

Synergy Between Ecological Needs and Economic Aspects of Ecosystem Restoration

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Abstract—The implementation of properly designed treatments to restore and sustain desired forest conditions in the Inland Northwest, besides moving forest stands more rapidly to an ecologically desirable and sustainable condition, can generate positive revenues from the timber to be removed. These treatments also have potential to increase the number of relatively high paying jobs, especially in rural areas where per capita incomes are nearly 30 percent below those of urban areas. In contrast the much-proposed thin-from-below prescription commonly does not fully accomplish ecological goals and often requires a subsidy of several hundred dollars per acre to implement.

Fire exclusion and selective harvest of the financially valuable seral species have resulted in ecologically unsustainable conditions on millions of acres of forestlands in the western United States. Treatments aimed at restoring these stands to more sustainable conditions have generally been viewed as requiring substantial subsidies; however, our work indicates that projects designed to restore and sustain desired forest conditions in the Inland Northwest often produce timber products with substantial positive value to underwrite treatment costs. Capitalizing on this potential value requires that prescriptions be designed to fully address ecological problems and that they be focused on areas most in need of treatment.

We illustrate this by examining a common stand condition in the ponderosa pine (*Pinus ponderosa*) forest type, which in one form or another covers tens of millions of acres in the Interior West. Our analysis was conducted on stand inventory data from the Bitterroot National Forest in western Montana, as part of the Bitterroot Ecosystem Management Research Project (BEMRP).

The example we use in this paper is a moderately high-density (120 ft² basal area/acre) ponderosa pine/fir stand condition, with a dense understory primarily comprised of Douglas-fir (*Pseudotsuga menziesii*). Ecological problems are manifested by high fire hazard, with pockets of mortality

due to the mountain pine beetle (*Dendroctonus ponderosae*), and successional transition from early seral to late seral species composition.

We examine two prescriptions for restoring sustainable, ponderosa pine-dominated conditions. The first prescription is a comprehensive treatment approach aimed at addressing ecological problems, high stand density, excessive numbers of sapling- and pole-sized trees, and species composition skewed toward Douglas-fir.

The second prescription involves the often-recommended thin-from-below approach, designed primarily to reduce fire hazard by removing the sapling/pole understory layer. These understory trees can serve as “ladder” fuels, allowing surface fires to torch into the overstory.

Methods

We analyzed U.S. Forest Service records from hundreds of stands that were historically dominated by ponderosa pine and evaluated the potential of timber products to underwrite the costs of restoration treatments. Stands that were selected to be included in the evaluation had to meet the following criteria:

1. Basal area density ≥ 100 ft²/ac.
2. Significant ladder fuel component.

We then developed a comprehensive restoration treatment prescription for the average (composite) stand condition in the mature pine/fir type that met the previously defined criteria. This “consensus” prescription was developed in consultation with silviculturists and ecologists from various agencies.

The comprehensive prescription includes the following silvicultural treatments:

1. Low thinning in which nearly all of the trees <9 inches in diameter are cut.
2. Modified selection cutting to reduce density and promote regeneration of ponderosa pine.
3. Improvement cutting to remove most Douglas-fir/true firs (*Abies* spp.) as well as low-quality trees of all species not reserved for other purposes.

The target stand density following these treatments is 50 ft²/acre.

The thin-from-below prescription evaluated for the mature pine/fir condition is aimed at cutting most (or nearly all) of the trees ≤ 9 inches in diameter. Trees <5 inches are cut and slashed, while trees from 5 to 9 inches in diameter are removed and available for products.

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Using diameter and species, we identified the potential timber products available from the trees we wanted to eliminate in the treatments. We then compared their potential value as timber products delivered to mills, less harvest and haul costs.

We developed harvest costs using an expert system approach. We presented a detailed description of stand conditions, along with descriptions of the two treatment prescriptions, to logging companies and asked them to bid on the harvest operations. The cost of logging was estimated for typical systems used on flat to moderate terrain (slopes under 35 percent) and for steeper ground requiring cable systems.

Results

The comprehensive restoration treatment is clearly superior in terms of ecological effects, the financial aspects of carrying out the treatment, and its potential to positively impact employment and wages in rural communities in the Inland Northwest. The comprehensive treatment prescription is designed to induce pine regeneration, develop and sustain old growth pine, reduce composition of late-successional species, and manipulate structure to reduce fire hazard. Thinning-from-below, a widely proposed restoration treatment for pine forests, does not address the full range of problems that threaten their sustainability. Rather, it only provides short- to mid-term reduction of fire hazard and a modest increase in vigor of leave trees.

Besides moving the stand more rapidly to an ecologically desirable and sustainable condition, the comprehensive restoration approach generates positive revenues from timber products ranging from \$300 to over \$1000/acre, depending on stand conditions, local industry infrastructure, and market conditions. Our analysis indicates that the thinning-from-below prescription not only does not fully accomplish key ecological goals, but also commonly requires a subsidy of hundreds of dollars per acre.

Broad scale application of comprehensive restoration treatments should sustain and even boost forest industry and agency employment. Both of these sectors are among the highest paying components of the economy in much of the rural West. Harvesting timber with commercial value, in addition to underwriting treatment costs, supports employment in processing of the removed material. The proposed treatments themselves are labor intensive—even those using only prescribed burning require fire specialists and large fire control crews. Treatments that employ silvicultural cutting to reduce hazard are also more labor-intensive than traditional harvesting because they are designed to produce a desired forest condition—not just remove timber at a low cost.

Discussion and Conclusion

We have looked at a number of forest types and potential prescriptions and found the timber products produced in ecosystem restoration treatments often have a substantial positive value that can be used to underwrite treatment

costs. Further, we have found that there is often a synergy between economic opportunity and ecosystem restoration. That is, implementing comprehensive restoration treatments in the stands most in need of treatment often results in increased timber product values and less need to subsidize the restoration activities.

The implementation of treatments designed to restore and sustain desired forest conditions has large potential to increase employment, especially in rural areas where per capita incomes are nearly 30 percent below those of urban areas. This is particularly true in Montana, which ranks 50th in average wages per worker.

This paper is based on the publications listed in the References section, which were produced at least in part through funding provided under the Bitterroot Ecosystem Management Research Project.

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