



# **Plumas Lassen Study 2006 Annual Report**

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## Introduction

The Pacific Southwest Region and the Pacific Southwest Research Station agreed in 2002 to jointly develop and fund an administrative study to fill management information needs concerning the relationship between management-caused changes in vegetation and their effects on spotted owl habitat and population dynamics. The detailed discussions explaining how this program was started is provided in previous Annual Reports. Copies of previous Annual Reports for this program are available on the Sierra Nevada Research Center web site ([www.fs.fed.us/psw/programs/snrc](http://www.fs.fed.us/psw/programs/snrc)) or upon request.

This is the fifth such Annual Report that we have compiled. The primary purpose of this is to provide a periodic synopsis of what we have been learning so all interested parties can remain abreast of the progress. Research products resulting from this effort will be disseminated as they are ready and this will vary from module to module, project to project, and from year to year. We expect that there will be a continuous flow of findings documented primarily with publications in both refereed journals and other publication outlets. The cadre of scientists, support staff, students, and others contributing to this effort will also be making oral presentations and providing other kinds of outreach materials to help inform interested parties and our peers on the results of this work.

We provide some review information here to reinforce the intent of our work. This background information provides general background information on the purpose of this research program and helps set the context for the report. We have had to remind many interested parties and in particular our own program administrators that we embarked on the project virtually from square one. A project of this magnitude and ambition is difficult to initiate under the best of circumstances and we have asked for patience in the development of findings (e.g. scientific publications). When a research program begins work in a new area, addressing large geographic areas with complex questions on a busy landscape that is already subject to many other demands, it is not easy to establish all the field activities and produce results quickly.

However, we now believe we have emerged from the initiation phase and we have collected an impressive amount of information. Many publications are in development and we expect to provide useful information in the immediate future. Of course much of our research purpose depends on forest management treatments to be put in place and then observe short and even long term response to those treatments. Such treatments are now being executed in some locations and thus some of our potentially most significant work is just starting. Observations of response after treatments will logically take place in the ensuing years. If funding can be sustained we intend to continue to follow up with further data collection, field observations and insights addressing the questions we have posed.

We recognize that response of different elements of the forest can occur immediately after treatments however it is also possible that response can occur slowly and not be recognized for some period of time depending on the response variable of interest.

Alternatively it is also possible that some response variables exhibit a notable initial response and then return to a state similar to that of before the treatments. Thus we believe it is prudent to look at a fairly long period of post treatment response if possible.

### **Purpose of the Study**

This study is interdisciplinary by design, examining at least five groups of response variables (spotted owls, small mammals, terrestrial birds, vegetation, and fuels conditions) through collaboration between researchers of the USDA Forest Service Pacific Southwest Research Station (PSW) and cooperators from the Universities of California, Berkeley and Davis, and the PRBO Conservation Science. The study addresses some of the most significant uncertainties that confound management decisions in the Sierra Nevada today, including in the HFQLG Pilot Project Area. How do old-forest-dependent species respond to vegetation management over space and time? Do fuels management approaches effectively address fuels loadings without negatively affecting species viability? How effective are landscape level fuels management strategies in modifying fire behavior and reducing the extent and severity of wildland fire? These and related questions are the focus of the work being done in this study.

### **Objectives of Study**

The original overarching objective of this proposed research was to address an array of related ecological questions in a coordinated, integrated effort, thereby providing empirical data to inform future management decisions. The landscape scale of this design was both the driving force addressing the key questions as well as the largest impediment to successful construction of a scientifically credible experimental design and implementation in the field. Our research team believes that assessing many of the key elements of forest ecosystems should be done over larger spatial and temporal scales than has typically been investigated in past research. The important difference we are investigating is the response to changes in forest structure and composition over space and time rather than simply site specific and immediate response. We believe this difference is especially relevant to forest management practices that are designed for large landscapes, executed over relatively long time frames, such as landscape level fuels treatment strategies.

This research program is designed to address the three principal issues described below. These issues are specifically addressed through research questions and attending hypotheses for five different research components of this research program. These specific questions are detailed in the individual study plans for each module. Here we simply highlight the main objectives of the integrated research program and summarize the primary research questions that we plan to pursue.

- ***Wildland Fire Behavior and Protection.*** How do landscape level fuels and silvicultural treatments affect potential fire behavior and effects? Are specific combinations of defensible fuel profile zones (DFPZs) and subsequent individual tree selection or area treatments to thin the matrix effective in reducing the extent and severity of wildland fires? Are realized fire management benefits consistent with hypothesized results in reducing fire risk and altering fire behavior?

- ***Landscape Dynamics.*** How do combinations of DFPZs, subsequent individual tree selection or area treatments to thin the matrix, group selection, riparian protection standards, and species-specific protection measures affect landscape dynamics such as forest structure, composition, and succession at multiple scales of space and time?
- ***Species Viability.*** Induced by a forest management regime, how will old-forest dependent species, particularly the California spotted owl and its prey base comprised of various species of small mammals, respond to changes in vegetation composition, structure, and distribution over space and time? How is response to treatments manifested at the individual and population levels of biological organization?

Below we provide brief summary statements that capture the essence of the questions we are pursuing under this research agenda. Once again we direct you to the detailed study plans for further information on each module of this research program.

**The specific management questions that are being addressed within the five different research components are:**

Fuels and Fire Module

1. Current conditions: measurement of vegetation and fuels at the landscape scale
2. Fire modeling: how might current conditions (above) affect fire *behavior* and *effects*?
3. Effects of treatments: how might landscape-scale treatments change fire behavior and effects (as measured by using simulation programs such as FlamMap)?
4. Fire and habitat model integration (how can we address fuels management objectives in ways compatible with sensitive species conservation?).

Vegetation Module

1. What are the effects of canopy reduction due to thinning treatments on understory microclimate and shrub cover? How do we accurately measure changes in canopy cover to meet management prescriptions?
2. What are the appropriate ecological conditions to induce regeneration of shade-intolerant conifer species?
3. How does ecosystem resilience to forest harvesting, particularly group selection silviculture, vary across landscape gradients of precipitation and soil type?

Small Mammal Module

1. What are the habitat associations of the different taxa of small mammals found in coniferous forests in the northern Sierra Nevada (objective of

developing refined yet functional models of habitat associations)? What is the relative abundance and distribution of these taxa with respect to forest structure and composition?

2. Estimate values of the demographic parameters (for example, population size, reproductive output, survivorship, and mortality rates) of these taxa.

3. Estimate values for spatial patterns (for example, home range area and configuration) for these taxa.

#### Bird Community Module

1. Do current forest management practices promote an ecologically balanced forest ecosystem that supports sustainable populations of the breeding bird community over time?

2. What are the critical local-scale habitat components and landscape-scale composition elements that should be managed for in order to sustain the avian community over time (20 to 50 years)? Can we predict species composition, abundance, and distribution in response to future landscape treatments?

3. How do, or will, a suite of avian species that are associated with a wide range of forest conditions respond to fuels treatments, at the local and landscape scales in the short (one to five years) and long term (five to 20 years)?

4. Do Spotted Owl protected activity centers provide high quality habitat for the broader avian community? What are the differences in the avian community composition within owl territories compared to the surrounding landscape?

#### California Spotted Owl Module

1. What are the associations among landscape fuels treatments and CSO density, distribution, population trends and habitat suitability at the landscape-scale?

2. What are the associations among landscape fuels treatments and CSO reproduction, survival, and habitat fitness potential at the core area/home range scales?

3. What are the associations among landscape fuels treatments and CSO habitat use and home range configuration at the core area/home range scale?

4. What is the population trend for CSOs in the northern Sierra Nevada and what factors account for variation in population trend?

5. Are barred owls increasing in the northern Sierra Nevada, what factors are associated with their distribution and abundance, and are they associated with reduced CSO territory occupancy?

6. Does West Nile Virus affect the survival, distribution and abundance of California spotted owls in the study area?

#### Progress to Date

Given that we have completed a fifth year of work we are beyond the initiation phase and some findings are beginning to take shape. Some results, based on primarily pretreatment data, are crystallizing and findings will be reported. Some of the work described here includes activities from other locations but are potentially relevant to the Plumas and Lassen National Forest landscape, thus they are included in this summary. A preliminary list of completed and anticipated publications is summarized below:

### **Fire and Fuels Module**

Menning, K. M. and S. L. Stephens (planned for 2006). "Spectral Entropy Canopy Diversity Analysis (SpECDA) used to Assess Variability in Forest Structure and Composition" To be submitted to Photogrammetric Engineering and Remote Sensing.

Menning, K. M. and S. L. Stephens (planned for 2006). "Fire Behavior and Effects as a Result of Defensible Fuel Profile Zones" To be submitted to International Journal of Wildland Fire.

Menning, K. M., S. L. Stephens, J. Keane (invited) and others. (Planned for 2006). "Integrated modeling of fire and California Spotted Owl habitat conditions given different weather and landscape treatment scenarios" To be submitted to a journal mutually agreed upon.

Menning, K. M. and S. L. Stephens (planned for 2006). "Landscape Forest Variability across the Northern Sierra Nevada" To be submitted to Landscape Ecology.

### **Vegetation Module**

In revision

Bigelow SW, North MP, Horwath WR. Age versus light as influences on growth of Sierra Nevada conifer saplings. Status: in revision.

Papers in preparation

Bigelow SW, Parks SA. Landscape analysis of group selection placement strategy in a patchy East-Side pine forest. For submission Spring 2006.

Bigelow SW, North MP. Group selection harvest impacts in a patchy East-Side pine forest. For submission summer 2007.

Papers planned

Bigelow SW, North MP. Understory light prediction after fuels treatment & group selection in a mixed-conifer forest. Status: pending follow-up measurements immediately after completion of experimental fuels treatments. Estimated completion date Fall 2007.

Salk CF, Bigelow SW, North MP. Interaction of soil texture and light on performance of seedlings of Sierran conifers. Status: data collection complete except for soils analyses. Estimated completion date Fall 2007.

Bigelow SW, Moghaddas J, North MP. Fuels treatments in western forests: relationship between canopy cover reduction and fire hazard reduction. Status: pending completion of experimental fuels treatments. Estimated completion date Spring 2008.

North MP, Bigelow SW. Effects of canopy cover reduction on fire climate and ecosystem trajectory. Status: pending completion of experimental fuels treatments and 1-year post-treatment measurements. Estimated completion date Spring 2009.

Bigelow SW, Moghaddas J, North MP. Surface fuel consumption and conifer mortality in a mixed conifer forest. Status: pending completion of experimental fuels treatments, and subsequent controlled burn, and 1 year of follow-up treatments. Estimated completion date Spring 2010.

### **Small Mammal Module**

#### **Publications (Peer-reviewed)**

Copetto, S. A. 2005. Habitat associations of small mammals at two spatial scales in the northern Sierra Nevada, California. M.S. Thesis, University of California, Davis, 39 pp.

Copetto, S. A., D. A. Kelt, D. H. Van Vuren, J. A. Wilson, S. Bigelow, and M. L. Johnson. 2006. Habitat associations of small mammals at two spatial scales in the northern Sierra Nevada. *Journal of Mammalogy* 87:402-416.

Innes, R.J. 2006. Habitat selection by dusky-footed woodrats in managed, mixed-conifer forest of the northern Sierra Nevada. M.S. Thesis, University of California, Davis, 31 pp.

#### **Submitted**

Innes, R. J., D. H. Van Vuren, D. A. Kelt, M. L. Johnson, J. A. Wilson, P. A. Stine. Submitted. Habitat selection by dusky-footed woodrats in managed, mixed-conifer forest of the northern Sierra Nevada. *Journal of Mammalogy*

Wilson, J. A., D. A. Kelt, D. H. Van Vuren, and M. Johnson. Submitted. Population dynamics of small mammals in relation to cone production in four forest types in the northern Sierra Nevada. *Western North American Naturalist*.

Wilson, J. A., D. A. Kelt, and D. H. Van Vuren. Submitted. Effects of maternal body condition on offspring dispersal in golden-mantled ground squirrels (*Spermophilus lateralis*). *Oikos*.



Wilson, J. A., D. A. Kelt, and D. H. Van Vuren. Submitted. Home range and activity of northern flying squirrels (*Glaucomys sabrinus*) in the Sierra Nevada. Southwestern Naturalist.

#### In Preparation

Coppeto, S. A., D. A. Kelt, and others. In Prep. A multiple spatial scale perspective of the habitat affinities of sympatric *Neotamias quadrimaculatus* and *N. senex*. Winter 2007.

Innes, R. J., D. H. Van Vuren, M. B. McEachern, J. M. Eadie, D. A. Kelt, M. L. Johnson, and J. A. Wilson. In Prep. Genetic relatedness and social organization of the dusky footed woodrat (*Neotoma fuscipes*) in mixed-conifer forests of the northern Sierra Nevada. Journal of Mammalogy. Winter 2007.

Mabry, K.E., and Wilson, J. A. In Prep. Trapping rodents in a cautious world: the effects of disinfectants on trap success. Journal of Wildlife Management.

#### Presentations

Coppeto, S. A., D. A. Kelt, J. A. Wilson, D. H. Van Vuren, and M. L. Johnson. 2004. Habitat selection by small mammals in the northern Sierra Nevada, California. Poster to the American Society of Mammalogists, Annual Meeting, Arcata, CA.

Coppeto, S. A., D. A. Kelt, D. H. Van Vuren, J. A. Wilson, S. Bigelow, and M. L. Johnson. 2005. Spatial scale and habitat use of small mammals in the northern Sierra Nevada, California. Poster to the American Society of Mammalogists, Annual Meeting, Springfield, MO.

Innes, R. J., D. H. Van Vuren, J. A. Wilson, D. A. Kelt, and M. B. Johnson. 2004. Factors affecting the distribution and use of dusky-footed woodrat (*Neotoma fuscipes*) houses. Poster to the American Society of Mammalogists, Annual Meeting, Arcata, CA.

Innes, R. J., D. H. Van Vuren, J. A. Wilson, D. A. Kelt, and M. B. Johnson. 2005. Space use and social organization of dusky-footed woodrats (*Neotoma fuscipes*) in mixed-conifer forests of the northern Sierra Nevada. Poster to the American Society of Mammalogists, Annual Meeting, Springfield, MO.

Innes, R. J., D. H. Van Vuren, D. A. Kelt, M. B. Johnson, J.A. Wilson. 2006. Habitat relations of dusky-footed woodrats (*Neotoma fuscipes*) in mixed-conifer forests of the northern Sierra Nevada. Poster to the American Society of Mammalogists, Annual Meeting, Amherst, MA.

Smith, W. 2006. Ecology of *Glaucomys sabrinus*: habitat, demography, and community relations. Presentation to the American Society of Mammalogists, Annual Meeting, Springfield, MO.

Wilson, J.A., and K.E. Mabry. 2005. Trap disinfection to reduce Hantavirus risk: does it also reduce small mammal trapability? Presentation to the American Society of Mammalogists, Annual Meeting, Springfield, MO.

Wilson, J. A., D. A. Kelt, and D. H. VanVuren. 2005. Effects of maternal body condition on offspring dispersal in golden-mantled ground squirrels (*Spermophilus lateralis*). Presentation to the American Society of Mammalogists, Annual Meeting, Springfield, MO.

Wilson, J. A., D. A. Kelt, and D. H. VanVuren. 2005. Effects of maternal body condition on offspring dispersal in golden-mantled ground squirrels (*Spermophilus lateralis*). Presentation to the IX International Mammalogical Conference, Sapporo, Japan.

Wilson, J. A., D. A. Kelt, and D. H. Van Vuren. 2006. Home range and activity of the northern flying squirrel (*Glaucomys sabrinus*) in the northern Sierra Nevada. Poster to the American Society of Mammalogists, Annual Meeting, Amherst, MA.

## **Terrestrial Bird Module**

### **Manuscripts in Preparation**

Howell, C.A., R.D. Burnett, et al. Local versus landscape effects on breeding birds in the northern Sierra Nevada with implications for future treatment. Landscape Ecology or Forest Ecology and Management.

Burnett, R.D., C.A.Howell, and N.Nur. Avian community composition in the context of Spotted Owl conservation in the Sierra Nevada, California. Wildlife Society Bulletin.

Humple, D.L, and R.D. Burnett. Nest site characteristics and habitat use of Yellow Warblers in Montane Shrub fields in the Northern Sierra Nevada, California. Western Birds.

Burnett, R.D., M. Herzog, and D. Humple. Reproductive ecology of shrub dependent breeding birds in re-generating clear cut brush fields in the Sierra Nevada, California. Forest Ecology and Management or Condor.

Burnett, R.D. Integrating Avian Monitoring into Forest Management: Pine-Hardwood and Aspen Enhancement on the Lassen National Forest. Partners in Flight publication.

Burnett, R.D., C.Howell, and N.Nur. Short-term response of coniferous forest songbirds to DFPZ treatments in the northern Sierra Nevada.

## Other Outreach Activities

Burnett, R.D. and Kim Maute. Presentation and Banding Demonstration. U.C. Forestry Institute for Teachers (FIT). July 2005. Meadow Valley, California.

Burnett, R.D. and Kim Maute. Banding Demonstration. PSW Staff. June 2005.

Burnett, R.D. and Kim Maute. Banding Demonstration Outreach Day to Plumas Audubon

## Owl Module

Keane, J.J., J.A. Blakesley, C.V. Gallagher, D.L. Hanson, P.A. Shaklee, and D.W.H. Shaw. Status and Distribution of the Barred Owl in the Sierra Nevada. To be submitted to the Condor.

Keane, J.J., J.A. Blakesley, C.V. Gallagher, D.L. Hanson, P.A. Shaklee, and D.W.H. Shaw. Nest-site habitat characteristics of California spotted owls in the northern Sierra Nevada. To be submitted to Journal of Wildlife Management.

Keane, J.J., J.A. Blakesley, C.V. Gallagher, D.L. Hanson, P.A. Shaklee, and D.W.H. Shaw. Landscape nesting habitat characteristics of California spotted owls in the northern Sierra Nevada. To be submitted to the Journal of Wildlife Management.

Keane, J.J., J.A. Blakesley, J.R. Dunk, and S.A. Parks. Predictive habitat suitability models of California spotted owls for assessing effects of forest management and fuels treatments. To be submitted to Ecological Applications or Forest Ecology and Management.

Keane, J.J., J.A. Blakesley, C.V. Gallagher, D.L. Hanson, P.A. Shaklee, and D.W.H. Shaw. Diets of California spotted owls in the northern Sierra Nevada. To be submitted to Forest Ecology and Management.

Dunk, J.R., J.J. Keane, and S.A. Parks. Predictive habitat suitability models of northern goshawks for assessing effects of forest management and fuels treatments in the northern Sierra Nevada. To be submitted to Ecological Applications or Forest Ecology.

J.J. Keane, J.R. Dunk, and S.A. Parks. Landscape habitat patterns and predictive habitat suitability models for northern goshawks in the Lake Tahoe Basin, Sierra Nevada. To be submitted to Journal of Wildlife Management or Forest Ecology and Management.

J.J. Keane, J.R. Dunk, and T. Gaman. Nest-site characteristics of northern goshawks in the southern Sierra Nevada. To be submitted to Condor.

J.J. Keane, B.Woodbridge, and S.A. Parks. Conservation status and distribution of the northern goshawk in California. To be submitted to the Journal of Biogeography or Biological Conservation.

J.J. Keane and J.R. Dunk. Predictive habitat modeling of California spotted owl and northern goshawk habitat in the Sierra Nevada. To be submitted to Ecological Applications.

B. Woodbridge, J.J. Keane, J.R. Dunk, and J. Hawley. Habitat conservation assessment for northern goshawks in California. To be published as a GTR.

J.J. Keane. Effectiveness of artificial great horned owls for capturing northern goshawks. To be submitted to the Journal of Raptor Research or Journal of Field Ornithology.

J.J. Keane and B. Woodbridge. Effectiveness of broadcast surveys for detecting northern goshawks. To be submitted to the Wildlife Society Bulletin.

J.J. Keane, E.B. Jepsen, L.A. Tierney and C.V. Gallagher. Effectiveness of survey techniques for detecting great gray owls. To be submitted to the Journal of Wildlife Management.

## **Summary**

This work represents some significant scientific study that has occurred over the last five years and is expected to continue for up to another four years within the HFQLG Pilot Project area. At the conclusion of the pilot project the HFQLG Act requires the Forest Service to commission a team of scientists to evaluate the pilot project and provide the Forest Service with guidance on the efficacy of the work and what were the environmental consequences on the natural resources of the geographic region. The results of these studies will contribute valuable, objective scientific insights that managers can use to develop subsequent management direction for the Plumas and Lassen National Forests, as well as other National Forest lands in the northern Sierra Nevada such as the portions of the Tahoe National Forest that contain similar ecological conditions.

We cannot ignore or deny the fact that designing a credible and useful research program in this area has been challenging. We want to be clear to all interested parties that the Pacific Southwest Research Station was asked to become involved in this project and for the purposes stated in the introduction above and we responded with the intent to provide as much new scientific learning as would be possible. PSW knew that we would be entering into efforts that would have many more challenges than research projects typically encounter. Our goal was to contribute as much as we could to the better understanding of forest ecosystem response to fuels and other forest management practices as they are manifested at a landscape scale.

We understand there is some uncertainty and sometimes controversy over how various forest elements will respond to planned forest management practices. This is likely to be

the case under any chosen management regime. The objective of PSW was to tackle the difficult scientific challenges derived from the salient management questions. PSW, as a research organization, remains wholly objective in executing this charge. We have assembled an excellent team of scientists with the appropriate areas of expertise and we have done the best we can to design our work to address the important questions. Many of these questions present significant challenges to experimental design of field ecology experiments and management constraints further constrain our ability to test questions with traditional hypothesis testing approaches. We expect to make the most of these opportunities in advancing our scientific understanding of forest ecosystem response to management practices.