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Forest Ecology and Management 211 (2005) 166–190
Forest Ecology and Management
www.elsevier.com/locate/foreco

A process for modeling short- and long-term risk in the southern Oregon Cascades

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Abstract

Evaluating tradeoffs between the short- and long-term risks of different management scenarios in fire prone ecosystems is crucial to implementation of the National Fire Plan and the Healthy Forest Restoration Act (H.R. 1904). We demonstrate a process for conducting these relative risk assessments using models and data generally available via the public domain. Our risk assessment process integrates information about the ecological characteristics of the landscape, vegetation dynamics as related to different management scenarios, and fire modeling, to generate inputs for effects analyses on water temperature, peak flows, landslides, and northern spotted owls (*Strix occidentalis caurina*). The process is demonstrated for current management with owl foraging emphasis and no management scenarios in a 325,000 ha landscape in southwestern Oregon. The current management with owl foraging emphasis scenario represents a reasonable portrayal of current land management policies and allocations with an emphasis on providing spotted owl foraging habitat across the landscape. The no management scenario portrays only vegetation dynamics as projected by a growth and yield model. Results from both management scenarios were subjected to fire and effects modeling. Simulation results indicated that risk metrics used in this demonstration were sensitive to the manner in which we described and attributed the landscape and our model formulations and thus, were useful measures for relative risk assessments. Model simulations demonstrated that the potential for uncharacteristic fire increased five-fold within the first 20 years under both management scenarios. The area burned by crown fire and uncharacteristic fire also increased over time for both management scenarios. Both management scenarios resulted in a decline of spotted owl habitat, with the current management with owl foraging emphasis scenario creating more unfavorable conditions. We attribute the relatively high long-term risk of the current management with owl foraging emphasis scenario to a combination of the large-scale passive management approach instituted on a substantial portion of the landscape (approximately 55% of the assessment area), the presence of plantation-based forestry (approximately 22% of the area), and by default, the limited opportunity to implement hazardous fuels reduction at a scale large enough to influence landscape-level fuel patterns. These preliminary results suggest that a spatially explicit, more aggressive hazardous fuels reduction management scenario, that may conflict with current land management

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0378-1127/$ – see front matter
doi:10.1016/j.foreco.2005.02.006

policies and allocations, is needed to reduce the continuity of hazardous fuels and sustain healthy forest conditions and spotted owl habitat.

Keywords: Fire effects; Fire modeling; Fuel treatment; Hazardous fuels reduction; Historical fire regime; Hydrologic modeling; Ignition probability; Landscape analysis; Landslides; FARSITE; FlamMap; Forest planning; Plant associations; Relative risk assessment; Restoration; Risk; Simulation; Spotted owls; Uncharacteristic fire

1. Introduction

Uncharacteristic fires in fire prone ecosystems of the United States have increased in frequency, spatial extent, and severity over the last two decades (U.S. General Accounting Office, 1999). Here, uncharacteristic refers to fires of such high intensity and severity that important ecosystem components or processes are altered or destroyed over significant portions of the burned area (Sampson and Sampson, 2005). These uncharacteristic fires are often linked to unprecedented levels of fuels in some forest types (U.S. General Accounting Office, 1999; Franklin and Agee, 2003; Graham et al., 2004). As a result, numerous ecological, economic, and social values are at risk (Graham et al., 2004).

One of the most pressing issues facing today's federal land managers is how to balance the short-term risks of actively managing uncharacteristic fuel loads with the long-term risks of inaction. Current management direction as specifically outlined in Section 106 of the Healthy Forest Restoration Act of 2003 (H.R. 1904), requires courts in the United States to ''balance the impact to the ecosystem of the short-term and long-term effects of undertaking the agency action against the short- and long-term effects of not undertaking the agency action'' when considering any request for an injunction applying to a proposed hazardous fuels reduction project. Accordingly, Williams and Hogarth (2002) directed the U.S. Fish and Wildlife Service (USFWS) and National Oceanic and Atmospheric Administration-Fisheries (NOAA-F), respectively, to ''evaluate and balance the long term benefits of fuels treatment projects, including the benefits of restoring natural fire regimes and native vegetation, as well as the long-term risks of catastrophic wildfire, against any short or long term adverse effects'' when conducting Endangered Species Act (ESA) Section 7 consultations for hazardous fuels reduction projects.

In wildfire terminology, risk is an integral portion of hazard (Bachmann and Allgöwer, 2000). Here, hazard is defined as ''a state or condition'' (consistent with Schmidt et al., 2002). Risk can be described as ''the probability of an undesired event and the outcome of it. An undesired event is a realization of a hazard'' (Bachmann and Allgöwer, 2000). According to these definitions, the level of wildfire hazard relates to uncharacteristic fuel amounts, types, and arrangements (Sampson and Sampson, 2005); particularly the continuity of the fuels across landscapes (U.S. General Accounting Office, 1999). Risk is the probability that an event (e.g., wildfire, habitat loss) will occur based on these hazard conditions.

Mealey and Thomas (2002) and Irwin and Thomas (2002), among others, discussed the rationale and need for ''relative risk assessments'' on hazardous fuels reduction projects. With current legislation endorsing active management to reduce uncharacteristic fuel loads (i.e., the Healthy Forest Restoration Act of 2003) and judicial review requiring consideration of both short- and long-term risks, a process for conducting timely risk assessments was needed (Irwin and Thomas, 2002). The need for these tools was exemplified in a 2001 letter from J.A. Blackwell, then Regional Forester for the Intermountain Region of the Forest Service, to the Chief of the Forest Service. Blackwell noted that projects anticipated by the U.S. Forest Service as having long-term benefits to ecosystems and species were often rejected by the USFWS and NOAA-F because of the overriding concerns of these agencies over short-term adverse effects. The regulatory agencies' short-term, risk-averse approach, with little attention to the long-term consequences of inaction, made it difficult to implement hazardous fuels reduction treatments.

This dilemma also plagues private landowners. Most private landowners use an ESA take avoidance, short-term risk-averse approach to protected species management, sometimes at the expense of longer-term