Sierra Nevada Forest Plan Monitoring Accomplishment Report for 2010

Sierra Nevada Forest Plan Implementation

In 2010 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 under direction in the Sierra Nevada Forest Plan Amendment Record of Decision 2004 (SNFPA ROD) may affect species, ecosystems, and processes. This year, we present the final report for a study on effects of livestock grazing on Yosemite toads that were completed in 2010.

Contents

Determining the Effects of Livestock Grazing on Yosemite Toads

Willow Flycatcher Demography Study

Fisher Status and Trend Monitoring

Amphibian Status and Trend Monitoring

California Spotted Owl – Eldorado Study Area

Management Indicator Species

Detecting Climate Change in Sierra Nevada Streams

Forest Monitoring Summary

Forest Relations with Tribes

For more information:

Patricia Flebbe
Monitoring Coordinator
707.562.8682

Websites that may be of interest:

www.fs.fed.us/r5/snfpa
www.fs.fed.us/psw
http://snamp.cnr.berkeley.edu

Determining the Effects of Livestock Grazing on Yosemite Toads (Anaxyrus [Bufo] canorus) and their Habitat

The Yosemite toad is endemic to the Sierra Nevada mountain range and is typically associated with montane wet meadows. 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.

Photo 1. Yosemite toad adult female (photo by R. Grasso)

Understanding the dynamics of livestock grazing on National Forest lands and potential effects on this meadow-associated species was the primary goal of this study, which was initiated in 2005. The study was conducted by USDA Forest Service, Pacific Southwest Research Station (PSW): Amy Lind, Robert Grasso, Julie Nelson, Kimberly Vincent, and Christina Liang; University of California, Davis (UC): Kenneth Tate and Leslie Roche; and University of California, Berkeley (UC): Barbara Allen-Diaz and Susan McIlroy.

Over the six years of the study, we examined the response of Yosemite toad populations and habitat to livestock grazing exclusion in an experimental context. We also evaluated some of the key environmental factors that determine occupancy of meadows by toads at a broad spatial scale. In 2010, we completed the field component of the study and the first full analysis of the study data. The specific objectives for the study were 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?

An additional objective was to develop models of the key environmental and management factors that determine the distribution (meadow occupancy) of Yosemite toads over a broader scale like an entire National Forest. Herein, results are divided into two sections: "Experimental Study", which addresses the two questions above, and "Distributional Modeling".

Experimental Study

The experimental design for this study was a randomized complete block (RCBD) with five allotments (blocks) and three meadow grazing management treatments randomized within each allotment. The treatments were:

1. Grazing in accordance with Riparian S&Gs 120 and 121 across the entire meadow (**GRZ** treatment);
2. Exclusion of livestock from breeding (i.e., wet) areas within a meadow (S&G 53; **F**ence **B**reeding **A**rea - **FBA** treatment);
3. No grazing within the meadow (**F**ence **W**hole **M**eadow - **FWM** treatment).

Two livestock grazing allotments on the Stanislaus National Forest and three allotments on the Sierra National Forest were included in this study. Within each allotment, each treatment was implemented. In addition, two meadows in Yosemite National Park were selected to represent long-term (>15 years) ungrazed or reference areas (REF). However, because there were only two meadows and surveys didn't start until 2007, they were not analyzed as part of the RCBD design. We collected data on all life stages of Yosemite toads at various levels of intensity each year, depending on field logistics, snowpack and funding (Table 1). We also collected data on the occurrence of amphibian chytrid fungus on captured Yosemite toads to aid in evaluation of the potential effect of this disease on our study populations.

Table 1. Sampling periods and Yosemite toad population data collected on the Sierra National Forest (SNF), Stanislaus National Forest (STNF), and in Yosemite National Park (YNP), from 2005-2010.

Sampling Period	**Locations and Years Surveyed**	**Life Stage Focus**	**Methods**
Late spring: May / June	• SNF – all meadows 2006-2010 • STNF – Highland Lakes only 2006-2009 • YNP -- 2007-2009	Adults, Eggs	• Multiple capture-recapture visits and measurements of adults • Egg mass counts • Amphibian chytrid fungus swabbing • Habitat (egg masses & adults)
Early-mid summer: July / August	• SNF, STNF – all meadows 2005-2010 • YNP -- 2007-2010	Tadpoles	• Stratified hoop counts in occupied breeding pools • Document occupied and unoccupied pools from previous years • Tadpole hoop-focused habitat • Breeding pool aquatic habitat
Late summer: August / September	• SNF, STNF – all meadows 2005-2010; • YNP 2007-2010	Young of the year (YOY = newly meta-morphosed toadlets)	• Multiple cap-recap visits and measurements of YOY • Habitat and vegetation

Fencing treatments were installed in 2006. Over the period of the study (2006-2010), we did not detect differences in tadpole and young of the year Yosemite toad density and breeding pool occupancy among the three livestock grazing - fencing treatments (Figure 1). However, variation in densities was high and is apparently strongly influenced by water-year type and meadow wetness (Figures 1 and 2).

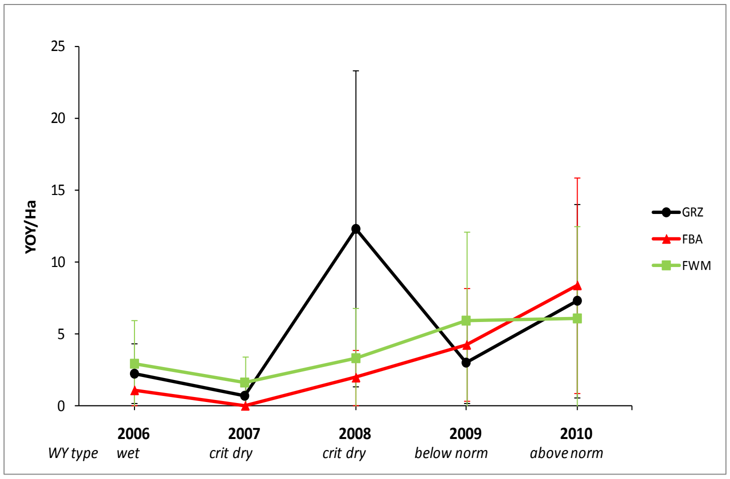

Figure 1. Yosemite toad young of the year mean (± 1 s.e.) density by grazing treatments over time. Means were adjusted for average meadow wetness (water table depth). Water-year types are presented below each year (source: California Department of Water Resources, San Joaquin Valley Runoff).

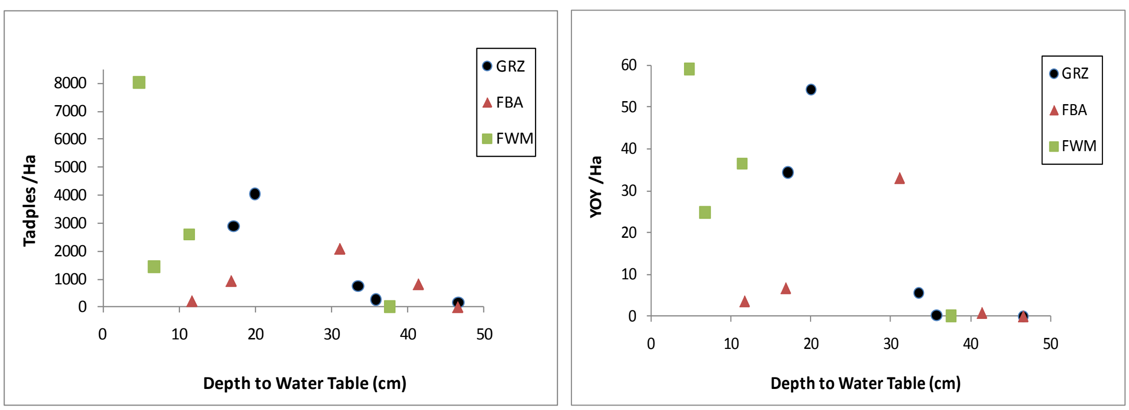

Figure 2. Tadpole (left panel) and young of the year (right panel) density relative to water table depths. Each point represents the 2006-2010 mean for a particular study meadow. All water tables are below the ground surface.

The year to year variation we observed may be a function of longer-term population cycles. This five-year study covered a relatively short time period, considering that Yosemite toads are fairly long-lived (10-15 years) and females do not reproduce for the first time until they are 4-5 years old. Thus, if there is an effect of the livestock grazing treatments on the population as a whole, it might not be evident for a generation or longer.

For the meadows in the grazed treatment (GRZ), livestock use was higher on dryer meadows than wet meadows, and Yosemite toad densities were negatively correlated with both livestock use (Figure 3) and depth to water table (dryer meadows). These relationships can inform management of meadows and livestock, and conservation of Yosemite toads.

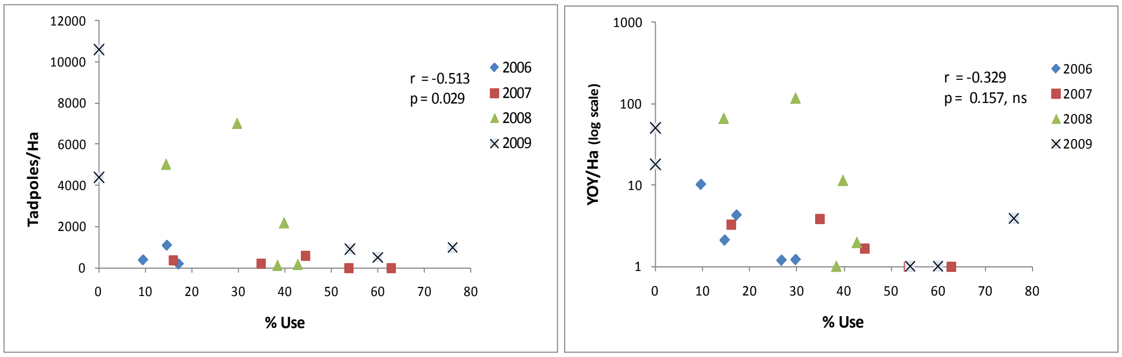

Figure 3. Yosemite toad tadpoles (left panel) and young of the year (right panel) density relative to livestock use.

Tadpole and young of the year densities were similar in National Forest and Yosemite National Park meadows. Substantial meadow to meadow and year to year variation was apparent, though some meadows had consistently high occupancy rates and densities of both life stages (Figures 4 and 5).

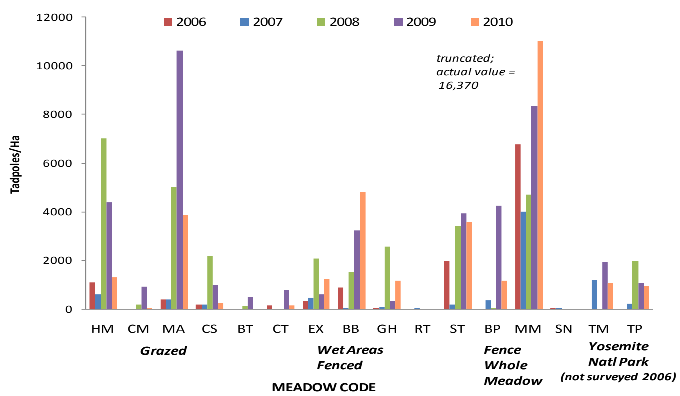

Figure 4. Yosemite toad tadpole density for each of the study meadows (2-letter codes) by year. Meadows are arrayed by grazing treatment and Yosemite National Park meadows are on the far right of the graph.

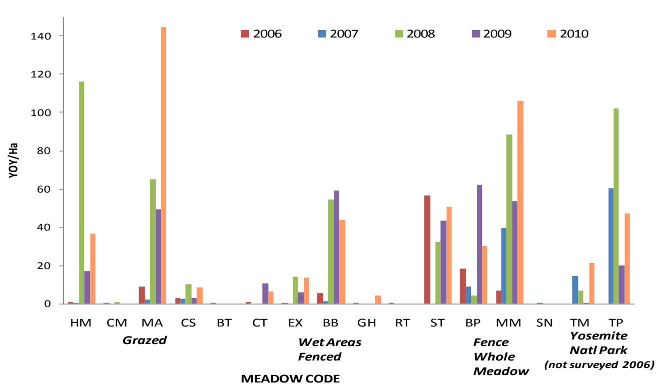

Figure 5. Yosemite toad young of the year density for each of the study meadows (2-letter codes) by year. Meadows are arrayed by grazing treatment and Yosemite National Park meadows are on the far right of the graph.

Based on our analyses of toad density on the National Forest experimental meadows and in the National Park, it appears likely that individual meadows play different roles in overall Yosemite toad population dynamics. Some meadows have consistently high numbers of toads, and some are more variable (Figures 4 and 5). Identifying key meadows and understanding these spatial dynamics will be important elements in the development of conservation options for Yosemite toads.

Chytridiomycosis is a common amphibian disease caused by the fungus, *Batrachochytrium dendrobatidis* (*Bd,* also called amphibian chytrid fungus). Both lethal and sub-lethal effects have been documented on species around the world. Five hundred *Bd* swab samples were collected from Yosemite toads in 2006 through 2010 at study meadows on the Stanislaus National Forest, Sierra National Forest, and Yosemite National Park. *Bd* was detected at all but one study meadow, but only one sample was taken at that meadow. Of the 500 samples, 17.0% were positive for *Bd* (Table 2). When combining data from all study meadows, *Bd* occurs at a higher prevalence in adult males (14.6% positive) than in adult females (10.9%) and has an even higher prevalence in juveniles (31.8%). *Bd* prevalence in young of the year was lower (20.3%) than in juveniles, although still higher than adults (Table 2). These apparent differences still need to be assessed at a meadow-population scale and tested statistically.

Table 2. Summary of results from sampling for amphibian chytrid fungus (*Bd*) in Yosemite toad populations from 2006-2010 for Sierra NF (SNF), Stanislaus NF (STNF), and Yosemite National Park (YNP). The upper part of the table is a summary of number of individuals sampled for *Bd* and the lower part of the table, numbers of individuals testing positive or negative from all years.

Year	Number of Locations	Young of the Year	Juveniles & Subadults	Adult Females	Adult Males	Totals By Year
2006	SNF, STNF: 15 meadows	0	0	15	63	78
2007	SNF, STNF, YNP: 16 meadows	1	2	13	57	73
2008	SNF, STNF, YNP: 18 meadows	0	23	32	70	125
2009	SNF, STNF, YNP: 15 meadows	28	23	12	37	100
2010	SNF, STNF, YNP: 14 meadows	45	18	20	41	124
	Totals by Life Stage	74	66	92	268	500
	Bd positive 2006-2010	15	21	10	39	85
	Bd negative 2006-2010	59	45	82	229	415
	% *Bd* pos	20.3%	31.8%	10.9%	14.6%	17.0%

Distributional Modeling

Meadow-scale species distribution models were developed for Yosemite toads on the Sierra NF using survey data collected by Sierra NF staff in conjunction with environmental and management data (e.g., precipitation, land management). Visual encounter surveys were conducted from 2002 through 2004 to determine the presence of Yosemite toads at over 2,200 sites in meadows covering its known geographic range on the forest. Three different species distribution models were developed: one that included all available biological, physical, and management-based variables (full model); a second model that focused on biological and physical variables only (biophysical model); and a third model that focused on variables related to management only (management model) (Table 3).

Table 3 . Yosemite toad distribution models and the top variables associated with each. For variables that are positively related to presence, higher values of the variables resulted in higher odds of Yosemite toad occurrence. For variables that are negatively related to presence, higher values of the variables resulted in lower odds of Yosemite toad occurrence.

Model	Description	Positively Related To Presence	Negatively Related To Presence
Full	Both biophysical and management related variables	• Annual snow cover area (75-100% covered in snow) • Land cover changes from 1985-1991 • Elevation • Land cover changes from 1990-1995 • Water temperature	• Temperature seasonality • Y-coordinate (more northerly sites had a lower odds of Yosemite toad presence) • Precipitation of driest quarter • Air temperature • Slope
Biophysical	Biological and physical variables relating to environmental variation only	• Water temperature • Spatial autocorrelate (sites with Yosemite toads in nearby meadows had a higher odds of Yosemite toad presence) • Precipitation of warmest quarter • Elevation • Aspect	• Air temperature • Precipitation of driest quarter • Slope • Y-coordinate (more northerly sites had a lower odds of Yosemite toad presence) • Temperature seasonality

Model	Description	Positively Related To Presence	Negatively Related To Presence
Management	Management related variables only	• Land cover changes from 1985-1991 • X-coordinate (more easterly sites had a higher odds of Yosemite toad presence) • Land cover changes from 1990-1995 • Spatial autocorrelate (sites with Yosemite toads in nearby meadows had a higher odds of Yosemite toad presence)	• Fire regime alteration from historical range • Distance to timber activity (sites further from timber activity had a lower odds of Yosemite toad presence).

Overall, Yosemite toads appear to have a complex relationship with the environment and are not dependent on any single environmental factor. Although the biophysical or management-related subset models alone can predict Yosemite toad occurrences, the full model had the best predictive ability. Thus, both types of factors influence Yosemite toad occurrence and need to be considered to effectively manage populations and habitat and develop conservation options. For more details on distribution modeling results see Liang (2010. Habitat modeling and movements of the Yosemite toad (*Anaxyrus* (=*Bufo*) *canorus*) in the Sierra Nevada, California. Ph.D. Dissertation, University of California, Davis, 126 pp).

Ongoing Work

The following work will be conducted in 2011:

- Analyze detailed microhabitat data, taken at all Yosemite toad egg mass and tadpole locations and at occupied and unoccupied pools, to determine key habitat variables for successful recruitment on both national forests and in Yosemite National Park.
- Analyze adult and juvenile toad population characteristics and ecology (e.g., egg mass characteristics, age and sex ratios, growth rates, size at metamorphosis).
- Analyze occurrence of amphibian chytrid fungus (*Bd*) in the study meadows relative to water year types, meadow wetness, and livestock grazing treatment.
- Analyze the Sierra NF-wide distribution of Yosemite toads relative to allotment information on livestock stocking rates (e.g., cow/calf pairs per month) and develop distribution models at this spatial scale.

Willow Flycatcher Demography Study

The willow flycatcher demography study was completed in 2010. The final report is currently (August, 2011) under review and will be made available when complete. Results from the final two years of monitoring are expected to continue the results reported for 2008.

Fisher and Marten Status and Trend Monitoring

This was a transition year in the fisher and marten monitoring program, moving from the intensive monitoring conducted from 2002-2009 (Phase I) to a restructured monitoring program beginning in 2011 (Phase II). Since the inception of the monitoring effort in 2002 there have been considerable advances in available detection devices that have the potential to increase the efficiency of the program. Our objectives for the 2010 pilot season were to

- test the efficacy of these latest detection methods
- develop a new sampling design and field protocol that achieves adequate biological and statistical rigor at reduced cost and increased safety for our field crews.

In 2010, pilot work included testing two new digital remote sensor cameras models, new hair snare methods, and field station designs. While film-based remote sensor cameras were part of the field methods from 2002-2005, they were removed as a detection device in later years due to repeated technical problems and difficulties using them in the field. The new generation of digital remote sensor cameras has the potential to resolve these problems with improved design and increased photo storage capacity. They also provide video capability that may enhance information obtained at detections.

We tested the effectiveness of these digital cameras in the field and developed a field protocol detailing specific cameras settings and field conditions that maximize detection probability of target species. At the camera station we also explored wire gun brushes (photo 2) as hair snare devices with a variety of different brush configurations. We tried two different field station designs for each type of camera: the traditional bait tree design used since 2002 and a new 'run pole' station (photo 3) designed to improve visibility of target species in photographs. Track plate stations were deployed within 75m of the camera stations to compare the two different detection devices.

Photo 2. Fishers detected at a digital remote sensor camera station. Gun brush hair snares are visible to the bottom and sides of the bait, which is encased in chicken wire.

Photo 3. A ringtail visiting an example of the 'run pole' design tested in 2010.

Other changes tested in 2010:

- Moving sampling locations from the FIA points to the center of the FIA hex cell to simplify data-sharing with the FIA sampling points.
- Increasing the check interval to seven days and the total survey duration at each sample unit to 21-28 days (Phase I sampling interval= 2 days and survey duration = 10 days) to simplify field logistics and crew work schedules.

Survey Areas

Three areas were sampled during this pilot season, selected to represent the general population and occurrence patterns observed during Phase I and population conditions that may be expected in future monitoring. The three pilot sample areas were defined as reliably occupied (Greenhorn Mountains), variably occupied (Shaver Lake), and low occupancy (Kaiser). Due to the limited time and funding for this pilot study year many of the areas regularly surveyed during 2002-2009 were not surveyed in 2010 (e.g., Hume Lake, Kern Plateau, northern Sierra National Forest) and sampling of these areas is planned to resume in 2011.

2010 Accomplishments

Forty sample units were completed in the three different sampling zones. Of these sites, we detected marten at five, and fisher at 15 (of which female fishers with kits were detected at four sites). We found the digital remote sensor cameras to be effective at detecting multiple species including both fisher and marten. The photo storage capacity of the digital cameras was more than adequate for the longer seven-day check interval. The gun brush hair snares were consistently successfully at collecting hair samples from target species at the camera stations. We found the 'run pole' design (photo 2) to be complicated and difficult to install and maintain in the field, and it did not provide a significant improvement in photograph quality. Shifting from the FIA points (phase I) to the FIA hex cell centroids this year sometimes resulted in sampling extremely different habitat types. As a result of this pilot effort we have developed a field protocol and revised the field forms and database for the new detection methods.

2011 Program of Work

Next year will mark the beginning of Phase II monitoring when we resume sampling across the entire monitoring study area. Phase II monitoring will have sample units co-located with the FIA points, as implemented 2002-2009, because moving to FIA cell centroid locations resulted in sampling different habitat types that would be inconsistent with the Phase I design. Our objective is to complete 100-140 sample units in occupied fisher zone on the Sierra and Sequoia National Forests and to expand marten monitoring efforts by conducting 20-30 additional sample units in the northern and central Sierra Nevada. In Phase II, each sample unit will comprise three digital remote sensor camera stations with gun brush hair snares and offset track plate boxes to maximize detection probabilities.

Amphibian Status and Trend Monitoring

Long-term, bioregional-scale monitoring for the Yosemite toad, mountain yellow-legged frog, and Pacific chorus frog, a management indicator species (MIS), continued in 2010 under the leadership of Cathy Brown, Stanislaus NF. The primary objectives of the amphibian monitoring program are to assess the status and trend in

1. the proportion of watersheds (2-4 km^2 in size) on national forest lands within the species' Sierra Nevada range that are occupied by breeding populations, and
2. the number of sites within each watershed that are occupied by breeding populations.

All three species are found in high elevation aquatic habitats:

- Yosemite toads are most commonly found in shallow, warm water areas including wet meadows, small ponds, shallow grassy areas adjacent to lakes, and slow-flowing streams.
- Mountain yellow-legged frogs are most commonly found in larger, deeper lakes that do not freeze during the winter because their multi-year tadpole life stage requires suitable winter habitat.
- Pacific chorus frogs are found in a variety of aquatic habitats including wet meadows, lakes, and ponds.

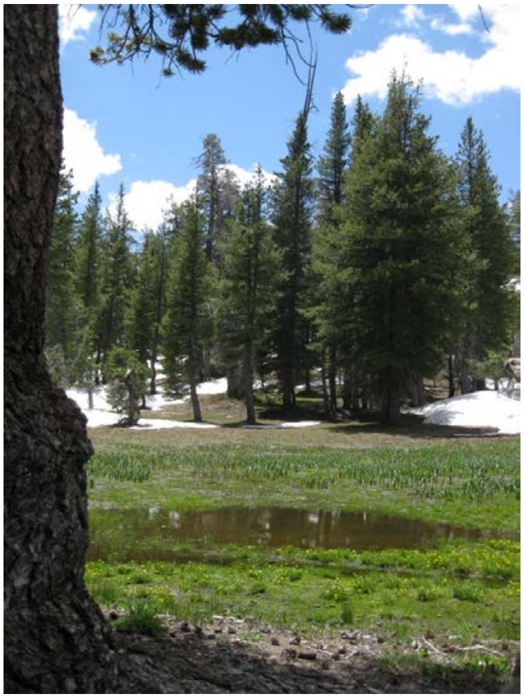

Photo 5 (left). Yosemite toad breeding area on the Stanislaus National Forest.

Photo 6 (right). Mountain yellow legged frog breeding lake in the Desolation Wilderness, Eldorado National Forest.

Photo 7. Mountain yellow legged frog in the Emigrant Wilderness, Stanislaus National Forest.

Monitoring was designed for the initial target species, Yosemite toad and mountain yellow-legged frog, in one integrated design. Extensively, occupancy (presence or absence) is monitored in small watersheds (2-4 km^2) throughout the range of each species in the Sierra Nevada. An unequal probability sample, based on historical occupancy of the Yosemite toad and mountain yellow-legged frog, was selected. That is, a larger proportion of our surveys were conducted in watersheds with documented occupancy between 1990 and the beginning of the monitoring (2002, *Recent*), and a smaller proportion from watersheds with known occupancy prior to 1990 (*Historical*) or where occupancy was unknown (*Unknown*). The Pacific chorus frog uses the same habitats as the Yosemite toad and mountain yellow-legged frog and often co-occurs with them; thus, its historical occupancy was based on the historical occupancy of these species. We assumed that if either Yosemite toad or mountain yellow-legged frog occurred in a watershed, the Pacific chorus frog probably did as well and defined its temporal categories to be *Historical* and *Unknown*. Within each watershed, all wet meadows and lakes and a sample of streams were surveyed.

Ideally, abundance information would supplement the extensive occupancy data providing further insight into the species' status. However, collecting precise abundance data generally is not economically feasible at the scale of the species range. The life history of the mountain yellow-legged frog permits us to estimate relative abundances from counts we make during the single-visit extensive surveys. For this species, all life stages remain near water during the summer and are relatively easy to find; furthermore, tadpoles are reliably found throughout the survey season because they take two to three years to develop. Count data from the extensive surveys are less reliable for evaluating abundances for the Yosemite toad and Pacific chorus frog; adults and subadults of these species move away from breeding sites and are not reliably seen after breeding. Furthermore, these species often breed in ephemeral water that dries over the summer and tadpoles develop within the season. Thus, counts of tadpoles and metamorphs must be made within a short time period. For these reasons, we intensively collect more detailed abundance data for the Yosemite toad in two small watersheds to estimate numbers of breeding males and egg masses during spring breeding, the narrow window of time these life stages are reliably found.

Photo 8. Yosemite toad male and female in amplexus at the beginning of the spring breeding period on snowy ground. Yosemite toads will travel across snow to reach breeding areas.

Preliminary Monitoring Results 2002-2009

Preliminary results for amphibian population status and trend were reported in the 2009 report. Results presented here, and in more detail in a report that is in process, differ slightly due to final data cleanup.

The **mountain yellow-legged frog** has declined in both distribution and relative abundance. Breeding occupancy was low in watersheds where the species had previously been found and relative abundances generally were low.

- Breeding was found in an estimated 4% (se=0.7) of watersheds rangewide; in about half, an estimated 48% (se=4.1), of watersheds with known presence of frogs between 1990 and the beginning of the monitoring project in 2002 (*Recent*); and in only about 3% (se=2.8) of watersheds with known presence prior to 1990 (*Historical)* (Figure 6).

- An estimated 9% (se=5.2) of populations had large abundances (i.e., >100 frogs or >500 tadpoles), and few were as large as those reported in the literature.

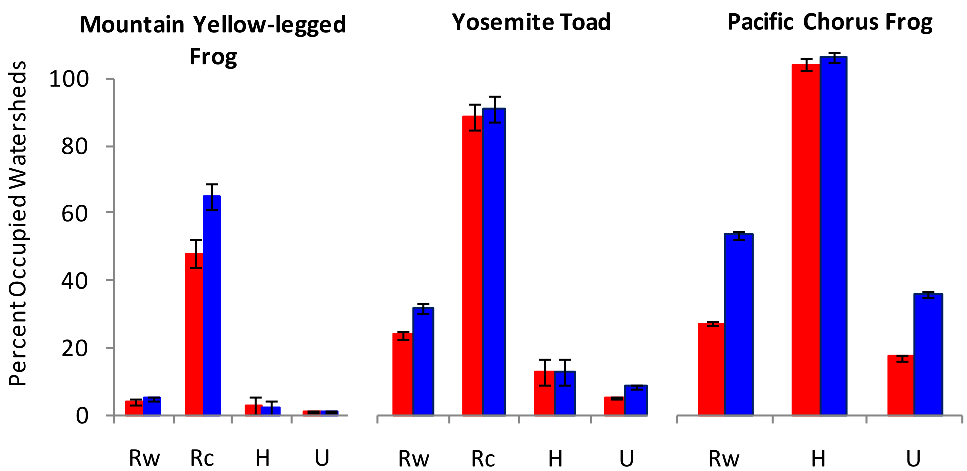

Figure 6. Estimated percent of watersheds occupied by the mountain yellow-legged frog, Yosemite toad, and Pacific chorus frog, 2002-2009, for two occupancy categories (breeding and any life stage) and four historical categories (Rangewide=Rw, Recent=Rc, Historical=H, Unknown=U). Red bars are occupancy by life stages that represent breeding (eggs, tadpoles, metamorphs), and blue bars are occupancy by any life stage. Historical occupancy was based on locality data.

The **Yosemite toad** was fairly widespread in recent watersheds (present 1990-2002), but has declined from historical watersheds (present prior to 1990). Population abundances of adult males and egg masses in the two intensive watersheds were small (Figure 7).

Photo 9. A male Yosemite toad in a breeding site on the Stanislaus National Forest. This toad's posture is typical of calling males in a breeding chorus.

- Breeding was found in an estimated 22% (se=1.2) of watersheds rangewide, an estimated 81% (se=3.4) of watersheds with known presence of toads between 1990 and the beginning of our monitoring in 2002 (*Recent*), and in about 12% (se=3.4) of watersheds with known presence prior to 1990 (*Historical)* (Figure 6).

- Population abundances of adult males were generally less than 20 per year and some meadows had very low abundances (Figure 7). Numbers of egg masses were similarly small (Figure 7).

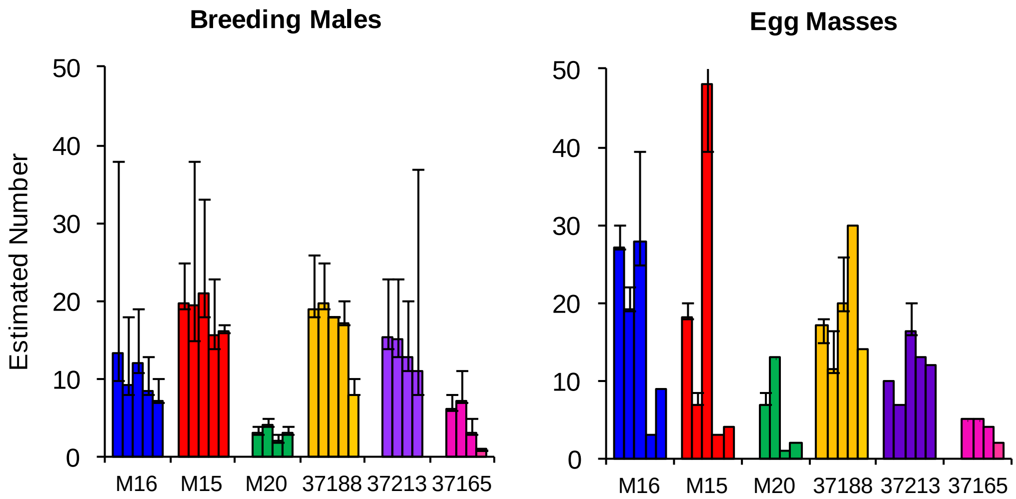

Figure 7. Yosemite toad adult and egg mass abundance estimates, 2006-2010, in two intensive watersheds. Bull Creek is on the Sierra National Forest, and Highland Lakes is on the Stanislaus National Forest. Each bar color represents a meadow and each bar within the meadow represents a year (surveys were not completed in all meadows in 2006). Overall, numbers of males and egg masses were small.

The **Pacific chorus frog** is relatively widespread in the Sierra Nevada; no abundance data were collected for this species. Breeding was found in an estimated 25% of watersheds rangewide (se=0.6) and in an estimated 95% (se=1.6) of watersheds where the species likely occurred historically (*Historical*) (Figure 6).

2010 Accomplishments

Having completed field surveys for the first full cycle of monitoring in the summer of 2009, the first half of fiscal year 2010 was spent on the analyses of the baseline data. During the field season of 2010, we began field data collection for the second monitoring cycle, during which all watersheds and sites will be re-visited. Second surveys were conducted in 64 watersheds for the mountain yellow-legged frog and Pacific chorus frog, including 1,045 lakes, ponds, meadows, and streams. Of these, 44 watersheds including 851 lakes, ponds, meadows, and streams were in the Yosemite toad range.

There are not yet sufficient data from the second cycle to evaluate changes rangewide. However, for the sampled watersheds, there was little change in occupancy for all 3 species. The percent of watersheds with no change in occurrence was 84% for the Yosemite toad, 92% for the mountain yellow-legged frog, and 95% for the Pacific chorus frog. The number of gains and losses were about equal for the Yosemite toad, no mountain yellow-legged frogs were found in three formerly occupied watersheds (losses), and Pacific chorus frog breeding was found in three formerly unoccupied watersheds (gains).

Limited work continued on the intensive component of the monitoring program for the Yosemite toad in 2010. Mark-recapture surveys of breeding males and egg mass counts were conducted during spring breeding in three meadows in each of two watersheds (Highland Lakes on the Stanislaus NF and Bull Creek on the Sierra NF). However, repeat surveys for tadpoles and metamorphs to measure recruitment were conducted only in the Bull Creek watershed.

2011 Program of Work

The program of work for 2011 includes completion and review of a population report, manuscripts for publication, and habitat analysis for the three species. A review and evaluation of the program is also planned. No field work will be conducted in 2011 to facilitate completion of reports and reviews prior to resumption in 2012.

California Spotted Owl – Eldorado Study Area

The long-term population demographic study of California spotted owls (*Strix occidentalis occidentalis*) on the Eldorado NF in the central Sierra Nevada, led by R.J. Gutiérrez, M. Zachariah Peery, and Douglas J. Tempel, is the longest such project on California spotted owls. Our methods are consistent with all other spotted owl population studies (Blakesley et al. 2010). We provide essential information about the status of the owl population in this region and facilitate forest management by providing locations and reproductive activities of owls. The Eldorado monitoring project is essential to the success of the Sierra Nevada Adaptive Management Project (SNAMP), which is designed to assess the effects of fuels treatments under the 2004 SNFPA.

Management Applications

Our monitoring last year reveals continuing evidence for decline in both reproduction and survival of adult owls over time, although in the former case it appears the decline is leveling. Our work with SNAMP and the forthcoming meta-analysis should provide more insight to the factors correlated with these declines.

Our past studies (http://fwcb.cfans.umn.edu/research/owls/) on habitat conditions associated with spotted owls provide managers with information that can guide silvicultural prescriptions. We have estimated landscape conditions associated with spotted owls in the study area, which should provide guidance on the spatial dimensions of habitat patches and amounts of habitat associated with spotted owls. Our work on stress hormones has provided guidance about operating periods and safe operating distances within spotted owl areas. Moreover, our annual monitoring has allowed preliminary assessments of environmental change on owls, which can be used to assess proposed operations for potential impact on owls. Our baseline data on habitat conditions can guide forest managers in developing silvicultural prescriptions or designing SPLATs (strategically-placed area treatments) on the landscape.

In the past year we used our long-term monitoring data on nest and roost sites to examine the efficacy of the Protected Activity Center as a long-term strategy for conservation of owl nesting habitat. This analysis demonstrated that

- USFS biologists have done an excellent job of delineating PACs using basic forest maps.

- The PAC concept is a useful management construct because owls use these protected areas over long periods of time.

Therefore, we feel PACs should be maintained in management plans (Berigan et al., in review). Our paper on placement of owl nests relative to forest edges was published (Phillips et al. 2010).

Technology Transfer

Our 2010 technology transfer activities included two field trips. On June 15, we guided members of the general public and USFS personnel on a walk-in survey near Blodgett Forest Research Station. On July 8, we returned to this same site with the District Biologist and Biological Technicians from the Georgetown Ranger District. During these field trips, we showed the attendees how we survey for owls, resight banded owls, and assess owl reproduction. We also discussed the long-term goals of our demographic study and reviewed some of our findings. Our other technology transfer activity was the maintenance of R.J. Gutiérrez's website on spotted owl research (http://fwcb.cfans.umn.edu/research/owls/). This site contains links to .pdf files for many of the papers we have published over our 30 years of owl work.

We have provided data and technical expertise for two meta-analyses examining spotted owl population vital rates throughout its range (Franklin et al. 2004, Blakesley et al. 2010) and many other owl-related activities. We continued to participate in the Sierra Nevada Adaptive Management Project (SNAMP), which is assessing the ecological and social impacts of "strategically placed area treatments" (SPLATs). Our specific role is to assess the impact of SPLATs on spotted owls in the Tahoe NF SNAMP treatment area. Our assessment areas are the north side of our Eldorado demography study area and the Eldorado monitoring area. We include the Eldorado project owls in the SNAMP study because the increased sample size will provide a more robust estimate of the effects of SPLATS on spotted owls.

Plans for 2011

We will continue monitoring owls for survival and reproduction during 2011 and measure vegetation characteristics at sites where SPLATs have been implemented. Treatments in SNAMP SPLATs began in 2010 and will continue into 2011. We have already helped convene a large spotted owl workshop in 2011 for USFS personnel to discuss our findings, techniques, and potential management applications. Finally, we plan to conduct additional workshops for the public during summer 2011.

Literature Cited

Berigan, W.J., R.J. Gutiérrez, and D.J. Tempel. Evaluating the efficacy of protected habitat areas for the California spotted owl using long-term monitoring data. Journal of Forestry, in review.

Blakesley, J.A., M.E. Seamans, M.M. Conner, A.B. Franklin, G.C. White, R.J. Gutiérrez, J.E. Hines, J.D. Nichols, T.E. Munton, D.W.H. Shaw, J.J. Keane, G.N. Steger, and T.L. McDonald. 2010. Population dynamics of spotted owls in the Sierra Nevada, California. Wildlife Monographs 174.

Franklin, A.B., R.J. Gutiérrez, J.D. Nichols, M.E. Seamans, G.C. White, G.S. Zimmerman, J.E. Hines, T.E. Munton, W.S. LaHaye, J.A. Blakesley, G.N. Steger, B.R. Noon, D.W.H. Shaw, J.J. Keane, T.L. McDonald, and S. Britting. 2004. Population dynamics of the California spotted owl (*Strix occidentalis occidentalis*): a meta-analysis. Ornithological Monographs 54.

Phillips, C.E., D.J. Tempel, and R.J. Gutiérrez. 2010. Do California spotted owls select nest trees close to forest edges? Journal of Raptor Research 44:311-314.

Management Indicator Species

The second Sierra Nevada Forests Bioregional Management Indicator Species (MIS) Report was completed in December, 2010. The report is a regularly updated summary of the status and trend of MIS for 10 National Forest units in the Sierra Nevada (Eldorado, Inyo, Lassen, Modoc, Plumas, Sequoia, Sierra, Stanislaus, and Tahoe National Forests and the Lake Tahoe Basin Management Unit) and serves as the primary tool to track and report the results of bioregional MIS monitoring.

During the period from the early 2000s to the mid-to-late 2000s, habitat changes observed previously (early 1990s to early 2000s) in coniferous forest types have continued:

- A slight increase in closed-canopy, late-seral coniferous forest, with a corresponding decrease in open-canopy, late-seral coniferous forest.
- An increase in mid-seral coniferous forest, with a corresponding decrease in early-seral coniferous forest.

Trends in snags per acre and fire burn severity were also reported. Distribution population monitoring is reported in individual species accounts for the 12 terrestrial species and aquatic macroinvertebrates. The report, which provides details about methods and current results, will be posted at a later date. It is available now from Diana Craig (mailto:dcraig01@fs.fed.us).

Detecting Climate Change in Sierra Nevada Streams

Dr. David Herbst, of the University of California Sierra Nevada Aquatic Research Laboratory, initiated monitoring in a set of sentinel watersheds in the Sierra Nevada as part of the Sierra Nevada MIS monitoring program in 2010. The following is adapted from his report on the first year of monitoring.

Anticipating that changing climate in California will substantially affect water resources, we need to develop strategies for assessing the impacts of altered stream flows. Changes in the Sierra Nevada, the primary source area of water in the state, are of particular concern. Warming has produced a shift toward more precipitation falling as rain than snow, which reduces snowpack water storage, causes earlier runoff, increases the frequency of catastrophic floods through rain-on-snow events, and diminishes late season flows and stability of headwater habitats that are crucial to maintaining watershed hydrological and ecological function (Figure 8). Climate change is shifting hydrologic patterns, especially in headwater and alpine streams where conservation of biological diversity may be at most risk. The goal of this project is to develop an observation network designed to detect the ecological impacts of climate-induced changes in hydrologic balance and temperature of Sierra Nevada streams and provide a historical context for recovery of degraded ecological conditions.

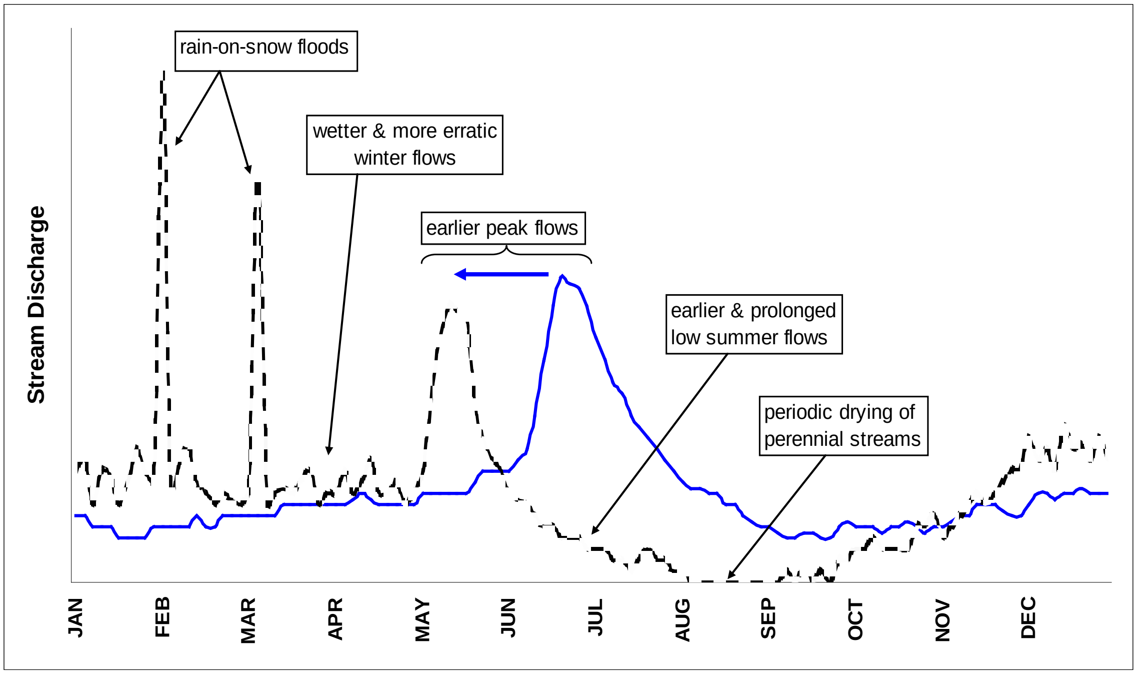

Figure 8. Conceptualization of annual stream discharge of a Sierra Nevada stream, depicting climate-driven (grey line) and historical (blue) hydrographs.

Streams in relatively undisturbed watersheds form the reference condition for biological assessment of water quality and ecosystem health. Against a background of climate-driven alteration of streams across the Sierra, it will be necessary to account for the potential loss of biological integrity in reference streams. Although all streams (and lakes) are potentially affected by climate change, reference streams may have more to lose than disturbed streams that already have been biologically depleted to varying extents due to other causes. Reference conditions for streams are typically developed from many sites sampled over many years; if streams are slowly degrading over time, the range of variability in the reference condition increases. The net effect of such drifting reference conditions is that the ability to detect impairment in non-reference streams is diminished: poor streams appear less impaired than they really are. Quantification of this climate-induced drift is therefore necessary for reference stream monitoring in the Sierra Nevada. Assessment of the true status of stream health will require that we both measure the historical state of streams before the onset of further major climate shifts and continue monitoring reference streams for regular re-calibration under altered climate and hydrologic conditions.

Management Indicator Species (MIS)

Benthic macroinvertebrate inhabitants of streams have been adopted as MIS for monitoring status, trend, and health of streams in Sierra Nevada National Forests. Understanding how aquatic MIS are affected by hydro-climatic change provides a means of gauging the health of national forest watersheds in different regions and ecological settings. These organisms can be used as sentinels to show how much the ecological integrity of watersheds is changing, and how effective management may be in protecting these natural resources.

Project Design

Down-scaled climate models predict distinct gradients of hydrological change related to loss of snowpack for the Sierra Nevada. The volume of snow lost, shift to earlier snow melt runoff, and reduced late season flows have been modeled by the USGS climate lab to forecast risk and estimate the extent of change compared to historic conditions.

In addition to risk exposure related to the geography of climate-driven alteration of snow and streamflow, there are natural gradients of environmental vulnerabilities to the effects of these changes, conferring greater or lesser resistance to warming and loss of snow cover including

- northern aspects holding snow longer than southern aspects,
- volcanic geology holding more groundwater for recharge than granitic geology, and
- meadows and riparian forests storing water and providing cooler temperatures.

These represent settings within which management actions have may be more or less potential to succeed, allowing decisions about priorities for protection where restoration may be most effective.

Using only undisturbed reference sites, we selected 12 sentinel catchments, each with a nested tributary stream, for a network of sites that can detect response to projected change (Figure 9). Three catchments were assigned to each of four categories that represent high and low risk for climate-induced loss of snow cover and hydrologic stability in combination with high and low resistance (vulnerability) to climate change (Figure 9). This monitoring design provides an optimal array for observing changes within an environmental risk analysis framework. This design also sets up a natural experiment for testing hypothesized risks based on forecast climate conditions and hydrographic susceptibility.

Six catchments are in the southern region of the Sierra Nevada, on the Sierra NF, Toiyabe NF, Yosemite National Park, and Sequoia – Kings Canyon National Park, and six are in the northern Sierra Nevada, on the Shasta NF, Eldorado NF, Tahoe NF, Plumas NF, Lassen NF, and Lassen Volcanic National Park. The sites selected are broadly representative of Sierra Nevada streams across a range of elevations (4,000-12,000 ft), 5 degrees of latitude, and varied geologic formations and forest ecoregions.

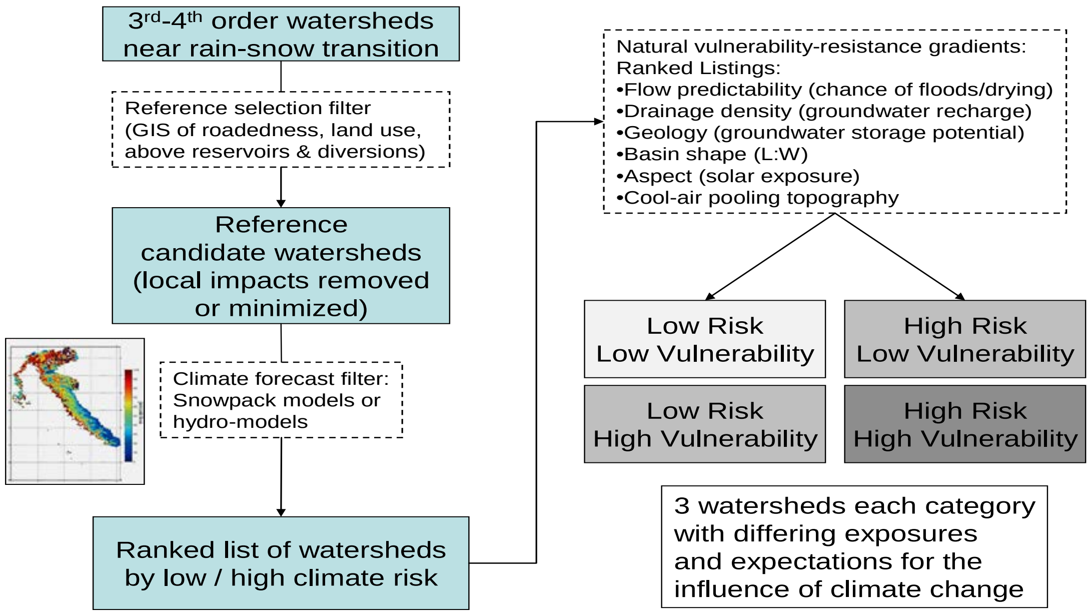

Figure 9. Site selection flow chart starting in upper left corner, with three decision boxes (dashed outline): (1) reference site criteria used to establish population of potential watershed study locations, (2) climate risk filter applied to rank level of exposure to changing snow and hydrologic conditions, and (3) natural vulnerabilities ranked to establish levels of potential resistance to climate change effects.

Data will be widely available and shared across agency management units of the Sierra Nevada:

- Water and air temperatures logged at less than one-hour intervals.
- Water level stage height from a pressure transducer at less than one-hour intervals.
- Complete geomorphic channel measurements: depth-width, bankfull profiles, substrate composition, current velocity, slope, etc.
- Riparian cover surveys.
- Water quality measures of conductivity, pH, alkalinity, and silicate.
- Ecosystem food web resources quantified as fine and coarse fractions of organic matter (leaf and wood inputs) and algal periphyton growth on rock substrates.
- Aquatic invertebrates collected using two standard protocols – one restricted to riffle habitat, and one that covers all habitats in the reach.

Accomplishments and preliminary results from the first year

In the first year of monitoring, we cataloged 200 aquatic invertebrate taxa (exclusive of aquatic mites and midges that will likely bring diversity to over 300 total taxa) across the network of sites. Some feature results from this first year of monitoring:

- Sites in the granitic southern Sierra Nevada, where flows are more variable and have lower summer minima, were in general lower in diversity than sites in the northern Sierra Nevada, where volcanic groundwater often sustains higher and more constant summer flows.

- The composition of communities also generally partitions into southern and northern groups.
- One outlier tributary stream in the northern Sierra Nevada has a distinct community composition. This tributary had the shortest upstream length of any site and is most likely to be intermittent in at least some years. Periodic drying may be one of the most important ecological limitations that could be induced by climate change, and this site had the lowest diversity and the most distinctively different community.
- Small streams of the southern Sierra Nevada may have little groundwater recharge, being limited mostly to surface runoff and snowmelt, and thus, low levels of dissolved minerals including silicate. The longer the upstream length of these streams, the less prone they are to drying, and the more diversity they hold (Figure 10, filled symbols).
- In contrast, small streams of the northern Sierra Nevada, where volcanic groundwater can sustain flows and cool temperatures, do not show the same depletion of diversity despite short upstream lengths (Figure 10, open symbols). Higher silicate content of these streams indicates groundwater input from more soluble volcanic rock types; even when snowmelt is exhausted, these small streams retain flow and harbor diverse communities.
- Thus, snowmelt-driven streams, as suspected, are more susceptible to low flows and drying and support less biological diversity.

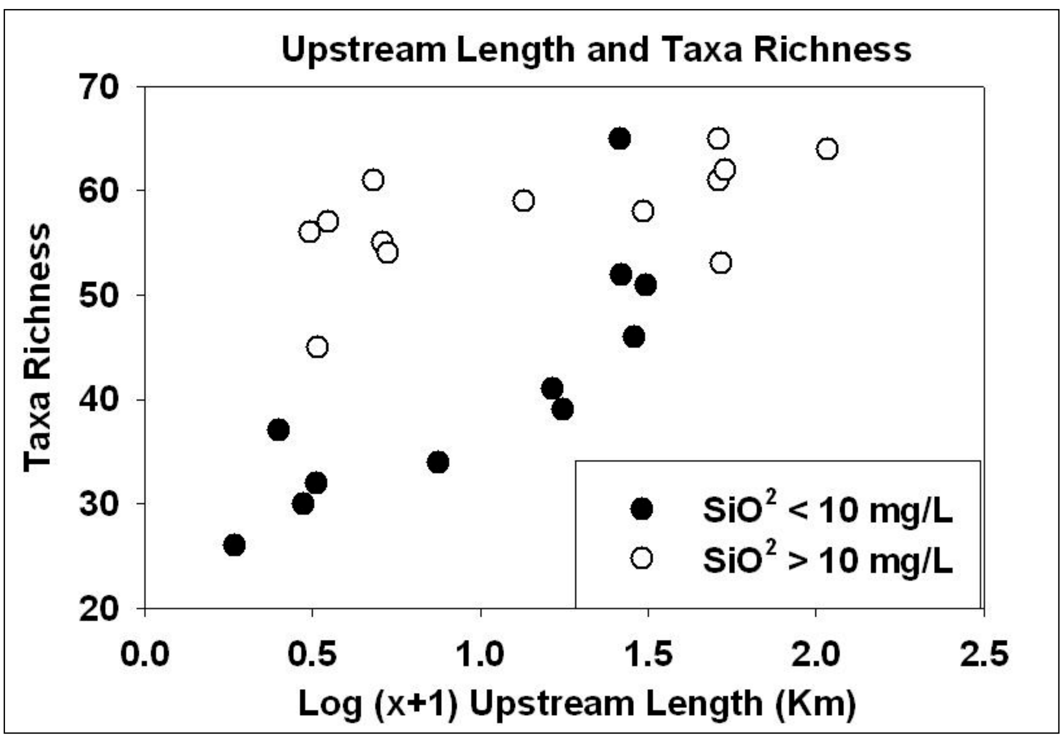

Figure 10. Relation of taxa richness of sentinel streams to upstream perennial channel length in 2010. Filled symbols are mostly southern streams in granite terrain with little groundwater input and SiO_2 levels below 10 mg/L, and open symbols are mostly northern streams with SiO_2 above 10 mg/L from volcanic groundwater sources.

Forest Monitoring Summary

October 1, 2009 to September 30, 2010 (FY 2010)

This summary is based on reports from the nine California 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 FY09. 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 FY10 are summarized in Table 4. Treated acres represent less than 0.5% of California Spotted Owl PACs and 1.7% of Northern Goshawk PACs.

Table 3. Summary of treatments in California Spotted Owl and Goshawk PACs and the WUI for 2010.

Forest	Treatment Acres in California Spotted Owl PAC*	Treatment Acres in Goshawk PAC*	Acres treated in WUI	Percent of total treated in WUI
Eldorado	81	226	1,915	19.6
Inyo	0	0	2,116	54.0
Lake Tahoe Basin	0	76	2,683	12.8
Lassen	26	596	2,940	99.0
Modoc	0	620	268	2.4
Plumas	514	111	4,445	37.4
Sequoia	37	24	4,835	34.5
Sierra	915	0	4,514	46.8
Stanislaus	302	9	7,074	66.6
Tahoe	126	202	4,422	38.6
Total acres treated	2,001	1,864	35,211	33.1
TOTAL acres in PACs	421,780	108,158		

* Data pulled from FACTS July, 2011

In 2010, fuel treatments were conducted on 106,426 acres on the Region 5 Sierra Nevada National Forests. Of those acres, 33% were located in the wildland-urban interface (WUI). The regional goal was to have 50% of all initial fuel treatments in the WUI (SNFPA ROD, page 5), and we have now completed many of those treatments.

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

- 2,069 acres on the Eldorado NF,
- 944 acres on the Lake Tahoe Basin Management Unit,
- 137 acres on the Lassen NF,
- 591 acres on the Plumas NF,
- 1,593 acres on the Sequoia NF,
- 3,920 acres on the Sierra NF,
- 2,713 acres on the Stanislaus NF, and
- 521 acres on the Tahoe NF.

The total of 12,488 acres treated within CSO PACs since 2004 is less than 3% of the 421,780 acres of CSO PACs designated within the Sierra Nevada. The ROD for SNFPA limits vegetation treatments to no more than 5% of the acres in CSO PACs per year and 10% per decade (page 61).

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

- 597 acres on the Eldorado NF,
- 200 acres on the Humboldt-Toiyabe NF (but reporting is incomplete),
- 3 acres on the Inyo NF,
- 159 acres on Lake Tahoe Basin Management Unit,
- 917 acres on the Lassen NF,
- 1,684 acres on the Modoc NF,
- 311 acres on the Plumas NF,
- 215 acres on the Sequoia NF,
- 370 acres on the Sierra NF,
- 762 acres on the Stanislaus NF, and
- 545 acres on the Tahoe NF.

The total of 5,763 acres treated in goshawk PACs since 2004 is 5% of the approximately 108,158 acres in Northern Goshawk PACs. The ROD for SNFPA limits mechanical treatments to no more than 5% of the acres in Northern Goshawk PACs per year and 10% per decade (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). For FY 2010:

- On the Plumas NF, 27 acres in one CSO PAC were affected by fire; replacement acres have been found.

The Sierra Nevada national forests identified fuels treatments in Great Grey Owl PACs and fisher den site buffers; none in marten den site buffers:

- Sierra NF treated 12 acres in the Swanson Great Grey Owl PAC and 54 acres in the Quarter Mile fisher den site buffer.

- Stanislaus NF treated 175 acres in Great Grey Owl PACs.

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 2010:

- Eldorado NF modified 5 PACs for the Big Grizzly fuels reduction project: 34 acres in PLA0010, 26 acres in PLA0012, 84 acres in PLA0015, 16 acres in PLA0050, and 21 acres in PLA0080.

- Stanislaus NF modified PAC boundaries, but did not report the number or acreage.

Implementation monitoring was conducted on all projects during 2010 except as follows:

- Eldorado NF reports no monitoring for SNFPA wildlife; emphasis for monitoring this year was travel management. Trail condition surveys for RCO objectives and sediment delivery to perennial streams was accomplished on nine OHV trail crossing sites with turbidity measurements upstream and 2-3 distances downstream. Stream macroinvertebrate samples were also taken above and below crossings to evaluate the effects of sediment on macroinvertebrate assemblages.

- Lassen NF conducts project monitoring, but not SNFPA implementation monitoring because it continues to operate under the Herger-Feinstein Quincy Library Group (HFQLG) Act. Monitoring for HFQLG is reported at http://www.fs.fed.us/r5/hfqlg/monitoring/.

- Lake Tahoe Basin Management Unit (100% of projects were monitored) provides a summary of its entire monitoring program in an annual report posted at http://www.fs.fed.us/r5/ltbmu/.

- Modoc NF reports botanical monitoring on 1% and soils monitoring on 3% of total projects; all vegetation management projects were monitored for vegetation prescription compliance.

- Plumas NF, 38% of projects; like the Lassen NF, the Plumas does not do SNFPA implementation monitoring because it continues to operate under the HFQLG Act. Monitoring for HFQLG is reported at http://www.fs.fed.us/r5/hfqlg/monitoring/.

- Sequoia NF reports no monitoring in 2010.

- Stanislaus NF reports monitoring for 1% of projects.

Forest Relations with Tribes

The Sierra Nevada 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 specific new instances where the forests worked with tribes on projects in 2010 include:

Inyo NF:

The Inyo National Forest continues to actively consult with eight local tribes on proposed Forest Service undertakings, policy changes, and other actions that may affect local tribal interests. The Inyo Heritage staff recorded 81 separate personal contacts with tribes and tribal members to discuss Inyo NF undertakings in FY2010. Particular accomplishments and innovations within the Tribal Relations program in FY2010 include:

- Collaborated with local tribes on the renaming of Squaw Peak to “Wunupu” Peak.

- Created the interagency “ARPA Working Group” for collaboration with tribes and local agencies to address vandalism of archaeological resources in the Owens Valley area.

- Facilitated reenactment of traditional Trans-Sierra walks by westside Mono Indians. The Inyo NF provided campsites for 50 participants at the eastern terminus.

- Facilitated tribal access to the Devil’s Postpile National Monument by supplying seasonal passes to local tribal members to visit the Monument and provide information on traditional uses of the area.

Lake Tahoe Basin Management Unit

- Developed an MOA for a path through national forest lands for Washoe to access Lake Tahoe.

- Drafted MOA for cooperative management of Skunk Harbor.

- Coordinated with the Washoe for review of trails project at Secret Harbor, to provide gate access to Skunk Harbor and Meeks Meadows, and to meet with LMP staff and Deputy Forest Supervisor on Land Management Plan revision.

- Developed an agreement for National Historic Preservation Act (NHPA) nomination of Cave Rock bolt.

Modoc NF:

- The Modoc NF botany section worked with the Cedarville Rancheria and Cultural Advocates for Native Youth to plant native tobacco seed at one project area pile burn site to restore this culturally important plant. They also assisted with collection of additional native tobacco seed for restoration plantings during 2011.
- The forest also gave sacred and ceremonial site access consideration in their travel management analysis and FEIS.

Plumas NF:

- Finalized a consultation protocol MOU with the Susanville Indian Rancheria, which includes the Lassen National Forest and Bureau of Land Management.

- Collaborated with the Maidu Stewardship Council and the Greenville Rancheria to designate the Greenville Rancheria Fire Crew as the subcontractor to carry out Maidu Stewardship fuels reduction projects.

- Implemented a multiple-vegetation enhancement project in collaboration with both federally recognized and un-recognized tribal groups, specifically aimed at enhancing the viability and health of Bear Grass by the use of prescribed fire. We have also consulted with traditional practitioners on replanting willow and other culturally important plants in areas where watershed restoration activities have recently been accomplished.

- Collaborated with tribes in conducting AVUE workshops that provide training to individual tribal members on creating and editing profiles, performing job searches, and applying for open positions with the Forest Service.

- The Forest heritage resource staff, in ongoing consultation with local tribal members, has designed and will soon install public interpretation of the Chandler Roundhouse Site, which is part of on-site protection measures completed last year for this unique cultural resource.

- Coordinated with the Sequoia NF, tribal groups, and Natural Resources Conservation Service to use video conferencing to hold various information sharing and collaborative meetings with tribal organizations.

Sequoia NF:

- Delivered a “Motivational Training” session to the Tule River Indian Reservation Fire Department staff on January 21. Former USFS Horseshoe Meadow Hotshot Crew leaders presented effective techniques and practices for building unit cohesiveness and teamwork.

- Maintained information flow between the tribal community and planners working on the Giant Sequoia National Monument Plan with timely updates and public meetings. Coordinated meetings for the Forest Supervisor for a formal consultation briefing to the Tule River Indian Reservation tribal council.

Sierra NF:

- Hosted the Regional Tribal Roundtable on National Forest Planning Rule process on May 4; over 25 Tribal representatives participated. The Planning Rule process was featured as an agenda topic at the May 11 Sierra Tribal Forum. The Indian Dispute Resolution Services (IDRS), Sierra Nevada Coordinator presented an update on the Planning Rule process at the Sierra Tribal Forum on August 25 at the Bass Lake Ranger District. On November 22 the TRP Manager and the North Fork Mono Tribal Chairman attended the Planning Rule meeting in Sacramento.

- Held four Tribal Forum Meetings on January 27, May 11, August 25, and November 16, 2010 to exchange information. Sessions were held at the Supervisor’s Office and District Offices, with the Forest Supervisor, District Rangers, archeologists, and designated subject-matter experts regularly in attendance. Forum participants included leaders from federally recognized Tribes, non-federally recognized Tribes, tribal groups, organizations, traditional cultural practitioners and interested individuals. The meeting topics generated meaningful dialogue and frequently lead to more in depth formal consultation.

Stanislaus NF:

- Worked with the Southern Sierra Miwuk Nation on Bower Cave – their traditional birthplace -- to remove weeds and safeguard the entrance into the cave. We removed star thistle from the property and approved the tribal-designed gate that will protect the entrance to the cave.

- Worked with the Tuolumne Band of Me-wuk to restore a meadow and ethnographic village site important to the Tribe. This year, we jointly filmed traditional users at the meadow; propagated 100 traditionally-used plants, which will be transplanted to the meadow, at the Tribal nursery; and secured one additional grant to pay for the week-long restoration project scheduled for June 27-July 1, 2011. The project will reduce conifer encroachment, release black oak saplings, and fence the spring from grazing activities.

- Focused collaboratively on a complex set of economic, social, and environmental issues that directly affect native people living in rural areas. An example of this collaboration is the Amador Calaveras Consensus Group: a partnership between forest, local, state, federal, and Tribal entities to find community-based solutions to these issues. One solution is the formation the Calaveras Healthy Impact Products Solutions (CHIPS), which specializes in vegetation management and forest products. Through this partnership, the Calaveras Ranger District provided training for an All-Native CHIPS Crew to do vegetation management within archaeological sites on FS land where fuel build-up and vegetation was encroaching on important native plants and cultural resources. With this project, resource stewardship, fuel reduction, and putting people back to work in the woods all came together to solve the problem.