Vegetation Module

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Objectives

The vegetation module of the Plumas-Lassen Administrative study has three principal objectives. First is to assess how management treatments affect forest structure and species composition at stand and landscape scales in the ponderosa pine, mixed-conifer and red-fir forests of the northern Sierra Nevada/southern Cascades region. Second is to generate vegetation and fuels data for other modules of the administrative study that can be linked to focal species or processes. Third is to investigate the ecology and silvics of mixed-conifer tree species.

The vegetation plot is a basic tool that will be deployed to meet many of the above objectives. Each plot consists of a circle with two concentric rings: the circle has a radius of 12.6 m and an area of 0.05 ha, the inner ring has an outer radius of 17.8 and a 0.1 ha area, and the outer ring has 56.4 m outer diameter and 1 ha area. The most intensive sampling will occur in the center circle, where all live trees ≥ 10 cm diameter at breast height (DBH) will have the following measurements taken: species identification, DBH, height, height to base of the live crown, crown radius, crown shape, and distance to nearest neighboring tree. Dead trees ≥ 10 cm DBH will have DBH, height, and decay class recorded. In the inner ring, the same sets of measurements (for live and dead trees) will be taken on all trees with DBH ≥ 50 cm. In the outer ring, all live trees of DBH ≥ 80 cm will have species and DBH recorded; dead trees of DBH ≥ 80 cm will have DBH, height, and decay class recorded. Two randomly oriented 50 m long transects, used to assess shrub and tree cover and fuel loading, will begin in the middle of the center circle and proceed at right angles to each other. Four circular plots of 2.5 m radius will be used to assess herbaceous cover (by species) and tree regeneration in the seedling and sapling size classes. Surface-soil samples will be taken in each plot and archived.

Vegetation plots will be located across the entire terrain of the Administrative Study, both in areas that are scheduled for management treatment and areas that have no planned treatments. Plot locations in untreated areas are to be selected from among a system of transects already established by workers in the songbird module, with several plots to be established on each transect. An additional series of plots will be installed in trapping grids established by small-mammal researchers. In treated areas, plots will be established and permanently marked prior to installation of shaded fuel-break and area treatments; these plots will be measured again within two years. Plots in areas scheduled for group-selection harvest will only have herb and shrub layers assessed prior to treatment. An additional series of vegetation plots will be established in exemplary late-successional stands to be located from vegetation maps and discussion with National Forest personnel. These stands will serve as reference conditions for managed stands.

The above system of vegetation plots and targeted sampling locations will generate data that are of direct use to researchers in the fire and fuels, owl, small mammal, and calling-bird modules. Vegetation module researchers will also use these plot data to answer two questions. First, how does the mixed-conifer plant community vary across the study site, and what are the physical factors that determine local community composition? Logistic regression will be used to formulate models of occurrence of individual tree species with respect to the continuous variables of soil pH, microclimate, slope, and aspect. Temperature maximums and minimums, and total precipitation will be calculated using PRISM models (http://www.ocs.orst.edu/prism/prism_new.html). Second, does application of fuels treatments make stand structure more similar to old growth? This question will be addressed both by analyzing the short-term change in stand structure from fuels treatments, and the longer-term changes as treated stands develop over time. Multivariate statistical techniques will be used to compress a suite of stand-structure and composition measures such as stem density, basal area of shade-intolerant trees, and shrub cover into an index of old-growth character that can be readily compared among stands.

The assessment of landscape integrity and heterogeneity will be done with a simulation approach. An existing map of the study area that was recently generated by interpretation of aerial photos will be used as a base: it classifies the landscape in patches defined by tree size class and canopy cover. The spatial metrics of connectivity, contagion, mean patch size, and patch diversity will be calculated for each treatment unit. Empirical research on stand structure, described in the previous paragraph, will allow estimation of how patch classification will change after fuels treatments. A new map of the treatment units will be generated incorporating the modeled changes in patch classification due to fuels treatments and spatial metrics will be recalculated. This procedure will provide an indication of how the integrity of forest cover and structure will change across the landscape once fuels treatments are applied.

Local (i.e., stand-level) spatial arrangement of vegetation elements is thought to be a key factor that influences 1) suitability of stands as wildlife habitat and 2) propagation of ecosystem processes such as fire. Researchers from vegetation, owl, and fire modules will collaborate closely to explore this theme. Working in stands that have been identified as foraging zones for the California spotted owl, we will apply nearest-neighbor and tree-height-diversity analyses to ask whether vegetation that combines a clumped distribution with a diverse height structure presents a risk for conveying flame from the forest floor to the canopy. These analyses will be carried out before and after fuels treatments in order to determine how fuels treatments affect horizontal and vertical vegetation structure, and how these changes are correlated with owl persistence in foraging zones after fuels treatments.

As part of their objective to investigate the ecology and silvics of mixed-conifer tree species, vegetation researchers will combine experimental and observational approaches to understand how biotic factors affect stand development. Researchers will take advantage of the large trees (referred to by foresters as leave-trees) that will be retained in group-selection openings: prior to cutting, the distance to, direction, DBH, and species identity of all trees within 25 m of the leave-tree will be measured. Three years after the group-selection harvest, cores will be extracted from the leave-trees with an increment borer and a release index will be developed by comparing growth rate during the three years prior to and after the harvest. Release will be related to the identity, size, and distance of neighboring trees using a series of nested equations based on the concepts of the crowding index and maximum likelihood estimation. The entire procedure will address the question of which species compete most intensely with one another. Data on local co-occurrence of tree species from the landscape vegetation plots, analyzed using the ecological concept of community assembly rules, will provide a complementary perspective on this question.

Vegetation researchers will also investigate the regeneration requirements of the most shade-intolerant of the mixed-conifer trees: ponderosa, jeffrey, and sugar pine. While installing vegetation plots field workers will assess resource availability and growth and survival rates of saplings of these species by taking a fisheye lens photograph of the canopy immediately above each sapling, a soil sample at the base of the saplings, and a measurement of the past season’s extension growth of the leader. Mathematical models relating extension growth to canopy openness and soil texture will be formulated, and details of local stand structure will be derived from the vegetation plots. A similar procedure (with the exception of the growth measurement) will be followed for dead saplings that do not appear to have been killed by fire; probability of survival with respect to canopy openness and soil texture can thus be estimated.

Accomplishments

The groundwork was laid for the 2003 field season. A post-doctoral research ecologist, Seth Bigelow, was hired and began work at the end of August. Dr Bigelow is a specialist in plant-soil relationships with an interest in ecological forestry. He received training in

Botany and Ecology at the University of Florida and has completed a four-year postdoctoral appointment at the Institute of Ecosystem Studies in New York.

In Fall 2002 module personnel made individual trips to the Mt. Hough, Almanor, Beckwourth, and Feather River ranger districts to build relationships with district personnel responsible for planning and implementation of management treatments. Input from management personnel was sought on knowledge gaps, silvicultural practices, and location of old-growth stands. Several trips to the field were made to evaluate methods – one such trip was made with Kurt Menning, the post-doctoral researcher for the Fire and Fuels module. Module members attended four day-long meetings for coordination with other modules, and attended the demonstration / discussion of experimental treatments in early September organized by the Mt. Hough ranger district. Module personnel also attended a three-day symposium on Science and Management in the Sierra Nevada.