

July 25, 2007 HW

## **Research Work Unit 4251: Maintaining Faunal Diversity in Forest Ecosystems of the Coastal and Intermountain West.**

### **Problem 1: Methods are needed for Sustaining Biodiversity on Fragmented Forest Landscapes of the West.**

We need a better understanding of species responses to fragmented forest landscapes in order to prevent listings and extinctions and promote viability. Threats to biodiversity in fragmented landscapes requires a sophisticated level of understanding of spatial and temporal processes that allow the development of management strategies that are consistent with ecological processes and their interactions in order to achieve sustainable land use objectives. Patterns--the spatial arrangement of landscape components--are a consequence of these processes. As an example, wildland fire acts in concert with other processes to shape spatial patterns of vegetation structure. Conversely, the expression of fire on a landscape is constrained by vegetation patterns and topography. An understanding of the interactions of patterns and processes at multiple scales is essential to developing tools for assessing risk and developing options to sustain biodiversity on forest landscapes.

Forest management involves managing large landscapes and all their interdependent parts. The contemporary approach to forest management is characterized by the use of administrative boundaries that constrains human activities. A forest plan, for example, subdivides the land base into regions of preferential or allowable use (e.g., timber production, recreation, grazing). While the boundaries set by the forest plan may have some congruence with natural ecological boundaries (e.g., a lake shoreline or watershed boundary), they can just as easily follow paths of administrative convenience (e.g., roads, state boundaries, section lines). Such boundaries may be entirely appropriate for certain issues, particularly when human activity is the primary target of management, but not others.

Research is needed on large-scale patterns of animal use, habitat quality, vegetation and physiognomic characteristics, disturbance patterns and ecosystem responses, especially as they are affected by forest management and ecosystem restoration activities. Landscape metrics must be evaluated to understand how to restore the integrity of ecosystems, and this can come only from a thorough understanding of the structural and functional linkages among the biotic and abiotic components of an ecosystem. Results of the research will contribute to the general body of knowledge about forest ecosystems, and they will help to guide managers in setting standards for ecosystem management in forests of California, the Pacific Northwest and elsewhere. Society requires innovative approaches for understanding and characterizing the factors that determine the composition, structure, and functioning of forest ecosystems. **We must develop an approach for assessing and planning for risk to biodiversity through understanding of landscape patterns and processes.**

**Element 1A. Assessing risks to biodiversity within a landscape context.**

**Element 1.B. Developing a multiple species monitoring approach for heterogeneous landscapes.**

**Element 1.C. Understanding the effects of transportation corridors and transportation planning on wildlife and developing methods to minimize negative effects.**

**Problem Area 2: Developing Quantitative Methods for Biodiversity Assessment at the Population Level.**

The statutory requirements under the National Forest Management Act, Endangered Species Act, and other regulations focus on protecting native and desired nonnative species. Fulfilling the goal of ecosystem management also requires assessments of status and changes in the diversity of plants and animals. Determining how species' abundances and distributions change through time in response to management actions is one of the most common challenges posed to researchers and managers. Managers have limited time and budgets with which to collect the data necessary to make decisions, and ecological studies are fraught with uncertainty, which may be attributed to the system (variation among individuals, environmental variation), or the methodology (sampling error, detection probability). Both of these factors diminish our abilities to forecast the results of management actions on wildlife populations.

Statistical techniques, experimental designs, and mathematical models, collectively called *quantitative methods*, help managers to make the best decisions possible in the face of uncertainty, given limited resources. For instance, developing standard methods for detecting the occurrence of species of concern, and using these methods in strategic designs to index changes in populations, helps researchers to collect meaningful data in the most efficient and cost-effective manner. An important challenge is the need to develop tools that are effective yet inexpensive enough to apply and amenable to change when new information suggests change is warranted.

Predictive models identify sources of uncertainty, and integrate them with the data to generate probabilistic statements about various outcomes. These probability statements can aid decision-makers in comparing the costs, benefits, error rates, risk, and uncertainty of alternative approaches to population and habitat conservation. Habitat models are one set of important predictive tools, which are frequently used for evaluating the effects of land management activities on populations of species of concern. Population viability analysis (PVA) encompasses another set of quantitative methods, which assess the probability of population growth or extinction under a given set of conditions, and are used to prioritize management actions or to identify life stages upon which to target research or management.

This problem requires developing cost-effective biodiversity assessment tools that include new detection protocols, monitoring designs, habitat models and PVAs. When complete these products also require the development of supporting software and documentation that will assure that the information is successfully transferred to, and applied by, the user. Our success at

addressing this problem will be measured by the extent to which the research products are used by land managers to improve natural resource management. **Quantitative methods are required to improve our understanding of the distribution, status, and viability of animal populations and to assess and monitor habitat conditions.**

**Element 2.A. Protocols to Detect Individuals and Inventory Populations**

**Element 2.B. Quantitative Methods for Modeling Habitat Suitability.**

**Element 2.C. Quantitative Methods for Population Monitoring and Viability Analysis**

**Problem Area 3: Understanding the Natural History (Autecology) of Species of Conservation Concern.**

Much of our current understanding of the relationship between forest management and wildlife species, both native and invasives, comes from studies directed at individuals. How individuals are distributed, which habitats they frequent, how changes in habitat conditions affect animal behavior or survival—these are all questions that require study of individual natural history. The understanding that comes from such studies forms the critical foundation for interpreting patterns or responses that emerge at higher levels of biotic organization, including that of regional biodiversity. It also provides the linkage between small-scale actions such as retention of snags or removal of migration barriers and their implications for wildlife species. Thus, studies and knowledge at this level always are in demand by land managers. Despite a long history of research, knowledge of the natural history and autecology of many western species is insufficient to permit accurate prediction of the effects of habitat alteration on the growth, reproduction, or survival of individual organisms. **Natural resource management continues to require an understanding of the ecology of species of conservation concern.**

Planned research at the level of individual organisms is divided into three problem areas: (1) habitat preferences of individuals; (2) behavioral responses of individuals to biotic and abiotic cues; (3) physiological responses of individuals to environmental stressors.

**Element 3A. Faunal Habitat Associations**

**Element 3B. Behavioral Responses**

**Element 3C. Physiological Responses**