 2001).

The number of SMS found at individual sites is highly variable. Depending on micro-site conditions and habitat quality, this species may be locally abundant. As few as zero and as many as 30 individuals per hour have been collected at sites known to support SMS (Clayton 1999). Nussbaum (1974) reported densities up to 0.53 animals per square meter. More recently, Ollivier et al. (2001) found densities up to 0.27 salamanders per square meter at sites within California. Farber (2001) used a sampling design that described results for SMS[4] as the number of individuals per hour of sampling time and reported that the relative abundance at each site ranged from 0.8 to 8.2 salamanders per hour.

The known occurrences for SMS are unevenly distributed across their range. Most surveys have been conducted for timber harvest planning or opportunistically. Few large-scale systematic surveys (e.g., Ollivier et al. 2001) have been conducted. The U.S. Forest Service (USFS) pre-disturbance surveys conducted in the northern portion of the range (i.e., north of the Siskiyou Crest) generally found that three to 14% of any given planning area (generally 10-15,000 acres) was comprised of suitable habitat (USDA, USDI Species Review Panel 2001); i.e., rock outcrops, talus (rock on rock substrate) and forested rocky soils (Clayton 1999). A predictive Geographic Information Systems (GIS) habitat model suggests that approximately 30% of the range north of the Siskiyou Crest contains high-quality habitat (USDA, USDI Species Review Panel 2002). Using a stratified random design, Ollivier et al. (2001) reported finding SMS[5] in 64 (27%) of 239 plots sampled in suitable habitat. Abundance at occupied sites can be high (i.e., greater than 20 individuals per hour), but animals are distributed patchily within suitable habitat which is often fragmented across the landscape (USDA, USDI Species Review Panel 2001).

[4] Based upon Mead et al., 2005; the plethontid salamanders in this study are Scott Bar salamanders.

[5] Based upon Mead et al., 2005; some of the plethontid salamanders in this study are Scott Bar salamanders. Based upon subsequent surveys by the Department, at least one of the sites where no salamanders were reported by Ollivier et al., 2001, actually supports Del Norte salamanders.

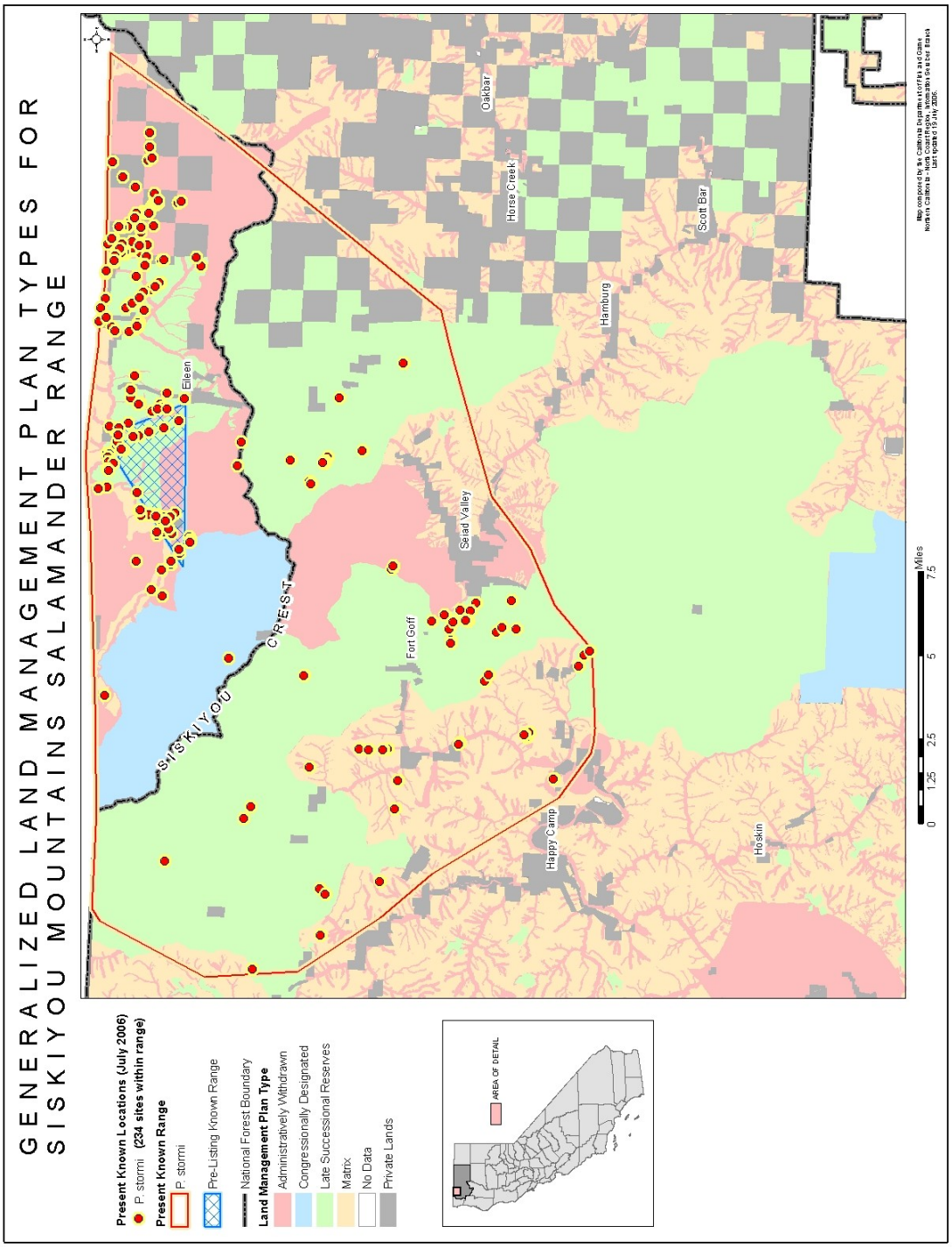
GENERALIZED LAND MANAGEMENT PLAN TYPES FOR
SISKIYOU MOUNTAINS SALAMANDER RANGE
Present Known Locations (July 2006)
P. stormi (234 sites within range)
Present Known Range
P. stormi
Pre-Listing Known Range
National Forest Boundary
Land Management Plan Type
Administratively Withdrawn
Congressionally Designated
Late Successional Reserves
Matrix
No Data
Private Lands
AREA OF DETAIL
SISKIYOU CREST
Eileen
Fort Goff
Salad Valley
Happy Camp
Hoskin
Hamburg
Horse Creek
Oakbar
Scott Bar
0 1.25 2.5 5 7.5
Miles

FIGURE 2.

The only reported attempt to determine abundance of SMS was by Nussbaum in 1974, when the known range was small relative to the current range. He concluded it was impossible to confidently estimate the carrying capacity of the entire range of SMS and it was nearly impossible to estimate the total abundance of such a small, secretive animal. Making certain assumptions he nevertheless attempted crude estimates of abundance. His major assumption was that it was better to underestimate than to overestimate abundance and he developed a conservative density estimate. The measured density was 0.54 salamanders/ meter^2. Using half the measured density (i.e. 0.27 salamanders/meter^2). Nussbaum estimated a population of 3,055,239 SMS in Oregon and California, with the caveat that actual abundance could be 10 times as high (Nussbaum 1974). This estimate was based upon a range less than half the size known to exist today. The available empirical data does not provide a basis for more precision.

Welsh and Lind (1992) estimated density of the related Del Norte salamander (*P. elongatus*) using mark recapture methods analyzed with two different models[6], based upon the same field data, which produced substantially different results (i.e., 3,200 salamanders/hectare and 9,000 salamanders/hectare). In comparison, the measured density of 0.54 salamanders/ meter^2 by Nussbaum (1974) extrapolates to 5400 salamanders/hectare. Further, the particular populations measured by Welsh and Lind (1992) and Nussbaum (1974) may have had higher densities than would be observed on most other sites.

Life History

SMS is a member of the family Plethodontidae; the lungless salamanders. SMS respire primarily through their skin, are completely terrestrial, and are very sensitive to temperature and moisture regimes. Moist microclimates are essential to survival. SMS move up and down through the substrate as microhabitat conditions change and are usually surface active during the fall, winter and spring rains. Feder (1983) described the physiological limitations that constrain a temperate zone, lungless species like SMS to limited microclimates that provide high relative humidity and cool temperatures. The skin must be moist and permeable for gas exchange to take place. Even in moist microhabitats, plethodontid salamanders may lose water outside underground retreats (Feder 1983). Surface activity for foraging and courtship is restricted to the wettest periods, presumably to limit water loss. Subterranean activity has not been studied (Welsh 2004 pers. comm.).

The closely related Del Norte salamander is a highly sedentary species (Welsh and Lind 1992; Lowe 2001). Using study plots 7.5 meters (24.6 feet) on a side, Welsh and Lind (1992) found the majority of Del Norte salamanders remained within the same plot where they were originally captured. An adult male showed the furthest movement of 36.2 m (119 feet) over a period of six months. In a two-year mark-recapture study, Lowe (2001) found that Del Norte salamanders moved an average of 6.7 m/22.0 feet (86% <10 m/32.8 feet, 57% < 5 m/16.4 feet), with the longest movement by an adult male (39.6 m/129.9 feet). Karraker and Welsh (2006) reported that over three years, Del Norte salamanders moved an average of 5.1 meters (range 0-45 meters).

Available data (Nussbaum et al. 1983) for SMS suggest that females lay eggs every other year in the spring. Gravid females may be found in the fall, winter and spring (Nussbaum 1974). Although no nests have been found, female SMS likely brood their embryos in nest cavities through the summer deep in talus. Mature females (n=37) had two to 18 (average = 9.2) enlarged, white, ovarian eggs

[6] The models were the Jolly-Seber open population model and the Lincoln-Peterson model.

(Nussbaum et al. 1983). Eggs apparently hatch in the fall (Clayton and Nauman 2005) and juveniles may emerge in fall if weather conditions are favorable for surface activity (Farber 2003c pers. comm.). Both sexes are thought to mature at five to six years of age (Nussbaum 1974).

Plethodontid salamanders are primarily sit-and-wait predators, preying mainly on small invertebrates on the forest floor or beneath cover objects at night. They may feed opportunistically under cover objects during the day. Higher densities of cover objects (rocks, logs, and coarse woody debris) result in higher abundances of plethodontids (Grover 1998). Most foraging is thought to occur at or near the surface of the ground under moist conditions. Primary prey includes spiders, pseudoscorpions, mites, ants, collembolans, and beetles (Nussbaum et al. 1983).

The lives of terrestrial plethodontids consist of long periods of inactivity interspersed with brief periods of activity when thermal and hydric conditions allow. Key physiological specializations (low metabolic rate, relatively large energy stores, and profound resistance to starvation) may enable plethodontids to survive extended periods between irregular feeding bouts. The absence of energetically costly adaptations that might allow more regular activity may be a partial explanation for the extraordinarily low energy requirements of plethodontids (Feder 1983).

SMS are small, slender salamanders (total length = 14.0 cm/5.5 inches) with short limbs (Figure 3). SMS have a modal number of 17 costal grooves and 4-5.5 intercostal folds between adpressed limbs (Nussbaum et al. 1983). SMS are chocolate-brown to purplish-brown, dorsally, with variable amounts of light-colored flecks on the head, sides, and limbs. Adults are gray-purple, ventrally. Juveniles are black or very dark brown with flecking, gray ventrally, and commonly display a light brown, tan or copper dorsal stripe (Nussbaum et al. 1983; Leonard et al. 1993; Clayton et al. 1999; Farber et al. 2002a). Salamanders identified as juvenile SMS have been found with dorsal stripes throughout their range (Farber 2004b pers. comm.; Klug 2003 pers. comm.; California Department of Fish and Game 2003); however, the dorsal stripe is thought to be a characteristic of the Del Norte salamander according to Bury (1998) and Wake (2004b pers. comm.).

Taxonomic Classification

The *Plethodon elongatus* species group of salamanders includes the Del Norte salamander, SMS and Scott Bar salamander. These species are restricted to the Klamath Province of northern California and southern Oregon (Bury and Pearl 1999). The broad scale patterns of morphological and molecular genetic variation among species in the genus *Plethodon* (Brodie 1970) indicate SMS, Del Norte and Scott Bar salamanders are sister taxa[7] (Mahoney 2001; Mahoney 2004; Mead et al. 2005); meaning they are the immediate descendants of a common ancestral species. The first analysis using nuclear microsatellite loci provided strong support for SMS and Del Norte salamanders as separate species (DeGross 2004). The deviation in morphology from coastal populations of Del Norte salamanders inland to SMS at the interior terminus in the Upper Klamath River (southern side of Siskiyou Mountains) raises the possibility of primary or secondary intergradations (Bury 1998; Mead et al., 2005). Additionally, SMS in northern California are morphologically differentiated from SMS inhabiting the Applegate drainage in Oregon (Bury 1998). The systematics of salamanders are often challenging to describe, and have been the subject of many research investigations (e.g., Wake

[7] A"taxon" is a specific group of organisms, in this case the species *P. stormi.* "Sister" taxa are the closest relatives. In this case the Del Norte salamander, *P. elongatus*.is a sister taxon.

1997; Wake and Jockusch 2000).

Because there are few well-defined distinguishing morphological characters, the relationship between Del Norte salamanders and SMS has been a matter of contention for some time. They have been alternatively recognized as distinct species (Nussbaum et al. 1983; Leonard et al. 1993; Bury 1998; Mahoney 2004) or as subspecies of a more inclusive Del Norte salamander (Bury 1973; Stebbins 1985). In the original species description of SMS (Highton and Brame 1965), differences in relative limb length, coloration and number of vomerine teeth were used to differentiate SMS from the Del Norte salamander. The dorsal stripe on juveniles is considered a Del Norte characteristic (Bury 1998; Mahoney 2004; Wake 2004b pers. comm.). However, the stripe has been found on juvenile SMS in northern California and in the Applegate drainage (Farber 2004b pers. comm.; Klug 2003 pers. comm.; California Department of Fish and Game 2003).

(Photo courtesy of Stu Farber)

Figure 3. Siskiyou Mountains Salamander

Recently, Mead et al. (2005) analyzed salamanders collected southeasterly from Seiad Valley for morphological and genetic differences. Based upon their work the authors identified two alternatives

for taxonomic treatment of Plethodontid salamanders near the Scott River. The first alternative would combine the two distinctive groups of SMS, salamanders near the Scott River and Del Norte salamanders into one species, *P. elongatus*, exhibiting extensive genetic and morphological variation. The second alternative is to treat the Scott Bar salamander as a separate species. The authors chose the latter. Upon publication of Mead et al. (2005), the Department solicited the views of several scientists as to the implications of the newly described species upon this petition. Individual responses were received from Dr. Deanna Olson, Dr. David Wake, Mr. David Clayton and Dr. Hartwell Welsh (all 2005 pers. comm.). Drs. Olson and Wake stated that the decision on delisting SMS should not be affected by the description of *P. asupak*, principally because the ranges of the two species are sufficiently distinct. Dr. Olson observed that public lands not subject to timber harvest appear to have lower rates of detection for SMS. Mr. Clayton expressed concerns for *P. asupak* based upon the small documented range, perceived vulnerability to timber harvesting and land management designations within the range. Dr. Welsh states that the recent description of the Scott Bar salamander as a new species demonstrates that knowledge regarding plethodontid salamanders in the Klamath region is poor, and he does not concur with the Department's analysis in the petition and recommends against delisting of SMS.

Genetic Studies

Several plethodontid species occupy restricted and highly fragmented habitats in Oregon and northern California. The geographical distributions of these plethodontid species suggest restricted gene flow and past habitat fragmentation are important processes in shaping the patterns of divergence and may be important for the conservation of SMS (USDA, USDI Species Review Process 2001; Mead et al. 2005). Movement data on Del Norte salamanders indicate a highly sedentary species (Welsh and Lind 1992; Lowe 2001; Karraker and Welsh 2006).

Mitochondrial DNA analyses (Mahoney 2004; Pfrender and Titus 2001; Mead et al. 2005; Mead 2006) indicated that Del Norte salamanders, Scott Bar salamanders and SMS have distinct evolutionary lineages. These studies concluded that within the *P. elongatus/stormi/asupak* complex, there are at least four genetically distinct population segments; two SMS, one Del Norte[8], and one *P. sp*. (south of the Klamath River and east of Grider Ridge). Pfrender and Titus (2001) provided four possible scenarios that included:

1) consider them all to be Del Norte salamanders and part of a single highly divided species;
2) include *P. sp*. into SMS;
3) elevate *P. sp.* to a species and include SMS into Del Norte salamanders;
4) elevate *P. sp*. to a species and recognize three distinct species within this complex.

This question is currently resolved by Mead et al. (2005), consistent with the fourth scenario, given the published description of *P. asupak*. Mahoney (2004) found that the morphological boundaries between SMS and Del Norte salamanders were similar to the mitochondrial DNA breaks, leading to support for treating them as sister taxa. Mead et al. (2005) found that within the zone of contact between SMS and Del Norte salamanders, haplotypes[9] did not reveal any genetic mixing (i.e.

[8] Mahoney (2004) found three distinct population segments within the range of Del Norte salamanders. Mead et al. (in review) and Pfrender and Titus (2001) did not explore the entire range of Del Norte salamanders.
[9] A "haplotype" is a combination of alleles for different genes which are located closely together on the same chromosome and which tend to be inherited together.

admixture), indicating that gene flow had not occurred between these groups. Further analysis using microsatellite markers indicates that there is some gene flow occurring between these species at Grider Creek and Upper Walker Creek (Mead 2006). Since mitochondrial DNA is inherited only through females, it is strongly biased against showing admixture. Dispersal in other salamanders appears to be by males and they will not transmit their mitochondrial DNA, so sharp borders will be apparent even if genetic interchange is taking place (Wake 2004c pers. comm.). These mitochondrial DNA analyses show that *P. asupak* exhibits the highest level of divergence and represents a third major lineage, but only in mitochondrial DNA (Pfrender and Titus 2001; Mahoney 2004; Mead et al. 2005).

Using microsatellite loci, DeGross (2004) found evidence of limited gene flow between SMS and Del Norte salamanders at several contact zone populations in western Siskiyou County. Specimens from populations in drainages that flow into the Klamath River near Seiad Valley showed variable levels of admixture which suggested limited hybridization with Del Norte salamanders. DeGross (2004) also found evidence of two lineages within SMS, but did not look at populations south of the Klamath River and east of Grider Ridge.

Wake (2004a pers. comm.) studied proteins using nuclear genes, which are spread by both males and females, from SMS and Del Norte salamanders. In California, SMS and Del Norte salamanders exchange genes over a relatively large area and some researchers believe *P. elongatus* and *P. stormi* are the same species (Stebbins 1985; Wake 2004a pers. comm.). Alternatively, some believe that if the zone of contact is narrow relative to the range as a whole, it should be two separate species (Wake 2004a pers. comm.).

The third lineage within SMS has been found only with analysis of mitochondrial DNA, and future nuclear gene studies may be conclusive. The third lineage has now been described as a new species, *P. asupak* (Mead et al. 2005).

SMS, Scott Bar and Del Norte salamanders are often difficult to distinguish based upon morphology and recent genetic studies affirm their close relationship (Mead et al. 2006). Current studies using several different approaches have detected genetic variations and proposed various descriptive family trees, called “phylogenies” to describe evolutionary relationships (Mahoney 2001; Pfrender and Titus 2001; Mahoney 2004; Mead et al. 2005; Wake 2004a pers. comm.). Genetic studies of SMS have determined that genetic variability in the species is very low (Pfrender and Titus 2001). It is often assumed that low diversity poses a risk to persistence at multiple scales, from an entire ecosystem to an individual species. However, some species with low levels of genetic diversity may have high fitness in their environment (Hedrick 1996) and SMS have persisted for a very long time.

Mead et al. (2006) examined further the contact zones where Del Norte, SMS and Scott Bar salamanders converge in Siskiyou County. Evidence of SMS and Del Norte salamanders occurring at the same site with no evidence of admixture occurs at only one known site. At the contact zones at Grider Creek /Upper Walker Creek and West Grider, mitochondrial DNA markers indicate no admixture, but microsatellite markers indicate that there is gene flow between SMS and Del Norte salamanders. Microsatellite markers for two Scott Bar salamanders in Horse Creek indicate that gene flow is taking place between SMS and Scott Bar salamanders (Mead et al. 2006). Although microsatellite markers show some gene flow, it is over small distances (Mead 2006). The levels of divergence between SMS, Del Norte and Scott Bar salamanders are similar to the members of the *Ensatina escholtzii* complex which are reproductively isolated. Yet the lack of significant geographic

barriers to dispersal, the fact that the species replace one another over short distances and integradation appears to be minimal, Mead (2006) concludes that this strengthens the support for Scott Bar salamanders as unique from SMS.

Habitat Necessary for Survival

Until recently, little was known regarding the environmental requirements and habitat use of SMS. This species was thought to primarily inhabit stabilized talus in old-growth forest stands with northern exposures (Nussbaum 1974; Nussbaum et al. 1983). Early surveys within the Applegate Valley of Oregon and Seiad Valley in northern California were carried out at only a few stand types and at elevations below 1,066 m (3,500 feet) (Highton and Brame 1965; Nussbaum et al. 1983).

The range of SMS is substantially greater than was known when the species was listed as rare in California. SMS occupies a wide range of forest types with a varied range of overstory canopy cover and can be found on all slope aspects (Ollivier et al. 2001; California Department of Fish and Game 2003; West 2004 pers. comm.; Clayton et al. 2004; USFWS 2006). SMS is considered a talus or rock substrate obligate and has rarely been found far from talus deposits or fissured rock outcrops (Nussbaum et al. 1983; Herrington 1988; Olson 1999; Ollivier et al. 2001; Clayton and Nauman 2005). The presence of talus (rock on rock substrates) and forested rocky substrate may be the most important environmental factor affecting terrestrial salamanders (Bury et al. 1991; Diller and Wallace 1994; Farber et al. 2001; West 2004 pers. comm.). These habitats are common but have a patchy distribution throughout the known range of SMS. Nussbaum et al. (1983) reported that populations of SMS are associated with talus deposits where forest floor litter is thin or absent. However, Stebbins (1985) described habitat for the genus *Plethodon* as talus often covered with leaf litter from deciduous trees or with moss. When leaf litter is moist, as occurs with rain, plethodontid salamanders forage away from moist retreats within talus (Feder 1983).

Ollivier et al. (2001) concluded there is a significant association of SMS with conditions found in later successional, undisturbed forests with a closed canopy and moist microclimate. These habitat attributes and rocky substrates dominated by cobble-sized pieces "appear optimal for reproductive success and long-term survival throughout the range of the species," although overstory canopy ranged from 2.75 to 95.75% at occupied locations within California. Their conclusion is arguably consistent with their survey data. However, as described previously in the section "Department of Fish and Game 2003 Field Studies" in this report the Department subsequently identified SMS, Scott Bar or Del Norte salamanders in 8 out of 13 precanopy sites where Ollivier et al. (2001) were unsuccessful in determining occupancy. The data supporting their conclusion was therefore biased toward more densely forested sites and warrants reconsideration. Ollivier also reported that hardwoods were an important habitat component associated with the presence of SMS.

Suzuki et al. (unpublished manuscript) determined habitat associations of SMS north of the Siskiyou Crest and developed habitat suitability models using available GIS data and logistic regression analysis with the information theoretic approach. These models were developed at the fine (10 ha), medium (40 ha) and broad (202 ha) spatial resolutions. These models indicated little support for models with structural features (e.g. tree canopy and tree size) across spatial scales. The occurrence of SMS was positively associated with increasing dominance of rocky soils and Pacific madrone, while SMS were negatively associated with elevation and white fir, at all spatial scales. Hardwood density was also positively associated with SMS at the medium spatial scale.

After sampling all known Scott Bar salamander sites on Timber Products Company lands (n = 23), Farber et al. (2001, updated 2003) used a step-wise logistical regression of 25 independent habitat variables. Of these, only total percent rock was significant (R^2=0.17, df=21, P<0.05) in a model that predicted the abundance (dependent variable), of Scott Bar salamanders. Other reviewers (i.e., Nauman 2004 pers. comm.; Welsh 2004 pers. comm.) are skeptical of the statistical validity of these findings. Similarly, Diller and Wallace (1994) found substrate was the primary factor predicting the presence of Del Norte salamanders, while slope, cover type and canopy cover were of secondary importance. Other studies indicated that hardwoods were an important habitat component associated with the presence of Del Norte salamanders (Raphael 1988; Welsh and Lind 1991; Welsh and Lind 1995). Bury et al. (1991) found that the strong association of *P. vehiculum* (western red-backed salamander) with talus or rocky soils may override other habitat relationships. They reported that occurrence and abundance of these salamanders were more likely to be related to the presence of rocky outcrops or underlying talus than to maturity of the forest stand.

Moisture in the litter and upper soil layers is important to lungless terrestrial salamanders. They require near constant contact with moist soil or litter so as to continuously maintain moist skin in order to respire. High relative humidity is required for surface activity, where the majority of feeding and mating is believed to occur. Even when salamanders are on the surface during high moisture conditions, they are at risk of dehydrating and must return to litter and subterranean refugia to rehydrate (Spotila 1971; Jaeger 1978).

Corn and Bury (1991) described three important surface microhabitats available to and heavily used by terrestrial salamanders: rocky substrates, downed wood, and leaf litter. The latter two microhabitats generally occur in greater amounts in unmanaged forests. However, Bury et al. (1991) stated that the occurrence and abundance of most species of woodland salamanders were more likely to be related to the presence of these microhabitats than to seral stage. For example, mid to late seral Douglas-fir stands regenerated by catastrophic fires maintained microhabitat features despite the changes that occurred and plethodontid salamanders were found in all regenerated stands ranging from 55 to 750 years old (Aubry and Hall 1991). Fire has been a dominant force in shaping vegetative patterns, in natural regeneration, in arresting succession and in controlling stand density within the range of SMS. USFS forest inventory data for the Klamath National Forest (USDA Forest Service 1994b) suggest a historic average high intensity, stand-replacing fire frequency of 110 to 180 years in all forest types.

Factors Affecting Ability to Survive and Reproduce

Studies of Salamander Response to Vegetative Disturbance

Since timber harvest disturbs more ground than any other land use in the known range of SMS, it is perceived to be the primary threat to SMS (Nussbaum 1974; California Department of Fish and Game 1987; Blaustein et al. 1995; Bury and Pearl 1999; USDA, USDI Species Review Panel 2001; Greenwald 2004). Timber operations may impact SMS directly when SMS are surface active during the spring and fall by killing animals during operations or indirectly by reducing habitat suitability. Harvesting removes tree and shrub canopy, which modifies the microhabitat at and potentially below the ground surface (Chen et al. 1993; Chen et al. 1995; Chen et al. 1999). Tractor operations can compact talus substrates, reducing habitat suitability, and may crush individual animals.

While several observational studies have shown persistence and reproduction of SMS following

removal of forested stands (California Department of Fish & Game 2003; Klug 2003 pers. comm.), these results do not quantify cause-and-effect relationships. The cause-and-effect response of SMS to removal of forested stands has not been critically examined and is unlikely to occur on private lands where the strict no-take requirements under CESA apply.

A paired plot survey was conducted by the USFS for SMS near Elliott Creek in Siskiyou County; one site was clearcut in 1992 and a second location was selectively cut , i.e., one or two of the largest trees per acre were removed in the mid-1950s (at Hutton Guard Station). In April 1993, a survey in the clearcut unit following harvest yielded 40 salamanders (10 salamanders per person hour). During single opportunistic searches conducted in the spring of 1994, 1995, 1998 and 1999, only one SMS was found (in 1999). The number of SMS found in the selectively cut site was relatively consistent (3 to 6 salamanders per person hour) during the years sampled (Clayton 2004a pers. comm.). Department staff surveyed this clearcut in the spring and fall of 2003 for SMS. In the spring, three salamanders (one juvenile, one subadult and one adult[10]) were found by a single surveyor in 17 minutes and five salamanders (one juvenile, two subadults and two adults) were found in the fall by a surveyor in 75 minutes.

Fruit Growers Supply Company has monitored SMS on the Elliott Fly Timber Harvesting Plan (THP) #2-95-015(SIS), which was submitted in 1995 and completed in 1997. The silvicultural method was selection and all yarding was by helicopter. A conservation measure in the Biological Opinion for this THP imposed pursuant to former California Fish and Game Code section 2090 required the company to monitor the THP area and control sites to collect data regarding the effects of proposed operations on SMS and its habitat. Eighty-eight percent (88%) of the treatment study plots were occupied preharvest. Seventy-two percent (72%) of the plots were occupied 1-year postharvest, and 72 percent (72%) were occupied four to eight years postharvest. Adult, subadult and juvenile SMS have been found, indicating that the animals have continued to occupy most of the sites and appear to be reproducing. In two plots where no animals were detected preharvest, subsequent searches one-year post harvest and four to eight-years post harvest yielded all life stages of SMS.

Farber et al. (2001; updated 2004) examined historical records of natural or human disturbance at each occupied Scott Bar salamander site on Timber Products Company timberlands. Of 23 sites occupied by adults and juveniles, a total of 17 sites (73.9%) had varying intensities of either natural or human disturbance prior to surveys being conducted. Natural disturbance by windthrow had occurred at two sites (8.7%) and historic fire occurred at two sites (8.7%). Human disturbance by either logging (selection silviculture) or mining occurred at four sites (17.3%). Disturbance by recent (post-1973) ground based tractor timber harvest had occurred at nine sites (39.1%). Of the 23 occupied sites, six had multiple disturbances noted. Gravid females and juveniles were found within a clearcut area six years after ground-based harvesting and road construction. Gravid Scott Bar salamanders have been found in recent clearcuts (Farber et al. 2001) and open canopy forests (California Department of Fish and Game 2003).

Several studies of the closely related Del Norte salamander demonstrated higher abundances in mature forests (Raphael 1988; Welsh and Lind 1991; Welsh and Lind 1995), although Diller and Wallace (1994) found no relationship between forest age and Del Norte salamander presence in

[10] Life stage determination in the field was classified using snout-vent length (SVL) data in Ollivier and Welsh (2003) for Del Norte salamanders: juvenile SVL<28.45 mm/1.1 in., subadult SVL 28.45 mm/1.1 in. to 46.74 mm/1.8 in., adult SVL ≥ 46.75 mm/1.8 in.

road-cut talus habitats. These results may be due to climatic differences within the species' range between the interior (Welsh and Lind 1991 and 1995) and coastal (Diller and Wallace 1994) areas.

Karraker and Welsh (2006) found that commercial thinning of late-seral stands did not reduce the numbers of Del Norte salamanders and abundance was actually higher in thinned stands. Abundance was lower in clearcuts than in mature stands although body condition indices for Del Norte salamanders were not different in forests and clearcuts. Their movement data found that none of the salamanders moved from clearcut to forest and salamanders move short distances. This movement data, coupled with detections of individuals of all life stages within the clearcuts, led them to the conclusion "that reproduction, foraging, and estivation by these salamanders is occurring in clearcuts within the study area."

Green Diamond (formerly Simpson) Resource Company is conducting an ongoing study to quantify the numerical response of Del Norte salamanders to clearcut timber harvest of occupied sites. Data have been collected since 1993 on 10 control-treatment plots. To date, Del Norte salamanders have not been extirpated from any site due to harvesting activities and all life stages have been found. Of 699 adult salamanders sampled, the proportion of gravid females in the clearcuts and undisturbed control sites was 12.7% and 11.4%, respectively (Diller 2003 pers. comm.). The data have not been statistically analyzed, but no strong change in population structure is apparent from inspection of the data (Diller 2004 pers. comm.). The most interior (i.e. inland) site had the fewest salamanders. In a paired plot survey for Del Norte salamanders conducted by Redwood Sciences Laboratory from 1987 to 1999 on one clearcut versus one old-growth plot, no gravid females were detected in the clearcut (Welsh 2003 pers. comm.).

Other coastal Pacific Northwest species of the genus *Plethodon* have been studied with regard to the effects of forest management. Corn and Bury (1991) found no significant difference in relative abundance of western red-backed salamanders (*P. vehiculum*) between clearcuts and old-growth forests in Oregon. The relative abundances of western red-backed salamanders in Washington were also similar in clearcuts and in mature forests (Aubry 2000).

In a control-treatment study in western Washington, Grialou et al. (2000) found western red-backed salamanders (including gravid females) in clearcut and thinning treatments. Although animals were found, their capture rates were reduced postharvest. Grialou et al. (2000) reported that soil compaction due to timber harvesting may have rendered the soil column more difficult for salamanders to access. Soil compaction and decreased leaf litter cover in the clearcut areas may have interacted with other factors to reduce abundance (Grialou, et al., 2000). Although SMS may be less abundant in clearcuts, the full representation of size classes and presence of gravid females in clearcuts suggest to the Department that SMS are reproducing and persisting.

In a study in Canada on western red-backed salamanders, abundance was three to six times higher in old-growth (>330 years) than in managed stands (Dupuis 1995). Cole et al. (1997) sampled western red-backed salamanders in deciduous red alder sites in the Oregon Coast Range. Average capture rates were highly variable from year to year, but capture rates increased significantly during the first year after clearcut logging. After two years, the capture rates decreased to preharvest levels.

The response of plethodontid salamanders to the harvest of forested stands on talus slopes has only recently been studied. Karraker and Welsh (2006) found no difference in the relative abundance of Del Norte salamanders on thinned and unthinned forests, but abundance was reduced in clearcuts.

In contrast to that study, the abundance of Del Norte salamanders was similar in mature forests and adjacent clearcuts in Oregon (Biek 2002). Timber harvesting may cause individual animals to simply move underground, reducing the chance of capture during surveys targeting surface active animals (deMaynadier et al.1995). Taub (1961) and Bailey et al. (2004) found that 2 to 32% of the total number of salamanders, in suitable habitat, is available at any one time for capture near the surface. The abundance of plethodontid salamanders may be reduced by some timber management activities. However, plethodontid salamanders, including reproductive females, have been documented after timber management disturbances.

More information is available about the effects on plethodontid salamanders of timber harvesting in the eastern United States. While all plethodontid salamanders are lungless, they do not necessarily have the same life histories or habitat requirements. In the eastern United States, summer rains are common and most of these studies have been done on the effects of timber harvesting in deciduous forests. A summary of some of the studies conducted on these eastern plethodontid salamanders is presented below. It is a common wildlife management practice to consider information from related species where it is available. However, caution must be used in the interpretation of these results when applied to comparisons with SMS because other salamander species may not respond in exactly the same way and their habitats are not identical.

Research conducted on eastern plethodontid salamanders (non-talus, deciduous forest dwelling species) has found that ground based logging, with various silviculture treatments (including clearcuts), reduces salamander abundance, but does not eliminate those species from occupied sites. Red-backed salamanders in New York deciduous forests were less abundant in clearcuts than adjacent old-growth, but the numbers of salamanders found in 60-year old second-growth forests were the same as in the old-growth forest (Pough et al. 1987). Petranka et al. (1993) found five times more salamanders in mature forests than on recent clearcuts (<10 years old) in western North Carolina. At low elevation sites in the southern Appalachians, fewer salamanders were found in clearcuts less than five years old than in mature stands (Petranka et al. 1994). Ash (1997) studied the effect of clearcut logging on plethodontid habitat in the southern Appalachians and found that relative abundance was decreased significantly, but salamanders were still present at the site. Herbeck and Larsen (1998) also found lower densities of plethodontid salamanders in clearcuts than in late seral forests in the Missouri Ozark forests. Red-backed salamanders were the most sensitive amphibian in a study on the effects of clearcut edges, with lower abundances in clearcuts and forest edges (deMaydenair and Hunter 1998).

Messere and Ducey (1998) studied abundance of plethodontid salamanders following timber harvest in central New York and found no significant difference in abundance of salamanders in forest canopy gaps (selection silviculture), forest edge, and forest stands. The abundance of western red-backed salamanders, three years after different silvicultural treatments, decreased significantly in group selection, shelterwood removal, leave tree and a clearcut, but not in the understory removal (Harpole and Haas 1999). In western North Carolina, Harper and Guynn (1999) found that salamander densities were lowest in young (<12 years old) stands. Densities were equal in stands 13 to 39 years and stands ≥40 years old. Duguay and Wood (2002) found lower numbers of plethodontid salamanders in two-age treatments than mature second-growth, but not lower in the clearcut than mature second-growth treatment. Knapp et al. (2003) found an overall decrease in abundance of all salamander species, but no significant difference between the short-term effects of clearcut treatments and other silvicultural treatments.

These studies in the eastern United States show that, in most cases, populations of plethodontid salamanders declined immediately following timber harvesting activities. The time required for populations to return to predisturbance levels after clearcutting of deciduous forests in the eastern United States was estimated to be 20 to 24 years (Ash 1997), 21.5 years (Harper and Guynn 1999) and 50 to 70 years (Petranka et al. 1993). Duguay and Wood (2002) found results that were consistent with Ash (1997).

California Department of Fish and Game 2003 Field Studies

In 2003, Department biologists attempted to visit as many known sites previously documented to support SMS as possible (included were sites now known as Scott Bar salamander sites). The objective was to document habitat elements, substrate, and disturbance. Ninety-two sites previously documented as occupied by SMS were inspected. This field study was designed to be as comprehensive as possible and presents data from every location known at the time on Fruit Growers Supply Company and Timber Products Company private timberlands and every site on Federal lands which Department staff could precisely locate. The majority (87%) of these sites were on private lands. The results cannot be used to statistically assess species preference, but do illustrate the range of variability of habitat conditions where SMS occur.

Of the 92 sampled sites, the following observations were made at the 68 sites that are occupied by SMS:

- All aspects were represented[11].
- Seventy percent of the sites occurred on slopes of 50% or greater.
- The majority (16 of 18) of the California Wildlife Habitat Relationships (CWHR) tree size and canopy classes[12] were represented on the 1/10 acre sites.
- Conifers dominated the basal area at most sites. Hardwoods provided some or most of the cover at a total of 37 sites, and of those, 17 sites were classified as either Montane Hardwood/Conifer or Montane Hardwood.
- The percent cover of rock >2.54 cm (1-inch) covering each plot was estimated at 50% or more at 35 sites.
- In each instance, the cover object where the first animal was detected was a cobble or boulder-sized rock. Cobble and/or boulder-sized rock were visually estimated to be 32% of the rock surface cover at the 68 sites. Cobble and/or boulder-sized rock were present at all but one site.
- Evidence of timber harvest (i.e., tree stumps) was observed at 31 sites. Multiple types of disturbance[13] were observed at 25 sites. No evidence of disturbance was found at 12 sites.
- Moderate (10- 50%) and high (>50%) basal area removal was estimated at 54% and 26% of the 68 sites, respectively.
- Soil disturbance was 50% or greater at nearly one-half (44%) of the sites.

The Department also attempted to locate the precanopy (defined as a clearcut or forest stand less than 30 years old) sites where Ollivier et al. (2001) did not detect SMS, to conduct opportunistic

[11] Aspect (# sites): North (21), East (10), South (17), West (20)
[12] CWHR size classes represented (#sites): 1(9), 2S(8), 2P(7), 2M(1), 3S(6), 3P(8), 3M(3), 3D(4), 4S(1), 4P(2), 4M(6), 4D(4), 5S(3), 5P(1), 5M(1), 6(4)
[13] Types of disturbance recorded: landslide, fire, timber harvest, skid trail, road, mining

surveys[14]. Using the data provided (Ollivier et al. 2001), 13 of 17 precanopy sites in California[15] were located in 2003. Plots sampled by Ollivier et al. (2001) were found at nine sites (consisting of survey flagging and/or a stake was found). At the other four sites where the exact plot could not be located, the stand was searched for suitable rock substrate and surveyed. SMS were detected by the Department at 5 of the 13 sites, Scott Bar salamanders at 2 locations, and Del Norte salamanders occupied another site. All life stages[16] of SMS were detected at three of the five occupied sites. All life stages of Scott Bar salamanders were found at the two sites where they were found. A gravid female Scott Bar salamander was found on an undisturbed precanopy plot, an indication that reproduction may occur even without dense canopy forest conditions.

Appendix B to this report includes the following:

1) An example data sheet with instructions used by the Department for this survey work
2) Graphic representations of the data presented above
3) Photographs of the eight precanopy sites where Ollivier et al. (2001) did not find salamanders and where Department staff were able to document presence of either SMS, Scott Bar or Del Norte salamanders.
4) Two data summary tables representing results of Department surveys of the eight precanopy sites where salamanders were found.

In any survey there is a chance that SMS will not be detected, even where they do exist. These "false negative", or "Type I[17]" errors occur for various reasons, one of which includes microclimate conditions forcing SMS to be further underground at the particular time of the survey than inspection techniques can detect. Another factor can be the experience level of the surveyor, simply not searching for a long enough period of time or searching less carefully in locations which the surveyor believes to be suboptimal. Later surveys under more suitable conditions or by more experienced surveyors may find SMS, Scott Bar salamanders or Del Norte salamanders in the same exact location.

On the basis of correlative data, collected during surveys which do not meet current protocols for determining absence, Ollivier et al. (2001), conclude that SMS are linked with conditions found more consistently in later seral forests. However, Ollivier et al. (2001), failed to detect SMS, Scott Bar or Del Norte salamanders in precanopy sites (both disturbed and undisturbed) where surveys by the Department later documented presence. Ollivier et al. (2001) incorrectly rejected the hypothesis that SMS occupied at least 7 of 13 precanopy and disturbed sites. This systematic Type I error fundamentally compromises their data analysis and conclusions regarding both microhabitat and macrohabitat requirements for the species. The conclusions presented in Ollivier et al. (2001) that SMS are more consistently found in late seral forests are, at best, marginally supported by their data

[14] Funding for Ollivier et al. (2001) was provided in part by the Department under contract FG 6508 R1. Detection of this species is difficult and the knowledge that species experts have not always been able to find SMS during optimal conditions at known localities (Olson 1999) prompted this effort.

[15] Ollivier et al. (2001) separates their analysis of California and Oregon sites but chose to add data from sites located within California north of the Siskiyou Crest into their data set for Oregon sites. In this report, where the Department characterizes the California sites visited by Olliver et al. (2001) we use the actual state boundary to separate the sites.

[16] Life stage determination in the field was verified by snout-vent length (SVL) data in Ollivier and Welsh (2003) for Del Norte salamanders: juvenile SVL<28.45 mm/1.1 in., subadult SVL 28.45 mm/1.1 in. to 46.74 mm/1.8 in., adult SVL ≥ 46.75 mm/1.8 in.

[17] A "Type I" error means that a true hypothesis (e.g. salamanders are present on a particular site) is incorrectly rejected and is more serious than a "Type II" error which means that a false hypothesis is not rejected.

analysis. If Ollivier et al. (2001) had detected SMS or other plethodontid salamanders in their "precanopy" study sites where the Department subsequently documented SMS, Scott Bar or Del Norte salamanders; their results would likely not have supported their conclusions. Further, one of the precanopy sites (#91) selected by Ollivier et al. (2001), is considered by the Department to be unsuitable for Plethodon salamanders due to the presence of only a single layer of rock. It is possible that SMS were also present in additional late seral sites but were not detected during surveys by Ollivier et al. (2001). This probability does not contradict the Department's conclusion that SMS occupy a wide range of sites as described in the Department's 2003 field studies, including both disturbed and undisturbed sites with low canopy cover.

Three surveys of habitat (Olson 1999) under strict environmental conditions are necessary to determine that a site is not occupied, as discussed above. The protocols were not developed until after Ollivier et al. (2001) collected the majority of their data using a less intensive protocol.

Other Disturbances Potentially Affecting SMS

Fire, road building, quarry development, and recreational developments may also impact the species. Most prehistoric fires were probably low intensity, frequent and occurred when the animals were not active near the surface, with little consequence for SMS. USFS forest inventory data for the Klamath National Forest (USDA Forest Service 1994b) suggest a historic average high intensity, stand-replacing fire frequency of 110 to 180 years in all forest types. Recent fire suppression has made the landscape more prone to high intensity, stand replacing fire events (USDA Forest Service 1994b; Taylor and Skinner 1998) that could impact the species, although Del Norte salamanders were found to persist in areas that had burned under moderate to high severity, at one, two and more than ten years following wildfire events (West 2004 pers. comm.). Another potential threat to the species is prescribed fire when conducted during the times of the year when salamanders may be active near the surface.

Available information indicates that SMS are found in areas with various levels of disturbance. SMS are known to occur within disturbed sites, such as rock quarries, log landings, and road and skid road cutbanks and fill-slopes. Due to ease of capture, many animals have been collected from talus banks of road cuts. SMS may colonize road cuts soon after road construction, moving in from talus above and below the road (Nussbaum 1974), move into the road cut only during the wet season (Nauman 2004 pers. comm.) or, more likely, were already on site (Welsh 2004 pers. comm.). Both adult and juvenile animals have been found in road cuts, quarries and mined areas (Farber 2004c pers. comm.; Klug 2003 pers. comm.). Forest roads are partial barriers to terrestrial salamander movement and these barrier effects mainly point toward behavioral avoidance (deMaynadier and Hunter 2000; Marsh et al. 2005) as roads decrease connectivity for many species.

Chytridiomycosis is a potentially fatal epidermal infection caused by a chytrid fungus, *Batrachochytrium dendrobatidis*, which has been found to affect several frog and other amphibian populations in Australia, New Zealand, Europe, United States, Central America, and South America (Berger et al. 1999, Lips 1999, Mutschmann et al. 2000, Bosch et al. 2001, Fellers et al. 2001, Speare et al. 2001, Bradley et al. 2002, Weldon et al. 2004). In the United States massive deaths have been recorded in Arizona, California, and Colorado (Daszak et al. 1999). Although the disease has been responsible for mass mortality, population declines, and species extinction (Berger et al. 1998a; Pessier et al. 1999; Mutschmann et al. 2000; Bosch et al. 2001; Waldman et al. 2001) not all infected populations and species are negatively affected (Weldon 2002; Mazzoni et al. 2003) and light

infections have also been found on amphibians in the wild which show no clinical signs of the infection (Retallick et al. 2004).

B. dendrobatidis is a member of the phylum Chytridiomycota. Some chytrids are found in water and soil, and contribute significantly to the initial degradation of organic matter such as chitin and keratin while other are parasites of algae, plants, nematodes or insects (Barr 1990). *B. dendrobatidis* is the first chytrid found to be a parasite of vertebrates. It is hypothesized that it spreads by its own movement through water bodies, via surface water during precipitation, or by the activity of individual infected amphibians (Speare et al. 2001; Knapp et al. 2006). It has also been postulated that the fungus may be transported by one or more vectors such as waterbirds and migratory fish (Laurance et al. 1997; Johnson et al. 2003a; Johnson et al. 2005).

The life cycle of *B. dendrobatidis* has two main stages: a zoospore and a thallus. The zoospore, which is the primary method of dispersal stage, is motile in water. The zoospore's ability to infect a host is limited as they swim less that two centimeters before they will encyst[18], usually within 24 hours following discharge from the zoosporangia (Piotrowski et al. 2004). Infection by the fungus and the subsequent spread of the disease requires moisture as complete drying will kill *B. dendrobatidis* within a period of approximately three hours (Johnson et al 2003b). On amphibians the zoospore or cyst can develop into the growing organism, called a thallus. From the thallus a single zoosporangium is produced. The contents of the zoosporangium cleave into new zoospores which exit the sporangium through one or more palillae (Berger et al. 2005). The duration of the life cycle in vitro is four to five days at 22°C (71.6°F). *B. dendrobatidis* will grow at four to 25°C (approximately 39 to 77°F) with optimal growth occurring between 17 to 25°C (approximately 63 to 77°F). It does not grow well at temperatures above 25°C (Piotrowski et al. 2004) and dies within four hours at 37°C (98.6°F) (Johnson 2003b).

The chytrid fungus can survive without a host and remain infectious for between three and six weeks in sterile aquatic environments (Johnson and Speare 2003a). It has also been shown to attached itself to plant debris and microorganisms within the sterile environment; however, no sign of degradation of these bodies was apparent. Survival of the chytrid fungus was also observed in some sand mixtures although results varied based on pH and moisture content (Johnson and Speare 2005). The location of sporangia on tadpoles and adults shows that a stratified, keratinizing epidermis is a requirement for *B. dendrobatidis* when occurring as a parasite (Berger et al. 1998; Marantelli et al. 2004). Sporangia infect cells in the stratum granulosum[19] and stratum corneum[20] in the superficial epidermis. Immature sporangia occur within the deeper, more viable cells while mature zoosporangia and empty sporangia are more prevalent in the outer keratinized layers. Discharge tubes generally project towards the skin surface and zoospores may be released to the environment.

The fungus appears to only grow on keratin in the epidermis. The distribution of sporangia in developing tadpoles follows the changes in the distribution of keratinized epidermis (Marantelli et al. 2004). In two experiments where tadpoles were raised in captivity, it was observed that almost all frogs died with chytridiomycosis in the weeks after metamorphosis. Examination of healthy appearing

[18] Encyst – to become enclosed in a cyst. A cyst is a thick walled resting spore.
[19] The **stratum granulosum** is a layer of the epidermis (outer-skin) that consists of approximately five layers of flattened (but not dead) keratinocytes with granules from which a water-repellent lipid is released.
[20] The stratum corneum is the outermost layer of the epidermis and is made of dead, flat skin cells that shed about every 2 weeks

tadpoles showed the fungus present only in the mouthparts. As only the mouthparts of tadpoles is keratinized, it was theorized that *B. dendrobatidis* spreads from the mouthparts of the tadpoles to the skin on the frog's body when it becomes keratinised after metamorphosis (Berger et al. 1998b). Subsequent experiments found there is differential sensitivity between species with the fungus negatively affecting some at the larval stage and not others (Blaustein et al. 2005). It is also possible animals which were not infected as larvae become infected after metamorphosis (Blaustein et al. 2005).

Two hypotheses have been proposed to explain how a fungus that is restricted to the superficial epidermis has the capacity to kill frogs (Berger et al. 1998; Pessier et al. 1999). (1) The chytrid might release proteolytic enzymes[21] or other active compounds that are absorbed through the permeable skin of the frog or, possibly, (2) damage to skin function results in disturbance of oxygen, water or electrolyte balance which results in death.

Recently, a chytrid fungus infection was reported on a wild-caught, strictly terrestrial salamander. A single adult, gravid female, Jemez Mountains salamander (*Plethodon neomexicanus*), a species endemic to the Jemez Mountains in New Mexico, was collected in a meadow containing a few aspen trees (*Populus* tremuloides) (Cummer et al. 2005). Infected tiger salamanders (*Ambystoma tigrinum*) and boreal chorus frogs (*Pseudacris maculate*) were found in the area and the article suggests the possibility that the fungus may have been transmitted to the terrestrial salamander through direct or indirect contact with an infected aquatic amphibian.

There is no evidence chytridiomycosis occurs in SMS nor are there any reports of infected aquatic amphibians being found within SMS range. The disease has been found in a North American bullfrog (*Rana catesbeiana*) in the Trinity River watershed (Bettaso 2006 pers. comm.). At this time there is no record of infected amphibians in the Klamath, Shasta, or Scott River watersheds, however, based on the hydrological connectivity of the Trinity and Klamath rivers (the Trinity flows into the Klamath near the community of Weitchpec in Humboldt County) the potential exists *B. dendrobatidis* could eventually be transported into these watersheds.

With the discovery of *B. dendrobatidis* on *P. neomexicanus*, the potential for SMS to act as a host to this fungus does warrant consideration and vigilance. Based on what is known of the chytrid fungus' life cycle, one would not expect to see in terrestrial SMS populations the rapid dissemination of the disease which sometimes occurs within aquatic amphibian populations. If an infected aquatic amphibian were to enter SMS range, the potential exists for the disease to be transferred through direct contact between the infected amphibian and an individual SMS. If infected amphibians occurred in a water body upslope from occupied SMS habitat, zoospores or cysts present in the water could flow down into occupied SMS habitat and come in contact with the species or survive in the soil or on plant material long enough for a SMS to happen by. If an individual SMS were to become host to the fungus, the outcome of the infection is unknown. Continued transmission of the disease between individuals would require direct contact between individuals or cysts would need to survive in the soil until contact with a new host happened to occur. As SMS lives consist of long periods of inactivity interspersed with brief periods of activity when thermal and hydric conditions allow (Feder 1983), the potential to transfer the infection between individuals would be limited. The isolated nature of SMS populations and the limited movement of the species would also greatly reduce the potential the disease in one isolated community would be transferred to a neighboring isolated population.

[21] Proteolytic enzymes are enzymes which digest (break down) protein

The DFG has determined chytridiomycosis is not a current threat to SMS and it is unlikely to be a threat in the future. *B. dendrobatidis* has not been found on amphibians within the SMS range. As water is the primary mode of transmittal for the disease, the terrestrial nature of SMS greatly reduces its risk of infection and, if an infection were to occur, the outcome is currently unknown. Based on the species sedentary nature, opportunities for transmission of the disease between individuals and between communities would be limited. Based on current research, it appears very unlikely the disease could result in large SMS population declines or potential species extinction.

No information is available for this species regarding predation, competition or other diseases.

Degree and Immediacy of Threat

Problem Statement

SMS was listed as rare in California based on the limited understanding of the species' distribution at the time, while current information shows it to be more widespread. At the time of listing, this species was thought to primarily inhabit stabilized talus in old-growth forest stands with northern exposures, though it is now known to inhabit talus in a wide range of habitat types and aspects. SMS were thought to be extirpated by intensive land management, although unpublished information presented to the Department over the past ten years by private timberland owners indicated otherwise. This new information was an impetus for the Department to review the status of the species.

Recent developments in ecology include the concept of naturally occurring "metapopulations." One useful definition for a metapopulation is a "…group of subpopulations with movement between the groups much less than movement within them" (Simberloff, 1988). Wildlife populations are rarely, if ever, dispersed in an even manner across the landscape. Instead, wildlife occurs in spatially discrete distributions where suitable habitat is present and there is a non-trivial probability of extinction for one or more discrete populations (McCullough 1996). This is true for SMS and many other wildlife species (e.g., pikas, marmots).

Habitat for SMS is naturally fragmented across the landscape in locations where suitable rocky talus substrate is present. At issue is whether natural (e.g., fire) or anthropogenic disturbances (e.g., timber harvesting, road construction, and mining) further fragment the landscape and extirpate populations of SMS.

The petition proposing Federal listing of SMS identified climate change (i.e., global warming) as a concern and partial justification for protection under the Federal ESA. The petition hypothesized that global warming may lead to less opportunity for SMS to forage and reproduce. Further, since SMS exhibit low vagility[22], the species is unlikely to simply relocate to more suitable habitat as the climate warms.

Analysis

SMS inhabit talus slopes and move vertically through the substrate as microhabitat conditions change. Conflicting information available to the Department represented that 1) SMS are significantly

[22] "Vagility" means the capacity or tendency of an organism to move about or disperse in a given environment.

associated with conditions found in later successional, undisturbed forests with a closed canopy (Ollivier et al. 2001) versus, 2) SMS and Scott Bar salamanders are also found within disturbed sites, such as timber harvest units, rock quarries, log landings, and road and skid trail cutbanks and fill-slopes (Farber et al. 2001; Farber et al 2002b; Klug 2003 pers. comm.). Timber harvest results in greater ground disturbance than any other land use in the known range of SMS and it is perceived to be the primary threat to SMS. Field studies were conducted by the Department to characterize habitat conditions and document disturbance at as many known locations as possible. In 2003, the Department visited 68 sites where SMS have been found[23]. These field studies documented habitat conditions and disturbance on each 1/10 acre plot with plot center where the first SMS was detected. Of these 68 sites, 82% had been disturbed by a landslide, fire, timber harvest, skid trail, road and/or mining. Timber harvesting has occurred on 46% of the plots and 37% had two or more disturbances. Opportunistic surveys by the Department detected SMS in talus with little or no overstory that had been clearcut, burned or had no disturbance. These observations weaken assertions that SMS require conditions found in later successional, undisturbed forests with a closed canopy.

In the future, 24% (10% private and 14% Federal matrix) of the lands within the currently documented range could be subjected to intensive timber harvesting, while the remainder are projected to have limited management under current Klamath National Forest management plans. Analysis of disturbance over the range of SMS in California shows that at least 37% of the landscape has been disturbed by fire or timber harvesting, yet SMS continue to be found in these areas and are reproducing. Talus and forested rocky substrate are likely the most important environmental factors affecting SMS, and though common, these habitats have a patchy distribution throughout the known range. SMS occupies a wide range of forest types with a varied range of overstory canopy cover and can be found on all slope aspects.

“Metapopulation models have largely replaced island biogeography as the theoretical framework for thinking about fragmentation issues” (Wiens 1996). Theory predicts that species fitting a metapopulation model (like SMS) will tend to persist relative to other species which are not subdivided into spatially discrete local populations (Simberloff 1988). Persistence of species increases with the number of subpopulations (Simberloff 1988) and the landscape scale (i.e., range) over which the species is distributed (Wiens, 1996). The original concept of metapopulation theory is credited to Levins (1970) and his model included three critical elements which were: density dependence in local population dynamics, spatial asynchrony in local population dynamics and limited dispersal linking the local populations (Wiens 1996).

Regarding the first element, there are little data available describing behavioral interactions between salamanders, or emigration from local populations. Generally, SMS are believed to exhibit low vagility (Welsh 2004 pers. comm.; Greenwald 2004; USFWS 2006) and documented movements for a closely related species are for relatively short distances (Welsh 1992; Lowe 2001; Karraker and Welsh 2006). According to Welsh (2003 pers. comm.), *Plethodon* salamanders are territorial (a density dependent population dynamic) and this leads to dispersal of juveniles away from the local population. However, Bury and Welsh (2005) indicate that it is not known if SMS have territories.

Dynamics of local SMS populations are likely to be asynchronous with other populations. Disturbances which may kill individual animals or impact local habitat suitability, such as road

[23] The Department also inspected another 24 sites previously identified as supporting SMS but now known to support Scott Bar salamanders. Field data collection at these 24 sites was conducted in the same manner as the SMS sites.

building, fire, timber harvesting or mining will ordinarily not affect disjunct populations. Metapopulation theory predicts that this characteristic is likely to increase persistence of a species on larger landscapes (Wiens 1996).

A potential exception to the above pertains to the risk of global warming. Any adverse effects of global warming would likely affect many, perhaps all, subpopulations at the same time (i.e., synchronous rather than asynchronous). The U.S. Environmental Protection Agency (2004) cites the National Academy of Sciences in reporting that "[T]he Earth's surface temperature has risen by about 1 degree Fahrenheit in the past century, with accelerated warming during the past two decades." The consequences of this trend could include an increase in the average global surface temperature of 1-4.5°F in the next 50 years. Predicted environmental consequences of this include changes in the geographic range of forests, increases in the frequency of fire and insect outbreaks, changes in the carbon storage function of forests, increased precipitation and changes in weather patterns (Intergovernmental Panel on Climate Change 2001). These predictions are generalized and not certain to apply in any specific geographic region.

The subterranean microenvironment in which SMS spend most of their time is less sensitive to temperature changes than aboveground environments. Changes in vegetation types aboveground, rainfall and fire frequency likely pose risks to SMS by altering elements of the current habitat conditions. Potential effect mechanisms include canopy modification which changes temperature at the soil surface, changes in the rates of organic input to the talus habitat and changes in the associated animal community which depends upon these organic inputs.

A relevant consideration is that SMS have likely occupied the Klamath-Siskiyou bioregion for at least three to four million years (Pfrender and Titus 2001). This region was not subject to extensive volcanic or glacial activity during either the Pliocene or Holocene epochs which would otherwise have impacted distributions of plants and animals. The Pliocene epoch, beginning about five million years ago and ending about one and one-half million years ago, was initially warmer than current conditions and began cooling about two and three quarter million years ago. "Relative to today, the Pliocene warm period was characterized by ~ 3°C higher global surface temperatures, 10-20 m higher sea level, enhanced thermohaline circulation, slightly reduced Antarctic ice sheets, emerging but small North American ice coverage, and slightly (30%) higher atmospheric carbon dioxide concentrations" (Ravelo et al. 2004). While postulated warmer conditions several decades hence will not be identical to early Pliocene conditions, SMS apparently have behavioral and physiological adaptations which have allowed them to persist, so far, through a wide range of conditions, including circumstances similar to those which may occur if the environment becomes warmer.

In 2004, the USFWS was petitioned to emergency list SMS under the Federal ESA. The USFWS determined that, while threats do exist from private and Federal land management activities, such threats did not constitute an imminent threat warranting emergency listing under the Federal ESA (USFWS 2004). The USFWS was subsequently sued by the petitioners and issued a 90-day finding in the Federal Register on April 25, 2006 (USFWS 2006). The USFWS considered and made five determinations in considering whether listing of SMS under the Federal ESA warranted further review. These threat factors were:

- present or threatened destruction, modification, or curtailment of habitat and range,
- overutilization for commercial, recreational, scientific, or educational purposes,
- disease or predation,

- inadequacy of existing regulatory mechanisms,
- other natural or manmade factors affecting their continued existence.

The USFWS determined that although timber harvesting and wildfire may reduce the suitability of habitat for SMS, these factors do not extirpate SMS populations. Timber harvesting on Federal lands has declined significantly within the range of SMS and the USFWS expects the rate to remain at or near the present rate (USFWS 2006). Based on their review, the USFWS determined that listing of SMS as threatened or endangered under the Federal ESA was not warranted.

Wildfire is a factor worth considering as a risk. USFS forest inventory data for the Klamath National Forest (USDA Forest Service 1994b) suggest a historic average high intensity, stand-replacing fire frequency of 110 to 180 years in all forest types. Wildfires occur more frequently during warm dry conditions when SMS are unlikely to be at the surface and direct mortality is likely infrequent. The potential loss of tree canopy and organic debris on the soil surface by burning may modify the talus microclimate and interrupt the supply of organic material serving as an energy source for prey organisms. Several decades of fire suppression have likely augmented fuel loading which increase the intensity of fire when it occurs. In this landscape where high intensity stand-replacing fires occurred on a frequency of 110 to 180 years, SMS have persisted for a very long time, conservatively three to four million years. No data is available documenting exactly how long SMS have occupied any specific location within their range. Assuming low vagility for the species and long persistence in the Klamath-Siskiyou bioregion, intense stand replacing fires and less intense, more frequent anthropogenic fires to reduce fuel loading appear to pose little risk to species viability.

Risk Characterization

Observations of current occupancy by SMS at disturbed sites indicate that some level of disturbance is likely tolerated by populations of SMS. There are at least four possible interpretations for these observations:

1) suitability of the disturbed habitat is reduced to the extent that the local population gradually declines and becomes extirpated;

2) populations are reduced or extirpated by the disturbance and then supplemented or replaced by other animals migrating into the habitat as it recovers;

3) populations persist but surface activity is reduced;

4) populations are initially reduced but recover over time.

Alternatives 1 and 2 are less likely than alternatives 3 and 4. Juveniles and gravid females were found at multiple disturbed sites (some 100-plus yards from closed canopy forests), which indicates that SMS were reproducing within disturbed sites. If alternative 1 or 2 were occurring, most or all of the animals on disturbed sites should be non-reproductive adults. SMS have low vagility (Welsh 2004 pers. comm.; Greenwald 2004; USFWS 2006), and coupled with the very limited time these animals are active above ground, makes it unlikely that juveniles (recent hatchlings < 28.5 mm/1.1 in.

SVL) migrate long distances[24] into disturbed areas.

Alternatives 3 and 4 are more likely than alternatives 1 and 2. Populations of SMS most likely decrease following timber harvesting, either through direct or indirect mortality, as reported for other plethodontid salamanders. Generally, fewer SMS are captured in recently disturbed sites than habitat which is either undisturbed or substantially recovered from disturbance. Without mark/recapture studies to attempt to determine population sizes and evaluate effects of timber harvesting this will remain unquantified. Prohibitions on take, and the issuance criteria required for an incidental take permit, currently make such studies impractical.

Current land management practices, including intensive forestry, likely have adverse site-specific impacts on individual animals and local populations. Individual animals may be killed and local populations may be reduced in size. Observations of all age classes on disturbed sites suggest that the scenario of local populations being extirpated is not likely though it may occur in the smallest, most isolated populations. The current known distribution of the species, presence of all age classes, and the range-wide history of logging, fires, road building and mining suggests the species can recover from local disturbances without affecting persistence of local populations occupying isolated habitat. Full recovery from significant disturbance may require several decades.

The current risk of extinction for this species is negligible. SMS populations will likely survive and reproduce within the known range even where resource management activities, including timber harvesting, mining, fuel reduction by prescribed burning and road building, are performed.

Impacts of Existing Management Efforts

Approximately 90% of the current known range of SMS in California occurs on Federal lands, with the remaining 10% falling on privately owned lands (Table 1). Of the sites currently known to support SMS, 72% occur on Federal lands and 28% occur on private lands. Due to non-random survey effort this may not reflect the actual distribution of animals and the proportional relationship of land ownership within the known range may not be correlated with the distribution of habitat.

The primary federal land allocations include (USDA and USDI 1994):

> (1) Administratively Withdrawn Areas are identified in current forest and district plans or draft plan preferred alternatives and include recreational and visual areas, back country, and other areas not scheduled for timber harvest. Administratively withdrawn areas are unregulated lands which do not have a regular programmed timber harvest and are not managed to provide timber outputs, although non-scheduled or incidental harvest might be obtained if they serve to enhance other resources.
>
> (2) Congressionally Reserved Areas are lands that have been reserved by act of Congress for specific land allocation purposes. Included in this category are National Parks and Monuments, Wilderness Areas, Wild and Scenic Rivers, National Wildlife Refuges, Department of Defense lands, and other lands with congressional designations.

[24] Based upon available information for *P. elongatus*, 50 meters would be an extraordinarily long movement (Welsh and Lind 1992; Lowe 2001; Karraker and Welsh, 2006).

(3) Late-Successional Reserves (LSR) are to be managed to protect and enhance old-growth forest conditions. For each late-successional reserve (or group of small reserves) managers should prepare an assessment of existing conditions and appropriate activities. No programmed timber harvest is allowed inside the reserves. However, thinning or other silvicultural treatments inside these reserves may occur in stands up to 80 years of age if the treatments are beneficial to the creation and maintenance of late-successional forest conditions. In the reserves east of the Cascades and in Oregon and California Klamath Provinces, additional management activities are allowed to reduce risks of large-scale disturbance. Salvage guidelines are intended to prevent negative effects on late-successional habitat. Non-silvicultural activities within late-successional reserves are allowed where such activities are neutral or beneficial to the creation and maintenance of late-successional habitat. Thinning or other silvicultural activities must be reviewed by the Regional Ecosystem Office and the Regional Interagency Executive Committee.

(4) Matrix lands are where most timber harvest will occur. Standards and guidelines assure appropriate conservation of ecosystems as well as provide habitat for rare and lesser-known species. Some of the major standards and guidelines for matrix lands are: a renewable supply of large down logs must be in place; at least 15 percent of the green trees on each regeneration harvest unit located on National Forest land must be retained (except within the Oregon Coast Range and Olympic Peninsula provinces); and 100 acres of late-successional habitat around owl activity centers that were known as of January 1, 1994, must be protected.

Private lands within the range of SMS in California are primarily timberlands and will likely continue to be managed for timber production.

Table1. Ownership and land management plan (LMP) type within the range of SMS in California.

Ownership	LMP Type	LMP Land Allocation	% within SMS Range	% of SMS Sites
Federal	Withdrawn	Administratively Withdrawn	23%	24%
		Congressionally Reserved Areas	9%	1%
		LSRs	44%	39%
	Matrix	Scenic River Retention Recreational River Partial Retention General Forest	14%	8%
Private			10%	28%

Federal Lands

Under the Northwest Forest Plan, in the 1994 Record of Decision, the Bureau of Land Management (BLM) and USFS adopted standards and guidelines for the management of habitat for late-

successional and late seral forest-related species within the range of the northern spotted owl. Specific standards and guidelines, called "Survey and Manage," addressed concerns for the persistence of rare and endemic species by providing for management of known sites, site-specific pre-habitat-disturbing surveys, and/or landscape scale surveys for about 400 rare and/or uncommon species. SMS were included in the list of Survey and Manage Species. Protection included no entry into occupied habitat and a one tree height (100-160 foot) buffer around the habitat. In accordance with the Northwest Forest Plan, LSRs, Congressionally Reserved Areas and Administratively Withdrawn areas are to be maintained as late-successional habitat over the next 100 years, maintaining suitable talus habitat for SMS. The USFS expects suitable habitat for SMS within matrix lands to be modified in the immediate future (USDA, USDI Species Review Panel 2001). Based upon surveys in 2003, *Plethodon spp.* may be less abundant in withdrawn lands, despite designation as late successional and riparian reserves, and more abundant in matrix lands (Nauman and Olson 2004). This relationship was observed even in riparian reserves adjacent to matrix lands. Nauman and Olson (2004) suggest these results may be driven by generally higher elevations in late successional reserves or biases created by differences in rainfall patterns. This rationale does not explain why SMS appear to be more abundant in matrix lands than in riparian reserves adjacent to matrix lands. However, the sample size was small (N = 9) and might not be conclusive.

In the Federal 2001 Survey and Manage annual species review for SMS, the panel of specialists and managers from the BLM, USFS, USFWS, and the Pacific Northwest Research Station compiled existing information and determined that further pre-disturbance surveys would not be necessary north of the Siskiyou Crest, because of the large number of known sites already protected in the northern range (including Oregon). It was determined that the level of rarity of SMS would not be affected by discontinuing pre-disturbance surveys or by the loss of some undiscovered sites. High priority sites for this species would continue to be managed to provide suitable habitat for SMS. High priority sites, generally, will be those needed to maintain well-distributed populations across the known range of the species on Federal lands and to avoid a trend towards listing under the Federal ESA. Approximately 110 such sites have been identified so far (Clayton 2004b pers. comm.). Whereas protection was decreased to the north, the Federal panel decided that no change in protection of the species was warranted south of the Siskiyou Crest. High-priority sites would continue to be identified through surveys and managed to provide for reasonable assurance of species persistence south of the crest. Until high-priority sites were identified, all known sites were to be managed south of the Siskiyou Crest.

If the Commission decides to remove SMS from the list of State threatened species, the USFS, BLM and USFWS will likely take that action into account as these agencies make their respective future decisions regarding treatment as a sensitive species or listing under the Federal ESA. Though the outcome of such consideration cannot be predicted it is worth noting that State listing as threatened or endangered is not a prerequisite for USFS or BLM listing as Sensitive. For example, Del Norte and Southern Torrent salamanders are both listed as Sensitive species by the USFS though neither is State-listed as threatened or endangered. Federal (i.e., USFS) lands account for 90% of the currently known range in California and almost all activities which can disturb SMS habitat on Federal lands are not subject to any of the requirements of CESA, including the prohibition on take. The principal application of the Commission's decision in this matter will apply to 10% of the currently known range.

In June 2004, a petition was filed for SMS to be emergency listed as threatened or endangered under the Federal ESA (Greenwald 2004). The petitioners cite the elimination of the Survey and Manage

Program in March of 2004 and its associated protection of SMS and its habitats as the main reason for filing. The 30-day finding for this petition from the USFWS concluded that there is no imminent threat to the species that would warrant an emergency listing (USDI Fish and Wildlife Service 2004).

The USFWS was subsequently sued by the petitioners and issued a 90-day finding in the Federal Register on April 25, 2006 (USFWS 2006). The USFWS determined that although timber harvesting and wildfire may reduce the suitability of habitat for SMS, these factors do not extirpate SMS populations. Timber harvesting on Federal lands has declined significantly within the range of SMS and the USFWS expects the rate to remain at or near the present rate (USFWS 2006). Based on their review, the USFWS determined that listing of SMS as threatened or endangered under the Federal ESA was not warranted. The USFWS and USFS are currently developing a conservation strategy for SMS and the Scott Bar salamander on Federal lands south of the Siskiyou Crest in order to preclude future listing under the Federal ESA. A draft conservation strategy has been developed for SMS north of the Siskiyou Crest and Oregon, but has yet to be approved and implemented.

During this time, a coalition of environmental and conservation groups filed suit against the Departments of Agriculture and Interior challenging the decision to eliminate the Survey and Manage program. On August 1, 2005, a judge found the Federal agencies deficient in three areas. On January 9, 2006, the 2004 Record of Decision was set aside and the January 2001 Record of Decision was reinstated, including any amendments or modifications to the 2001 ROD that were in effect as of March 21, 2004. To address the deficiencies identified, the agencies are preparing a supplement to the 2004 Final Supplemental Environmental Impact Statement (SEIS) to Remove or Modify the Survey and Manage Mitigation Measure Standards and Guidelines (January 2004) and plan to issue a new Record of Decision in March 2007 (USDI Bureau of Land Management 2005).

Data from 1994 satellite imagery (Fox 1997) indicate that approximately 34,850 acres were in areas with functional late seral condition (i.e. used modified CWHR Size Class 5 as a proxy) in 1994 on Federal lands and are found in all LMP types.

Private Lands

Timber harvesting on private land in California is governed primarily by the Z'Berg-Nejedly Forest Practice Act (Pub. Resources Code, § 4511 et seq.) and the Forest Practice Rules (Cal. Code Regs., tit. 14, § 895 et seq.). Approval of THPs by the California Department of Forestry and Fire Protection (CDF) pursuant to these provisions of state law is also subject to required environmental review under the California Environmental Quality Act (CEQA). Review of proposed THPs under CEQA is governed in the first instance by CDF's certified regulatory program in the Forest Practice Rules. (See generally Pub. Resources Code, § 21080.5; Cal. Code Regs., tit. 14, § 15251, subd. (a).)

When a THP is proposed within the range of SMS, consultation with the Department is required under the Forest Practice Rules. Where the proposed timber harvesting will result in "take" of SMS as defined by section 86 of the California Fish and Game Code, activities causing the proposed take are prohibited except as authorized by CESA. (See, e.g., Fish G. Code, §§ 2080, 2081, subd. (b).) As a matter of historic practice, CDF has conditioned approval of THPs on measures that avoid the potential for take of SMS. These measures render required take authorization from the Department unnecessary. State take authorization for SMS in the timber context has been limited as a result to circumstances involving scientific, educational and management purposes under California Fish and Game Code section 2081, subdivision (a). The once exception to the general rule and CDF's historic

practice is incidental take of SMS authorized by the Department under former Fish and Game Code section 2090 for the Elliot Fly THP (THP #2-95-015-SIS).

To assure compliance with California Fish and Game Code section 2080, and based upon current information about SMS, the Department considers all suitable habitat (rocky/talus patches covering at least 25% of the surface area) within the known range of SMS to be occupied unless surveys, conducted according to protocol, indicate otherwise. When potentially suitable habitat is present within a proposed THP, the project proponent consults with the Department. In this process the Department specifies measures necessary to avoid incidental take. These measures include prohibitions on timber harvesting operations where SMS or suitable habitat is present. Buffer zones are established around the habitat (15m/50feet or 30.5m/100 feet, depending on silvicultural methods) where heavy equipment is excluded and canopy must be maintained at or above the canopy present within the habitat areas. To avoid take of SMS in buffer zones, restrictions limit operations to dry, hot periods when SMS are not active near the surface of the ground. This is because SMS usually are active near the surface in the spring and fall, when temperatures are low and humidity is high. SMS retreat below the surface into talus when conditions are not suitable. If SMS are observed at or near the surface anywhere in the THP area when conditions are otherwise being met to conduct operations, the operations halt immediately and do not resume without first consulting the Department. These measures protect and maintain suitable habitat.

Recent information indicates that SMS occupy a wide range of sites, including both disturbed and undisturbed sites with low canopy cover. In terms of "old growth" habitat potentially subject to private timber harvesting, there are approximately 20 acres combined reported from Fruit Growers Supply Company and Timber Products Company (these companies own 66% of the private timberlands) within the range of SMS mapped as CWHR 5M[25] or greater. Data from 1994 satellite imagery (Fox 1997) indicate that approximately 1,970 acres of private timberlands were in areas with functional late seral condition (i.e., used modified CWHR Size Class 5 as a proxy) in 1994. The extent, if any, of habitat for SMS in these stands is not known.

Conclusions/Recommendations

The Department believes there is sufficient scientific information to indicate delisting of SMS by the Commission under CESA is warranted. Available information indicates the continued existence of SMS is no longer threatened, that SMS is not likely to become an endangered species as defined by California law in the foreseeable future absent special protection and management afforded by CESA, and that SMS is not in serious danger of becoming extinct throughout all or a significant portion of its range. The Department recommends as a result that the Commission determine the petitioned action is warranted.

In determining whether the petitioned action is warranted, the Commission's decision is governed by provisions in CESA set forth in the California Fish and Game Code and, specifically, section 670.1, subdivision (i)(1)(B), of Title 14 of the California Code of Regulations. Under this section of the Code of Regulations, a species may be delisted under CESA as an endangered or threatened species if the

[25] CWHR size class 5M stands are dominated by trees ≥ 24.0" diameter at breast height (dbh) with a moderate canopy closure (40.0 to 59.9%). CWHR 5D size class stands are dominated by trees ≥ 24.0" dbh with a dense canopy closure (≥ 60.0%). CWHR size class 6 is a multilayered stand with a distinct layer of size class 5 trees over a distinct layer of size class 4 (12.0-23.99-inches) and/or 3 trees (<12.0-inches) with a dense canopy closure (≥ 60.0%).

Commission determines the species' continued existence is no longer threatened by any one or any combination of the following factors:

1. Present or threatened modification or destruction of its habitat;
2. Overexploitation;
3. Predation;
4. Competition;
5. Disease; or
6. Other natural occurrences or human-related activities.
   (See Cal. Code Regs., tit. 14 § 670.1, subd. (i)(1)(A).)

Section 2062 of the California Fish and Game Code defines an endangered species as one "which is in serious danger of becoming extinct throughout all, or a significant portion, of its range due to one or more causes, including loss of habitat, change in habitat, overexploitation, predation, competition, or disease." A threatened species, as defined by section 2067, is a species "that, although not presently threatened with extinction, is likely to become an endangered species in the forseaable future in the absence of the special protection and management efforts required by [CESA]."

The Commission will base its decision regarding the petitioned action on the Department's Status Report, other scientific reports or information submitted to the Commission related to the proposed delisting, and any other relevant public comments, submissions, or other information it receives prior to a final decision under CESA. (See generally Fish & G. Code, § 2075.5.)

Alternatives to the Petioned Action

The alternative to the petioned action is to decline to remove the species from the list of threatened species.

Determine Delisting of SMS under CESA is Not Warranted

If the Commission determines delisting is not warranted, SMS will remain a threatened species in California under CESA. With that result, "take" of SMS as defined by section 86 of the California Fish and Game Code will continue to be prohibited, except as authorized by CESA. Likewise, as state and local agencies approve discretionary projects subject to CEQA, those agencies will continue to be subject to the requirement that all project related significant impacts on the species are avoided or substantially lessened to the extent feasible. The Department, in turn, as the State's trustee for fish and wildlife resources, will review and comment on impacts to SMS, and recommend mitigation measures to address those impacts under CESA and CEQA.

In the absence of a delisting decision by the Commission, the Department would continue to participate in studies to improve the knowledge about this species. The Department would continue to work with various federal agencies and private timberland owners to collect data on SMS.

Suggestions for Future Management

The Department has considered whether designation of SMS as a State species of special concern is warranted, absent listing as a threatened species, and concluded the criteria for such listing are not

met. Species of Special Concern status applies to animals not listed under the Federal ESA or CESA, but which nonetheless: 1) are declining at a rate that could result in listing, or 2) historically occurred in low numbers and known threats to their persistence currently exist. Species of special concern share one or more of the following criteria:

1. occur in small, isolated populations or in fragmented habitat, and are threatened by further isolation and population reduction;

2. show marked population declines. Population estimates are unavailable for the vast majority of taxa. Species that show a marked population decline, yet are still abundant, do not meet the Special Concern definition, whereas marked population decline in uncommon or rare species is an inclusion criterion;

3. depend on a habitat that has shown substantial historical or recent declines in size. This criterion infers the population viability of a species based on trends in the habitats upon which it specializes. Coastal wetlands, particularly in the urbanized San Francisco Bay and south-coastal areas, alluvial fan sage scrub and coastal sage scrub in the southern coastal basins, and arid scrub in the San Joaquin Valley, are examples of California habitats that have seen dramatic reductions in size in recent history. Species that specialize in these habitats generally meet the criteria for Threatened or Endangered status or Special Concern status;

4. occur only in or adjacent to an area where habitat is being converted to land uses incompatible with the animal's survival;

5. have few California records, or which historically occurred here but for which there are no recent records; and

6. occur largely on public lands, but where current management practices are inconsistent with the animal's persistence.

None of these criteria currently apply to SMS.

The Department further believes that no special management provisions or protections under the CEQA or Forest Practice Rules are necessary to conserve this species.

The Department proposes to enter into an initial five year program in collaboration with private forest landowners to document and report on the response of SMS to timber operations. At, or before, the conclusion of this effort the Department may elect to extend the work further in time if necessary to document longer term response by SMS to disturbance.

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C. Contact Information

i. Bettaso, Jaime. US Fish and Wildlife Service. 1655 Heindon Road. Arcata, CA 95521. 707. 822.7201.
ii. Bull, Jennifer. Department of Fish and Game. 303 South Street, Yreka, CA 96097. 530.842.0805.
iii. Clayton, Dave. USDA Forest Service. Rogue-Siskiyou National Forest. 333 West 8th Street, Medford, OR 97501. 541.858.2276.
iv. Cuenca, Sam. USDA Forest Service. Klamath National Forest, Scott River Ranger District. 1312 Fairlane Road, Yreka, CA 96097. 530.468.5351.
v. Diller, Lowell. Green Diamond Resource Company. P.O. Box 68, Korbel, CA 95550. 707.668.3709.
vi. Farber Stu. Timber Products Company. P.O. Box 766. Yreka, CA 96097. 530.842.2310.
vii. Klug, Rich. Roseburg Forest Products. 98 Mill, Weed, CA 96094. 530.938.5729. Formerly of Fruit Growers Supply Company.
viii. Mead, Louise. The Shaffer Lab. Section of Evolution & Ecology. University of California, Davis. One Shields Avenue, Davis, CA 95616. 530.752.2939.
ix. Nauman, Richard and Dede Olson. USDA Forest Service. Pacific Northwest Research Station. 3200 SW Jefferson Way, Corvallis, OR 97331. 541.750.7250.
x. Wake, David. University of California, Berkeley. Museum of Vertebrate Zoology. 3101 Valley Life Science Building #3160, Berkeley, CA 94720. 510.642.3567.

xi. Welsh, Hartwell and Don Ashton. USDA Forest Service. Pacific Southwest Research Station. Redwood Sciences Laboratory. 1700 Bayview Drive, Arcata, CA 95521. 707.825.2956.

xii. West, Karen. USDA Forest Service. Klamath National Forest. 1312 Fairlane Road, Yreka, CA 96097. 530.842.6131.

xiii. Woodbridge, Brian. US Fish and Wildlife Service. 1833 S. Oregon Street. Yreka, CA 96097. 530.842.5763.

Appendix A1

Public Notification and
Solicitation of Information Relating to the
Siskiyou Mountains Salamander
Petition to Delist

March 28, 2006

State of California – The Resources Agency ARNOLD SCHWARZENEGGER, Governor
DEPARTMENT OF FISH AND GAME
http://www.dfg.ca.gov

March 28, 2006

Dear Landowner or Interested Party:

As a landowner or interested party, attached for your information is a public notice regarding the Siskiyou Mountains salamander (*Plethodon stormi*).

If you have any questions, please contact Mr. Mark Stopher, Habitat Conservation Program Manager, by telephone at 530.225.2300 or by sending an electronic mail request to SMSrecord@dfg.ca.gov.

Sincerely,

Donald B. Koch
Regional Manager
Northern California-North Coast Region

Attachment

PUBLIC NOTICE

TO WHOM IT MAY CONCERN:

Pursuant to Section 2074.4 of the California Fish and Game Code (FGC), **NOTICE IS HEREBY GIVEN** that on August 18, 2005, the California Fish and Game Commission (Commission) received a petition from the Department of Fish and Game (Department) to amend the official State list of endangered and threatened species (Section 670.2, 670.5, Title 14, California Code of Regulations) as follows:

Species	Proposal
Siskiyou Mountains salamander (*Plethodon stormi*)	Delist as Threatened

The California Endangered Species Act (FGC, Chapter 1.5, Section 2050 *et seq.*) requires that the Department notify affected and interested parties that the Commission has accepted the petition for the purpose of receiving information and comments that will aid in evaluating the petition and determining whether or not the above proposal should be adopted by the Commission. The Commission's September 30, 2005, action does not change the species current status of "threatened." Notice of the Commission's designation of the species as a candidate for delisting appeared in the October 14, 2005, Notice Register. The Department has 12 months to review the petition, evaluate the available information, and report back to the Commission whether the petitioned action is warranted (FGC 2074.6). The Department's recommendation must be based on the best scientific information available to the Department.

Therefore, **NOTICE IS FURTHER GIVEN** that anyone with data or comments on the petition, taxonomic status, ecology, biology, life history, management recommendations, distribution, abundance, threats, habitat that may be essential for the species, or other factors related to the status of the above species, is hereby requested to provide such data or comments in writing to:

SMS Status Report
Attn: Sharon Hope
Department of Fish and Game
601 Locust Street
Redding, CA 96001

or by electronic mail to SMSrecord@dfg.ca.gov

The petition can be accessed at: http://www.dfg.ca.gov/hcpb/whatsnew/whatsnew.shtml.

Responses received by June 30, 2006, will be included in the Department's final report to the Commission. If the Department concludes that the petitioned action is warranted, it will recommend that the Commission adopt the proposal. If the Department

concludes that the petitioned action is not warranted, it will recommend that the Commission not adopt the proposal. Following the receipt of the Department's report the Commission will allow a 30-day public comment period prior to taking any action on the Department's recommendation.

To assist in making a final decision later this year, the Department will be preparing a Status Report for the Commission. The Department will also prepare an Environmental Document to identify any potentially significant impacts which may result from delisting. The Department has prepared a Notice of Preparation and Initial Study in accordance with the California Environmental Quality Act. These documents are available by sending an electronic mail request to SMSrecord@dfg.ca.gov or by calling 530.225.2720. A Public Scoping Meeting to accept suggestions for the content of the Environmental Document has been scheduled at the Department office located at 601 Locust Street in Redding, CA on April 6, 2006, from 1:00 P.M. to 3:00 P.M.

Donald Koch, Regional Manager
Northern California-North Coast Region

Appendix A2

Affected and Interested Parties
Notified by the
Department of Fish and Game

March 28, 2006

George Arnold
Bureau of Land Management
Medford District Office
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Medford, OR 97504

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Ecosystem Science Center
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Corvallis, OR 97331

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US Forest Service
Rogue River-Siskiyou National Forest
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Medford, OR 97501

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Criss & Company Consultants
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Weed, CA 96094

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US Forest Service
Scott River Ranger District
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Olympia, WA 98502

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Hilt, CA 96044

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Sierra Club
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Sacramento, CA 95814

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US Fish and Wildlife Service
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Scott River Watershed Council
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Etna, CA 96027

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University of Michigan
Museum of Zoology
2017 Museums, 1079
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Dr. Dede Olson
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Corvallis, OR 97331

Glenn Olson
Audubon California
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Sacramento, CA 95825

Felice Pace
Klamath Forest Alliance
P.O. Box 21
Orleans, CA 95556

Jennifer Sawada
American Lands Alliance
726 7th Street, SE
Washington, D.C. 20003

Lisa Shelton
Siskiyou Regional Education Project
9335 Takima Road
Cave Junction, OR 97523

Deanna Spooner
Pacific Rivers Council
P.O. Box 10798
Eugene, OR 97440

Joseph Vaile
Klamath-Siskiyou Wildlands Center
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Dr. Dave Wake
University of California Berkeley
Museum of Vertebrate Zoology
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Berkeley, CA 94720-3160

Jay Ward
Oregon Natural Resources Council
5825 North Greeley
Portland, OR 97217-4145

Dr. Hartwell H. Welsh, Jr
US Forest Service
Redwood Sciences Laboratory
1700 Bayview Drive
Arcata, CA 95521

Dave Wemtz
Conservation Northwest
1208 Bay Street #201
Bellingham, WA 98225-4301

Catherine Kuhlman, Executive Director
North Coast Regional Water Quality
Control Board
5500 Skylane Blvd, Suite A
Santa Rosa, CA 95403

Bill Snyder, Deputy Director
Resource Management
Department of Forestry and Fire Protection
1416 Ninth Street
P.O. Box 944246
Sacramento, CA 94244-2460

Siskiyou County Administrative Officer
201 Fourth Street
Yreka, CA 96097

Karen West
US Forest Service
Klamath National Forest
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Yreka, CA 96097
Peter Yolles

The Nature Conservancy
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San Francisco, CA 94105

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Eureka, CA 95502

Environmental Protection Information
Center
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Garberville CA 95542

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Hilt, CA 96044

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Pacific Northwest Research Station
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Richard Klug
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Bob Carey
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Redding, CA 96001

Lou Folden
6321 Rio Blanco Drive
Rancho Murieta. CA 95683

Appendix A3

Newspapers that published the
Siskiyou Mountains Salamander
Legal Notice
on
March 28-31, 2006

The Times-Standard
Record Searchlight
The Siskiyou Daily News

PROOF OF PUBLICATION

(2015.5 C.C.P.)

STATE OF CALIFORNIA
County of Humboldt

I am a citizen of the United States and a resident of the County aforesaid; I am over the age of eighteen years, and not a party to or interested in the above-mentioned matter. I am the principal clerk of the printer of THE TIMES-STANDARD, a newspaper of general circulation, printed and published daily in the City of Eureka, County of Humboldt, and which newspaper has been adjudged a newspaper of general circulation by the Superior Court of the County of Humboldt, State of California, under the date of June 15, 1967, Consolidated Case Numbers 27009 and 27010; that the notice, of which the annexed is a printed copy (set in type not smaller than nonpareil), has been published in each regular and entire issue of said newspaper and not in any supplement thereof on the following dates, to-wit,

March 29, 30

All in the year 2006

I certify (or declare) under penalty of perjury that the foregoing is true and correct.

Dated at Eureka, California,

this 30th day of March, 2006

Helma McFarland
Signature

This space for filing stamp

PUBLIC NOTICE

TO WHOM IT MAY CONCERN:

Pursuant to Section 2074.4 of the California Fish and Game Code (FGC), NOTICE IS HEREBY GIVEN that on August 16, 2006, the California Fish and Game Commission (Commission) received a petition from the Department of Fish and Game (Department) to amend the official State list of endangered and threatened species (Section 670.5, Title 14, California Code of Regulations) as follows:

Species
Siskiyou Mountains salamander
(*Plethodon stormi*)

Proposal
Delist as Threatened

The California Endangered Species Act (FGC, Chapter 1.5, Section 2050 et seq.) requires that the Department notify affected and interested parties that the Commission has accepted the petition for the purpose of receiving information and comments that will aid in evaluating the petition and determining whether or not the action proposed should be adopted by the Commission. The Commission's adopted September 30, 2005, action does not change the species' current status or "listedness." Notice of the Commission's designation of the species as a candidate for delisting appeared in the October 14, 2005, Notice Register. The Department has 12 months to review the petition, work up the available information, and report back to the Commission whether the petitioned action is warranted (FGC 2074.6). The Department's recommendation must be based on the best scientific information available to the Department.

Therefore, NOTICE IS FURTHER GIVEN that anyone with data or comments on the petition taxonomic status, ecology, biology, life history, management, status, recommendations, distribution, abundance, threats, habitat that may be essential for the species, or other factors related to the status of the above species, is hereby requested to provide such data or comments in writing to:

SMS Status Report
Attn. Sharon Hope
Department of Fish and Game
601 Locust Street
Redding, CA 96001

or by electronic mail to
SMSstatus@dfg.ca.gov.

The petition can be accessed at: http://www.dfg.ca.gov/licensing/wildlife/smsstatus.html.

Responses received by June 30, 2006, will be included in the Department's final report to the Commission. If the Department concludes that the petitioned action is warranted, it will recommend that the Commission accept the proposal. If the Department concludes that the petitioned action is not warranted, it will recommend that the Commission not accept the proposal. Following the receipt of the Department's report the Commission will allow a 30-day public comment period prior to taking any action on the Department's recommendation.

To assist in making a final decision later this year, the Department will be preparing a Status Report for the Commission. The Department will also prepare an Environmental Document to identify any potentially significant impacts which may result from delisting. The Department has prepared a Notice of Preparation and Initial Study in accordance with the California Environmental Quality Act. These documents are available by sending an electronic mail request to SMSscoping@dfg.ca.gov or by calling 530.225.2320. A Public Scoping Meeting to accept suggestions for the content of the Environmental Document has been scheduled at the Department office located at 601 Locust Street in Redding, CA on April 5, 2006, from 1:00 P.M. to 3:00 P.M.

Dennis Kosh, Regional Manager
Northern California North Coast Region
3/29, 30

In the Superior Court of the State of Cal.
in and for the County of Shasta

CERTIFICATE OF PUBLICATION
RECORD SEARCHLIGHT

NO CALIF DEPT OF FISH AND GAME
601 LOCUST ST
REDDING CA 96001

REFERENCE: 00601925
6420915 PUBLIC NOTICE TO WHOM

State of California
County of Shasta

I hereby certify that the Record Searchlight is a newspaper of general circulation within the provisions of the Government Code of the State of California, printed and published in the City of Redding, County of Shasta, State of California; that I am the principal clerk of the printer of said newspaper; that the notice of which the annexed clipping is a true printed copy was published in said newspaper on the following dates, to wit;

PUBLISHED ON: 03/30 03/31

FILED ON: 03/31/06

I certify under penalty of perjury that the foregoing is true and correct, at Redding, California on the above date.

RECORD SEARCHLIGHT
1101 Twin View Blvd, Redding, CA 96003

AFFIDAVIT OF PUBLICATION

DEPARTMENT OF FISH AND GAME
NO. CAL - NORTH COAST REGION
601 LOCUST STREET
REDDING, CA 96001

IN THE MATTER OF

PUBLIC NOTICE

STATE OF CALIFORNIA } ss:
County of Siskiyou }

[illegible]

of said County, being duly sworn, deposed and says: THAT she is and at all times herein mentioned was a citizen of the United States of America, over the age of twenty-one years, and that she is not, nor was she at any of the times hereinafter named, a party to, nor interested in the above entitled matter; that she is the PRINCIPAL CLERK OF THE PRINTER of THE SISKIYOU DAILY NEWS, a newspaper of general circulation, printed and published in the City of Yreka, County of Siskiyou, State of California, and which newspaper is published for the dissemination of local and telegraphic news and intelligence of a general character, and which newspaper [illegible] has a bona fide subscription list of paying subscribers, and which newspaper has been established, printed and published at regular intervals in the said City of Yreka, County of Siskiyou, State of California, for a period exceeding one year next preceding the date of publication of the notice hereinafter referred to, and which newspaper is not devoted to the publication of [illegible] interests, entertainment or instruction of a particular class, profession, trade, calling, race or denomination or any number of same; that the notice, of which the annexed is a printed copy, has been published in each regular and entire issue of said newspaper and not in any supplement thereof, on the following dates, to-wit:

MARCH 28, 31, 2006

Siskiyou Daily News [illegible] May [illegible] 1952, No. 15[illegible]

I certify (or declare) under the penalty of perjury that the foregoing is true and correct.

(Signed) [illegible signature]

Date: 3-31-06

PUBLIC NOTICE
TO WHOM IT MAY CONCERN:

Pursuant to Section 2074.4 of the California Fish and Game Code (FGC), NOTICE IS HEREBY GIVEN that on August 18, 2005, the California Fish and Game Commission (Commission) received a petition from the Department of Fish and Game (Department) to amend the official State list of endangered and threatened species (Section 670.5, [illegible], Title 14, California Code of Regulations) as follows:

Species
Siskiyou Mountains salamander
(Plethodon stormi)
Proposal
Delist as Threatened

The California Endangered Species Act (FGC, Chapter 1.5, Section 2050 et seq.) requires that the Department notify affected and interested parties that the Commission has accepted the petition for the purpose of receiving information and comments that will aid in evaluating the petition and determining whether or not the above proposal should be adopted by the Commission. The Commission's September 30, 2005, action does not change the species current status of "threatened." Notice of the Commission's designation of the species as a candidate for delisting appeared in the October 14, 2005, Notice Register. The Department has 12 months to review the petition, evaluate the available information, and report back to the Commission whether the petitioned action is warranted (FGC 2074.6). The Department's recommendation must be based on the best scientific information available to the Department.

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SMS Status Report
Attn: [illegible]
Department of Fish and Game
601 Locust Street
Redding, CA 96001

or by electronic mail to [illegible].

The petition can be accessed at [illegible].

Responses received by June 30, 2006, will be included in the Department's final report to the Commission. If the Department concludes that the petitioned action is warranted, it will recommend that the Commission adopt the proposal. If the Department concludes that the petitioned action is not warranted, it will recommend that the Commission not adopt the proposal. Following the receipt of the Department's report the Commission will allow a 30-day public comment period prior to taking any action on the Department's recommendation.

To assist in making a final decision later this year, the Department will be preparing a Status Report for the Commission. The Department will also prepare an Environmental Document to identify any potentially significant impacts which may result from delisting. The Department has prepared a Notice of Preparation and Initial Study in accordance with the California Environmental Quality Act. These documents are available by sending an electronic mail request to [illegible] or by calling 530.225.2020. A Public Scoping Meeting to accept suggestions for the content of the Environmental Document has been scheduled at the Department office located at 601 Locust Street in Redding, CA on April 8, 2006 from 1:00 P.M. to 3:00 P.M.

Donald Koch, Regional Manager
Northern California North Coast Region
News [illegible] Pub Mar 28, 31, 2006

Appendix B

Summary of Results
from the
Department's 2003 Field Surveys

Department of Fish and Game
Siskiyou Mountains Salamander
Site Information Form

Observers: _____ USDA/Company Site ID: _____

Org./Phone # _____ Latitude* N-_____

Date: _____ Longitude* W-_____

Photo #s *

0° _____

90° _____

180° _____

270° _____

1. CHARACTERIZATION FOR ENTIRE 1/10-ACRE PLOT

Site Description

% Slope* _____

Azimuth* _____

Elevation* _____

CWHR* _____

BA hwd* _____

BA cfr*

Percent Cover*

Rock ≥1”	
Moss/Lichen	
Leaf Litter	
Slash*	
Medium Logs*	
Large Logs*	
Grasses/Forbs	
Understory*	
Overstory*	%

Rock Composition*

Bare Soil <1/16”	%
Gravel 1/16 – 1”	%
Pebble 1 – 2.5”	%
Cobble 2.5 – 10”	%
Boulder > 10”	%
Total	100 %

% Cover

0 – 0%

1 – 1-25%

2 - 25-50%

3 – 50-75%

4 – 75-100%

2. OBSERVED DISTURBANCE WITHIN 1/10-ACRE PLOT

Disturbance

☐ Landslide ☐ Skid Trail ☐ Road ☐ None

☐ Fire ☐ Timber Harvest ☐ Mining

Evidence of Fire

☐ Charred Brush* ☐ Charred Log* ☐ Catface Tree*

Timber Harvest

Year ☐Pre-1974 ☐_____ ☐_____

Silviculture* _____ _____ _____

Silviculture Intensity(Basal Area Removed)

☐ Unknown ☐ Low (<10%) ☐ Moderate (10-50%) ☐ High (>50%)

Soil Disturbance

☐ 0% ☐1%-25% ☐ 25%-50% ☐ 50%-75% ☐75%-100%

Overstory Hits/Misses

C _____

N _____

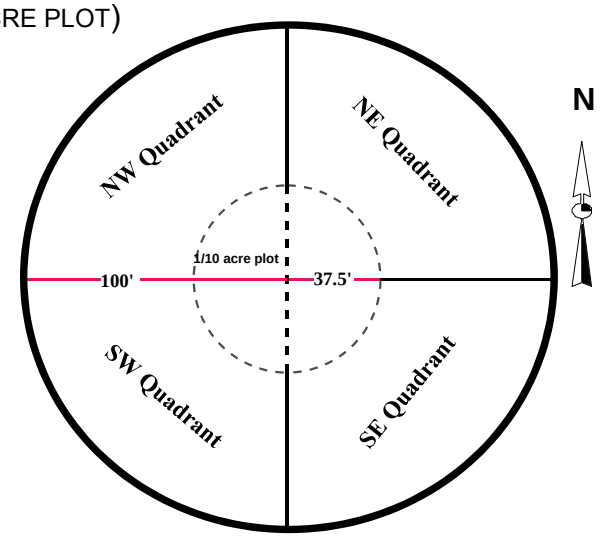
E _____

S _____

W _____

3. OBSERVED WITHIN 100-FOOT (OUTSIDE 1/10 –ACRE PLOT) QUADRANT AREA*

	NE	SE	SW	NW
Landslide	☐	☐	☐	☐
Skid Trail/Landing	☐	☐	☐	☐
Road	☐	☐	☐	☐
Fire	☐	☐	☐	☐
Timber Harvest (pre-'74)	☐	☐	☐	☐
Timber Harv. (post-'74)	☐	☐	☐	☐
Mining	☐	☐	☐	☐
SMS Habitat*	☐	☐	☐	☐



Conifers		Hardwoods		Conifers		Hardwoods	
Species	DBH	Species	DBH	Species	DBH	Species	DBH

Comments

INSTRUCTIONS

EQUIPMENT LIST

clinometer
compass
gps unit
site tube
biltmore stick
range finder
camera
data sheets
pencils
100-foot (minimum) tape
flagging

- **Ocular Estimates:** Use a 1/10-acre plot (37.5' radius) to summarize characterization and disturbance information. It may be useful to: 1) partition the plot into four artificial quadrants, 2) assess each quadrant, 3) then record the sum total.
- **Lat/Long:** Using a gps unit, mark the plot center as a waypoint. The plot center is where the 1st animal was captured. If this is not known, then the plot center should be the best estimate of 1st capture. Name the waypoint identical to the "DFG Database Site #" located in the upper right-hand corner. Record the Lat/Long information on the datasheet.
- **Photos:** From the center of the plot, use a digital camera to take photos at eye level. Take a photo in each cardinal direction and record the photo number in the space provided. Photos should be saved on a hard drive and labeled by "DFG Database Site #_direction". You may submit the storage card with the site forms if you wish.
- **% Slope:** Using a clinometer from the center of the plot, take one slope reading facing uphill and another reading facing downhill. Average the two readings and record that number in the space provided.
- **Azimuth:** Use a compass to record the aspect in degrees. Make sure the declination on the compass is set at 17° East (clockwise).
- **Elevation:** Record the elevation from the gps unit.
- **CWHR:** Use CWHR for treed habitats. Remember, a montain conifer-hardwood (MCH) stand must have at least 1/3 conifers and at least 1/3 hardwoods representing the overstory. Place the C or H first based on the dominant overstory. See the definitions for size classes and canopy closures. A multi-layered size class (6) is a class 5 over another class.
- **Basal Area:** Measure the dbh for conifers (cfr) and hardwoods (hwd) using a biltmore stick. Record the species and dbh in the spaces provided on the back side of the site form. Trees must have a minumum dbh of 6".

- **Percent Cover:** Everything except “overstory” will be assigned a cover class code based on the chart on the right hand side of the site form. For example, if rock >1” is present in 50 – 75% of the plot, then it will be assigned a “3”. **Understory** is for trees and shrubs under the canopy. *Poison oak* is a shrub.
- **Overstory:** Using a site tube, record a hit or miss at five locations. These five locations include the center point (C), and at 37.5’ in each cardinal direction (N, E, S, W). Record a “1” for a hit, a “0” for a miss. Multiply the number of hits by 20, then record that number as a percentage in the space provided.
- **Rock Composition:** Rock composition is recorded as unique ocular estimates in percentage. The total will equal 100%.
- **Timber Harvest:** A Forest Service or Company employee may be able to provide this information in the field. Use the codes from the definitions section. This information may need to be documented using GIS analyses, personal contacts, etc.
- **100-foot Quadrant Area**: Record general disturbance and habitat information for each individual quadrant. This applies out to 100 feet from the 1/10-acre plot center **and** from outside edge of 1/10-acre plot.

DEFINITIONS

CWHR

size class	dbh	Canopy Closure	% Cover
1	< 1”	S	10 – 24.9%
2	1” – 5.9”	P	25 – 39.9%
3	6” – 10.9”	M	40 – 59.9%
4	11” – 23.9”	D	> 60%
5	> 24”		
6	Multi-layered		

Tree species

Tree species	Code		
Red fir	ABMA	Sugar pine	PILA
Lodgepole pine	PICO	Black oak	QUKE
White fir	ABCO	BigLeaf Maple	ACMA
Douglas fir	PSME	Madrone	ARME
Cedar	CADE		
Ponderosa pine	PIPO		
Live oak	QUCH		
White oak	QUGA		
Knobcone pine	PIAT		
Aspen	POTR		
Other	Write Name		

Percent Cover

Slash	1-10” (no length criteria)
Medium Logs	10-20” (no length criteria)
Large Logs	>20” (no length criteria)

Evidence of Fire

Charred Brush	Burned leaves and limbs indicating recent disturbance
Charred Log	Evidence of burning on down log indicating 5-10 year history
Catface Tree	A partially healed or grown-over wound on a tree stem resulting from fire. Indicates historic burn.

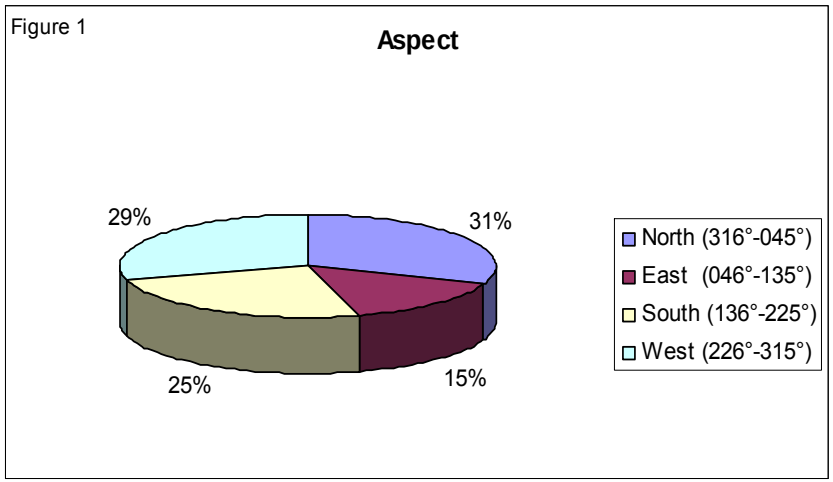
Silviculture

Unknown	Clear Cut(CC)
Commercial Thin(CT)	Seed Tree Step(STS)
Shelterwood(SW)	Seed Tree Removal(STR)
Selection(SN)	Conversion(CN)

SMS Habitat

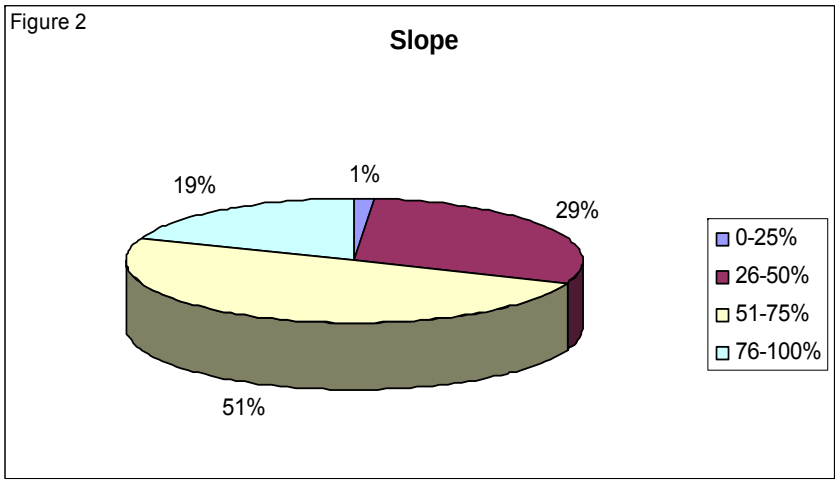
Sites occupied by SMS generally have a rock talus substrate with at least some cobble-sized rock that serve as cover objects.

Figure 1



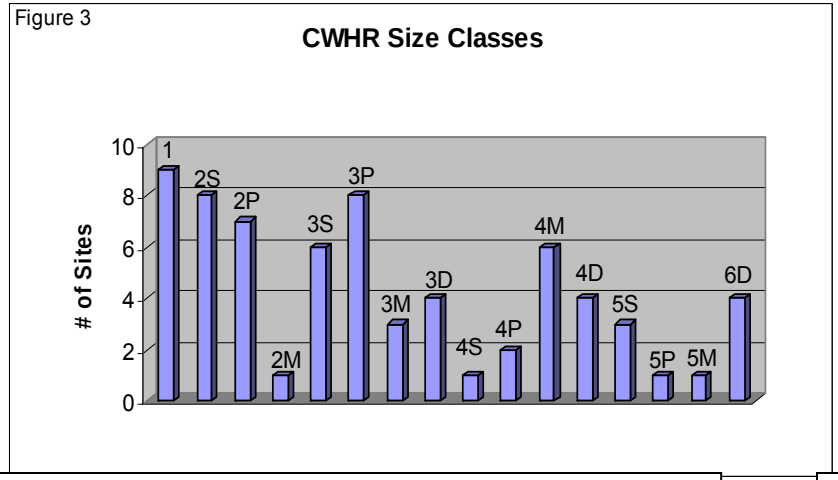
All aspects are represented.

Figure 2



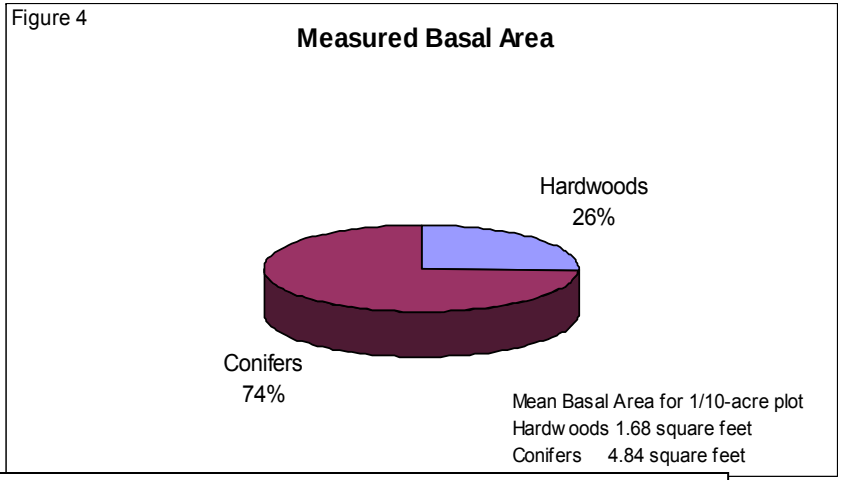
Seventy percent (70%) of the sites have a slope of 50% or greater (N=68).

Figure 3



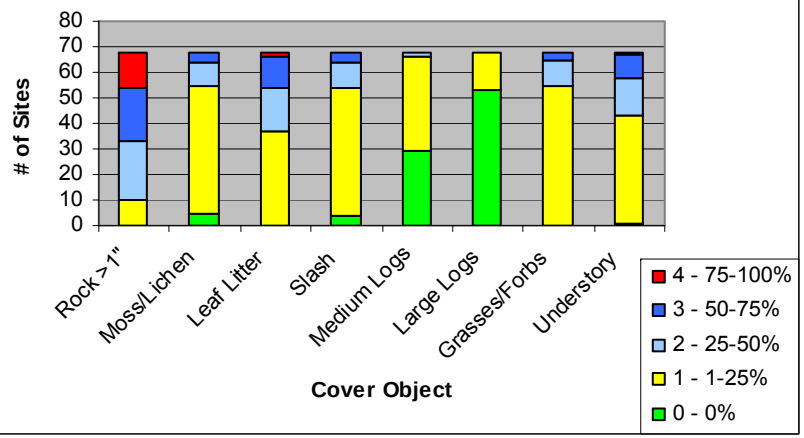
The majority (16 of 18) of CWHR tree size and canopy classes are represented among the 68 sites.

Figure 4



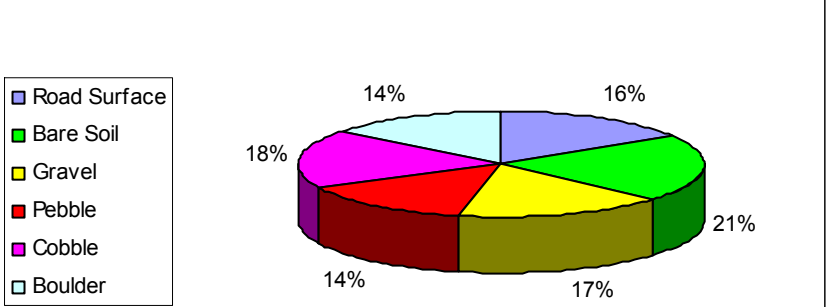
Conifers dominate the basal area at most sites. Hardwoods provided some or most of the cover at a

Figure 5



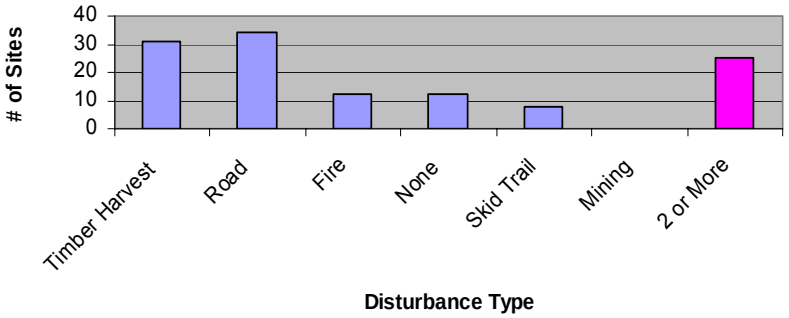
The percent cover of rock >2.54cm (1-inch) covering each plot was estimated at 50% or more at 35 sites.

Figure 6



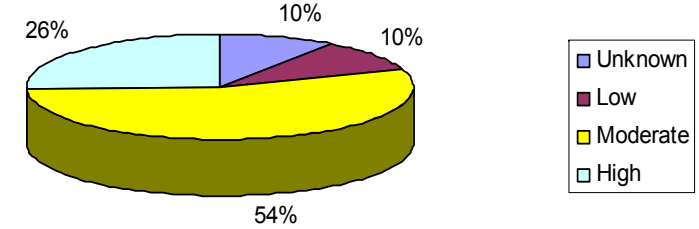
In each instance, the cover object where the first animal was detected was a cobble or boulder sized rock. Cobble and/or boulder-sized rock were visually estimated to be 32% of the rock surface cover at the 68 sites. Cobble and/or boulder-sized

Figure 7



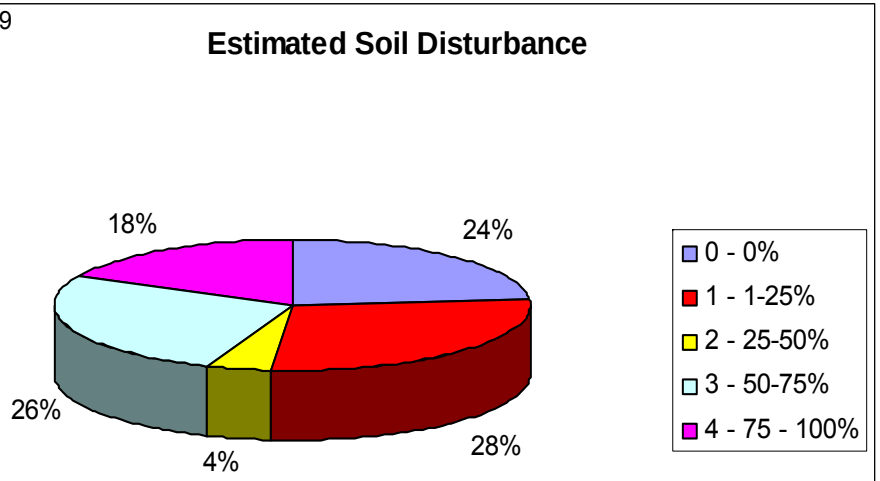
Evidence of timber harvest (i.e., tree stumps) was observed at 31 sites. Multiple types of disturbance were observed at 25 sites. No evidence of disturbance was found at 12 sites.

Figure 8



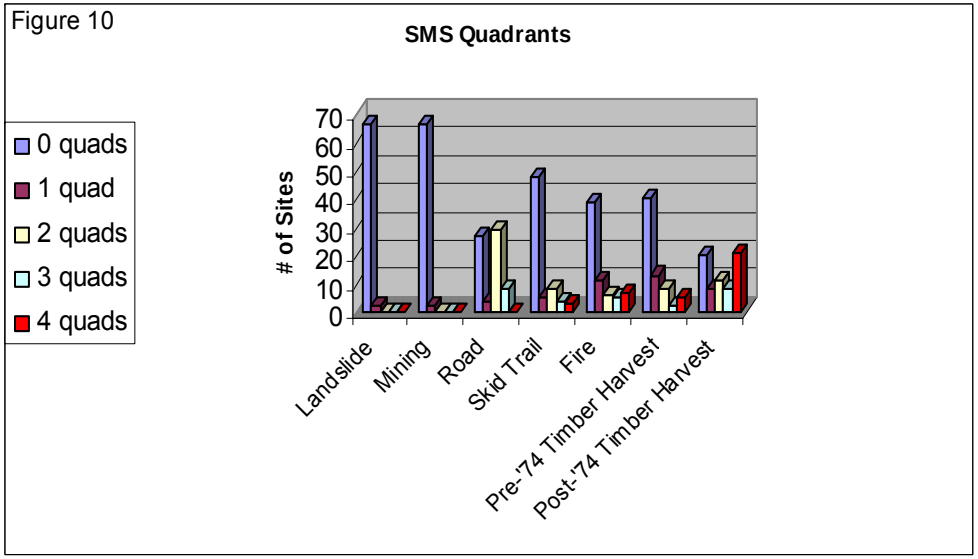
Moderate (10-50%) and high (>50%) basal area removal was estimated at 54% and 26% of the 68 sites, respectively.

Figure 9



Soil disturbance was 50% or greater at almost one-half (44%) of the sites.

Figure 10



Timber harvest has occurred in all 4 quadrants at 26 sites.

SMS habitat is available in all 4 quadrants at 50 sites.

sysno11_0.JPG

sysno11_90.JPG

sysno11_180.JPG

sysno11_270.JPG

sysno76_0.JPG

sysno76_90.JPG

sysno76_180.JPG

sysno76_270.JPG

sysno77_0.JPG

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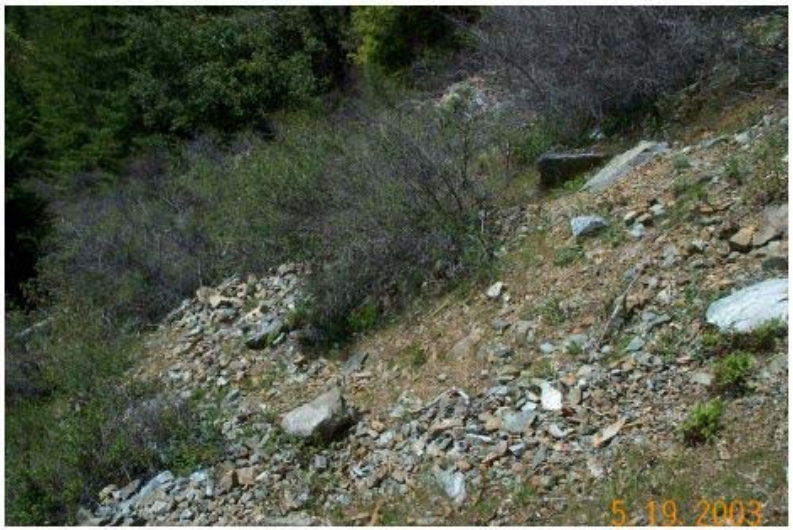
sysno269_90.JPG



sysno269_180.JPG

sysno269_270.JPG

sysno275_0.JPG

sysno275_90.JPG

sysno275_180.JPG

sysno275_270.JPG

sysno289_0.JPG

sysno289_90.JPG

sysno289_180.JPG

sysno289_270.JPG

	2003 Precanopy Survey Sites (X = Survey)															
	11**	46*	57*	76	77*	86**	91***	101	266*	269	275	278	289	130	139	143*	181*
Date																	
9-Apr-03						Snow		Snow									
11-Apr-03													Gate				
12-Apr-03																	
14-Apr-03		X					X		X								
17-Apr-03	X		X	X	X												
18-Apr-03																X	X
22-Apr-03		X	X						X								
24-Apr-03							X										
29-Apr-03	X			X	X				X	X							
30-Apr-03											X						
4-May-03											X						
12-May-03						Snow		Snow					X				
7-Nov-03				X	X												
10-Nov-03																X	X
17-Nov-03						X		Snow			X						

Not located

Not located

Not located

	North of Crest		South of Crest		California Precanopy	
	Survey Points	*Plethodon sp.*	Survey Points	*Plethodon sp.*	Survey Points	*Plethodon sp.*
Correlates Study	6	2	14	1	20	3
2003 Surveys	2	2	11	6	13	8

	S. of Crest
	N. of Crest
	P. stormi
	P. elongatus
	P. asupak

For the habitat correlates study, the Redwood Sciences Laboratory surveyed 20 precanopy sites in California between 1995 and 1998. *P. stormi* was detected in 2 of 6 sites north of the Siskiyou Crest, and 1 of 14 sites south of the Siskiyou Crest.

In 2003, DFG attempted to survey the 17 precanopy sites where *P. stormi* was not previously detected. Three sites could not be located and one was inaccessible due to snow. In the remaining 13 sites, *P. stormi* was detected in or near 5 sites, *P. elongatus* was detected near 1 site, and *P. asupak* was detected in or near 2 sites.

To date, *Plethodon sp.* have been detected in 11 of the 20 precanopy sites from the habitat correlates study within California.

* Found Flagging
** Found Stake
*** Found the stake at what DFG considers unsuitable habitat, containing unlayered rock on soil.

2003 SMS Survey Data Collected for the DFG Status Review

All plots surveyed have <30% canopy closure

Site #	Spring/Fall	Adult	Subadult	Juvenile
76*	Spring	1	2	3
	Fall	2	0	0
Sub-total		**3**	**2**	**3**
77*	Spring	2	1	0
	Fall	4	1	0
Sub-total		**6**	**2**	**0**
181*	Spring	1	1	1
	Fall	2	2	1
Sub-total		**3**	**3**	**2**
275*†	Spring	1	1	0
	Fall	0	2	3
Sub-total		**1**	**3**	**3**
143*	Spring	0	1	0
	Fall	0	1	1
Sub-total		**0**	**2**	**1**
Total		**13**	**12**	**9**
11†	Spring	2**	1	1
269	Spring	1	3	6
289***	Spring	2	0	0
Total		**5**	**4**	**7**
Grand total		**18**	**16**	**16**

* Timber harvest within 15 years

** 1 gravid female

*** *P. elongatus*

† *P. asupak*