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Evaluating forest product potential as part of planning ecological restoration treatments on forested landscapes

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Abstract

As landscape scale assessments and modeling become a more common method for evaluating alternatives in integrated resource management, new techniques are needed to display and evaluate outcomes for large numbers of stands over long periods. In this proof of concept, we evaluate the potential to provide financial support for silvicultural treatments by selling timber harvested during treatments designed to achieve non-timber objectives such as fire hazard reduction or wildlife habitat improvement. We introduce the concept of dimensionless indices to describe and compare physical accessibility, harvest and hauling costs, and potential revenue from wood products. These indices are combined into a composite utilization index that portrays the relative potential of each polygon for wood utilization and associated cost offsets from integrated resource management activities. To illustrate these concepts, we simulate vegetation dynamics, management interventions, and natural disturbances over a 100-year period and summarize results into both tabular outputs and maps for a 178,000 ha landscape with more than 50,000 stands.

Keywords: Forest products; Ecological restoration; Wood supply; Cost; Revenue; GIS; Landscape analysis; Landscape modeling; Ecosystem management

1. Introduction

A growing consensus suggests that active management to change vegetative condition is warranted to reduce fire hazard in many forested ecosystems in the western United States. This conclusion is reached in the scientific literature (Brown, 2000), by policy makers (Feinstein, 2002), technical organizations (Oregon Forest Resources Institute, 2002) and in the popular press (Bales, 2002; Cameron, 2002; Fitzgerald, 2002). In addition to concerns about fire hazard, managing habitat for wildlife species that require or prefer certain forest structural conditions has been another common driver for manipulating vegetation in this region's public forests; however, the details of treatments and schedule of activities appropriate for achieving a common objective are more contentious (Hill, 2000; Thomasson, 2002; Coile, 2003; Taylor, 2003).

When a proposed management action requires changes in forest vegetative structure, public land managers really only have three tools to choose from: prescribed burning (activities from broadcast burning to piling and burning ground fuels), mastication (mowing or grinding of unwanted vegetation on site), and felling of trees. Depending on the circumstances, trees felled to achieve a desired vegetation structure might either be removed or left on site. From a financial point of view, prescribed burning and mastication are always implemented at a net cost because no merchantable products are generated to offset costs. Felling trees can result in either positive or negative net revenue (the difference between the cost of the treatment and the value of the wood removed) depending on a variety of factors including the size and species of the trees removed, the location of the stand, the complexity of the treatment, and prevailing economic conditions.

The fact that felling and removal of trees can sometimes pay for itself (positive net revenue) or at least offset some of the treatment costs is appealing to some people, but creates suspicion about actual motives for others (Brown, 2000; Hill, 2000). Not surprisingly, proposals to harvest and use timber from public lands in the western United States are frequently controversial and can result in heated public debate (Back, 2001;

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Milstein, 2004). The intensity of these discussions and likely public scrutiny of proposed management plans can cause technical specialists who design management alternatives and decision makers who select from among these alternatives to act differently than they might in the absence of such contentious public discussions. Public land managers cannot escape the fact that proposals to remove wood will almost certainly attract criticism from opposite perspectives, either because "not enough" wood is being removed to meet society's demands or because "too much" wood is being removed to maintain environmental quality. These two criticisms are routinely leveled at the same management action (Milstein, 2004).

Our objective is to provide objective tools that are useful in sorting out technical questions about when and where tree felling and timber removals can actually help to achieve other non-timber goals on a target landscape, when and where they might make conditions worse, and the financial costs or revenues from those treatments. We deal specifically with analysis of financial returns from treatments intended to meet the objectives of the Healthy Forests Restoration Act of 2003. At least in theory, access to better analytical capability could allow managers to design options that include objective consideration of the benefits of timber harvest. Understanding the costs and revenues of timber harvests is an important first step in conducting an unbiased analysis because it helps clarify the potential motivation for treatments involving removal of timber.

The techniques we describe here are intended to help managers to objectively assess financial costs and revenues of different management activities in the context of large landscapes and long planning horizons (in this case more than 50,000 stands and up to 100 years, respectively). When this information is combined with other analytical procedures developed under the Interior Northwest Landscape Analysis System (INLAS), it is possible for managers to evaluate the potential of timber harvest and other silvicultural treatments to reduce fire hazard (Hemstrom et al., 2007), enhance wildlife habitat (Wales et al., this volume; Graetz et al., 2007; Ager et al., this volume), change the susceptibility of trees to insect attack (Ager et al., this volume), or influence grazing by cattle, deer, and elk (Vavra et al., this volume).

The INLAS utilization module (Barbour et al., 2004b) was developed to encourage managers to think about timber harvest in an integrated sense as they design strategies to meet ecosystem management objectives. It describes the potential revenues and costs associated with silvicultural treatments that involve harvesting, as well as a conceptual framework for calculating and displaying the "utilization potential" of landscape polygons (roughly equal to stands) and larger landscape units, such as watersheds or subbasins. We display utilization potential as a composite index (utilization index) derived by combining two other indices: accessibility index (physical access to the site) and net revenue index (estimated gross value minus logging costs). We describe and demonstrate the techniques needed to calculate and display these primary indices and to combine them to derive utilization indices for the upper Grande Ronde River Basin in northeastern Oregon, USA, the pilot landscape for the INLAS project (Barbour et al., 2004a). Our intent is to describe a set of techniques that managers could use to conduct analyses and provide information about cost effectiveness and economic consequences of a variety of management scenarios.

2. Methods

The simulation process requires three types of input data – spatial, tree list, and economic – that feed into the utilization module (Fig. 1). These data are used to calculate the accessibility and net revenue indices, which are combined into an integrated utilization index (Fig. 1).

2.1. Spatial data

The spatial data component for the module begins with a photo-interpretation map used to assign density, cover, and species composition to each polygon in the target landscape

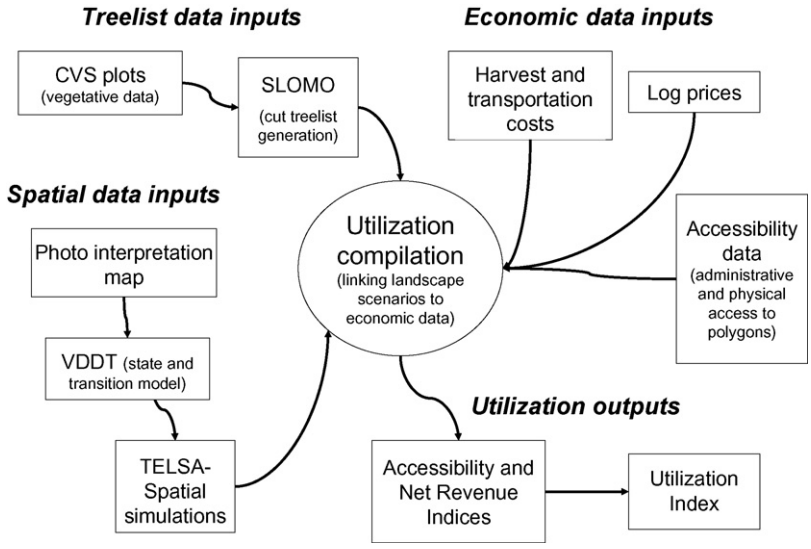

Fig. 1. INLAS utilization module analysis flowchart.