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Ecological Research at the Blacks Mountain Experimental Forest in Northeastern California

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Abstract

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At Blacks Mountain Experimental Forest in northeastern California, an interdisciplinary team of scientists developed and implemented a research project to study how forest structural complexity affects the health and vigor of interior ponderosa pine *(Pinus ponderosa* Dougl. ex Laws.) ecosystems, the ecosystem's resilience to natural and human-caused disturbances, and how such ecosystems can be managed for sustained resource values. A randomized, split-plot, factorial design has been developed to test the influences of structural diversity, cattle grazing, and prescribed fire on twelve 250-acre study units. A permanently monumented data reference system on a 100-meter (328-ft) grid will facilitate spatial and temporal analysis as well as integration of information at various scales. Intensive preliminary sampling has established baseline data on small mammal and avian diversity and behavior, forest vegetation structures and floristic diversity, historical fire patterns, bark beetle dynamics, soil properties and processes, and genetic structure of pines and understory species.

Retrieval Terms: ponderosa pine, white fir, stand development, stand structure, succession, prescribed fire, thinning, cattle grazing, small mammals, passerine birds, bark beetles, arthropods.

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In Brief . . .

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This paper discusses an interdisciplinary large-scale, long-term ecological research project initiated in 1991 at the Blacks Mountain Experimental Forest (BMEF) in northeastern California. The research goals of the study were to increase our understanding of the effects of forest structural complexity on the health and vigor of interior ponderosa pine (*Pinus ponderosa* Dougl. ex Laws.) ecosystems, quantify the ecosystem's resilience to natural and human-caused disturbances, and determine how these ecosystems can be managed for sustained resource values.

Two forest structures were created with various combinations of ground disturbances—with and without prescribed fire—on 12 units of about 250 acres each: high structural diversity without grazing, high structural diversity with grazing, low structural diversity without grazing, and low structural diversity with grazing.

Each treatment was replicated three times in a randomized block design with split plots. In each plot, prescribed fire was introduced into one half and kept out of the other half. Although the design does not include untreated controls, four Research Natural Areas (RNAs) well-distributed within the BMEF were also studied to provide quantitative and qualitative information on undisturbed systems.

All data were referenced to a 100-meter grid, surveyed, and permanently monumented in each treatment plot. This grid facilitated spatial and temporal analyses, as well as integration of information at various scales.

The years between the conception of a study this size and its implementation allowed for collection of baseline data. We gathered data on the pre-treatment vegetation and forest floor conditions, small mammals and birds, and tested various methods of re-introducing fire without killing the large old trees we wished to retain in the high structural diversity plots. The results of our study showed that we don't have a definitive answer about the best time of year to conduct the initial burns. The only mortality observed was in early spring and late fall.

We also wanted information on rates of nitrogen fixation and mineralization and their degree of seasonal and spatial variability. For instance, we found that nitrogen processes within and beneath large, downed woody debris are no greater than beneath other types of ground cover. In fact, the areal importance of downed woody debris as a nitrogen source is less in proportion to its areal cover than other cover types.

The pre-treatment inventory illustrated the well-recognized ability of Jeffrey pine *(Pinus jeffreyi)* to tolerate harsher sites compared to ponderosa pine. Thus, Jeffrey pine was found almost exclusively on the floor of the valley where tolerance of late spring frosts favored Jeffrey pine and on the rocky and shallow soils at upper elevations. Baseline genetic diversity was determined for ponderosa pine, antelope bitterbrush, and Idaho fescue. These baseline data are the genetic control level of reference that will be used to evaluate the impact of management options on genetic diversity of these systems over time.

Soil arthropods were sampled on tree-centered transects in units with completed treatments. Preliminary results suggest that low intensity prescribed fire has little effect on species richness, diversity, and evenness of oribatid mites, but moderate intensity prescribed fire has a more profound effect on the measures of community structure.

As an example of the interdisciplinary opportunities offered by the main study, ornithologists are studying bird use of snags that were created by bark beetles or mechanically girdling. Initially at least, they have found that woodpecker use of bark beetle-killed trees is much greater than for mechanically-killed trees.

BMEF has some of the greatest snag densities to be found anywhere in northeastern California. As a result, it has one of the most abundant and diverse assemblages of sapsuckers and woodpeckers in California.

The interdisciplinary study on the Blacks Mountain Experimental Forest is designed to restore late seral stands to conditions perceived as common before differential cutting of pine and fire exclusion in the eastside pine type. We are attempting within a few years to reverse processes that took decades to develop. Regardless of our success in sustaining uneven-aged ponderosa pine stands, our interdisciplinary study should provide insights into how eastside pine ecosystems have been altered by the loss of late seral structures.

The Forest Service, U.S. Department of Agriculture, is responsible for Federal Leadership in forestry. It carries out this role through four main activities:

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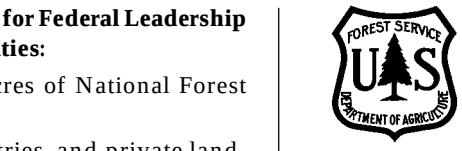
- Participation with other agencies in human resource and community assistance programs to improve living conditions in rural areas; and
- Research on all aspects of forestry, rangeland management, and forest resources utilization.

The Pacific Southwest Research Station

- Represents the research branch of the Forest Service in California, Hawaii, American Samoa, and the western Pacific.



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