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A simulation study of thinning and fuel treatments on a wildland–urban interface in eastern Oregon, USA

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Abstract

We simulated long-term forest management activities on a 16,000-ha wildland–urban interface in the Blue Mountains near La Grande, Oregon. The study area is targeted for thinning and fuels treatments on both private and Federally managed lands to address forest health and sustainability concerns and reduce the risk of severe wildfire. We modeled a number of benchmark management scenarios through time and examined potential wildfire behavior, stand structure, species composition, and other forest characteristics over the study area. The simulation models indicated that substantial area would require repeated thinning over time to meet desired forest density guidelines for the landscape as a whole. Fire models predicted significant reductions in crown fire activity for a specific weather scenario as a result of thinning and treatment of surface fuels. Substantial changes in stand structure and other characteristics were noted for the thinning versus no-treatment scenarios. The study provided a template of modeling methods and information for forest planners concerned with forest and fuel management issues in the Western United States.
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Keywords: Landscape simulation; Fuels treatment; Stand density index; FVS; Wildfire

1. Introduction

Forest thinning and fuel reduction treatments have become a high priority for forest managers throughout the Western United States to address a wide range of forest health and sustainability issues. However, few studies have closely examined the long-term effectiveness of management strategies in terms of mitigating the impacts from natural disturbances, and achieving desired future forest condition. Although case studies show that stand-scale treatments can create desired stand structures that are more resilient to wildfire and insects (Kalabodkidis and Omi, 1998; Negron and Popp, 2004; Pollet and Omi, 2002; Stephens, 1998), the effectiveness and feasibility of these treatments at larger scales is dependent on many factors including climate, vegetation dynamics, treatment rate and type, spatial arrangement, operational and resource constraints, financial considerations, and key resource values (Finney and Cohen, 2002; Schoennagel et al., 2004). Interactions among disturbances, such as fire and bark beetles (*Dendroctonus* spp.), must also be considered (Mitchell and Martin, 1980). The problem of long-term forest planning in disturbance-prone forests is a complex spatiotemporal problem that warrants attention.

We simulated forest management scenarios on a wildland–urban interface (WUI) near La Grande, OR, USA. The La Grande Ranger District identified the Mount Emily area as high risk because of the intermingling of homes with forest vegetation and the potential for extreme fires. The design of an extensive fuel treatment project was initiated by the La Grande Ranger District. Like many areas in the Blue Mountains, the forests have high surface and ladder fuel loadings resulting from decades of fire exclusion and multiple insect epidemics (Quigley et al., 2001). We simulated five management alternatives and examined them for the following: (1) What treatment rate is required over time to achieve and maintain national forest density guidelines? (2) How well do widely used density management prescriptions address fire behavior issues at the stand scale? (3) What are the net effects

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of long-term treatments on fire behavior, forest structure, and species composition?

2. Materials and methods

2.1. Study area

The Mount Emily wildland urban interface is an area 30 km long immediately north of La Grande, Oregon, where the forested slopes of Mount Emily and adjacent ridges descend to the agricultural lands in the Grande Ronde Valley (Fig. 1). For analysis purposes, a boundary was established around the area following major drainages, natural breaks in vegetation, and land ownership boundaries, and the area within contained 16,343 ha of federal, state, and privately owned lands (Fig. 1). About 12,259 ha of the study area is forested based on the definitions used in the Wallowa-Whitman and Umatilla Forest Plans. Approximately 9432 ha is managed by the USDA Forest Service. The forest composition ranges from dry forests of ponderosa pine (*Pinus ponderosa*), cold forests dominated by subalpine-fir (*Abies lasiocarpa*) and Engelmann spruce (*Picea engelmannii*), and a transition zone containing grand fir (*Abies grandis*), Douglas-fir (*Pseudotsuga menziesii*), and western larch (*Larix occidentalis*). Forest Service lands are managed for a number of resources including summer and winter range for Rocky Mountain elk (*Cervus elaphus*), habitat for Lynx (*Lynx canadensis*), old growth, recreation, and scenery. Surface fuel loadings exceed 140 metric tonnes/ha in some areas, with high loading of dead ladder fuels in a large number of the stands. Fuel accumulations accelerated after the 1980–1986 western spruce budworm (*Choristoneura occidentalis*) epidemic that caused extensive mortality within the stands in the project area.

2.2. Vegetation and fuel data

Stand delineations were obtained from existing vegetation GIS layers on file at the La Grande Ranger District. Stands outside the Forest Service boundary were digitized by using digital orthophotos from 2000. We built a database consisting of stand density by species and 2.5 cm diameter class for each stand by using data obtained from stand exams and photo-interpretation of 1:12000 aerial color photos taken in 1998.

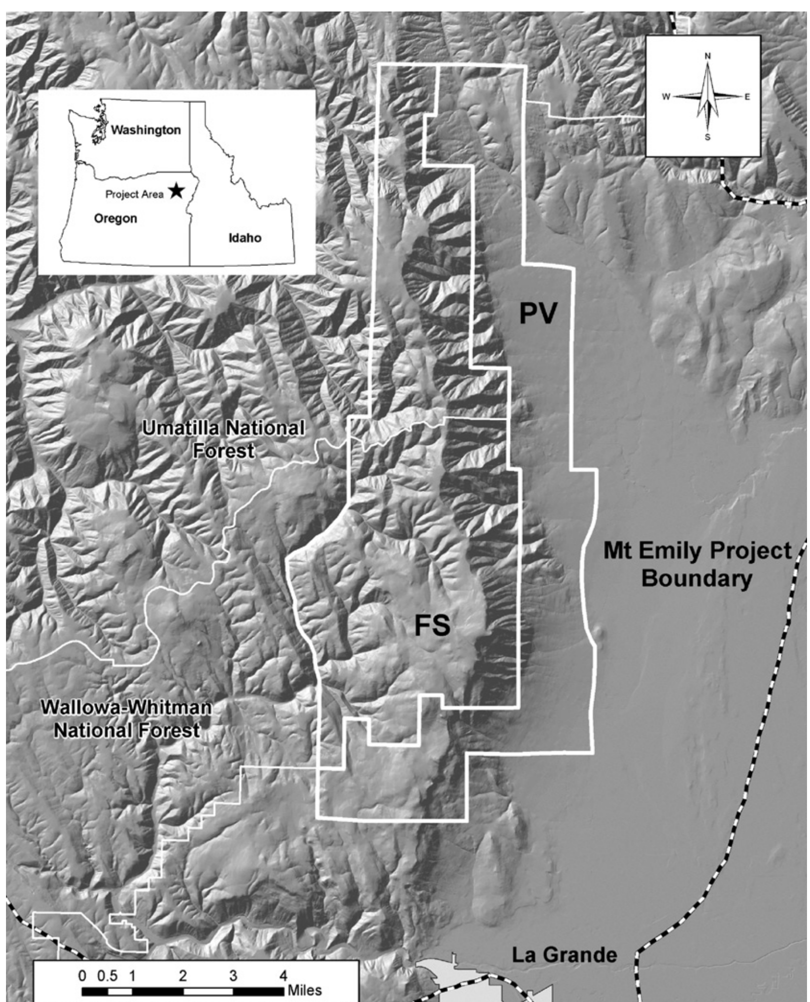

Fig. 1. Vicinity map of the Mount Emily area showing study area and land ownership boundaries. Bold white line indicates study area boundary. FS denotes lands managed by the Forest Service. PV denotes privately owned land. Several small tracts owned by the State of Oregon within the study area are not shown.

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