Sierra Nevada Forest Plan
Monitoring Accomplishment Report for 2007

Sierra Nevada Forest Plan Implementation

In 2007 the Forest Service, Region 5, which includes California, Hawaii, Guam, and the Trust Territories of the Pacific Islands, continued several long term monitoring studies of significant wildlife species in the Sierra Nevada.

The studies focus on developing scientifically valid assessments of the status of several species and increasing understanding of how forest and rangeland management may affect species, ecosystems and processes over time under the management direction in the Sierra Nevada Forest Plan Amendment Record of Decision 2004 (SNFPA ROD).

Other websites that may be of interest:

www.fs.fed.us/r5/snfpa/

www.fs.fed.us/psw/

http://snamp.cnr.berkeley.edu/

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Willow Flycatcher Distribution and Demographic Study

Sierra Nevada Forest Plan Monitoring Accomplishment Report for 2007

Once common throughout the western United States, the willow flycatcher (*Empidonax traillii*) has been eliminated from much of its historical range. The willow flycatcher is a neotropical migratory bird that breeds in North America and migrates outside the continental United States during the non-breeding, winter season. In Central California the willow flycatcher raises its young in montane meadows. All three subspecies of willow flycatcher occurring in California were listed as state endangered birds by the California Department of Fish and Game in 1990. The southwestern willow flycatcher (*Empidonax traillii extimus*), found in the southwestern United States including the Kern and Owens River regions of southern California, was listed as federally endangered by United States Fish and Wildlife Service (USFWS) in 1995. Both *Empidonax traillii brewsteri* and *Empidonax traillii adastus* are currently designated sensitive species by Forest Service, Region 5 and are listed as species of concern by USFWS. Activity-related standards and guidelines for conserving willow flycatchers were developed and included in both the 2001 and 2004 SNFPA ROD.

Willow flycatcher (photo by Ivan Samuels).

Surveys indicating a declining population trend led to the initiation of a distribution and demographic study in the central and northern Sierra Nevada. The project is funded by the Forest Service, directed by Dr. Michael L. Morrison of Texas A&M University, and supervised by Heather Mathewson of University of Nevada, Reno.

To provide information needed by land managers to make management and restoration decisions, the primary objectives of the willow flycatcher study are to

1. determine the distribution of breeding willow flycatchers;
2. quantify reproductive success, recruitment, dispersal and survival of willow flycatchers in selected meadows; and
3. examine factors influencing demographic patterns through associated graduate research projects.

Accomplishments

During June through August 2007, we visited 44 sites to survey for and monitor territories of willow flycatchers. These sites include meadows south of Lake Tahoe and in the central Sierra Nevada north of Lake Tahoe. We have monitored breeding willow flycatchers at 14 of these 44 sites since 1998 and nine of these 14 sites currently support breeding willow flycatchers. We detected willow flycatchers at 64% of 44 visited sites.

In 2007 we monitored all breeding willow flycatchers at 10 occupied study sites. The number of territories at these same sites declined from 47 in 2006 to 34 in 2007. Sixty-six percent (n = 24) of the territories with females produced at least one or more young. Overall nesting success (Mayfield) was 46%, which was higher than the 34% in 2006 and lower than the 51% in 2005. Twenty-seven females produced 46 fledglings, based on the maximum estimate of the number of fledglings, so that fecundity (number of young per female) is 1.703. Three nests were parasitized by brown-headed cowbirds. Cowbirds parasitize nests by laying their eggs in the nest of another species thereby relying on the adult host species to raise the young to the detriment or even death of their own young.

Overall, the number of willow flycatcher territories in meadows we surveyed decreased in 2007. At Perazzo meadows, the number of territorial willow flycatchers declined this year. Nest success was higher this year than in the previous year. Nests failed primarily as a result of predation or brown-headed cowbird parasitism. Although cowbird parasitism does not appear to be a major factor for the decline in flycatchers Sierra wide, parasitism is negatively impacting flycatchers in some meadows. Overall the population in this region continues to decline. Over the next few years our research will focus on determining whether cowbird control is indicated, and if so, the specific locations and intensity of control indicated. Habitat restoration, primarily aimed at increasing meadow wetness, remains the priority goal for recovery of the willow flycatcher in the Sierra Nevada.

Amphibian Status and Trend Monitoring

Sierra Nevada Forest Plan Monitoring Accomplishment Report for 2007

The Yosemite toad (*Bufo canorus*) is endemic to the Sierra Nevada and the majority of the mountain yellow–legged frog (*Rana sierrae*, formerly *Rana muscosa*) range falls within the Sierra Nevada. Populations of both species have declined throughout the bioregion. Assessments from the mid–1990s found that both the Yosemite toad and mountain yellow–legged frog had disappeared from more than half the sites where they were known to occur historically (Jennings 1996). In a recent assessment the mountain yellow–legged frog had declined more than 93% (Vredenburg et al. 2007). Current population sizes for both species are thought to be small relative to historical numbers.

Yosemite toad male calling during spring breeding chorus.

Both species are candidates for listing as threatened or endangered by the United States Fish and Wildlife Service, species of special concern for California, and designated sensitive species by the Forest Service. Little quantitative data exist for these species, particularly for the Yosemite toad, to aid in conservation and management decisions.

Yosemite toad breeding area — they will breed in shallow water like this.

Both species are found in high elevation aquatic systems. The Yosemite toad is most commonly found in shallow, warm water areas like wet meadows, small ponds, and shallow grassy areas adjacent to lakes. The mountain yellow–legged frog is most commonly found in larger, deeper lakes that do not freeze during the winter because it remains a tadpole for more than a year. To date, preliminary habitat analysis from survey data collected by this study supports current knowledge of habitat associations for both species.

Yosemite toad breeding meadow in Highland Lakes Basin, Stanislaus National Forest.

The long–term, bioregional Sierra Nevada Amphibian Monitoring Program (SNAMPH) quantifies trends in population status (occupancy, abundance) and habitat quality across the range of each species in the Sierra Nevada (10 National Forests). This monitoring combines extensive and intensive components of monitoring for both species in one integrated design. Extensively, occupancy is monitored in small watersheds (2-4 km^2) throughout the range of the species over a 5–year cycle, with 20% of the watersheds revisited annually. We selected an unequal probability sample based on historical occupancy. Most of our samples are from watersheds that were recently occupied (since 1990), and a smaller proportion from watersheds that were historically occupied (before 1990) or where occupancy was unknown. Within each watershed, we survey all lentic (i.e., standing water like ponds and meadows) habitat and a sample of the lotic (i.e., stream) habitat. Intensively, we collect more detailed Yosemite toad abundance and habitat data in two small watersheds. Ultimately, the goal is to implement the intensive component in one additional watershed for the Yosemite toad and in 3 watersheds for the mountain yellow–legged frog. Information gathered in both components is complementary and aids in interpretation of trends.

Mountain yellow–legged frog breeding lake on the Toiyabe National Forest.

Accomplishments

In 2007, we surveyed 921 lakes, ponds, meadows, and stream reaches in 53 sample watersheds in the Sierra Nevada. Of these sites, 846 had available or potentially available aquatic habitat. Following is a summary of preliminary occupancy patterns to date.

From 2002 to 2007, 89 watersheds have been surveyed within the Yosemite toad's range including almost 1500 meadows, lakes, ponds, and stream reaches. Eighteen of these watersheds have been resurveyed for at least four years. In figure 1, we show the percentage of watersheds in the sample that were occupied by breeding categories — breeding, adults or subadults, or none found — and by historical occupancy category.

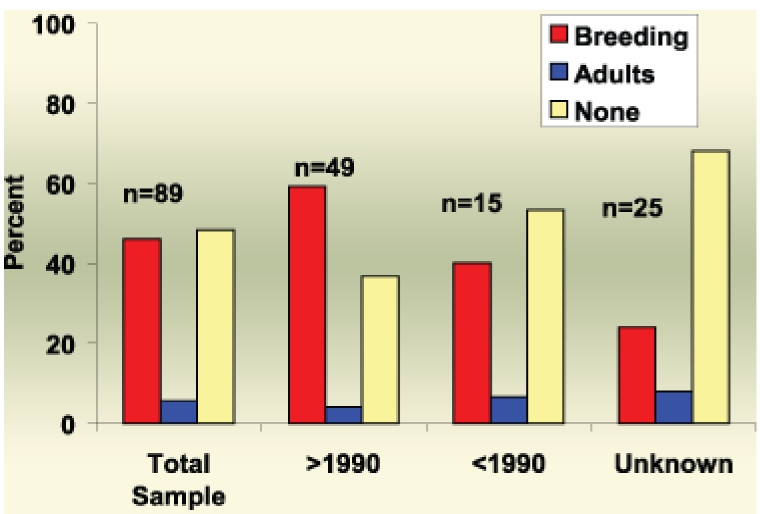

Figure 1. Percent of sample watersheds occupied by Yosemite toad from 2002–2007 by breeding category and historical occupancy. Breeding categories include 1) breeding life stages (eggs, tadpoles, metamorphs), 2) adults or subadults, and 3) none found. Historical occupancy was based on locality data.

Of the 49 watersheds occupied by Yosemite toad since 1990 (>1990), 59% (n=29) had breeding at least one year during this period, an additional 4% (n=2) of the watersheds had adults or subadults but no signs of breeding, and 37% (n=18) were not occupied. Forty percent (n=6) of the 15 watersheds occupied before 1990 (<1990) and 24% (n=6) of the 25 watersheds with unknown history were also occupied by breeding. No trends were apparent in the data, although 5 years is a short timeframe to detect trends. Annual variability was low. Fourteen of the 18 watersheds sampled every year were occupied, and these 14 were occupied most of the years they were surveyed (every year or every year except one).

In 2007, due to funding cuts, only a portion of the work continued on the intensive component of the monitoring program for the Yosemite toad. Capture–mark–recapture surveys for adult males and egg mass counts were conducted during spring breeding in 3 meadows in each of two watersheds (one on the Stanislaus National Forest and one on the Sierra National Forest). No counts or repeat surveys were conducted for tadpoles and metamorphs in either watershed. Preliminary estimates of adult males and egg mass counts for the two watersheds suggest population sizes in these watersheds are small (Table 1).

Yosemite toad male and female in amplexus during the spring breeding period. Note the strands of eggs.

Table 1. Yosemite toad adult and egg mass abundance estimates from 2006 and 2007 in two intensively sampled watersheds. Bull Creek is on the Sierra National Forest and Highland Lakes is on the Stanislaus National Forest.

	2006			2007		
	Breeding areas (count)	**Adult males (95% CI)**	**Egg masses [1] (95% CI)**	**Breeding areas (count)**	**Adult males (95% CI)**	**Egg masses [2] (95% CI)**
Bull Creek						
520M16	3	10–13	35.0–37.7	3	7–10	23.1–28.9
520M15	5	18–20	18.0–19.9	1	11–17	7.0–8.5 [3]
520M20				2	2–4	7.0–8.5
Highland Lakes						
37188	3	19–20	15.0–17.8	2	18–20	11.1–16.6
37213	5		10.0	3	13–15	7.0
37165				2	6–7	5.0

[1] Dependent double observer counts

[2] Independent double observer counts

[3] Count not total for meadow

From 2002 to 2007, we have surveyed 131 watersheds in the mountain yellow–legged frog's Sierran range, including over 1900 meadows, lakes, ponds, and stream reaches. Twenty–six of the watersheds have been resurveyed for at least four years. Occupancy for the mountain yellow–legged frog is lower than for the Yosemite toad (Figure 2). Of 42 watersheds occupied since 1990 (>1990), 40% (n=17) had evidence of breeding, 5% (n=2) had adults or subadults with no signs of breeding, and 55% (n=23) were not occupied. Of the 26 watersheds surveyed every year, only 5 were occupied by breeding life stages, and 3 of the 5 showed evidence of breeding during all years surveyed. One medium and 6 low probability watersheds (9%) also had breeding life stages.

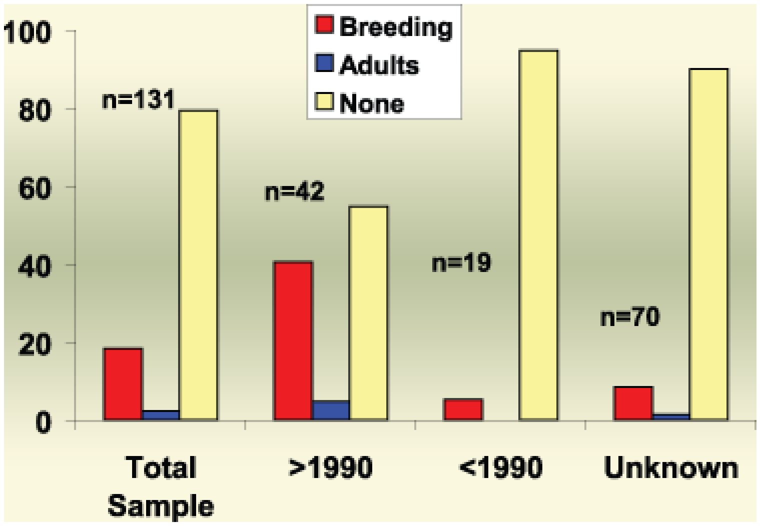

Figure 2. Percentage of sample watersheds occupied by Mountain yellow–legged frog from 2002–2007 by breeding category and historical occupancy. Breeding categories include 1) breeding life stages (eggs, tadpoles, metamorphs), 2) adults or subadults, and 3) none found. Historical occupancy was based on locality data.

This program provides statistically defensible status and trend data that support biological evaluations, bioregional assessments, and the next Forest plan revisions. In addition to meeting these primary monitoring goals, data collected in this program will increase our knowledge about population dynamics and habitat requirements for both species, allowing more informed management decisions and increased management options. Funding for 2008 remains similar to 2007; thus, the program objectives for fiscal year 2008 are to

1. collect population (and not habitat) data in re–survey watersheds only;
2. continue adult and egg mass counts in the two Yosemite toad intensive basins;
3. finalize the 5–year population status analysis;
4. continue the habitat–relationship analysis; and
5. continue the 5–year program evaluation.

References

Jennings, M. R. 1996. Status of amphibians. Pages 921–944 in *Sierra Nevada Ecosystem Project: Final Report to Congress*. University of California, Davis.

Vredenburg, VT, et al. 2007. Concordant molecular and phenotypic data delineate new taxonomy and conservation priorities for the endangered mountain yellow–legged frog. *Journal of Zoology*. 271: 361–374.

Effects of Livestock Grazing on Yosemite Toads

Sierra Nevada Forest Plan Monitoring Accomplishment Report for 2007

This study is a collaborative effort between the USDA Forest Service, Region 5 and the Pacific Southwest Research Station (PSW), Sierra Nevada Research Center (SNRC), led by Dr. Amy Lind, and UC Berkeley and UC Davis, led by Drs. Barbara Allen–Diaz and Kenneth Tate, under a Cooperative Ecosystem Studies Agreement.

The primary goal of the study is to better understand the relationships between cattle grazing and Yosemite toad populations and habitats. The Yosemite toad is endemic to the Sierra Nevada mountain range and is typically associated with wet, high–mountain meadows and shallow lakeshores. Yosemite toads are believed to have declined or disappeared from at least 50% of known localities during the latter part of the 20 th century and are a species of special concern in California, a sensitive species for the U.S. Forest Service, and a candidate for federal listing under the Endangered Species Act.

Livestock grazing, air–borne chemical toxins, disease, and climatic shifts and variability, especially of temperature and precipitation, are suspected factors in the decline of Yosemite toads. Livestock grazing is suspected because the toads are associated with shallow–water habitats in montane meadows. Preliminarily, livestock use of these wet meadow habitats may affect Yosemite toads through:

- Changes to meadow stream hydrology and bank stability (i.e., increased down–cutting and head–cutting).
- Changes to water quality.
- Changes in fine–scale topography of egg deposition and larval rearing areas.

The extent of these potential effects and their relationship to toad population survival and persistence has not been quantified. The results of this study will provide guidance to land managers who are faced with decisions regarding human and livestock use of montane meadows. We expect that this study will increase understanding of the role that livestock grazing may be playing in the decline of the Yosemite toad.

The specific objectives for the study are to gather data to answer the following two questions:

1. Does livestock grazing under Forest and SNFPA Riparian Standards and Guidelines have a measurable effect on Yosemite toad populations?
2. What are the effects of livestock grazing intensity on the key habitat components that affect survival and recruitment of Yosemite toad populations?

2007 Accomplishments — UC

In the second year of **Part I**, livestock utilization monitoring was continued on 24 selected meadows that provide Yosemite toad breeding. Utilization cages and paired plots were installed along transects perpendicular to flow in each meadow. To provide an estimate of the livestock use throughout the season, standing herbaceous crop inside cages and paired plots was estimated monthly (comparative yield method, Interagency Technical Reference 1996). Additionally, species composition by percent cover was determined at each cage using the point intercept method (Interagency Technical Reference 1996). Forage quality samples for each cage and paired plot location were also collected to assess overall palatability of meadow patches.

To link livestock utilization to Yosemite toad occupancy, we conducted an independent toad occupancy survey of all 24 meadows. Survey method followed protocols set by the PSW team on Part II of this study. Meadows were searched for tadpoles, metamorphs, and adults. Search effort was standardized across all meadows (~ 0.5hr/acre). Meadow hydrology class was assessed by dominant plant community and compared to water table data of similarly ranked Part II meadows.

Preliminarily, we found no significant difference in toad occupancy across a range (0–80% utilization) of grazed meadows; however, there is an apparent difference in livestock utilization between meadows occupied and unoccupied by toads (Figure 3). Preliminary analysis of livestock utilization by meadow hydrology (Figure 4) demonstrates that meadows classified as "wet" experience lower utilization levels and have the highest toad occupancy rates. Meadow hydrology is characterized from "dry" to "wet", which will be extrapolated and further defined from Part II water table data. Among dry, moderate, and wet meadows, 14, 31, and 67 %, respectively, are occupied (confirmed toad populations in at least 2 years).

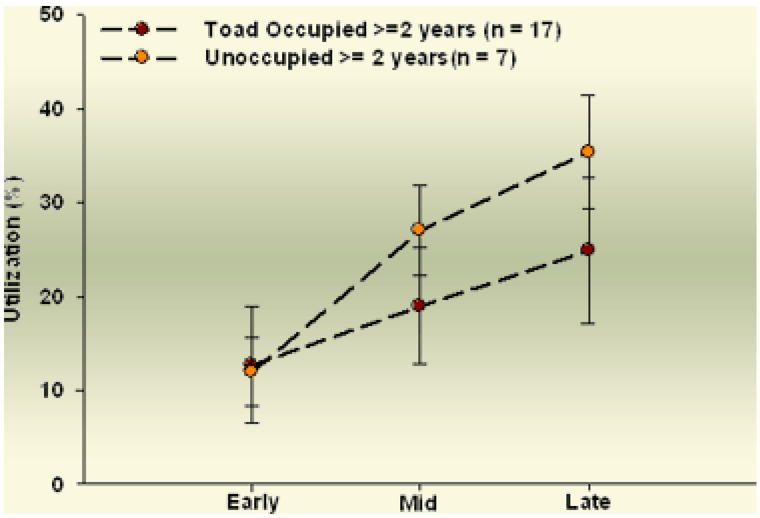

Figure 3. Livestock utilization and toad occupancy for the 2007 Season. "Occupied" meadows have had confirmed toad populations in at least 2 years. Vertical lines on bars are one standard deviation.

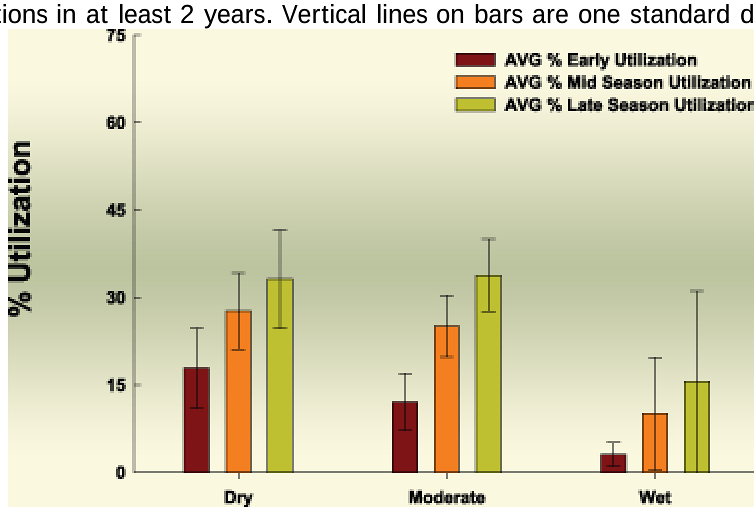

Figure 4. Seasonal livestock utilization by meadow type. Meadow hydology is characterized from "dry" to "wet". Vertical lines on bars are one standard deviation.

We continued collecting data for **Part II**, sampling species composition, biomass, and water table depth at each of the 17 study meadows. Species composition was measured inside each utilization cage at peak standing crop using the point intercept method (Interagency Technical Reference 1996). Early, mid and late–season biomass was estimated via the Comparative Yield method (Interagency Technical Reference 1996) at each utilization cage and paired plot. Meadow production and utilization were calculated from these data. Piezometers were measured to calculate groundwater depth at every meadow system. Additionally, we continued digital camera data collection on the 10 Sierra National Forest meadows.

Most of the plants we identified in 2007 were also seen in 2005 and 2006, which we expected in these perennial meadow systems. Vegetation is primarily composed of *Carex, Juncus*, and *Eleocharis* species and a number of different grasses and forbs. We are using multivariate statistics to identify the key environmental variables (e.g. groundwater depth, elevation, biomass) driving plant distribution across and between meadows. Specifically, our analyses thus far are showing a connection between vegetation functional groups and differences in water table levels. We have also used water table data to characterize meadow moisture gradients (Figure 5), which will be useful for analyzing connections between meadow hydrology and Yosemite toad habitat requirements.

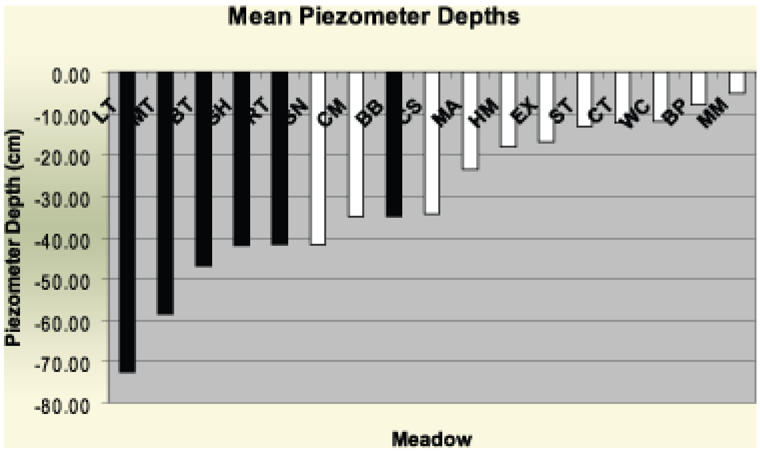

Figure 5. Mean water table (piezometer) depths for 2006 and 2007 for all study meadows arranged from dry to wet. Stanislaus meadows are in black and Sierra meadows in white.

Digital image of livestock grazing in Hash Meadow (Patterson Mountain Allotment). Red squares are cow marks; this image has seven cow marks. Note the date, time, and temperature at the top of the image as well as utilization cages in the upper left corner (arrow).

Digital camera data for 2006 have been analyzed, and we are in the process of reviewing and analyzing 2007 images. The cameras are distributed across the 4 treatments (Table 2), and each camera image covers between 0.04 and 0.45 ha of meadow. To identify cows and calves, we first explored using image recognition software, which identifies and counts objects (e.g. cows) in images. However, we were unable to use an automated program for this project because of the large area covered by some cameras. Cows further from the cameras would have been harder to identify, so we chose to manually review each image. We used MATLAB computing language to develop marking and counting tools and to increase data review efficiency. For 2006, we recorded

269,000 total images, with at least one cow seen in 2,227 (< 1%) of images. We had a total of 5,307 cow marks for the season, and presence of cows varied widely by meadow and over the course of the summer.

Table 2. Digital camera distribution by treatment and meadow.

Treatment	Meadows	Total Cameras
Standard Grazing	3	9
Fence Whole Meadow	3	3
Fence Wet Areas	3	6
Holding/Gathering Pasture	1	3

2007 Accomplishments – PSW

Over the past year, work continued on both parts of the project. For the **Part I** toad habitat distributional model, we continued to work with Sierra National Forest (SNF) personnel on compiling GIS data layers (e.g. soils, weather, topographic) that correspond with SNF 2002–2006 toad survey sites. Supplementary funding for this work was obtained from the U.S. Fish and Wildlife Service. In addition, toad status at SNF survey sites was validated by comparing toad occupancy data from SNF surveys to those done by an independent monitoring team (Sierra Nevada Amphibian Status and Trend Monitoring Program).

For **Part II** (experimental fencing treatments), field data collection continued to be focused on quantifying toad populations and their habitat associations (Table 3). Population levels for all life stages of toads (adults, eggs, tadpoles, and young of the year) were quantified along with information on local scale (pool and individual–focused) habitat characteristics. We added two reference meadows in Yosemite National Park because long–term (>10 years) ungrazed reference meadows could not be found at appropriate elevations on the national forests. The same set of data was collected at these reference meadows.

Table 3. Sampling periods and data collected by PSW for the Yosemite toad livestock grazing study.

Sampling Period	Life Stage Focus	Methods
Late spring May/ June (2006-2007)	Adults, eggs	• Multiple cap–recap visits and measurements of adults • Egg cluster counts • Amphibian chytrid fungus swabbing • Individual–focused habitat data (egg clusters & adults) • *[collected at all meadows except Stanislaus–Herring Creek allotment]*
Early–mid summer July/ August (2005–2007)	Tadpoles	• Stratified hoop counts in occupied breeding pools • Documentation of unused pools from previous years • Tadpole hoop–focused habitat • Breeding pool aquatic habitat data
Late summer August/ September (2005–2007)	Young of the year (yoy)	• Multiple cap–recap visits and measurements of yoy • Breeding pool aquatic habitat and vegetation data

In 2006 we began collecting data on the occurrence of amphibian chytrid fungus (a fungus that has been found to cause declines in other species of amphibians) in our toad study populations using standard swabbing methods; we continued this work in 2007. A total of 110 adult toads were swabbed from the study meadows during 2006 and early 2007. Seventy–three additional samples from 2007 are being analyzed by Dr. Vance Vredenburg at San Francisco State University.

This past year we finalized the design of an ACCESS database to house the toad data collected for this project. The database has seven main data tables organized around each toad life stage and microhabitat — vegetation data, and 24 "look–up" tables. Data entry is currently underway and is approximately 50% complete for 2005–2007 data.

Preliminary analyses of data collected to date are currently underway. An initial presentation of this data was made at the Region 5 Rangeland Managers Meeting in February:

- Water depth and water temperature (point in time measurement) for Yosemite toad egg clusters for 2006 and 2007 by experimental treatment (Figure 7). Apparent differences between years and among treatments have not been formally analyzed.
- Counts of young of year for each year and experimental treatment (Figure 8). Numbers do not include recaptures and are not corrected for meadow size.
- Prevalence of amphibian chytrid fungus in 110 swab samples from 2006 and early 2007 (Table 4).

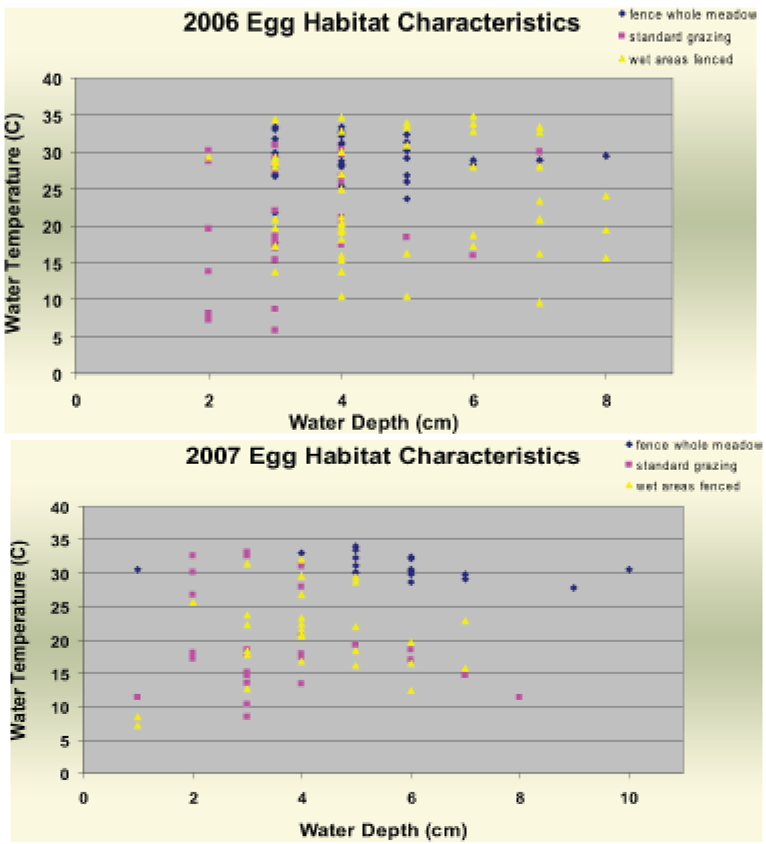

Figure 7. Water depth and water temperature (point in time measurement) for Yosemite toad egg clusters for 2006 (top) and 2007 (bottom) by experimental treatment (colors). Apparent differences between years and among treatments have not been formally analyzed.

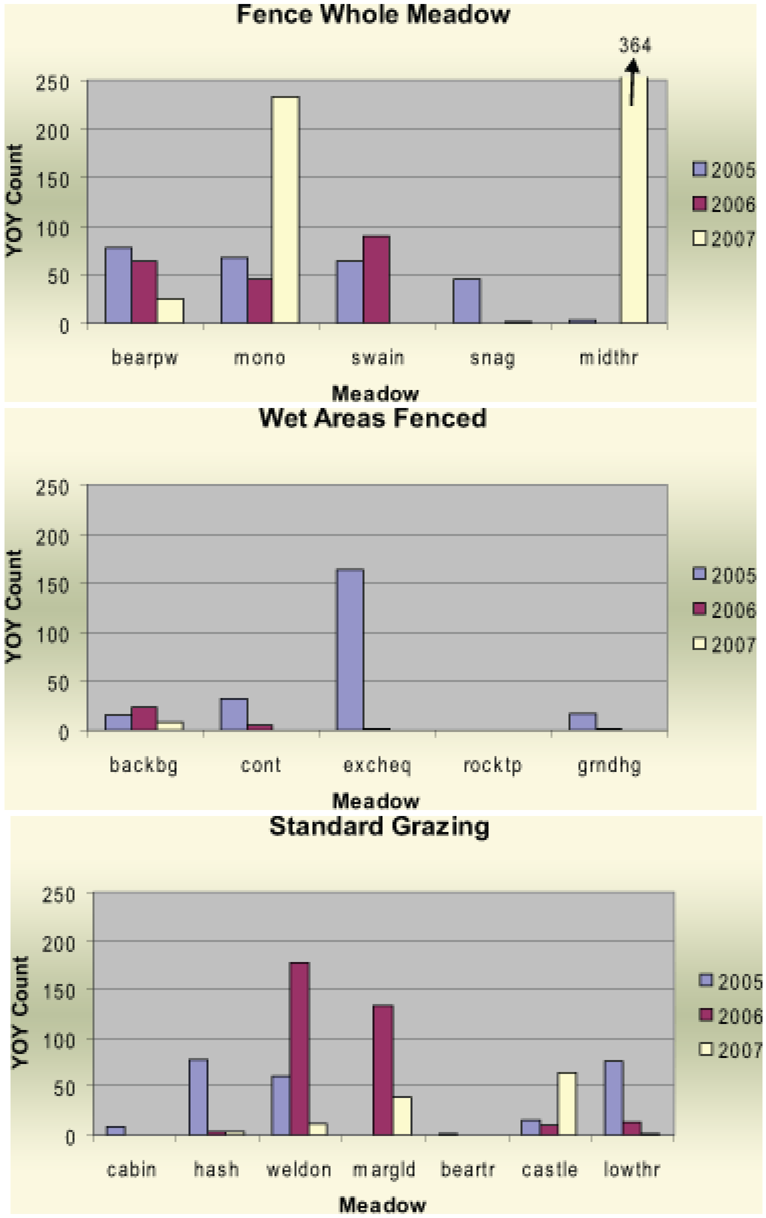

Figure 8. Counts of young of year for each year (colors) for individual meadows under whole meadow fenced (top), wet areas fenced (middle), and standard grazing (bottom) experimental treatments. Counts do not include recaptures and are not corrected for meadow size.

Table 4. Amphibian chytrid fungus swab results from 2006 and early 2007 samples of Yosemite toads. Percent and number of positive individuals (over total swabbed) are presented by allotment.

Forest	Allotment (Meadows)	% Positive
Sierra (All meadows with at least one positive individual except Footprint and Mono)	Patterson Mountain (Hash, Continental, Swain Thrush)	16.7 (3/18)
	Dinkey (Exchequer, Bear Paw, Cabin)	27.3 (6/22)
	Blasingame (Back Badger, Mono, Weldon, Marigold)	17.0 (8/47)
Stanislaus (All meadows with at least one positive individual except Bear Tree and Snag)	Herring Creek (Lower Three Meadows, Castle)	30.0 (3/10)
	Highland Lakes (Bear Tree, Snag, Rock Top)	7.7 (1/13)

Research Team Science Meeting

Our annual meeting took place in Davis February 28th and 29th, 2008. The goals of the meeting were to present results from 2005–2007, discuss data integration and share sampling and analysis updates, and prepare a plan for 2008 sampling. All the PIs and graduate students working on the study attended. Each presenter focused on the specific questions they study, how often and where data were collected, collection methods, analysis and results, and issues and concerns in data collection and integration.

We updated our summary table from last year, including data types and the spatiotemporal scale of data collection for each variable in the study. This exercise has been helpful in discussions of how data are going to be integrated in the final report and has been useful in keeping everyone apprised of the data being collected on both forests.

Links between landscape condition and survival and reproduction of fishers in the Kings River Area, Sierra National Forest

Sierra Nevada Forest Plan Monitoring Accomplishment Report for 2007

This monitoring study is being conducted by Drs. Craig Thompson and Kathryn Purcell at the USFS Pacific Southwest Research Station, Sierra Nevada Research Center in Fresno. This report is excerpted from a report at http://www.fs.fed.us/psw/programs/snrc/.

Captured female fisher taking refuge in the 'cubby'.

Accomplishments

Capture and monitoring: Between February and September, 2007, 15 fishers (10 female: 5 male) have been captured and equipped with radio collars in the Kings River area (Table 4). These animals have been monitored extensively using a combination of ground and aerial telemetry, resulting in over 500 locations and annual home range estimates for all ten females and two of the five males. Female ranges (the area that each female uses) average 994 ha (range 461 to 2173 ha), while male ranges average 2340 ha (range 1947 to 2732 ha). The remaining three males died before a range could be estimated. Causes of death were bobcat predation, unknown predation, and getting trapped in an air quality monitoring device.

Table 5. Fishers captured in the Kings River area. No juveniles were captured.

Gender	Adult	Subadult	Mortalities
Male	4	1	3
Female	10	0	0

Reproduction: In 2007, seven of the ten adult female fishers showed evidence of having nursed kits that year. Two litters were observed by technicians, one with at least one kit and one with at least two kits.

Rest and den structures: Between February and September, 2007, 19 resting locations were located in a variety of species (Figure 9) and structures. Cavities were used most often, making up 54% of the observed rest structures. Other structures used included branch clusters (15%), forks (15%), rock burrows (8%), and stick nests (8%). Rest sites were most often in live trees (47%), closely followed by snags (37%).

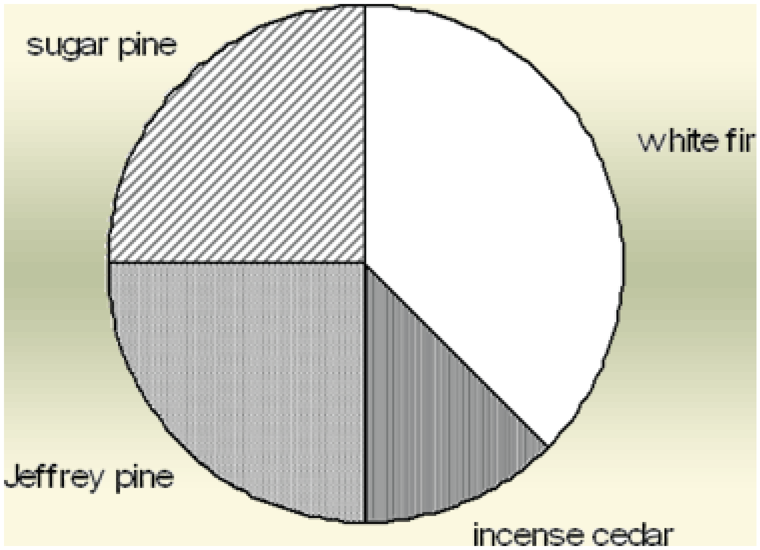

Figure 9. Tree species use for 19 fisher resting locations located in the Kings River area of the Sierra National Forest.

Scat Detector Dog Surveys: Detector dog teams, provided by the University of Washington's Center for Conservation Biology, conduct fall and spring surveys of the core study area. Scats are confirmed as fisher by genetic analysis, then sent on to the USFS Rocky Mountain Research Station Wildlife Genetics Laboratory in Missoula, MT for individual identification. We also collect information about habitat characteristics surrounding scat collection site, prey remains, and hormone levels.

As of September 2007, we have completed three surveys and collected 969 scats (Table 6). Of these, 578 have been verified to species with 351 confirmed as fisher (60.7% accuracy). These 351 scats are currently being individually identified and analyzed for diet and hormones.

Table 6. Scats collected with dog surveys, 2006 and 2007.

Survey	# scats collected	% confirmed fisher
Fall 2006	542	45%
Spring 2007	152	63%
Fall 2007	275	71%

Fisher and Marten Status and Trend Monitoring

Sierra Nevada Forest Plan Monitoring Accomplishment Report for 2007

During the 2007 field season, fisher (*Martes pennanti*) and marten (*M. americana*) population monitoring was limited to the southern Sierra Nevada. Monitoring both species relies on tracking an index of abundance – the proportion of sites occupied — over time. The same field methods are used for fisher and marten: primary sample units are co–located with Forest Inventory and Analysis (FIA) plots and include an array of six baited track–plate stations. Each primary sample unit is surveyed for ten consecutive days, and stations are visited by field technicians every other day to collect tracks. A species is considered present at the primary sample unit if it is detected at one or more stations during the ten–day survey. Track–plate stations have been modified by strategically placing barbed–wire hair snares at the entrance to each track–plate enclosure. These hair snares permit non–invasive collection of genetic material from fishers, martens, and other carnivores. In addition to intensive sampling on the Sequoia, Sierra, and southern Stanislaus national forests, we also surveyed the Inyo National Forest, Yosemite National Park, and Sequoia–Kings Canyon National Park.

Sampling in the southern Sierra was modified slightly during 2007 based on experience during the first five years of monitoring. We emphasized sampling a somewhat reduced elevation range where fishers are most widely distributed. Some of the high elevation and wilderness sites were eliminated from future consideration due to the low chance of detecting fishers and the considerable time and cost spent accessing the sites. Focusing on the middle and low elevation sites for the remainder of the monitoring cycle (expected to extend through 2011) should allow efficient monitoring of the fisher population and provide the opportunity to empirically explore future monitoring scenarios that may be accomplished with reduced sampling effort and cost.

Accomplishments

From 2002–2007, 1099 primary sample units were sampled throughout the Sierra Nevada. Fishers have been were detected at 111 sample units (45 on Sierra NF, 64 on Sequoia NF, one in Yosemite NP, and one in Sequoia–Kings Canyon NP). Marten have been regularly detected on Sierra NF and parts of Sequoia NF, though most sampling occurs at elevations lower than where martens are presumably most abundant. Although formal analysis of the fisher monitoring data are not yet complete, no dramatic decline in the index of population abundance has been observed during the first six years of monitoring. Other mid–sized carnivores commonly detected using track plates include gray fox (*Urocyon cinereoargenteus*), ringtail (*Bassariscus astutus*), and spotted skunk (*Spilogale gracilis*).

The results for 2002 – 2006 have been re–assessed based on the reduced elevation range sampled during 2007, as described above. Remote cameras were included at primary sample units in addition to the six track–plate stations during the first three years of the monitoring program. During this time, several sites recorded fisher detections at camera stations but not at track plate stations; the camera detections have been excluded and preliminary results are based only on track plate surveys. Preliminary, naïve occupancy estimates during the first six years of the monitoring program in the southern Sierra Nevada (Table 7) are calculated as

sites where species detected / # sites surveyed

After adjustment based on species' detectability, the annual estimates ultimately used to assess trend will likely be higher than these estimates

Table 7. Naïve occupancy rates, the proportion of sample units where each carnivore species was detected over the 2002–2007 time period for the southern Sierra Nevada.

	Naïve Occupancy				
Year	**Fisher**	**Marten**	**Gray Fox**	**Spotted Skunk**	**Ringtail**
2002	0.261	0.130	0.243	0.130	0.078
2003	0.269	0.054	0.280	0.183	0.161
2004	0.207	0.104	0.148	0.170	0.119
2005	0.289	0.096	0.167	0.149	0.149
2006	0.276	0.125	0.151	0.208	0.130
2007	0.267	0.108	0.199	0.182	0.165

The general pattern of detections observed during the first five years remained consistent during the sixth monitoring season. Fishers appear to be well–distributed in portions of Sequoia and Sierra National Forests and fisher detection rates tend to be higher on the west slope of Sequoia National Forest than on the Kern Plateau or Sierra National Forest. Fishers have not been detected on Stanislaus National Forest, and the northernmost detection to date has been in southern Yosemite near Highway 41. Fishers have not been detected in the Mammoth Lakes area despite the relative proximity to fishers on Sierra NF. Survey locations on Inyo NF are within 20 miles of fisher detections recorded along the San Joaquin River near the Kaiser Wilderness. Martens are more commonly detected on Sierra NF than on Sequoia NF, and have not been detected on the west slope of Sequoia NF south of Tulare County. No marten detections have been recorded on the Kern Plateau.

Collecting hair samples at track plate stations was successful during 2006 and 2007. Analysis investigating various fisher population genetics questions is ongoing at the U.S. Forest Service, Rocky Mountain Research Station, Wildlife Genetics Laboratory in Missoula, MT. The genetics research includes three main components:

1. Identify individual fishers to attempt estimating population size.
2. Explore genetic substructure within the southern Sierra population.
3. Use landscape genetics to identify features (e.g., river canyons, large historical fires) that influence gene flow within the fisher population.

In addition to collecting genetic material at all primary sample units during 2007, 22 additional areas were surveyed where fishers have previously been detected but where few or no hair samples were collected. Of particular importance was collecting fisher genetic samples in Sequoia–Kings Canyon National Park to provide a more comprehensive spatial sample of the population.

In 2006 and 2007, about 72% of stations with fisher detection via tracks yielded at least one hair sample. The quantity and quality of DNA in non–invasive samples varies depending on sample size and environmental conditions; not all samples contained enough DNA to accurately genotype an individual. Laboratory success rates for individual identification of fisher samples collected was 64.5% (78 genotypes / 121 samples) in 2006 and 55.3% (78 genotypes / 141 samples) in 2007.

In 2006, genetic analysis at 10 microsatellite loci found 50 individuals (30 males, 20 females), and in 2007, analysis found 42 individuals (20 males, 22 females) with a low recapture rate between years. Preliminary results indicate that there may be a greater amount of gene flow across the Kings River Canyon than previously thought.

Continued monitoring will allow us to observe trends in the southern Sierra fisher population, and document fisher population expansion into the central and northern Sierra Nevada, should it occur. Field program objectives for 2008 include:

- Continued intensive sampling of the fisher population in the southern Sierra.

- Sentinel site sampling in the central and northern Sierra Nevada with emphasis on Inyo NF and Stanislaus NF.
- Continued marten monitoring in the southern Sierra.
- Continued collection of genetic material throughout the southern Sierra Nevada.

Analysis of the fisher and marten monitoring data using contemporary occupancy modeling methods is ongoing in collaboration with PSW scientists and statisticians. Primary expected outcomes from the ongoing analysis include adjusted estimates of occupancy for each year of monitoring for fisher and marten (rather than the naïve estimates reported here) and estimates of change in occupancy rates during the first 5 years. For fisher, these analyses will include comparisons of occupancy rates and trends for males and females as possible; gender can be identified based on track size or using genetic methods.

California Spotted Owl — Eldorado Study Area

Sierra Nevada Forest Plan Monitoring Accomplishment Report for 2007

In this report, we summarize the results of our field work on the Eldorado study area during the April–August 2007 field season. Our report covers basic demographic characteristics of the study population in the central Sierra Nevada through the 2007 owl breeding season.

After two extremely poor reproductive years on the Eldorado study area in 2005 and 2006, spotted owl reproduction rebounded sharply this past breeding season. Mild weather during the early nesting period likely contributed to the productive breeding season, an observation consistent with previous research (Franklin et al. 2000, Seamans 2005). Much of the study area was accessible in early April when we arrived for field work, and precipitation was light during April and early May. The effects of the preceding two poor reproductive years may have been apparent, however, in the historically low number of subadults (1 female) in the territorial population.

Contrary to prior years, we estimated reproductive output rather than fecundity because we are now uncertain that the sex ratio is even (an assumption of standard fecundity estimates) in this population. Our preliminary results from estimating sex of fledglings using DNA suggested that the assumption of 50:50 sex ratios in previous years was invalid. The model rankings from our analyses of reproductive output and productivity suggested an alternating–year effect, a negative correlation with the proportion of subadults in the breeding population, and a linear decrease over time.

Estimated apparent survival reached an historic low between the 2005 and 2006 breeding seasons. We propose two possible explanations:

1. Harsh winter conditions that contributed to poor reproduction in 2006 also affected owl survival.
2. The complete lack of reproduction in 2005 may have prompted an unusually high number of territorial birds to emigrate from the study area. Previous research has suggested that territorial spotted owls are more likely to disperse to new territories following years of no reproduction and after they have lost a mate (Blakesley et al. 2006). However, Seamans and Gutiérrez (2007a) did not find a relationship between reproductive success and subsequent probability of breeding dispersal in our study population.

Our analysis of population rate of change (λ) on the Eldorado study area indicated that λ for the population of territorial owls has gradually declined over the course of our study (Figure 10). Higher rates of population growth in the study's early years may have been due to high reproductive output from 1992 to 1994 (Figure 10). Seamans and Gutiérrez (2007b) found that variation in population rate of change on this study area was most likely due to variation in reproductive output and juvenile survival. Although population rate of change is most sensitive to changes in the annual survival rate of territorial owls, temporal variation in survival has been much smaller than temporal variation in reproductive output on this study area (Seamans and Gutiérrez 2007b). We estimated that the average λ over the course of our study was slightly less than 1.0, and the 95% confidence interval of this estimate overlaps 1.0.

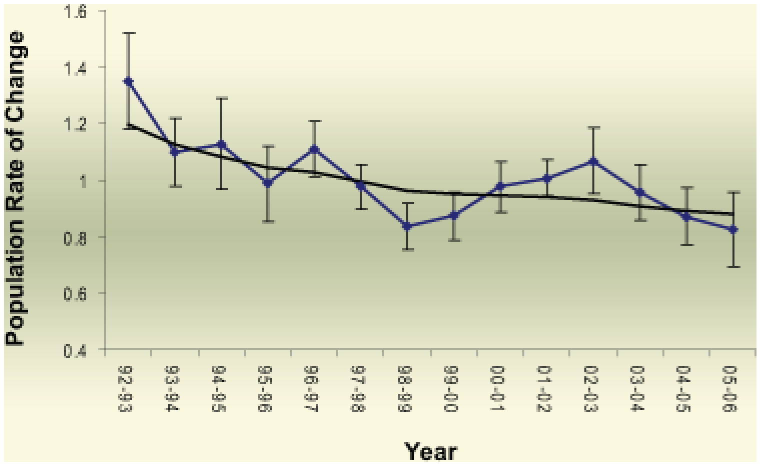

Figure 10. Estimated annual population rate of change (λ) using the random effects means model for California spotted owls on the Eldorado Density Study Area, 1992–2006. Vertical lines are standard errors of the estimates. A fitted line for a log–linear time trend, as suggested by the top–ranked model, is included.

We believe that continued monitoring of the spotted owl population remains vital for guiding forest management in the Sierra Nevada as the Forest Service implements fuel treatments across the landscape under the direction of the 2004 Sierra Nevada Forest Plan Amendment. Continued monitoring will enhance our ability to distinguish whether changes in owl vital rates are due to natural events or management–induced changes in forest composition and structure.

In January 2007, we joined scientists from UC–Berkeley, UC–Merced, and UC–Davis as part of the Science Team for the Sierra Nevada Adaptive Management Project (SNAMP). The Science Team will assess the ecological and social impacts of fuel treatments conducted under the Forest Plan; our specific role on the Team will be to study spotted owls on the SNAMP northern study site.

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Forest Monitoring Summary
October 1, 2006 to September 30, 2007 (FY 2007)

Sierra Nevada Forest Plan Monitoring Accomplishment Report for 2007

This summary is based on reports from nine of eleven national forests and the Lake Tahoe Basin Management Unit (LTBMU). Nearly all Sierra Nevada NFs in California have completed FACTS (Forest Activity Tracking System) data base entry for projects through FY2007.

Treatments in California Spotted Owl and Northern Goshawk Protected Activity Centers (PACs) and in the wildland urban interface (WUI) during FY 2007 are summarized in Table 8. Treated acres represent 0.4% of California Spotted Owl PACs and 0.8% of Northern Goshawk PACs.

Table 8. Summary of California Spotted Owl and Goshawk PAC and WUI treatments for 2007.

Forest	Goshawk PAC Treatment Acres	California Spotted Owl PAC Treatment Acres	WUI Acres Treated
Eldorado	191	407	1,143
Inyo	3	0	3,066
Lake Tahoe Basin	1	194	85
Lassen	105	11	1,853
Modoc	181	0	1
Plumas	84	0	1,491
Sequoia	12	40	10,114
Sierra	0	394	1,241
Stanislaus	255	516	2,601
Tahoe	66	135	2,529
Humboldt – Toiyabe			705
Total treated	898	1,697	24,124
TOTAL acres in PACs	108,158	421,780	

In 2007, fuel treatments were conducted on 99,942 acres on the Region 5 Sierra Nevada National Forests. Of those acres, 24% (24,124 acres) were located in wildland–urban interface (WUI) areas — the regional goal is to have 50% of all fuel treatments in the WUI (SNFPA ROD, page 5). A number of forests greatly exceeded their 2007 targets for non–WUI treatments and the Modoc NF had essentially no WUI treatments.

Treatments within California spotted owl (CSO) Protected Activity Centers (PACs) have occurred on seven of the 11 National Forests in the Sierra Nevada Bioregion since 2004:

- 1,669 acres on the Eldorado NF,
- 388 acres on the Lake Tahoe Basin Management Unit,
- 11 acres on the Lassen NF,
- 40 acres on the Sequoia NF,
- 644 acres on the Sierra NF,
- 1,285 acres on the Stanislaus NF, and
- 135 acres on the Tahoe NF.

The total of 4,172 acres treated since 2004 is 1% of the 421,780 acres of CSO PACs designated within the Sierra Nevada.

A number of treatments have been conducted in Northern Goshawk PACs since 2004:

- 215 acres on the Eldorado NF,
- 200 acres on the Humboldt–Toiyabe NF,
- 3 acres on the Inyo NF,
- 80 acres on Lake Tahoe Basin Management Unit,
- 105 acres on the Lassen NF,
- 581 acres on the Modoc NF,
- 200 acres on the Plumas NF,
- 55 acres on the Sequoia NF,
- 322 acres on the Stanislaus NF, and
- 260 acres on the Tahoe NF.

The total of 2,021 acres treated since 2004 is less than 2% of the approximately 108,158 acres in Northern Goshawk PACs — the ROD for SNFPA limits vegetation treatments to no more than 5% of the acres in Northern Goshawk PACs per year (page 61).

The ROD requires evaluation of CSO PACs after potentially stand replacing fires to determine whether PACs or PAC acres that may have become unsuitable should be replaced (SNFPA ROD, page 37). Three CSO PACs were affected by wildfire in FY 2006 — one on the Tahoe NF and two on the Plumas NF. On one of the Plumas PACs, 25 acres were rendered unsuitable for CSO and replaced by adjoining acres. A Tahoe NF PAC of 38 acres was rendered totally unsuitable; replacement acres have been identified.

The Sierra Nevada National Forests identified no vegetation management treatments in Great Grey Owl PACs, fisher den site buffers, or marten den site buffers, except for

- 6 acres of fisher den site buffers on the Sequoia NF and
- 75 acres of Great Grey Owl PAC on the Stanislaus NF.

The ROD allows some vegetation treatments in these areas (SNFPA ROD, pages 61–62).

The Stanislaus NF used the flexibility in S&G #71 to change two California Spotted Owl PAC boundaries to implement projects during 2004 – 2007. A total of 9 acres were modified as follows:

- Quartz–Summit Knobs project (6 acres)
- Bear Mountain project (3 acres)

Boundary changes to PACs on the Tahoe NF have been more extensive (Table 9).

Table 9. Boundary Changes to PACs on the Tahoe NF for 2004 – 2007.

Species	PAC ID	Acres Changed	Project Name	Comments
CA spotted owl	NV015	+46	So. Yuba Canal	Increased acres to incorporate suitable acres and latest info on detections
CA spotted owl	NV024	+44	So. Yuba Canal	Increased acres to incorporate suitable acres and latest info on detections
CA spotted owl	NV051	-17	So. Yuba Canal	
CA spotted owl	NV057	-6	So. Yuba Canal	Minor mapping refinement
CA spotted owl	SI037	-38	Bassetts Fire	Fire impact changes
Northern	R05F1753T01	-55	Bassetts	Fire impact changes

goshawk			Fire	
CA spotted owl	SI019	-3	Red Ant	Minor mapping refinement
CA spotted owl	SI020	-6	Red Ant	Minor mapping refinement
CA spotted owl	SI025	+7	Red Ant	Minor mapping refinement
CA spotted owl	SI072	-1	Red Ant	Minor mapping refinement
CA spotted owl	SI080	-2	Red Ant	Minor mapping refinement
CA spotted owl	SI081	-7	Red Ant	Minor mapping refinement
CA spotted owl	SI091	-16	Red Ant	
Northern goshawk	R05F1753T14	+17	Red Ant	Mapping refinement to include adequate suitable habitat
CA spotted owl	SI001	+5	Ruby	Minor mapping inaccuracy refinement
CA spotted owl	SI026	+8	Ruby	Minor mapping refinement
CA spotted owl	NV011	+20	Washington	
CA spotted owl	NV054	+8	Washington	Minor mapping refinement
CA spotted owl	NV059	-4	Sagehen	PAC relocated to incorporate new information on most recent detections
Northern goshawk	R05F17D57T06	-54	Sagehen	PAC relocated to incorporate new information on most recent detections
Northern goshawk	R05F17D57T01	-47	Sagehen	PAC changed to incorporate new information on most recent detections

Implementation monitoring conducted during 2007 was reported as follows:

- On the Eldorado NF, about 30% of projects.
- On the Lassen NF for 53% of projects.
- On Lake Tahoe Basin Management Unit for 50% of projects:
- On the Modoc NF, implementation monitoring on all of its sale projects and specific BMP effectiveness monitoring on a randomly selected 50% of projects.
- On the Sequoia NF, BMP monitoring in accordance with the Regional and California Water Quality Control Board Central Valley Region protocols was completed for all the ground–disturbing activities, specifically the Red Mountain Thin, Camp Nelson Interface Project, and Big Meadows Improvement Project.
- On the Stanislaus NF for 1% of projects.
- On the Tahoe NF for 100% of projects.

Forest Relations with Tribes

Sierra Nevada Forest Plan Monitoring Accomplishment Report for 2007

The Sierra National Forests maintain Government–to–Government relationships with the tribes in the region. They consult and cooperate with tribes on culturally important vegetation, prescribed burning and fuel reduction, and other forest management activities. Forests protect and provide access to sacred and ceremonial sites and tribal traditional use areas. Some particular instances where the forests worked with tribes on projects in 2007 include:

The Inyo NF signed a Stewardship Contract with a tribe–related business.

The Lassen NF conducted three formal tribal consultations with the Susanville Indian Rancheria (SIR) and the Pit River Tribe. An annual special use permit was issued to the Honey Lake Maidu for the Bear Dance and to the SIR for the Papoose Meadows ceremony. The Lassen NF maintains access to these ceremonial sites and removed Papoose Meadows from a grazing allotment.

The Lake Tahoe Basin LTBMU continues to invite the Washoe Tribe to participate in all landscape analysis projects, benefits from tribal membership on the Lake Tahoe Federal Advisory Committee and participation in the joint agency planning process, and supports traditional management of riparian areas at Meeks Meadow and Taylor Creek. Each year the LTBMU coordinates local fire response agencies to insure that they will not respond inappropriately during Washoe ceremonial fire use at the Cave Rock Traditional Cultural Property.

The Modoc National Forest is in the process of developing specific protocols for all tribes in the national forest. The protocols will emphasize consultation and coordination and outlines tribal officials' responsibilities, particularly in areas of tribal fire protection plans, fuels management, vegetation management, forest planning, noxious weed management, cultural resource management, training, outreach and other activities to support national forest fire programs.

The Modoc National Forests' Tribal Relations Program is in early development of a pilot project to use remote sensing data to assist tribes in creating a national cultural resource database for future cultural resource, tribal forest, fire protection, fuels, vegetation, and noxious weed management plans. A national tribal agreement has been approved between the U.S. Geological Survey and a tribal organization that provides the foundation for a tribally–based GIS program. This GIS program will assist the national forest in land use and watershed practices and restoration activities.

The Modoc National Forest has recently completed a Noxious Weed Treatment Project EIS that includes documented coordination and consultation with tribes. In the protocols, we consider increasing the availability of American Indian traditional plants in a manner that balances noxious weed reduction with tribal concerns. Tribal monitors have access to selected treatment sites; however, compensation for tribal monitoring activities is unavailable.

The Sequoia NF continues to maintain and provide appropriate access to sacred and ceremonial sites and tribal traditional use areas. The Forest Service continues to work with the Yokut–Wukchumni Tribes in opening up Eshom Campground on the Hume Lake Ranger District for spring and fall Native American gatherings. District Rangers provided cards to local Native Americans that permit access through fee areas to traditional use and gathering areas.

Local Native Americans worked with the Tahoe NF to identify 78 acres of underburning for beargrass enhancement for the Last Chance project at American River.

The Sierra Nevada Adaptive Management Project — SNAMP

Sierra Nevada Forest Plan Monitoring Accomplishment Report for 2007

This project will determine how vegetation treatments to prevent wildfire will affect fire risk, wildlife, forest health, and water. A team of university scientists has agreed to act as an independent third party, monitoring the effects of vegetation management treatments implemented by the Forest Service in two areas (Last Chance and Sugar Pine) in the Sierra Nevada. Results will be used to improve forest management in the future.

The SNAMP is a collaborative effort among resources agencies, the public, and the University Science Team. The Forest Service will be planning and implementing the treatments, while the University Science Team will be independently monitoring and studying the effects of the projects on four important categories: wildlife (specifically the Pacific fisher and spotted owl), fire and forest health, water quality and quantity, and public participation. The public will be invited to provide feedback on the entire process.

This report is excerpted from SNAMP newsletters at http://snamp.cnr.berkeley.edu/news/

SNAMP Science Teams

The science teams are made up of researchers from the University of California Berkeley, the University of California Merced, University of California Cooperative Extension, and the University of Minnesota.

Public participation. The Public Participation team will monitor the Forest Service public participation processes, working to increase stakeholder involvement in the project through regular open meetings and reporting, an interactive website to facilitate stakeholder contact with project scientists, and joint monitoring programs.

Wildlife. The wildlife team focuses on two species: the Pacific Fisher (*Martes pennanti*), and the California Spotted Owl (*Strix occidentalis*). Both groups will be monitoring their target species through the life of the SNAMP.

Water. Water team members will be monitoring water quality and quantity across treatment and control catchments prior to and after strategic fuel treatments.

Fire & forest health. The Fire and Forest Health Team will investigate effects of strategic fuel treatments on fire behavior, tree morbidity and mortality, and forest health.

Spatial analysis. This team has responsibility for supporting GIS, remote sensing and spatial analysis needs for all the other teams.

The first two years of the project (2007 and 2008) are focused on collecting pre-treatment data, with treatments beginning in 2010.

As an example of how the multiple SNAMP teams will collaborate, the fire and forest health team has completed a more extensive fire history and age structure survey — coring every tree and completing fire scar analysis — within two subwatersheds of the Oakhurst study area. These same subwatersheds will be monitored by the water quality team to better understand how fuel treatments impact water quality.

This effort is particularly significant because of the large spatial scale: previous research focused on understanding the impacts of fuel treatments across tens of hectares, while SNAMP will cover an area of thousands of hectares. Researchers hope that this focus on reducing fire hazard across the landscape, as well as the emphasis on an adaptive management approach that integrates important ecosystem variables and public participation, will provide resource agencies with an effective means for addressing large scale forest fire management throughout the Sierra Nevada.

Accomplishments

In 2007, the fire and forest ecosystem health team established field plots (1/20th of a hectare) on 500 m and 250 m grids in both the treatment and control watersheds in each site. There are 200 plots in the Foresthill site; 115 plots in the Sugar Pine site; and 122 plots in the Cedar Valley site (which is scheduled for immediate treatment).

Canopy cover across the plots is mixed. In the Foresthill site, overstory species include (in order of dominance) white fir (*Abies concolor*), Douglas fir (*Pseudotsuga menziesii*), sugar pine (*Pinus lambertiana*), followed by incense cedar (*Calocedrus decurrens*), California red fir (*Abies magnifica*) and black oak (*Quercus kelloggii*). Overall canopy cover in the Foresthill site is 51% and the average basal area (the area of the cross section of all trees in a stand) is 178 ft 2/acre. In the Sugar Pine site, overstory species include white fir, ponderosa pine (*Pinus ponderosa*), black oak, sugar pine, with small amounts of the live oaks (*Quercus* spp.), incense cedar (*Calocedrus decurrens*), and California red fir (*Abies magnifica*). Overall canopy cover is 64% in the Sugar Pine site, and average basal area is 234 ft 2/acre.

Shrub cover in our sites is also mixed and includes a range of manzanita species (*Arctostaphylos nevedensis* and *A. patula*), chinquapin (*Chrysolepis sempervirens*), shrub oaks (*Quercus vaccinifolia*), tan oaks (*Lithocarpus densiflorus*), snowberry (*Symphoricarpos mollis*), ribes shrubs (like currant, gooseberry, etc.), mountain misery (*Chamaebatia foliolosa*) and whitethorn (*Ceanothus cordalatus*).