Sierra Nevada Forest Plan
Monitoring Accomplishment Report for 2008

Sierra Nevada Forest Plan Implementation

In 2008 the Forest Service, Pacific Southwest Region, which includes California, Hawaii, Guam, and the Trust Territories of the Pacific Islands, continued several long term monitoring studies 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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Amphibian Status and Trend Monitoring

Sierra Nevada Forest Plan Monitoring Accomplishment Report for 2008

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. 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.

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—it remains a tadpole for more than a year.


Yosemite toad male calling during spring breeding.

In the long-term, bioregional Sierra Nevada Amphibian Monitoring Program (SNAMPH), led by Cathy Brown, Stanislaus National Forest, we quantify trends in population status (occupancy, abundance) and habitat across the range of each species in the Sierra Nevada (10 National Forests). We conduct extensive and intensive components of monitoring for both species in one integrated design. Extensively, we monitor occupancy 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. 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 also collect detailed Yosemite toad abundance and habitat data in two small watersheds. Information gathered in both components is complementary and aids in interpretation of trends.

In 2007, the Pacific chorus frog (*Pseudacris regilla*) was chosen as a management indicator species (MIS) for montane meadow ecosystems (USDA Forest Service 2007). The range of the mountain yellow-legged frog in the Sierra Nevada encompasses the majority of the Pacific chorus frog's range in the Sierra Nevada, and montane meadows are one of the target habitat types surveyed. Further, data on the Pacific chorus frog were already being collected as part the amphibian monitoring surveys. Incorporating the Pacific chorus frog into this program was an efficient and statistically robust means to accomplish the MIS goals. Historical occupancy for this species was based on the historical occupancy of the Yosemite toads and mountain yellow-legged frog because the Pacific chorus frog uses the same habitats as these species and often co-occurs with them. We assumed that if either species occurred in a watershed, it was historically occupied by the Pacific chorus frog; otherwise historical occupancy was unknown.

Accomplishments

In 2008, 933 lakes, ponds, meadows, and stream reaches were surveyed in 53 sample watersheds in the Sierra Nevada. Of these sites, 861 had available or potentially available aquatic habitat. Following is a summary of preliminary occupancy patterns in the sample to date.

From 2002 to 2008, 101 watersheds were surveyed within the **Yosemite toad**'s range, including approximately 1800 meadows,

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

lakes, ponds, and stream reaches (Table 1). No trends were apparent in the data, though 7 years is a short timeframe to detect trends. Annual variability was low.

- Eighteen of these watersheds have been resurveyed for at least five years. Fourteen of these watersheds were occupied, and most were occupied most of the years they were surveyed.
- Of the 54 watersheds occupied before 1990, 61% (n=33) had *breeding* at least one year during this period. The proportion of watersheds occupied by *any stage* was similar because adults are not commonly found outside of breeding.
- Six (38%) of the 16 watersheds occupied since 1990 and 26% (n=8) of the 31watersheds where occupancy was unknown were also occupied by *breeding.*

From 2002 to 2008, 156 watersheds were surveyed in the **mountain yellow-legged frog**'s Sierran range, including more than 2300 meadows, lakes, ponds, and stream reaches (Table 1).

Twenty-six of the watersheds have been resurveyed for at least five years. Occupancy for the mountain yellow-legged frog is lower than for the Yosemite toad (Table 1). Of 50 watersheds occupied since 1990, 42% (n=21) had *breeding* and 54% (n=27) were occupied by *any stage*. Of the 23 watersheds occupied before 1990 but not since then, only one was occupied by *breeding* or *any stage*. Six (7.2%) new *breeding* and 4 (5%) new *adult/subadult* watersheds were found. Of the 26 watersheds surveyed every year, only 5 were occupied by breeding, and 3 of the 5 were occupied by breeding during all years surveyed.

Table 1. Number and percent of sample watersheds and sites occupied by Yosemite toads, mountain yellow-legged frogs, and Pacific chorus frogs from 2002-2008 by two occupancy categories and three historical occupancy categories. Occupancy categories in the rows include 1) breeding (eggs, tadpoles, metamorphs) or 2) any life stage. Historical occupancy was based on locality data.

	Yosemite Toad				Mountain Yellow-Legged Frog				Pacific Chorus Frog			
	Watersheds		Sites		Watersheds		Sites		Watersheds		Sites	
	#	%	#	%	#	%	#	%	#	%	#	%
Total sample	101		1811		156		2357		156		2357	
	Since 1990								**Historically Occupied**			
Total	54		1064		50		1029		108		1900	
Breeding	33	61.1	118	11.1	21	42.0	76	7.4	86	79.6	551	29.0
Any Stage	35	64.8	177	16.6	27	54.0	164	15.9	88	81.5	605	31.8
	Before 1990											
Total	16		245		23		309					
Breeding	6	37.5	8	3.3	1	4.3	1	0.3				
Any Stage	7	43.8	19	7.8	1	4.3	1	0.3				
	Unknown											
Total	31		502		83		1019		48		457	
Breeding	8	25.8	20	4.0	6	7.2	12	1.2	20	41.7	92	20.1
Any Stage	11	35.5	27	5.4	10	12.0	23	2.3	24	50.0	105	23.0

Sample sizes for the Pacific chorus frog were the same as for the mountain yellow-legged frog. Occupancy for this species was high (Table 1). Of the 108 historically occupied watersheds, 86 (79.6%) were occupied by *breeding*, and 88 (81.5%) by *any stage*. Adult chorus frogs are not commonly found outside of spring breeding. In the *unknown* watersheds, 41.7% (n=20) were occupied by *breeding*, and 50% (n=24) were occupied by *any stage*. Nineteen of the 26 watersheds surveyed every year were occupied by breeding. Fourteen of these were occupied most of the years they were surveyed.

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 three meadows in each of two watersheds (one on the Stanislaus NF and one on the Sierra NF). No counts or repeat surveys in either watershed were conducted for tadpoles and metamorphs or to measure recruitment. Table 2 shows estimates of adult males using mark-recapture models and egg mass counts for the two watersheds. These results suggest population sizes in these watersheds are small.

Table 2. Yosemite toad adult and egg mass abundance estimates from 2006-2008 in two intensive watersheds. Adult male numbers were estimated with mark-recapture models. Bull Creek is on the Sierra National Forest, and Highland Lakes is on the Stanislaus National Forest. Overall, numbers of adult males and egg masses are small.

	Abundance of Adults and Egg Masses								
	2006			2007			2008		
	Adult Males (95% CI)	Adult Females [1]	Egg Masses [2] (95% CI)	Adult Males (95% CI)	Adult Females [1]	Egg Masses [3] (95% CI)	Adult Males (95% CI)	Adult Females [1]	Egg Masses [3] (95% CI)
Bull Creek									
520M16	11-32	4	35-38	8-20	1	19-22	11-18	11	25-39
520M15	19-25	5	18-20	15-41	3		17-29	10	40-73
520M20				3-4	5	7-9	4-5	2	13
Highland Lakes									
37188	18-24	4	15-18	19-27	13	11-17	19-22	19	19-26
37213		0	10	14-31	8	7	14-31	10	16-20
37165				6-8	2	5	7-9	2	5

[1] Number of females found during surveys

[2] Dependent Double Observer

[3] Independent Double Observer

2009 Program of Work

The program objectives for fiscal year 2009 are to

- collect population data in re-survey watersheds,
- continue adult and egg mass counts in the two Yosemite toad intensive basins,
- finalize the 5-year population status analysis,
- continue the habitat-relationship analysis, and
- continue the 5-year program evaluation.

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.

References

Jennings, M. R. 1996. Status of amphibians. In: Sierra Nevada ecosystem project: Final report to Congress. University of California, Davis. pp. 921-944.

USDA Forest Service. 2007. Sierra Nevada Forests Management Indicator Species Amendment FEIS. Pacific Southwest Region, R5-MB-159, 410pp.

Vredenburg, V.T. 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 2008

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 20th 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?

2008 Accomplishments–UC

In the third year of **Phase I**, livestock utilization was monitored on 24 previously selected meadows providing Yosemite toad breeding habitat (as determined by Sierra National Forest surveys). Details of field methods are provided in the 2007 SNFPA annual report.

Just as we showed for 2007, our preliminary results for 2008 show no significant difference in toad occupancy across a range of utilization levels in the early and mid season periods; however, there is a significant ($p<0.05$) difference in utilization levels between occupied and unoccupied meadows during the late season period (Figure 1).

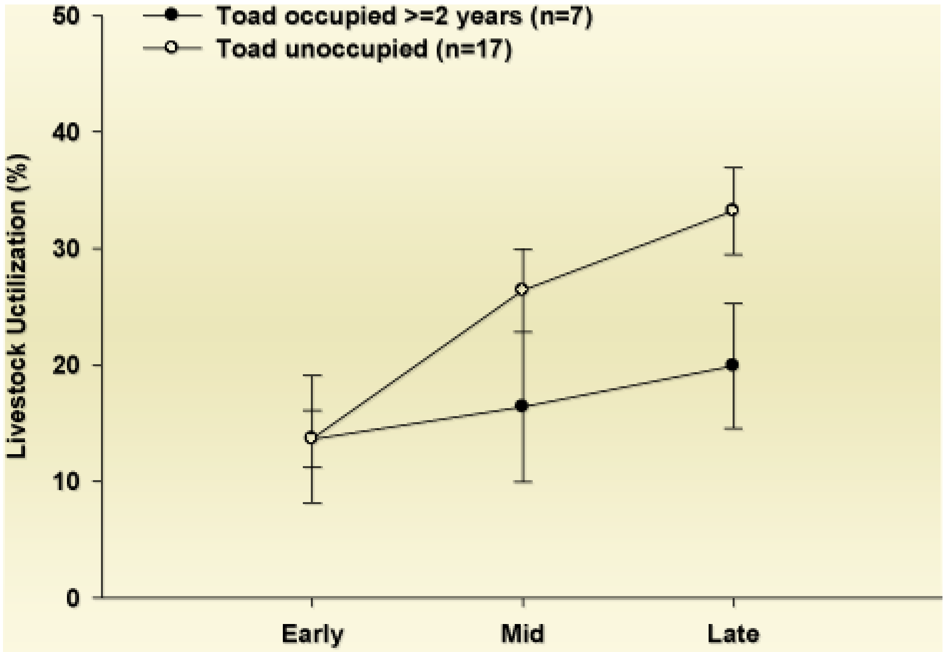


Figure 1. Livestock utilization and toad occupancy for the 2008 season. “Occupied” meadows have had confirmed toad populations in at least 2 years (out of a possible 3 years of surveys). Vertical bars = 1 standard error. There is a significant ($p<0.05$) difference in utilization levels between occupied and unoccupied meadows during the late season period.

To link livestock utilization to Yosemite toad occupancy, we conducted an independent toad occupancy survey of all 24 meadows for the second year, as described in the 2007 report. Preliminary analysis of livestock utilization by meadow hydrology (Figures 2 and 3) demonstrates that meadows classified as “wet” experience lower utilization levels and have the highest toad occupancy rates.

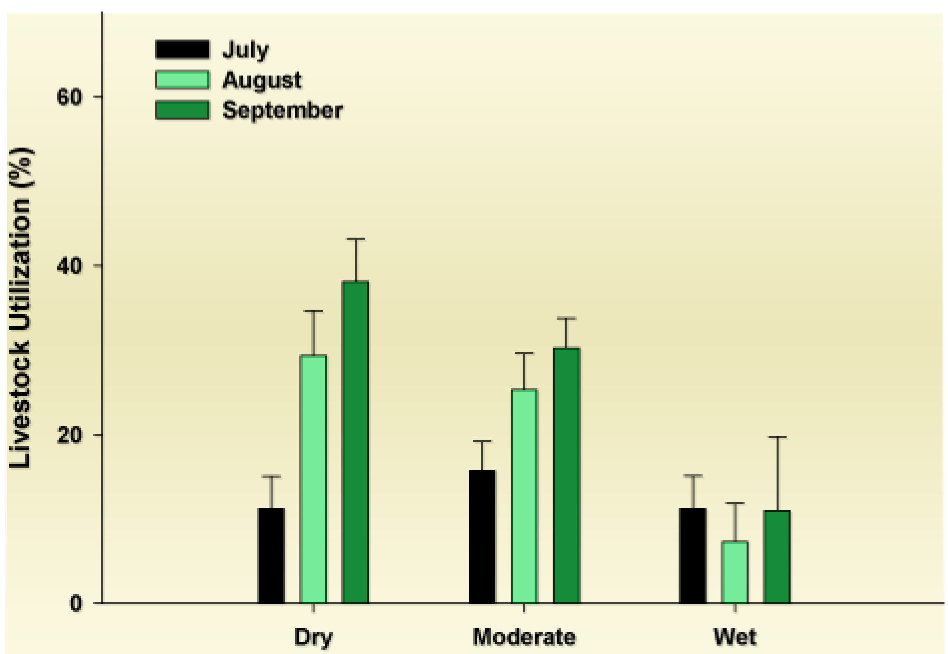


Figure 2. Livestock utilization by meadow hydrology, from “dry” to “wet”. Both dry and moderately wet meadows experienced overall higher livestock utilization levels in August and September than wet meadows ($p<0.05$). Early season (July) utilization was not significantly different between meadow types. Vertical bars = 1 standard error.

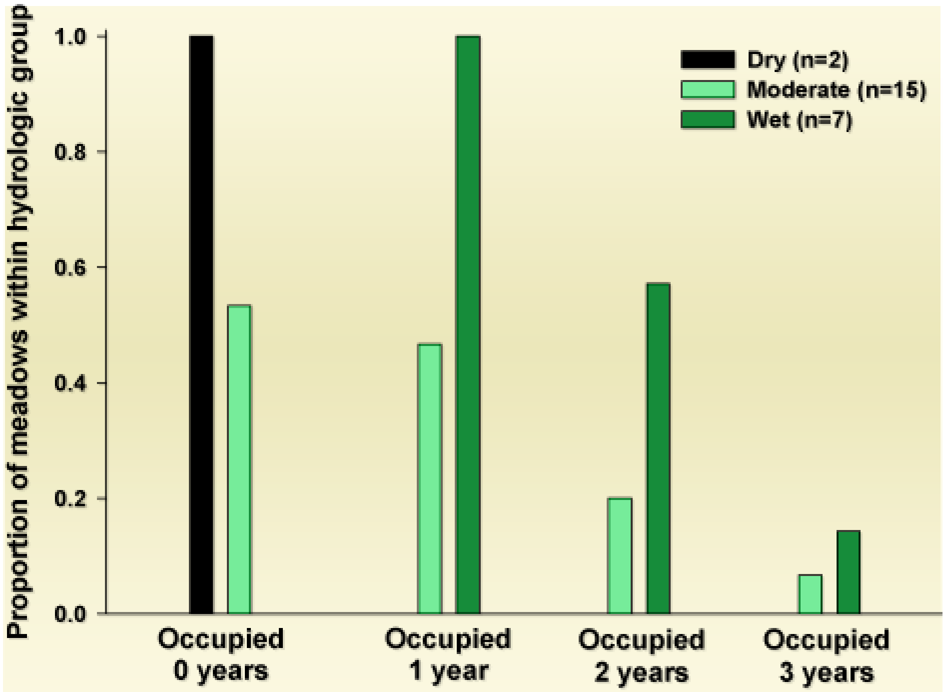
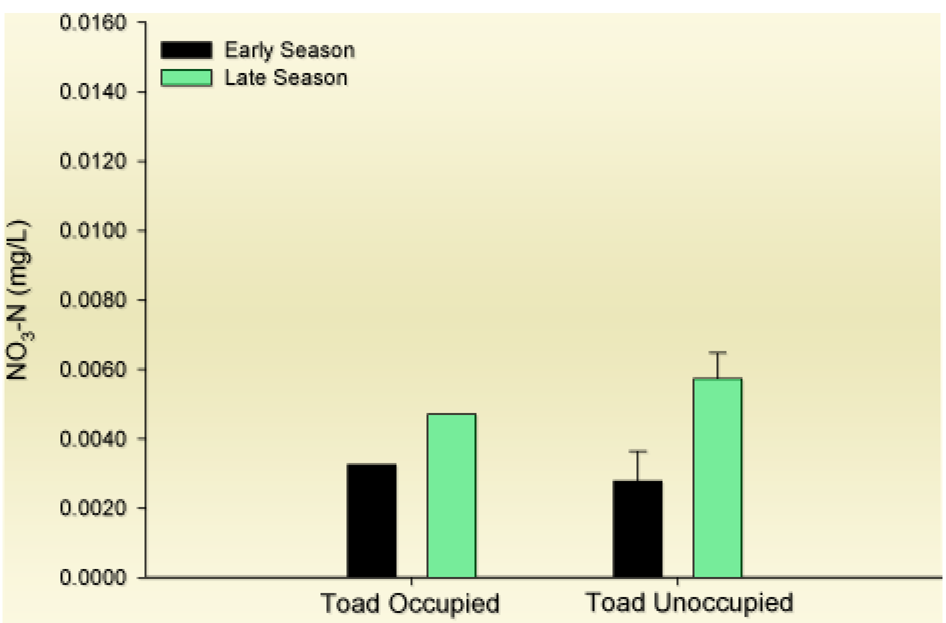


Figure 3. Proportion of meadows within each hydrologic group by confirmed toad occupancy. Dry meadows were unoccupied for all 3 survey years, and wet meadows had the highest occupancy rates (e.g. all wet meadows [n=7] were occupied for at least 1 survey).

Water Quality

For **Phase II**, water quality data were collected for the third year in two pools occupied by toads and two unoccupied pools for each of three grazing treatment meadows across three allotments on the Sierra National Forest. Water samples were collected before cattle turn–out ("early season") and after toad metamorphosis ("late season"). Samples were analyzed for pH, electrical conductivity, total suspended solids, turbidity, NO_3–N, NH_4–N, Total N, PO_4–P, Total P, and dissolved organic carbon using standard methods. This data collection effort has generated an immense amount of data. Overall, these habitats have very low nutrient concentrations, with the majority of sample analyses falling below minimum detection limits. Three Dinkey allotment meadows were selected to show some preliminary results for NO_3–N analyses (Figure 4a–c).



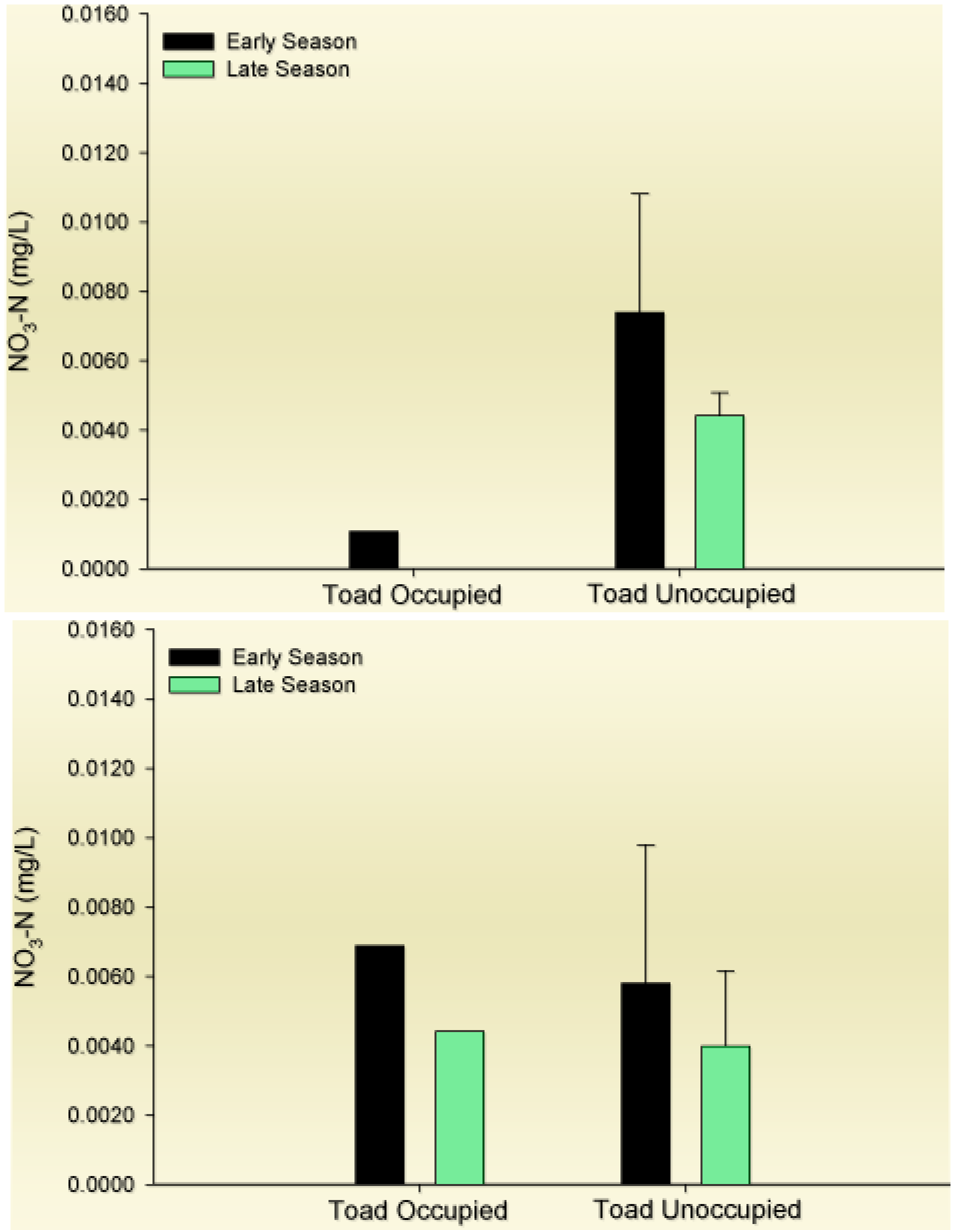


Figure 4. NO_3–N levels for early and late season periods of toad occupied and unoccupied pools in three grazing treatments of the Dinkey allotment as determined in 2008: a) Bear Paw meadow (Fence Whole Meadow), 1 toad occupied and 3 toad unoccupied pools; b) Exchequer meadow (Fence Wet Areas), 1 toad occupied and 3 toad unoccupied pools; and c) Cabin meadow (Standard Grazing), 1 toad occupied and 2 toad unoccupied pools. All samples were below minimum detection level (0.01mg/L). Vertical bars = 1 standard error.

Meadow Plant Communities and Environmental Variables

We continued collecting plant species composition, biomass, and water table data for **Phase II** on the 10 Sierra National Forest 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. We measured piezometers to calculate water table depth at every meadow monthly from May to September on the Sierra National Forest. On the seven Stanislaus National Forest meadows, we placed utilization cages and measured water table depth in early July. We then measured late–season utilization and water table depth at the Stanislaus National Forest meadows in September.

Using classification techniques, we identified five plant community types across the 17 study meadows with the 2006 and 2007 cage species composition data. In an ordination analysis, we found that water table depth and elevation were key environmental factors contributing to the distribution of plant community types. The *Eleocharis* spp. plant community type had the highest water tables both years, with *Carex jonesii* and *Carex nebrascensis* types often occurring in more mesic sites. *Carex–Group 8* (including *C. athrostachya, C. leporinella, C. microptera,* and *C. multicostata*) and *Veratrum californicum* types were consistently found in drier sites. Figure 5 shows seasonal changes in mean water table depth by plant community for 2006 and 2007. We are currently analyzing 2008 results.

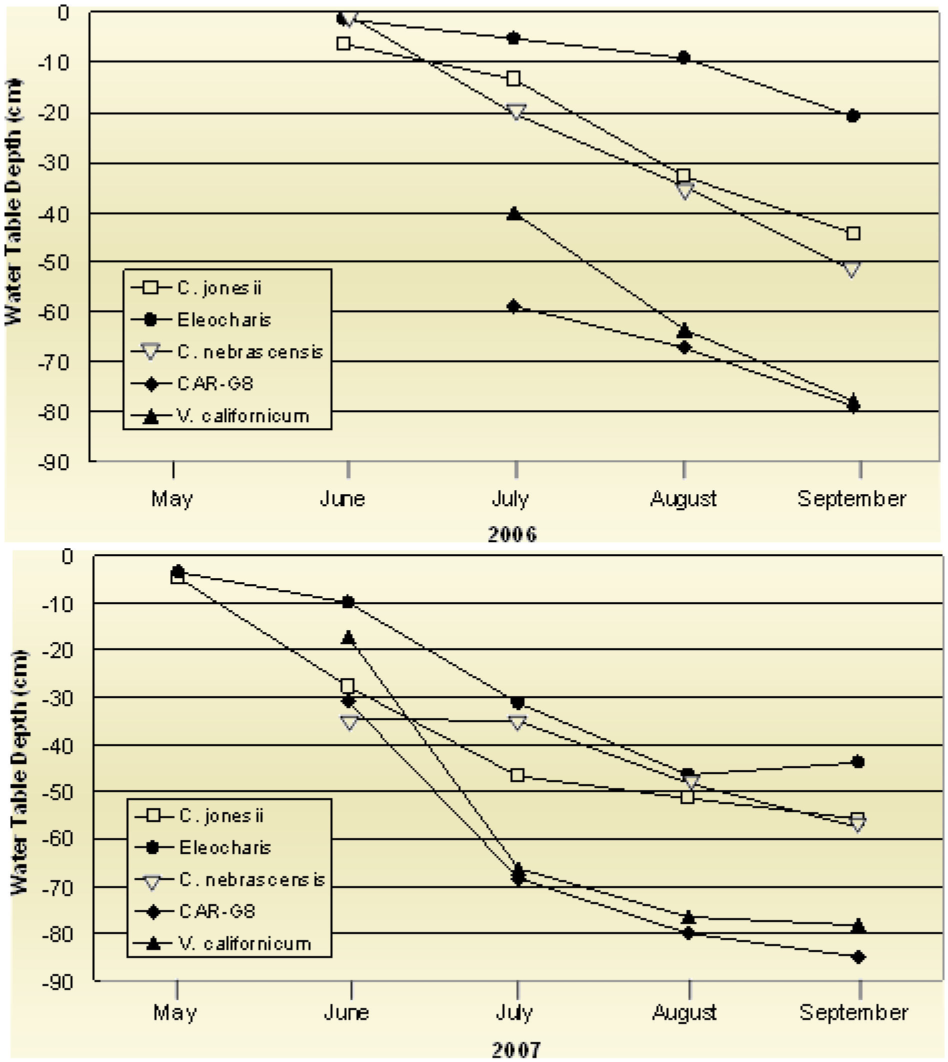


Figure 5. Mean water table depth for plant community types for 2006 and 2007. Some community types lack early–season piezometer data due to inaccessibility. Negative values denote water level below the soil surface.

We have started analyzing 2005–2008 late–season utilization data. We collected pre–treatment utilization data on meadows in 2005 before fences were constructed. From 2006–2008 we collected utilization data on all study meadows. For the fence wet area meadows, we placed five cages outside the fenced areas to measure use in the areas that were still available for forage, and we separated fence wet area in from fence wet area out for our analyses. There are five replicates per treatment, and 10 cages per meadow except for the fence wet area meadows, which have the additional five cages outside the fence (n = 195 cages for 2006–2008, Table 3). Grazing levels within treatments across years was relatively stable. Among treatments, fence wet area out consistently had the highest levels, reflecting the effect of partial meadow fencing. We also measured utilization values ranging from 10% (+ 4 SE) to 18% (+ 7 SE) within fences, due at least in part to deer and livestock grazing within fences, which was captured by digital cameras on the Sierra National Forest.

Table 3. Percent utilization (+ SE) by treatment. n=5 areas per treatment except in 2005 when 11 meadows were sampled.

Year	Standard grazing	Fence wet area inside	Fence wet area outside	Fence whole meadow
2005	29 (12)			
2006	20 (7)	10 (4)	36 (8)	18 (7)
2007	42 (8)	10 (4)	51 (7)	15 (5)
2008	33 (7)	10 (4)	52 (8)	13 (4)

2008 Accomplishments – PSW

Over the past year, work continued on both phases of the project. For the Phase I toad habitat distributional model, data analysis and modeling are nearly complete.

For Phase II (experimental fencing treatments), field data collection continued to be focused on quantifying toad populations and their habitat associations on 17 national forest meadows (Table 4). Population levels for all life stages of toads (adults, eggs, tadpoles, and young of the year) were quantified, and we recorded information on local scale (pool and individual–focused) habitat characteristics. We also continued work at two reference meadows in Yosemite National Park because long–term ungrazed (>10 years) reference meadows could not be found on the Stanislaus and Sierra National Forests.

Table 4. Sampling periods and data collected by PSW for the Yosemite toad / livestock grazing study.

Sampling Period	Life Stage Focus	Methods
• Late spring • May /June • (2006-2008) [1]	Adults, eggs	• Multiple cap-recap visits and measurements of adults • Egg cluster counts • Amphibian chytrid fungus swabbing • Individual-focused habitat data (egg clusters & adults)
• Early-mid summer • July / August • (2005-2008)	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 • (2005-2008)	Young of the year (yoy)	• Multiple cap-recap visits and measurements of yoy • Breeding pool aquatic habitat and vegetation data

[1] Except for Herring Creek

Amphibian Chytrid Fungus Occurrence

Amphibian chytrid fungus (*Batrachochytrium dendrobatidis*) is a disease that has been seen in association with large die–offs and declines of amphibians around the world. It is known to infect native amphibian species in the Sierra Nevada, including Sierra Nevada yellow–legged frogs (*Rana sierrae*). To date, we have not witnessed any die–offs in the Yosemite toad populations we are studying. The fungus is detected by sampling skin cells from toads using a cotton swab, which are sent to a collaborator (Dr. Vance Vredenburg, San Francisco State University) for DNA analysis. A total of 155 adult toads were swabbed from the study meadows in 2006 and 2007 (Table 5) — 2008 samples are currently being analyzed.

Table 5. Amphibian chydrid fungus detection rates for Yosemite toads. The percent and number of positive individuals (over total swabbed) are presented at the allotment scale.

Location	Allotment (Meadows)	% Positive	
		2006	2007
Yosemite NP	(Topper and Turner Meadows, only Turner positive)	not visited	16.7 (1/6)
Sierra NF (All meadows with at least one positive individual except Footprint and Mono)	Patterson Mountain (Hash, Continental, Swain Thrush)	16.7 (2/12)	16.7 (1/6)
	Dinkey (Exchequer, Bear Paw, Cabin)	15.4 (2/13)	40.0 (4/10)
	Blasingame (Back Badger/ Footprint, Mono, Weldon Camp, Marigold)	9.1 (3/33)	9.1 (2/22)
Stanislaus NF (All meadows with at least one positive individual except Bear Tree)	Herring Creek (Lower Three Meadows, Middle Three, Castle)	7.7 (1/13)	18.7 (3/16)
	Highland Lakes (Bear Tree, Snag, Rock Top)	30.0 (3/10)	7.1 (1/14)

Pool Occupancy Rates

Within a given meadow, Yosemite toads are using some breeding pools consistently from year to year while other pools are not used every year. Periodically new breeding pools are established. We are currently analyzing data to determine if there are differences in overall pool occupancy rates and spatial patterns of occupancy among the grazing treatments.

Study Modifications for 2009

For meadow environmental and utilization data collection, we will modify data collection further in the 2009 field season. We collected our third and final year of Phase I data in 2008. For Phase II in 2008, we reduced field work on the Stanislaus National Forest by not continuing plant species composition data collection. Instead, we placed cages early in the season and measured utilization late season and also collected water table data during these two visits. We will conduct sampling at this same level on the Stanislaus National Forest in 2009. For the Sierra National Forest, we will measure water table depth and biomass at least three times during the season. Additionally, we have removed two meadows (Middle Three and Lower Three) from the study due to extensive difficulty with treatment implementation.

We plan some modifications to Yosemite toad population and habitat data collection in 2009: fewer surveys on the Stanislaus National Forest meadows (3 visits, instead of 4 or 5 to each meadow), reduced microhabitat data collection at all study meadows, and eliminate water quality and water temperature data for Yosemite toad habitat.

Following the 2009 field season, we will focus on data analysis. Depending on our findings, we may have an additional summer field season in 2010.

Fisher and Marten Status and Trend Monitoring

Sierra Nevada Forest Plan Monitoring Accomplishment Report for 2008

Fisher (*Martes pennanti*) and marten (*M. americana*) population monitoring, conducted by Rick Truex, Sequoia NF, was again limited to the southern Sierra Nevada during the 2008 field season. The population monitoring study area for fishers occurs from Highway 120 in southern Tuolumne County to the southern end of the Greenhorn Mountains in Kern County. Within this area, sampling includes elevations ranging from ~800 – 3200 m and is limited to public lands. Nearly all monitoring occurs on national forest lands, though some sampling has been completed on lands administered by the National Park Service. In addition to intensive population monitoring in the southern Sierra, the monitoring plan includes sampling additional sites in the central, northern, and eastern Sierra. Sites established outside the fisher population monitoring study area serve two purposes: detecting fishers outside their current geographic range at 'sentinel sites' to document population expansion and monitoring marten. Sampling effort in the central and northern Sierra has been limited during the past several years due to logistical and budget considerations, and to focus on monitoring of the geographically–isolated southern Sierra fisher population.

A fisher trap. As a target species (e.g., fisher, gray fox [Urocyon cinereoargenteus]) enters the track–plate enclosure to inspect the bait (chicken, at the rear of the enclosure), its feet collect soot from the dark track plate and deposit tracks on the light adhesive surface (Con–tact® paper) positioned just in front of the bait. Animals are prevented from entering the back of the track–plate station by fastening a piece of mesh hardware cloth to the rear of the box. The barbed wire positioned near the entrance to the enclosure often collects hair from larger target species as they enter the box to inspect the bait.

Monitoring these mid–sized carnivores relies on tracking an index of abundance — the proportion of sites occupied —over time. The same non–invasive field methods are used for fisher and marten monitoring. Primary sample units are co–located with Forest Inventory and Analysis (FIA) plots and include an array of six baited track–plate stations. The center track–plate station is located within approximately 100 m of an FIA point, and the perimeter stations are spaced at regular intervals ~500 m from the center station (Figure 6). Track–plate stations are considered non–invasive survey techniques because animals are never restrained or handled, but instead enter a track–plate enclosure to retrieve a small piece of bait, and in doing so first walk over a sooted aluminum plate then an adhesive surface where tracks are deposited (see photo). Tracks collected from carnivores in this manner provide a verifiable record of species presence (see photo) and, in the case of fisher and marten, can be used to identify gender as well.

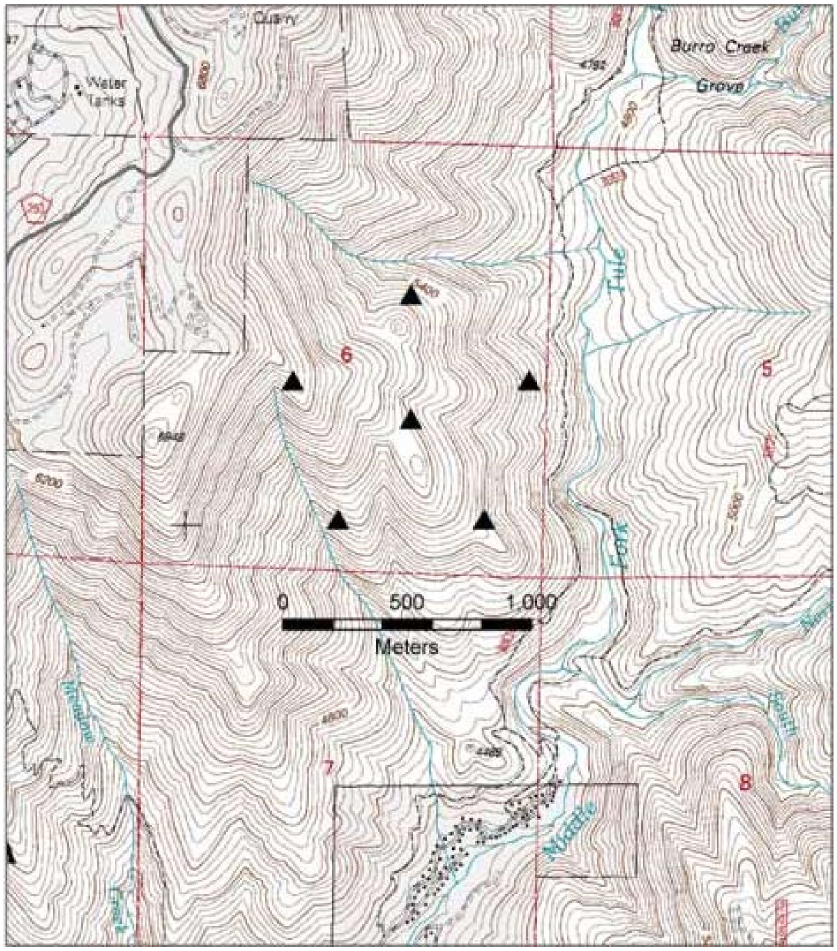
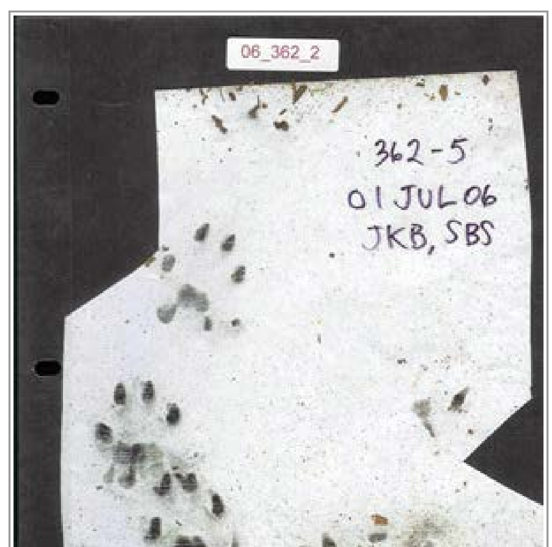


Figure 6. Illustrative spatial configuration of a carnivore monitoring primary sample unit plotted on 1:24,000 topographic map. Each triangle represents a track–plate station, and the center station is located within 100 m of a Forest Inventory and Analysis (FIA) point. To adhere to the FIA Privacy Policy, the true survey locations may not be revealed and must instead be 'fuzzed' from their true locations. The sample unit displayed here has been 'fuzzed' in a random direction 500 – 850 m from its true location.

Once deployed in the field, each primary sample unit is surveyed for ten consecutive days and stations are visited by field technicians every other day to collect tracks and assure track–plate stations are operating correctly. A species is considered present at a sample unit if it is detected at one or more stations during the ten–day survey. For the past 3 seasons (2006–2008), all track–plate stations have been modified by placing barbed–wire hair snares at the entrance to each track–plate enclosure (see photo). These hair snares permit collection of genetic material from fishers, martens, and other carnivores. Sampling occurs annually from June – October.



Example of fisher tracks permanently archived in a document protector. The

Accomplishments

Survey Effort and Fisher Occupancy Rates

Sampling in the southern Sierra during 2008 followed the same approach as 2007, which differed from previous years in that a somewhat reduced elevation range where fishers are most widely distributed was sampled. In addition to sampling within the fisher population monitoring study area (Sequoia, Sierra, and southern Stanislaus National Forests), part of Inyo National Forest was surveyed during 2008. A total of 184 sample units were surveyed during 2008 (89 on Sierra NF, 72 on Sequoia NF, 16 on Inyo NF, and 7 on Stanislaus NF).

Fishers were detected at 40 sample units (23 on Sequoia NF and 17 on Sierra NF). The general pattern of fisher detections during previous seasons was recorded again during 2008: the observed occupancy rate (calculated as # sites detecting fisher / # of sites sampled) for the west slope of Sequoia NF was higher than observed occupancy rates on the Sierra NF or the Kern Plateau portion of Sequoia NF. The observed occupancy rate for the west slope of Sequoia NF was slightly lower than during previous seasons, but still higher than for the Kern Plateau or Sierra NF (Table 6). Although the 'Sierra' geographic region includes ~10 sites on the southern Stanislaus NF (south of Highway 120), fishers have not been detected on Stanislaus NF.

image is reduced to about half of its actual size.

Table 6. Observed occupancy rates (# of sites detecting fisher / # of sites sampled) for fishers in 3 geographic areas within the southern Sierra population and pooled across the entire population. The geographic areas include Sierra National Forest and Stanislaus NF south of Highway 120 (Sierra), the west slope of Sequoia NF including the Hume Lake Ranger District (Sequoia), and the Kern Plateau portion of Sequoia NF (Kern).

Year	Geographic Region			All Sites
	Sierra	Sequoia	Kern	
2002	0.217	0.353	0.167	0.252
2003	0.200	0.483	0.133	0.281
2004	0.113	0.390	0.214	0.207
2005	0.155	0.514	0.294	0.291
2006	0.170	0.508	0.185	0.276
2007	0.142	0.540	0.222	0.262
2008	0.181	0.392	0.143	0.241

Although the observed occupancy rates reported here have not been adjusted for fisher detectability (the probability of detecting fisher when truly present), seven years of monitoring suggest no conspicuous decline or increase in occupancy rates across the entire population, and some variability among years for the three geographic areas (Table 6).

From 2002 – 2008, 439 sites were surveyed throughout the Sierra Nevada on 1286 sampling occasions, with the majority of the effort (>80% of all sampling) occurring within the fisher population monitoring study area. Fishers have not been detected in the northern, central, or eastern Sierra. Occupancy rates for other mid–sized carnivores (martens, gray foxes, spotted skunks, and ringtails) in 2008 were similar to previous years.

In the fisher population monitoring study area, fishers have been detected at 112 of 251 (44.6%) sites sampled during the 7 monitoring seasons. Of these 251 sites, 203 (80.8%) have been sampled at least 3 years (112 on Sierra NF, 62 on the west slope Sequoia NF, and 29 on the Kern Plateau). For sites that have been sampled at least 3 years, the overall occupancy pattern can be characterized as either:

1. Reliably occupied: fisher detected during ≥50% of years sampled
2. Occasionally occupied: fisher detected at least one year, but <50% of the years sampled
3. Unoccupied: fisher never detected

Examining the distribution of detections using these definitions reveals that fishers are reliably detected most often on the west slope of Sequoia National Forest, where 31 of 62 sites sampled 3 or more years have detected fishers at least half of the years surveyed (Figures 7 & 8). On the Kern Plateau, only 3 of 29 sites meet the criteria to be considered reliably occupied, while more than half are characterized as occasionally occupied. On Sierra NF, reliably occupied sites (14 of 112 sites, 12.5%) are scattered through the mid–elevations, often surrounded by sites considered occasionally occupied (Figure 8).

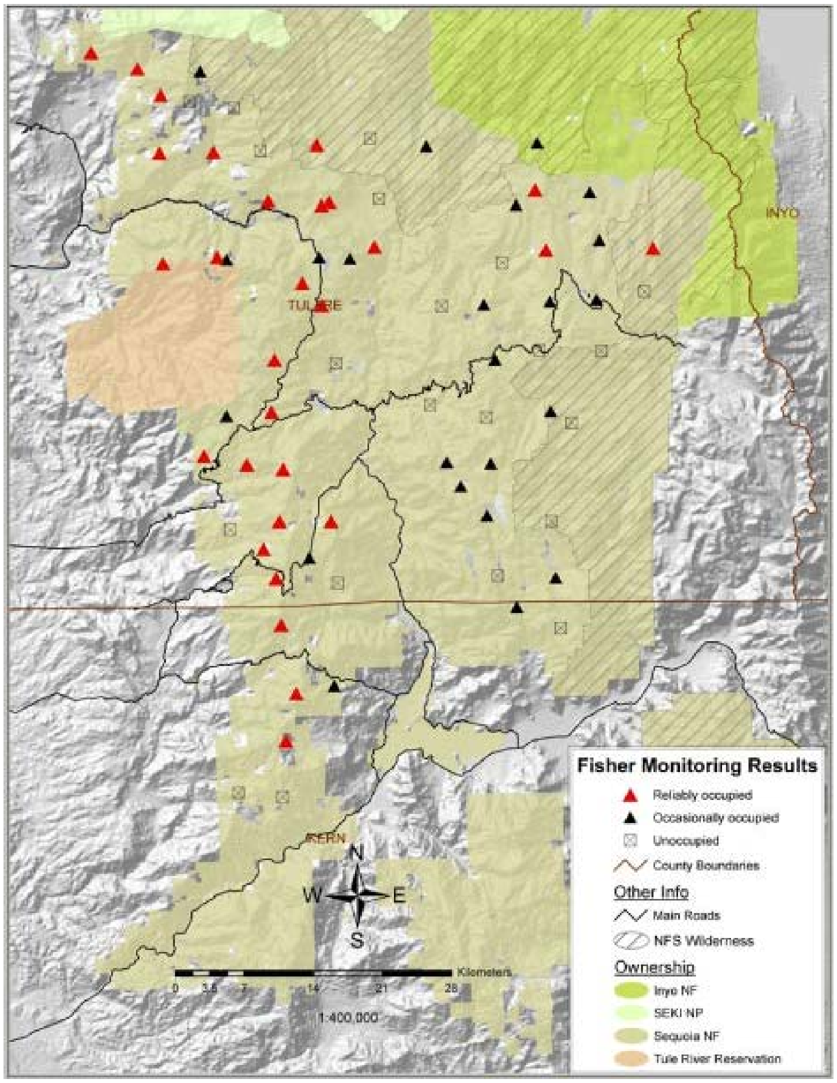


Figure 7. Map depicting monitoring sites on Sequoia NF that have been surveyed at least 3 years during the 2002–2008 monitoring period. At 'reliably occupied' sites, we have detected fishers during at least half of the years they have been sampled while at 'occasionally occupied' sites, we have detected fisher at least one year, but fewer than half of the years surveyed. At 'unoccupied' sites, we have failed to detect fisher during all years surveyed.

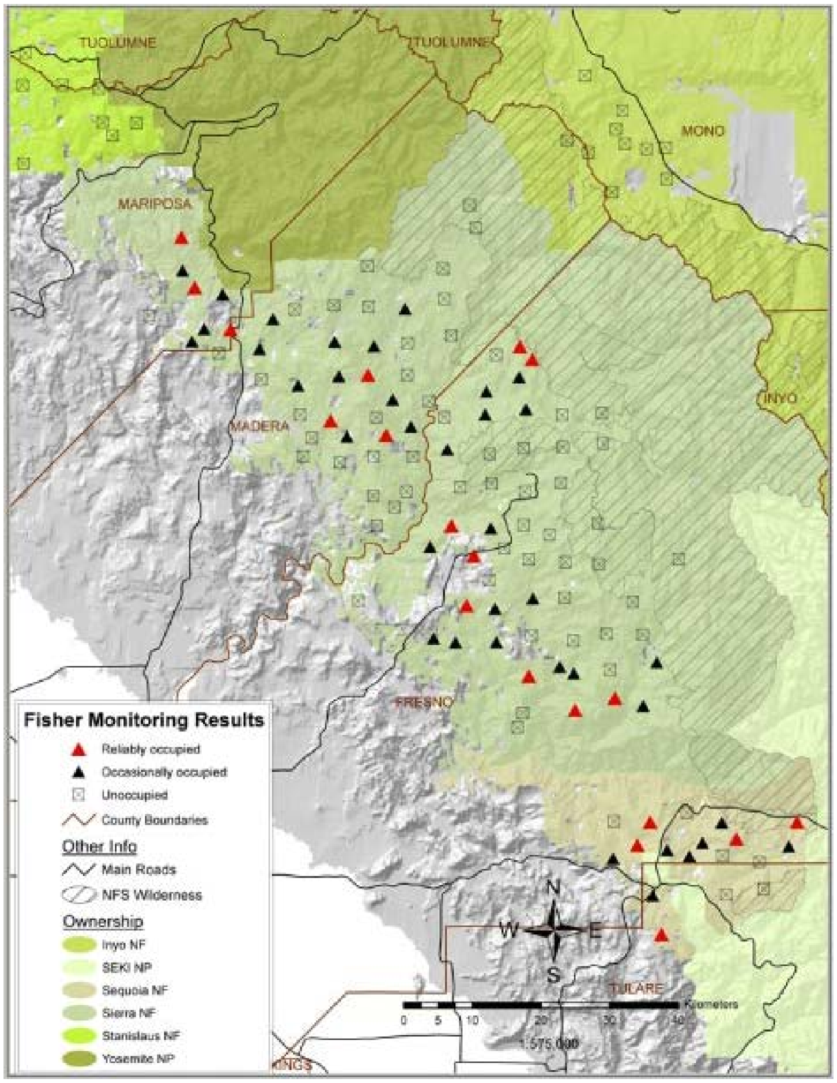


Figure 8. Map depicting monitoring sites on Sierra NF, the Hume Lake Ranger district of Sequoia NF, and southern Stanislaus NF that have been surveyed at least 3 years during the 2002–2008 monitoring period. Sites are designated as in Figure 7.

Fisher Population Genetics

Within the fisher population monitoring study area, genetic samples have been collected since 2006 to investigate various fisher population genetics questions. To complement the genetic samples collected at primary sample units as part of the annual population monitoring effort, additional hair snare surveys were conducted during 2007 and 2008 to fill in gaps in the genetic sample distribution. These surveys occurred opportunistically, relying on road and trail access rather than co–locating survey locations with FIA points, and considerable effort was expended in Sequoia–Kings Canyon National Park to provide a spatially comprehensive genetic sample of the southern Sierra fisher population.

Because the quantity and quality of DNA in non–invasive samples is variable depending on sample size and environmental conditions, not all samples contain enough DNA to accurately genotype an individual. Laboratory success rates for individual identification of fisher samples collected ranged from 43.7 % in 2008 to 60.0% in 2006 (Table 7). To date 132 individuals have been identified from hair samples with a low recapture rate between years. Gender determination is complete for 2006 and 2007, but is still ongoing for samples collected in 2008.

Table 7. Summary of genetic results 2006–2008.

Year	Fisher Hair Samples	Genotypes	Success Rate	# of Individuals	Male	Female
2006	130	78	60.0 %	50	30	20
2007	145	81	55.9 %	42	20	22
2008	167	73	43.7 %	52		

Total	442	232	52.5%	132		

One of the primary objectives of the fisher population genetics research is to examine genetic connectivity and structure within the population. Previous research indicated that the southern Sierra fisher population may be heavily impacted by a lack of population connectivity. In 2004, researchers found extreme population subdivision within the population north and south of the Kings River Canyon (Wisely et al. 2004). This study used the commonly reported metric of population subdivision of F_{ST} in their analysis. F_{ST} is an index of genetic subdivision between population that ranges from 0–1 where 0 indicates complete connectivity and 1 indicates complete genetic isolation; high F_{ST} values indicate low levels of gene flow between populations. Wisely et al. (2004) found an F_{ST} value of 0.51 between samples on either side of the river canyon. This amount of gene flow is equivalent to 0.02 migrants per generation (*Nm*) or only one migrant every 50 generations moving across the Kings River. The results of this study were surprising considering that the two sampling areas were separated by less than 100 km which is within the known dispersal distance of the species.

While the results of the Wisely et al. (2004) study were striking, they were based on a relatively small sample sizes collected from two small geographic areas (Kings River area n=14 and Tule River area n=19), each of which may have had a relatively high degree of familial relatedness compared to individuals across the entire population. The genetic sampling conducted in conjunction with our fisher population monitoring program has provided a larger and more geographically representative sample than has been previously available. Genetic analysis of the SNFPA samples is ongoing, but preliminary analyses of 2006, 2007, and part of the 2008 data indicate much greater genetic connectivity across the Kings River Canyon than reported by the Wisely (2004) study. Analysis of the SNFPA fisher data found an F_{ST} value of 0.07 between individuals north and south of the Kings River Canyon, which is roughly equivalent to 3.5 migrants per generation moving between populations. This is a dramatic increase in the estimate of genetic connectivity compared to the previous estimate (Wisely 2004) (Table 8).

Table 8. Comparison of population genetics analysis between Wisely et al. (2004) and the SNFPA fisher monitoring data. Values reported reflect the amount of genetic connectivity across the Kings River Canyon; n = sample size, F_{ST} = index of population subdivision, *Nm* = number of migrants per generation.

	n	F_{ST}	*Nm*
Wisely et al. 2004	33	0.51	0.02
06-08 SNFPA data	132	0.07	3.5

A preliminary population assignment analysis has been completed in which the genetic data are used to infer the most likely number and location of subpopulations (Figure 9). This analysis indicates three subpopulations within the southern Sierra fisher population, and a moderate level of gene flow among all three (F_{ST} = 0.06–0.12). Although genetic analysis is ongoing and population assignments may change with additional data, the three subpopulations include

1. a relatively small subpopulation in northwestern Sierra NF and Yosemite National Park (generally north of the San Joaquin River);
2. a subpopulation that includes the Kern Plateau and southern portion of the west slope of Sequoia National Forest; and
3. the largest subpopulation comprising most of Sierra NF, the Hume Lake Ranger District of Sequoia National Forest, and Sequoia–Kings Canyon National Park (Figure 9).

Although these results may change somewhat as additional samples are collected and analyzed, it is evident that genetic connectivity within the southern Sierra population is higher than previously thought and that the Kings River does not seem to pose a barrier for gene flow.

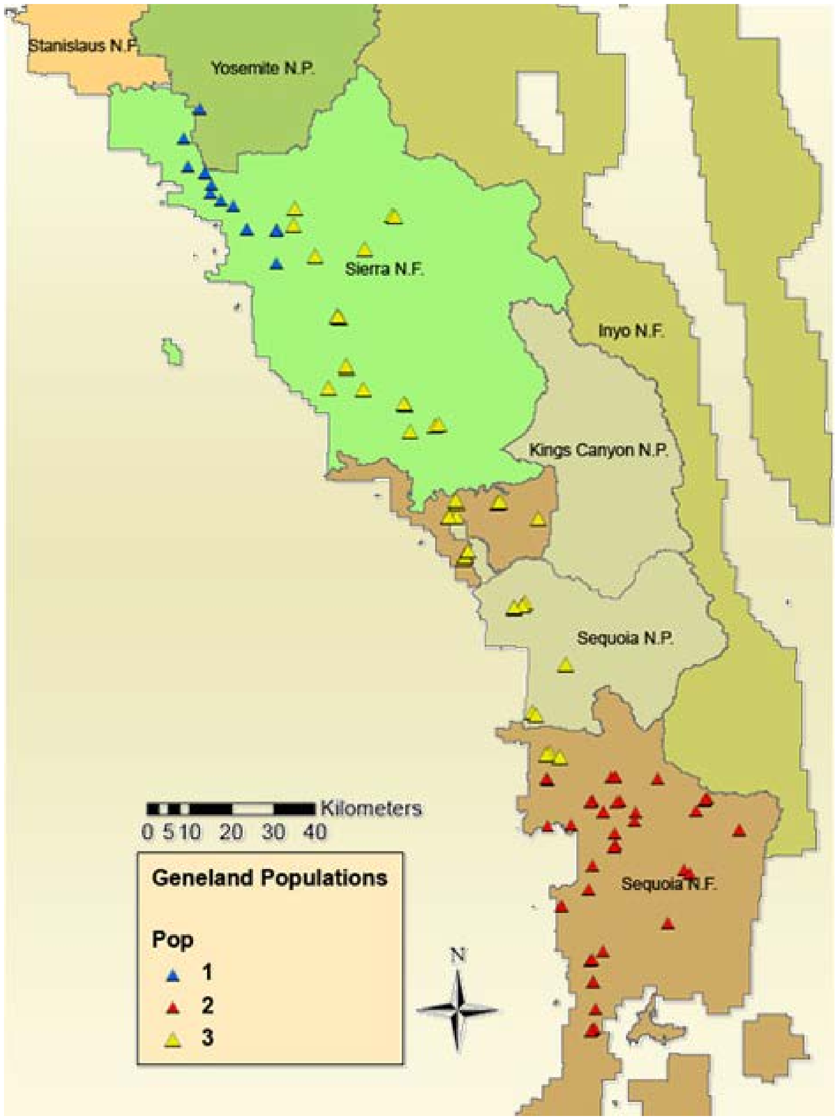


Figure 9. Preliminary population assignments and F_{ST} estimates for adjacent subpopulations. Preliminary population assignments as identified by program GENELAND and F_{ST} estimates for adjacent subpopulations. Population assignments may change as additional genetic samples are included in the analysis.

Future Work

We expect to continue intensive monitoring of the southern Sierra fisher population during 2009. In addition to monitoring the southern Sierra fisher population, we plan to strategically survey the southern portion of Stanislaus National Forest as part of an effort to identify the northern extent of the fisher population. These surveys will not rely on co–locating sites with FIA points, and will instead focus on surveying high quality habitat (as predicted from various habitat suitability models and inspection of aerial imagery and similar resources).

Analysis of the fisher monitoring data is ongoing and we expect to meet several program objectives during 2009 and 2010. This will include completing analysis of the first eight years of monitoring data and developing recommendations for potential changes to the monitoring approach. Analysis of the fisher monitoring data will rely on formal occupancy modeling techniques and will commence in earnest following the 2009 field season. This analysis will provide a rigorous assessment of overall population trend, and will include additional metrics of population dynamics such as site colonization and extinction rates (changes in occupancy state from year to year). Efforts are currently underway to identify fisher and marten gender and thereby allow assessment of sex–specific population trends, as well as identifying potential differences in distribution and habitat association between males and females. Potential changes to the fisher monitoring approach will be considered in an effort to reduce the cost and administrative burden of intensive monitoring, while still allowing adequate effort to monitor population trends. Such changes may include reducing the number of sites sampled annually, changing the periodicity of monitoring (e.g., from every year to every third year), using different field techniques (e.g., rely exclusively on genetic monitoring), or conducting monitoring during non–summer months when species detectability may be higher and thus require less sampling effort required to achieve comparable results. Potential changes in the design of the monitoring program will be guided by the ongoing analysis and peer review and tempered by future agency mission objectives and budgets.

Literature Cited

Wisely, S.M., S.W. Buskirk, G.A. Russell, K.B. Aubry, and W.J. Zielinski. 2004a. Genetic diversity and structure of the fisher (*Martes pennanti*) in a peninsular and peripheral metapopulation. Journal of Mammalogy 85: 640–648.

Links between Landscape Condition and Fishers in the Kings River Area

Sierra Nevada Forest Plan Monitoring Accomplishment Report for 2008

Research by Drs. Craig Thomson and Kathryn Purcell, of the Forest Service Pacific Southwest Research Station, on the fisher population in the Kings River area continued in 2008, with the following results:

Pacific Fisher. Credit: U.S. Fish and Wildlife Service

Capture and Monitoring

As of October 1, 2008, 32 fishers (17 female, 15 male) have been captured as part of the Kings River Fisher Project. Thirty of these animals (17 female, 13 male) were equipped with radio collars (Figure 10). These animals have been monitored extensively using a combination of ground and aerial telemetry, resulting in 1169 accurate locations. Sixteen animals provided sufficient data to estimate an annual home range, with females averaging 2066 ha and males averaging 13,455 ha.

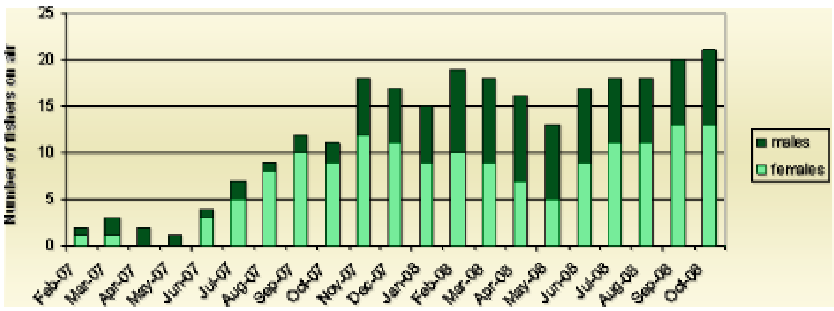


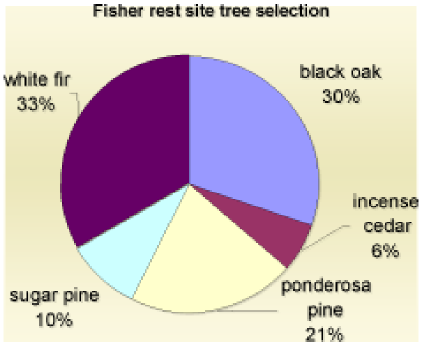
Figure 10. Number of radiocollared fishers by month in the Kings River area.

Reproduction

In spring 2008, 10 of 11 adult females (91%) were documented to have produced litters. All known births occurred between 28 March and 10 April. Seven natal dens were located, and kits were successfully counted at five. Litters averaged 1.6 kits per litter (range: 1-2), with a total of eight kits observed. Three more kits were documented via remote photographs of them accompanying collared females later in the season, though additional kits may have been missed. Two additional adult females captured after denning season showed evidence of nursing, but were never observed with kits.

Den and Rest Structures

Between October 2007 and September 2008, we located 15 dens (7 natal, 8 maternal) and 78 rest sites. Black oak was the most common species used for denning (8 of 15 dens, 53%), followed by incense cedar (13%) and sugar pine (13%) (Figure 11). Dens were also located in ponderosa pine and white fir. Rest structures were identified on 68 of the 78 occasions (Figure 11). Live trees were used twice as often as snags, and conifers were used over twice as often hardwoods. Overall, live and dead trees (n=66) used as rest sites were 83.2 ± 34.6 cm in diameter (mean + sd). Live trees (n=42) used as rest sites were 77.3 ± 30.7 cm in diameter.



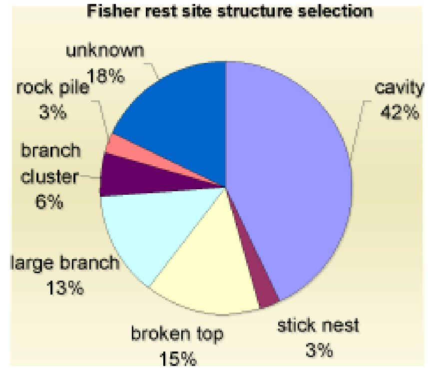


Figure 11. Tree species and structures selected by fisher for rest sites.

Mortalities

During FY08, seven radiocollared fishers died (3 female, 4 male). Sources of mortality included coyote predation (1), mountain lion predation (3), drowning (1), roadkill (1), and unknown predation (1).

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. As of September 2008, five surveys have been completed with 1724 scats collected (Table 9). Of these, 1025 have been genetically verified to species with 280 (30%) failing to amplify and 403 of the remaining 745 confirmed as fisher. Of the confirmed fisher samples, 345 were further analyzed to the individual genetic level, with only 30 (9%) successfully amplifying. Mammalian remains were found in 95% of scats, followed by birds (in 30% of scats), insects (27% of scats), and reptiles (21% of scats). Fourteen different mammalian species were identified, with the most common being Douglas squirrel and Western grey squirrel. The most common prey items were alligator lizards, found in 12% of scats, fence lizards, found in 7% of scats, and bald faced hornets, found in 6% of scats.

Table 9. Summary of scat dog surveys, 2006 through 2008.

Survey	# Samples collected	Accuracy [1]
Fall 2006	315	45 %
Spring 2007	242	57 %
Fall 2007	381	62 %
Spring 2008	408	47 %
Fall 2008	378	?
Total	2284	53 %

[1] Percentage of collected scats that were genetically verified as fisher

California Spotted Owl—Eldorado Study Area

Sierra Nevada Forest Plan Monitoring Accomplishment Report for 2008

We report here 2008 field results and long–term demographic characteristics of the study population using data collected over the period of 1990–2008 from the study of California spotted owl (*Strix occidentalis occidentalis*) population dynamics conducted by Dr. Rocky Gutiérrez, University of Minnesota. We did not include the years 1986−1989 in analyses because of small sample sizes and small expected values. Our study provides estimates of spotted owl vital rates that can be used to assess the impact of management actions on the owl population.

The Eldorado Density Study Area (EDSA) and the Regional Study Area (RSA) are located in the central Sierra Nevada, approximately between Georgetown and Lake Tahoe, in El Dorado and Placer Counties, California. The EDSA is located within the Eldorado National Forest, although 37% of the EDSA consists of private land. All RSA territory centers (i.e., nesting and roosting locations) except for one are on public land. Fifty–eight percent of the RSA territory centers are located on the Eldorado National Forest and 42% are on the Tahoe National Forest.

California spotted owl peering down from a branch. P. Flebbe photo.

We conducted 1,573 surveys for spotted owls on the EDSA and RSA in 2008, which was the second highest number conducted over the entire study period. We surveyed each historic owl territory on the EDSA and RSA at least 4 times and the entire EDSA (i.e., random call points) at least 3 times. We detected spotted owls at 20 of 48 (41.7%) historic territories on the EDSA and at 17 of 28 (60.7%) historic territories on the RSA. We also resighted the male barred owl (*Strix varia*) × spotted owl hybrid at the same RSA territory that he occupied in 2005 and 2006. He was paired with a female spotted owl in 2008, but the pair did not nest. Reproduction was assessed at 34 of the 37 occupied territories on the EDSA and RSA. Thirteen owl pairs nested successfully on the EDSA and RSA, producing a total of 19 fledglings. We identified (captured, recaptured, or resighted) 104 individuals in 2008. We captured 17 new adult or subadult birds, and we banded all 19 juveniles with cohort bands. Among the territorial owls identified to age–class in 2008, 4 of 39 females and 3 of 39 males were subadults.

Long–Term Reproductive Activity

On average, from 1990 to 2008, 82.4% of known nesting attempts in a given year were successful, but the annual proportion differed among years ($\chi 2 = 88.85$, 17 df, $P < 0.001$). We did not statistically compare the annual proportions of pairs that nested and subsequently fledged young because of small sample sizes and small expected values. From 1990−2008, 39.6% of all pairs checked for reproduction successfully fledged young, and the annual proportion of pairs fledging young was different among years ($\chi 2 = 147.74$, 17 df, $P < 0.001$). The owl population exhibited intermediate reproductive activity during 2008 relative to other years, and if a nest was initiated, the attempt was likely to be successful.

Reproductive Output

To estimate fecundity, we assessed reproductive status on 455 occasions at 68 unique territories from 1991−2008. The best model, which explained 62.2% of the temporal variation, indicated that fecundity varied from year to year in an alternating manner, declined over the period of study, and was negatively related to the proportion of subadults in the female population. Mean fecundity among years was 0.450 female young fledged per territorial female.

Annual Survival

We used the capture histories of 306 individuals (1990 — 2008) to model survival using a data set partitioned by sex and three age–classes (first–year subadults, second–year subadults, and adults). Too few owls were banded as juveniles and subsequently recaptured as territory holders (32 recaptured out of 305 banded prior to 2008) to allow modeling of juvenile survival rate. The top model suggested that:

1. survival varied among years;
2. first– and second–year subadults had a lower survival rate than adults; and
3. females had a lower survival rate than males.

After a historically low survival rate from 2005−2006, survival has rebounded to more typical values the past two years.

Population Rate of Change

We modeled population rate of change (λ) using a data set partitioned by sex. The top–ranked model suggested that λ initially declined but began to recover slightly in the latter years of study. The random effects means model suggested that the population has been stable from 1992 to 2007 (mean λ =1.000, SE = 0.027). Annual population rate of change exhibited relatively low temporal variability.

California Spotted Owl Canopy Reduction Study

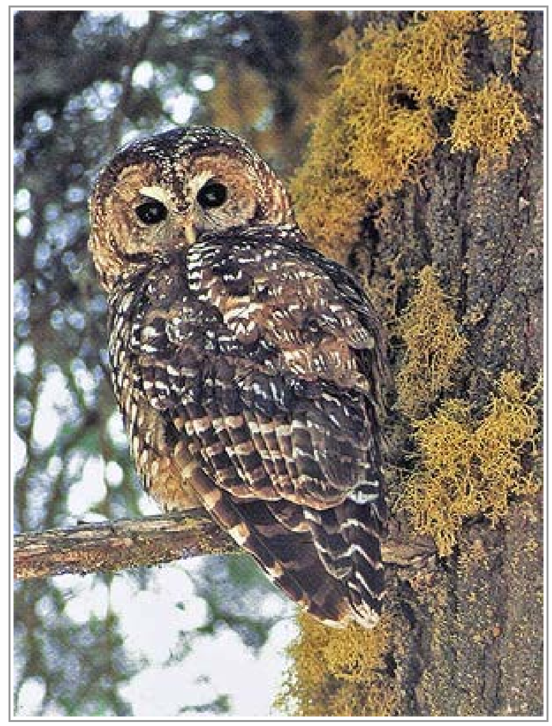
Sierra Nevada Forest Plan Monitoring Accomplishment Report for 2008

The canopy reduction study was conducted by Dr. Rocky Gutiérrez, University of Minnesota, to investigate California spotted owl response to reduction in canopy cover following the implementation of Strategically Placed Land Allocation Treatments (SPLATS) within owl territories in the central Sierra Nevada. The complete final report is available [on request, as a hard copy].

The habitat associations of the California spotted owl have been of long-standing interest to biologists and forest managers. We have assumed because of the owl's observed habitat relationships that logging negatively affects spotted owls. We designed this study to provide direct causal links between logging and acute (short-term) effects on spotted owls. The results of our study were equivocal; however, we feel they provide a basis for designing and monitoring effects of logging on spotted owls.

Effect of Logging on Forest Structure

In all cases, the percent canopy cover was reduced at the treatment sites. The range of canopy reduction we measured was approximately 10-13%, a relatively small change given the wide latitude that is allowed under the treatment guidelines (up to 40%). This small decrease could be eliminated by normal tree growth in a few years. Similarly, the density of large trees (>30 dbh) decreased between the pre-treatment and post-treatment sampling at 3 of 4 treatment sites. However, these declines were relatively minor and could be related to four sources of variation: sampling error, logging mistakes, logging engineering, and "hazard" tree removal. It was our opinion that generally the estimates of forest characteristics showed that the logging produced the desired effects of reducing canopy closure, retaining larger trees, and reducing ladder fuels and understory (visual inspection). Post-treatment increases in suitable habitat within all 5 control territories were attributable to home range displacements (shifts) of owls between sampling periods. It was not clear if the decrease in suitable habitat in treatment territories was due to treatment effects or shifts in home range by owls in response to treatments.



Photograph of a California spotted owl.
(From Verner et al. 1992)

Effects of Canopy Reduction on Owl Home Range

For a variety of reasons, effects on home range of owls were not clear. Owls were lost to natural causes, which was unexpected and lowered our sample size to a level that made interpretation of results more difficult. It is unlikely that a study population like this would experience such a high natural mortality during an experiment. Other issues were related to implementation of the treatments, sample size, and models used for analysis. Thus, we cannot draw firm inference from these results.

Treatment owls appeared to show greater general home range displacement than control owls but this was related more to the amount of pre-treatment habitat than it was to the treatment effect itself.

Deviations in Implementation of Original Study Design

We expected that owl responses might be modest given moderate rather than drastic changes in forest structure. Indeed, the design of SPLATS was predicated on reducing tree density, ladder fuels, and canopy cover while maintaining large trees.

Our experimental design was based on extensive knowledge of spotted owl ecology gathered by biologists over the last three decades. For example, we knew that spotted owls behave as central place foragers, may move nest sites or primary foraging sites over time, and show variation among home range size within and among years and geographic areas. Hence, we predicted that logical responses to canopy reduction were changes in home range size and shifts or displacements of home ranges. We also predicted that there could be a large number of confounding factors such as the extent of treatment, the conditions of the owl's home range prior to treatment, natural annual shifting of territories or home ranges, timing of treatments, the social status of the bird, and its breeding status. We designed the study to address these factors, strengthen our inferential capability, and reduce bias.

In implementation, some key deviations occurred, which we believe had a substantial influence on the outcome of the study:

1. Some areas initially selected for logging could not be logged for logistical reasons, which required a late assessment of alternative areas.
2. One control site was actually logged and reassigned to the treatment group.
3. The treatment sites were not logged on the proposed schedule, which probably introduced a confounding year effect and resulted in a smaller sample size because birds disappeared over the winter.

In addition, the study also suffered from issues that could not be controlled:

- substantial apparent natural mortality or abandonment of territories -- spotted owls suffered the highest over-winter mortality recorded on the Eldorado demographic study since its inception;
- inability to capture extremely wary birds;
- loss of radio contact due to dispersal or transmitter failure; and
- mortality after radio-marking.

Management Implications and Conclusions

Radio-telemetry was probably not the best method to assess spotted owl responses to canopy reduction. This study demonstrated why no large-scale experiments on the effect of logging on spotted owls have used radio-telemetry despite a long-standing desire by biologists to do so. Radio-telemetry presented substantial logistical, design execution, and planning challenges, which we feel ultimately influenced the results.

Substantial variation in responses of owls to changes in habitat can confound the results and would require a much larger sample of owls, too expensive to radio-collar. We recommend an approach based on occupancy analysis, which is the evaluation of so-called presence-absence data that is corrected for detection probability. We are now using occupancy analysis to study chronic effects of SPLATS in the Sierra Nevada Adaptive Management Project.

Willow Flycatcher Demographic Study

Sierra Nevada Forest Plan Monitoring Accomplishment Report for 2008

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 winter. In central California the willow flycatcher raises its young in montane meadows of the Sierra Nevada. 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. Activity-related standards and guidelines for conserving willow flycatchers were developed and included in both the 2001 and the 2004 SNFPA ROD.

This demographic study is directed by Dr. Michael L. Morrison of Texas A&M University, and supervised by Heather Mathewson, University of Nevada, Reno. The following text has been excerpted from a lengthy report.

Accomplishments

In 2008, we visited 52 total sites: 17 were designated survey sites, 14 were band- resight sites, and 21 were monitoring sites. We surveyed sites and monitored nests at 13 of the 15 original sites and at all sites added in 2003 and 2005 in the south and central regions. We monitored nests in the northern region at sites monitored in previous years and at a new site; combined, they comprise the majority of Warner Valley. In the southern region we detected 3 females at 2 of the 3 territories located; therefore we added these 2 sites to our monitoring effort.

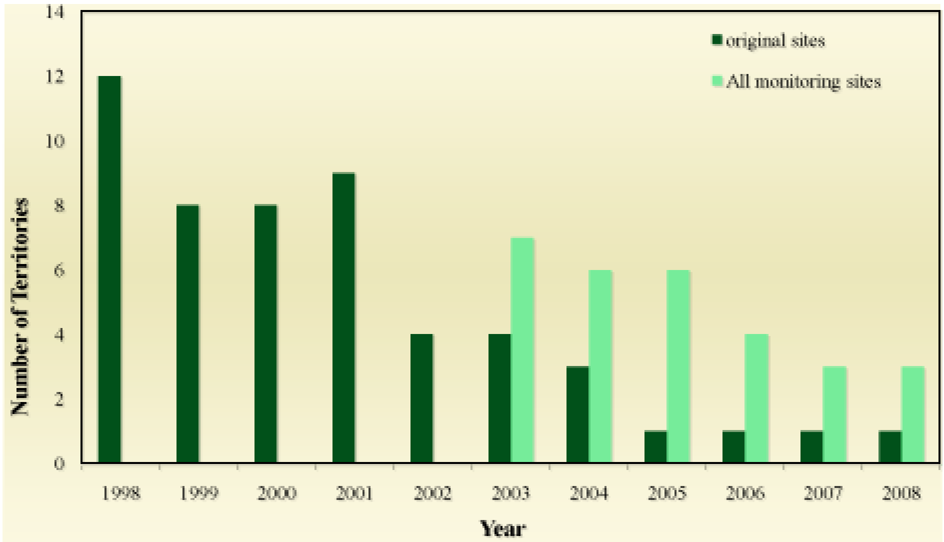
Territory success (i.e., territory fledged ≥1 young) was 63% (n = 84) at the 21 monitoring sites. The first nest fledged on 8 July in the northern region and 17 July in the central region. The last nest in the central region fledged on 24 August. Observed and Mayfield nest successes were 57% (n = 32) for the central and southern regions and 56% (n = 61) for the northern region. For the central and southern regions, mean annual fecundity was 2.07 fledglings per female; for the northern region the mean annual fecundity was 2.18 fledglings per female.

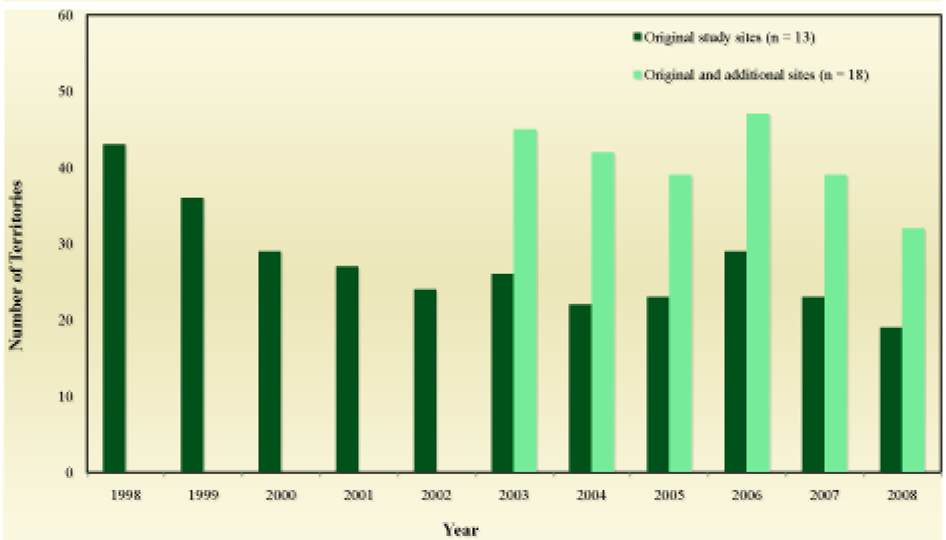
Of all the unsuccessful nests in the central and southern regions, predation was the primary cause of failure for 59% of nests, whereas 45% of the nests in the northern region were lost to predation. Other causes of failure involved Brown-headed Cowbird (*Molothrus ater*) parasitism and partial predation of nine nests for the central and southern regions and ten nests for the northern region. In the central and southern sites, cowbirds parasitized 10% of nests, whereas 16% of the nests were parasitized in the northern sites. We banded 66 nestlings in the central and southern sites, of which 60 (91%) fledged. At the northern sites, we banded 103 nestlings of which 88 (85%) fledged. At the 15 original demographic monitoring sites we observed bands on 70% of the adults. We attempted to resight bands on 234 total adults, of which 51 (22%) were banded. At our monitoring sites 49 (29%) individuals were banded and 63% were males.

Cumulative Results 1997-2008

Our cumulative analyses focus on comparisons across years and among three study regions. Over the 12 years of this study, the specific study sites monitored each year varied due to changes in annual funding and accessibility of properties. We provide cumulative analyses of territory and nest monitoring results for the original sites (initiated in 1997 or 1998) and for all long-term monitoring sites together (original sites and all sites added after 2003).

Willow Flycatchers in our south and central study sites experienced population declines from 1997 to 2008 (Figure 12). In the south region the decline was substantial and flycatcher populations may be extirpated from this region in the near future without suitable intervention. Populations in the central region declined early in this study but the number of territories has remained stable over the last five years. Populations in the north region, in Warner Valley, appeared stable. Population declines need not result from consistent or dramatic changes in demographic parameters and our study indicated that regardless of annual fluctuations the trend across years revealed declining populations.





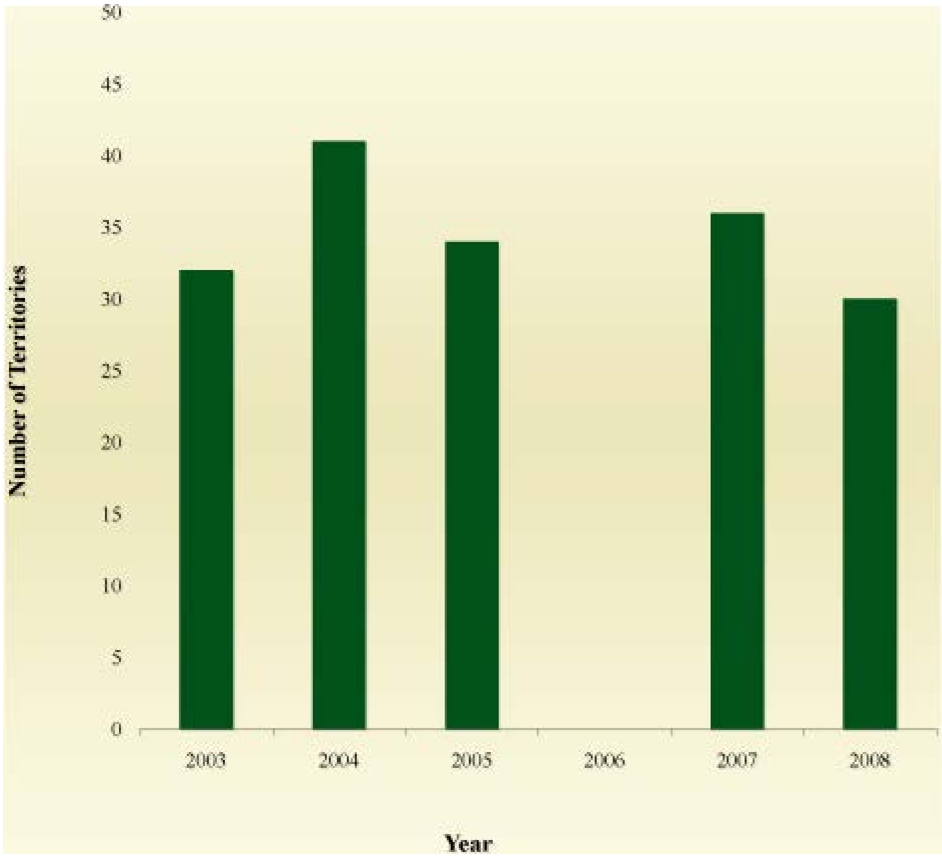


Figure 12. Number of willow flycatcher territories in the (A) south, (B) central, and (C) north study sites in the Sierra Nevada.

Nest failure rates directly and indirectly influence multiple demographic parameters. Predation was the primary cause of nest failure (86% of failed nests) at all our study sites. Abandonment associated with parasitism, unknown abandonment, and unhatched clutches comprised the remaining nest losses. Cowbird parasitism occurred at relatively few sites. Nest success rates at our south and central region (54 to 56%) were lower than for willow flycatchers elsewhere and were lower than estimates for other nesting passerines in our study sites. Nest success for southwestern Willow Flycatchers is reported to range from close to 30% to almost 70% depending on study site, suggesting that Sierra Nevada Willow Flycatchers have nest success rates slightly below those usually seen for the endangered southwestern subspecies and other shrub-nesting passerines.

An annual output of 2.23 young per female is thought to be the minimum needed to keep most populations of small passerines stable (Robinson et al. 1993, 1995a, 1995b). Our mean annual estimates of Willow Flycatcher fecundity (2.07 in north region, 1.67 in central region, and 1.58 in south region) were below this suggested minimum. Furthermore, they were at or below the reported fecundity values for southwestern Willow Flycatchers. Our estimates of fecundity were biased high because we did not consider survival during the last few days of the nesting period. Our fecundity estimates also include re-nests, for which the initial clutch size is reduced to 2-3 eggs, thus automatically reducing overall fecundity averages.

Dispersal from natal site was generally limited. Where we could assign a natal location:

- In the south region, all birds returned to their natal sites.
- For the central region 34.3% returned to their natal site, and mean natal dispersal distance for first-year breeders was 5.65 km. The majority of individuals (76%) dispersed <10 km from their natal sites (Figure 13).
- In the north region, 31.3% returned to their natal site, and mean natal dispersal distance was 11.78 km. One female bird from the north region had a long-distance dispersal of 134

km, documented in 2004, breeding in the central region at Perazzo meadow. When we removed this long-distance movement from the estimates in the north, the mean natal dispersal distance was 3.6 km.

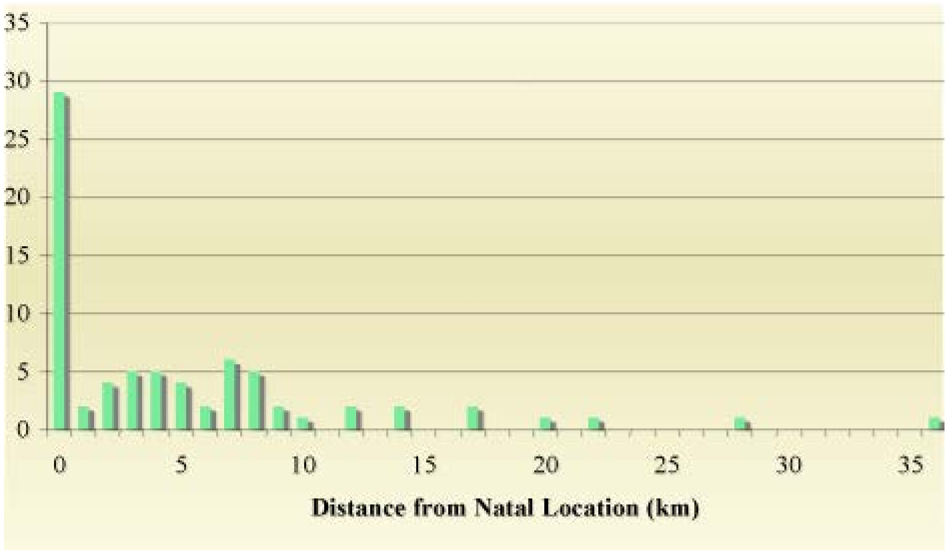


Figure 13. Number of first-year breeding Willow Flycatchers by dispersal distance in the central study region from 1999 to 2008.

Mean annual juvenile recruitment across all years (15.5% at our south and central study sites returned to breed in the following year) was comparable to estimates for other Willow Flycatcher populations. Despite limitations on accurately estimating recruitment, we think our estimates reliably represented juvenile recruitment.

Adult survival is similarly difficult to estimate. Adult survival at our sites was estimated to be 65-70%, depending on how data were pooled and analyzed. Willow flycatchers in other western landscapes have shown adult survival rates of 35-52% (Stoleson et al. 2000) and 50% (Sedgwick and Iko 1999). Mean annual survival of long-distance migrants is generally estimated to be 50-70% (Ricklefs 1992).

Our estimates of population change for the willow flycatcher population are:

- In the south region, the mean annual population change has decreased by 11.9 to 14.1% (λ = 0.881 to 0.859) since 1997.
- In the central region, the mean annual population change has decreased by 5.6 to 10.2% (λ = 0.944 to 0.898) since 1997.
- In the north region, the mean annual population change ranges from a mean annual increase of 0.04% to a mean annual decrease of 3.3% (λ = 1.004 to 0.967) since 2003.

Manipulating these estimates of demographic parameters to obtain stable population change (i.e., λ = 1) in models allows researchers to identify individual parameters that could be improved with management to achieve a stable population. In practice, it may be more feasible to influence one parameter through management actions than another. Our relatively high estimates of adult survival would have to be increased unrealistically to bring the population to equilibrium, and our ability to influence this parameter is minimal. Increasing juvenile recruitment is challenging because sources of mortality are unknown and mortality occurs outside of our management jurisdiction.

Increasing fecundity is more practical than manipulating survival and recruitment and, therefore, is the demographic factor for which we have the greatest management opportunity. Ensuring that first nesting attempts are successful would most efficiently increase fecundity; first clutches typically have four eggs while renest clutches are often only two or three eggs. Therefore, improving success of first clutches automatically increases fecundity, even if the overall proportion of successful nests does not increase. Increasing nesting success of the first nest attempt may also increase juvenile recruitment. By successfully breeding at the beginning of the season, birds have more time to forage during peak conditions, building fat stores for an earlier migration. Early migration may allow the flycatchers to avoid foul weather or reduced food availability at migration stopover sites. The cascading effect of successful first nest attempts means that with potentially higher adult survival and juvenile recruitment, a small increase in fecundity could result in population stabilization

Management and Restoration Recommendations

Management and restoration efforts should focus on increasing nesting success early in the season (first nest attempts) and fledgling survival (improving recruitment). Minimizing the influence of predation on nest success is needed to manage the declining population of Willow Flycatchers in the Sierra Nevada. Restoration of vegetation and water levels may reduce predation rates on nests, fledglings, and adults. Female reproductive success may be higher for nests placed over water (Picman et al. 1993). Enhancing meadow wetness could reduce the access of some predators (e.g., weasels, chipmunks) to nests (Cain et al. 2003). Water levels are typically higher early in the season and by encouraging meadow wetness, first nesting attempts could be alleviated of intense predation pressure. Habitat improvements also will impact juvenile recruitment by proving ample shrub cover for fledglings, which are subject to relatively high mortality rates.

Direct control of cowbirds is often suggested as a means of increasing nesting success. Although cowbird parasitism rates at our sites are below those thought to substantially impact songbird populations (i.e., ~25-30%), our data clearly indicate that steps must be taken to increase fecundity. Removing the effects of cowbird parasitism could contribute to the goal of increasing nest success. Parasitism events are predictable at several of our meadows so initial efforts to control cowbirds should focus on those specific sites: Uppermost Upper Truckee, Little Perazzo, and the area south of Lake Tahoe where only a few breeding territories exist and where parasitism rates are highest.

Restoration efforts should focus on meadows currently occupied by breeding Willow Flycatchers and meadows within 10 km of occupied sites to provide dispersal opportunities. Meadow restoration in the Sierra Nevada should consider dispersal patterns and reduce isolation of willow flycatcher breeding locations.

Publications and Theses

The following publications and theses were derived directly from research conducted in association with this project:

Bombay, H. L. 1999. Scale perspectives in habitat selection and reproductive success for Willow Flycatchers (*Empidonax traillii*) in the central Sierra Nevada, California. Thesis, California State University, Sacramento, California, USA.

Bombay, H. L., M. L. Morrison, and L. S. Hall. 2003b. Scale perspectives in habitat selection and reproductive success for Willow Flycatchers *(Empidonax traillii)* in the central Sierra Nevada, California. In M. K. Sogge, B. E. Kus, M. J.Whitfield, and S. J. Sferra, editors. Ecology and conservation of the Willow Flycatcher. Studies in Avian Biology 26:60-72.

Cain III, J. W., 2001. Nest success of Yellow Warblers (*Dendroica petechia*) and Willow Flycatchers (*Empidonax traillii*) in relation to predator activity in montane meadows of the entral Sierra Nevada, California. Masters Thesis. California State University, Sacramento.

Cain III, J. W., and M. L. Morrison. 2003. Reproductive ecology of dusky flycatchers in montane meadows of the central Sierra Nevada. Western North American Naturalist 63:507-512.

Cain III, J. W., M. L. Morrison, and H. L. Bombay. 2003. Predator activity and nest success of Willow Flycatchers and yellow warblers. Journal of Wildlife Management 67:600-610.

Cain III, J. W., K. S. Smallwood, M. L. Morrison, and H. L. Loffland. 2006. Influence of mammal activity on nesting success of passerines. Journal of Wildlife Management Vol. 70, No. 2 pp. 522–531.

Soroka , D. E., 2003. Time budgets of the Willow Flycatcher in the Central Sierra Nevada in relation to nest success. 49 pp. Masters Thesis. California State University, Sacramento.

Soroka, D.E., and M.L. Morrison. 2005. Behavioral activities and breeding success of Willow Flycatchers in the Sierra Nevada. Western North American Naturalist 65:441-450.

Technology Transfer

In addition to the publications listed above, information from our research has reached additional audiences annually during presentations at meetings of national and regional chapters of The Wildlife Society, The Cooper Society, and The American Ornithological Union, and others.

Survey Techniques have been one our most notable technology transfers. In 2001 we partnered with the Forest Service and Fish and Game to prepare a standardized survey protocol (updated in 2003). We also collaborated to create a training video entitled “How to identify and locate willow flycatchers in the field”. We have coordinated on an annual basis with the Tahoe National Forest to provide survey training for Forest Service Personnel.

Over the last 12 years our researchers have partnered with the Forest Service, the Department of Fish and Game, and their consultants to provide input based on our research to the following management related documents:

Bombay, H. L., T. M. Benson, B. E. Valentine, and R. A. Stefani. 2003. A Willow Flycatcher protocol for California. USDA Forest Service, Region 5. Vallejo, California, USA.

Green, G. A., H. L. Bombay, and M. L. Morrison. 2003. Conservation Assessment of the Willow Flycatcher in the Sierra Nevada. USDA Forest Service, Region 5, Vallejo, California, USA.

Stefani, R. A., H. L. Bombay, and T. M. Benson. 2001. Willow Flycatcher. Pages 143-195 *in* USDA Forest Service, Sierra Nevada Forest Plan Amendment Final Environmental Impact Statement, vol. 3, Part 4.4. USDA Forest Service, Pacific Southwest and Intermountain Regions, Sacramento, California, USA.

Literature Cited

Cain III, J. W., M. L. Morrison, and H. L. Bombay. 2003. Predator activity and nest success of Willow Flycatchers and yellow warblers. Journal of Wildlife Management 67:600-610.

Picman, J., M. L. Milks, and M. Leptich. 1993. Patterns of predation on passerine nests in marshes; effects of water depth and distance from edge. Auk 110:89-94.

Ricklefs, R. E. 1992. The megapopulation: a model of demographic coupling between migrant and resident landbird populations. Pages 537-548 *in* J. M. Hagan III and D. W. Johnston, editors. Ecology and conservation of Neotropical migratory birds. Smithsonian Institution Press, Washington DC.

Robinson, S. K., J. A. Gryzbowski, S. I. Rothstein, M. C. Brittingham, L. J. Petit, and F. R. Thompson, III. 1993. Management implications of cowbird parasitization on Neotropical migrant songbirds. Pages 93-102 *in* D. M. Finch and P. W. Stangel, eidtors. Status and management of Neotropical migratory birds. USDA Forest Service Gen. Tech. Rep. RM-229. USDA Forest Service, Rocky Mountain Forest and Range Experiment Station, Fort Collins, Colorado, USA.

Robinson, S. K., S. I. Rothstein, M. C. Brittingham, L. J. Petit, and J. A. Gryzbowski. 1995a. Ecology of cowbirds and their impact on host populations. Pages 428-460 *in* T. E. Martin and D. M. Finch, editors. Ecology and management of Neotropical migratory birds. Oxford University Press, New York, NY.

Robinson, S. K., F. R. Thompson, III, T. M. Donovan, D. R. Whitehead, and J. Faaborg. 1995b. Forest fragmentation and the regional population dynamics of songbirds. Science 267:1987-1990.

Sedgwick, J.A. and W.M. Iko. 1999. Costs of Brown-headed Cowbird parasitism to Willow Flycatchers. *In* M.L. Morrison, L.S. Hall, S.K. Robinson, S.I. Rothstein, D.C. Hahn, and T.D. Rich, editors. Research and management of the Brown-headed Cowbird in western landscapes. Studies in Avian Biology 18:167-181.

Stoleson, S. H., M. J. Whitfield, and M. K. Sogge. 2000. Demographic characteristics and population modeling. Pages 83 – 94 *in* D. M. Finch, and S. H. Stoleson, editors. Status, ecology, and conservation of the Southwestern Willow Flycatcher. Gen. Tech. Rep. RMRS-GTR-60. USDA, Forest Service, Rocky Mountain Research Station, Fort Collins, Colorado, USA.

Management Indicator Species

Sierra Nevada Forest Plan Monitoring Accomplishment Report for 2008

The Sierra Nevada Forests Management Indicator Species (MIS) Amendment Record of Decision was signed in December, 2007. During 2008, a report describing life histories and summaries of the status and trend of MIS was published. The implementation package was also completed.

Monitoring was initiated in 2008 and a report on black-backed woodpecker is available.

Forest Monitoring Summary

Sierra Nevada Forest Plan Monitoring Accomplishment Report for 2008

This summary is based on reports from nine of ten 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 FY2008. The forests conduct landscape-level assessments in designing most fuel treatments.

Fuel treatments in California Spotted Owl and Northern Goshawk Protected Activity Centers (PACs) and in the wildland urban interface (WUI) during FY 2008 are summarized in Table 10. Treated acres represent 1% of California Spotted Owl PACs and <1% of Northern Goshawk PACs.

Table 10. Summary of California Spotted Owl and Goshawk PAC and WUI treatments for 2008.

Forest	Treatment Acres in California Spotted Owl PAC	Treatment Acres in Goshawk PAC	Acres treated in WUI	Percent of total treated in WUI
Eldorado	254	59	5,049	35
Inyo	0	0	3,979	38
Lake Tahoe Basin	252	3	6,062	>99
Lassen	0	0	3,666	23
Modoc	0	153	3,188	25
Plumas	64	0	770	8
Sequoia	1,275	107	409	6
Sierra	1,530	282	7,458	44
Stanislaus	1,126	233	3,111	56
Tahoe	31	31	1,706	28
Humboldt-Toiyabe	0	0	2,869	14
Total acres treated	4,532	868	38,267	32
TOTAL acres in PACs	421,780	108,158		

In 2008, fuel treatments were conducted on 120,572 acres on the Region 5 Sierra Nevada National Forests. Of those acres, 32% were located in wildland-urban interface (WUI) areas. The regional goal was to have 50% of all initial fuel treatments in the WUI (SNFPA ROD, page 5), and we are now past the initial phase of treatment.

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:

- 1,923 acres on the Eldorado NF,
- 640 acres on the Lake Tahoe Basin Management Unit,
- 11 acres on the Lassen NF,
- 64 acres on the Plumas NF,
- 1,315 acres on the Sequoia NF,
- 2,174 acres on the Sierra NF,
- 2,411 acres on the Stanislaus NF, and
- 166 acres on the Tahoe NF.

The total of 8,640 acres treated since 2004 is 2% 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:

- 274 acres on the Eldorado NF,
- 200 acres on the Humboldt- Toiyabe NF,
- 3 acres on the Inyo NF,
- 83 acres on Lake Tahoe Basin Management Unit,
- 105 acres on the Lassen NF,
- 734 acres on the Modoc NF,
- 200 acres on the Plumas NF,
- 162 acres on the Sequoia NF,
- 282 acres on the Sierra NF,
- 555 acres on the Stanislaus NF, and
- 291 acres on the Tahoe NF.

The total of 2,889 acres treated since 2004 is less than 3% 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).

- One CSO PAC was affected wildfire in FY 2007 on the Lake Tahoe Basin MU, where 300 acres were rendered unsuitable, and replacement acres have been identified.
- On the Plumas NF, 25 CSO PACs and Home Range Core Areas (HRCAs) were affected by the Moonlight and Antelope fires, and 20 of those were lost (Table 11). Replacement acres were found for PAC 107 after post-fire monitoring revealed use of a PAC by an owl pair. No replacement acres could be found for the remaining 20 PACs lost.
- On the Tahoe NF, eight CSO PACs (275 acres) were affected by wildfire and replacement acres were found.

Table 11. Plumas NF California spotted owl Protected Activity Centers (PACs) and Home Range Core Areas (HRCAs) burned at moderately high and high severity during FY 2007 Moonlight and Antelope fires.

PAC #	Total Acres		Total Mod-High Severity Fire	
			Acres	%
PL005	PAC	345	260	75%
	HRCA	550	407	74%
	total	895	667	75%
PL006	PAC	316	308	98%
	HRCA	498	366	74%
	total	814	675	83%
PL041	PAC	360	203	56%
	HRCA	797	405	51%
	total	1,157	608	53%
PL042	PAC	417	353	85%
	HRCA	758	647	85%
	total	1,175	1000	85%
PL043	PAC	316	314	99%
	HRCA	613	608	99%
	total	929	922	99%
PL044	PAC	387	360	93%

	HRCA	662	402	61%
	total	1,049	761	73%
PL071*	PAC	383	209	54%
	HRCA	645	308	48%
	total	1,028	516	50%
PL073*	PAC	661	496	75%
	HRCA	699	480	69%
	total	1,360	976	72%
PL106	PAC	392	284	72%
	HRCA	551	526	95%
	total	943	810	86%
PL107*	PAC	290	164	57%
	HRCA	755	270	36%
	total	1,045	434	42%
PL109±	PAC	336	0	0%
	HRCA	761	86	11%
	total	1,097	86	8%
PL122	PAC	322	266	83%
	HRCA	800	558	70%
	total	1,122	824	73%
PL123	PAC	301	300	100%
	HRCA	708	584	83%
	total	1,009	885	88%
PL125	PAC	499	397	80%
	HRCA	508	433	85%
	total	1,007	830	82%
PL126	PAC	457	439	96%
	HRCA	457	380	83%
	total	914	819	90%
PL167±	PAC	386	11	3%
	HRCA	687	185	27%
	total	1,073	196	18%
PL198	PAC	356	345	97%
	HRCA	861	819	95%
	total	1,217	1164	96%
PL199	PAC	396	209	53%
	HRCA	593	482	81%
	total	989	691	70%
PL201	PAC	452	367	81%
	HRCA	743	610	82%
	total	1,195	977	82%
PL229	PAC	323	126	39%
	HRCA	909	736	81%

	total	1,232	862	70%
PL230+	PAC	321	0	0%
	HRCA	649	29	4%
	total	970	29	3%
PL253	PAC	359	225	63%
	HRCA	637	244	38%
	total	996	470	47%
PL262	PAC	409	409	100%
	HRCA	654	615	94%
	total	1,063	1024	96%
PL263	PAC	326	326	100%
	HRCA	398	391	98%
	total	724	717	99%
PL284	PAC	314	213	68%
	HRCA	680	474	70%
	total	994	686	69%
PL286+	PAC	423	62	15%
	HRCA	660	203	31%
	total	1,083	265	24%
PL287+	PAC	322	2	1%
	HRCA	750	538	72%
	total	1,072	540	50%
PL303	PAC	321	317	99%
	HRCA	391	359	92%
	total	712	676	95%

* PACs redrawn after the Moonlight-Antelope Fires = PL071, PL073, PL107.

+ PACs retained (low to no damage as a result of Moonlight-Antelope Fires) = PL109, PL230, PL287, PL167, PL286.

The Sierra Nevada national forests identified only a few vegetation management treatments in Great Grey Owl PACs, fisher den site buffers, or marten den site buffers:

- Sierra NF treated 112 acres of great gray owl PAC for fuels.
- Stanislaus treated three great gray owl PACs: 29 acres in North Stone meadow, 29 acres in South Stone meadow, and 97 acres in Jordan meadow.

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

Forests used the flexibility in S&G #71 to change California spotted owl and goshawk PAC boundaries to implement projects during 2008:

- The Blackwood Creek Restoration Project on Lake Tahoe MU modified about 4 acres in the Blackwood Creek CSO PAC and 4 acres in East Blackwood goshawk PAC.
- Sequoia NF dropped 37 acres from one 87 acre CSO PAC when it was determined to be larger than necessary.
- Stanislaus NF modified CSO PACs: 6 acres in Quartz-Summit Knobs and 3 acres in Bear Mountain projects.
- Tahoe NF modified CSO and northern goshawk PACs (2004-2008), driven by pre-project

protocol surveys, vegetation typing, and new technology:

- For CSO, PACs NEV0011 (7 acres), NEV0015 (65 acres), NEV0024 (28 acres), NEV0051 (27 acres), NEV0054 (15 acres), NEV0057 (33 acres), SIE0001 (4 acres), SIE0019 (1 acres), SIE0020 (6 acres), SIE0025 (43 acres), SIE0026 (7 acres), SIE0037 (77 acres), SIE0072 (2 acres), SIE0080 (3 acres), SIE0081 (20 acres), and SIE0091 (36 acres).
- For northern goshawk PAC 53T01, 55 acres.

Implementation monitoring conducted during 2008 was reported as follows:

- Eldorado NF, about 75% of projects.
- Inyo NF, 100% of projects.
- Lassen NF, about 67% of projects.
- Lake Tahoe Basin Management Unit provides a summary of its entire monitoring program in an annual report posted at http://www.fs.fed.us/r5/ltbmu/.
- Plumas NF, about 80% of projects.
- Sequoia NF, 100% of projects.
- Sierra NF, 100% of projects.
- Stanislaus NF, about 1% of projects.
- Tahoe NF for 100% of projects.

Forest Relations with Tribes

Sierra Nevada Forest Plan Monitoring Accomplishment Report for 2008

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 new instances where the forests worked with tribes on projects in 2008 include:

Inyo NF:

- The Big Horn Sheep Habitat Enhancement project proposed the use of prescribed burning to improve bighorn sheep habitat quality. Initially, the Big Pine and Bishop Tribes raised concerns about this project because we proposed to burn pinon pine forests where tribal members gather pine nuts, and we might disturb prehistoric sites. We took the Tribal Historic Preservation Officers (THPOs) from both tribes on a field visit to the project areas with a Forest archaeologist. The THPOs discussed site protection measures with the archaeologist, opening a dialogue about identification and protection of cultural resources and traditional gathering areas.
- During the development of the proposed action for the Crowley Communities Fuel Reduction project, Raymond Andrews of the Kutzedikaa Tribe suggested that tribal members gather traditional materials (birch, etc.) prior to completing hazardous fuel reduction treatments in riparian areas; that we consider cutting in spring, especially if there is a good pine nut crop; and that we ask private landowners adjacent to the project area if non-profit groups (e.g., Inyo-Mono Advocates for Community Action) may remove pinon to provide firewood for tribal elders and others in the community.
- Local tribes were consulted regarding monitoring of the areas burned in the 2007 Baker Creek and Sage fires on the Inyo NF. The Bishop THPO conducted a site visit and commented on the condition of traditional tribal lands within the area affected by the fire.

Lassen NF:

- Quarterly formal consultation meetings about planned forest activities were held with Pit River and Susanville Indian Rancheria. Informal consultation and field tours of project areas were also conducted.
- The Lassen National Forest entered into a Participating Agreement with Greenville Rancheria to foster integrated heritage resource management with tribes.
- We continued our partnership and Challenge Cost Share Agreement with the Susanville Indian Rancheria to research the historical ecology of freshwater mussels on Lassen National Forest lands. This project has provided employment opportunities for tribal youth and has increased their understanding of cultural and natural resource management.

Lake Tahoe Basin MU:

- Worked with the Washoe Tribe and a local contractor to restore the Cave Rock Traditional Cultural Property. We removed over 350 climbing bolts and associated hardware, approximately 5 tons of concrete, gravel and paving stones, and approximately 35 linear feet of graffiti.
- Began work on an access Memorandum of Agreement with the Washoe Tribe and the Humboldt- Toiyabe National Forest as directed in the Carson City Lands Bill.

Modoc NF:

- Engaged in the early development, coordination, and consultation process with tribal governments on the Land and Resource Management Plan for the national forest.
- Consulted and coordinated with tribes on Travel Management to assure continued tribal access to Native American sacred and ceremonial sites and traditional use areas. On Wednesday, 3 September 2008, Pit River Tribal Councilman, Irvin Brown, reiterated the tribe's need to access sacred sites and traditional use areas during a Travel Management consultation.

Plumas NF:

- Continued the work begun in FY07, working closely with tribal members, to develop a plan to protect the Chandler Roundhouse site, a site of high cultural significance.
- Implemented multiple vegetation enhancement projects in collaboration with both Federally recognized and un-recognized tribal groups, focused on fire management and plants culturally important to tribal groups (e.g., prescribed burns to enhance beargrass).

Sequoia NF:

- Forest instituted quarterly Tribal Forum Meetings, in which the Ranger Districts participate.

Stanislaus NF:

- Worked with Tribal personnel to restore traditionally used plants in archaeological sites.

Sierra Nevada Adaptive Management Project

Sierra Nevada Forest Plan Monitoring Accomplishment Report for 2008

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 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.

For further information, see 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.