# TECHNOLOGY TRANSFER OPPORTUNITIES FOR SMALL DIAMETER TIMBER PROBLEMS

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The small diameter problem has been legendary for decades driven first by the transition from harvesting old growth to managing second growth. Treatment of overly-dense, fire-prone stands has added complexity and urgency to the removal of substantial quantities of even smaller material. Every reduction in cost and improvement in processing or marketing contributes, on the margin, to the successful removal of an increment of small timber. But compared to the size of the problem, namely millions of acres of overly dense stands ripe for catastrophic fires, substantial new breakthroughs are needed. Even with new technologies to handle the wood, technology transfer remains a problem in achieving sufficient implementation. The Rural Technology Initiative (RTI), a pilot regional network and service system to increase technology transfer is a response to the growing rural forest community issues. It provides a setting for technology transfer needs. RTI's efforts to contribute to the small diameter removal problem will focus heavily on training, not just on field crews but on policy participants. The biggest opportunity seems to be to understand and account for what are generally called nonmarket benefits, values that should be represented in the market but are not.

## THE TECHNOLOGY TRANSFER OPPORTUNITY

The Rural Technology Initiative, funded by Congress and established at the University of Washington and Washington State University, is developing a pilot regional network and service system for increasing technology transfer to rural forestry communities.

An important objective is to help rural communities adapt to changing regulations and social pressures affecting forest management, habitat protection, and production. The thrust of the activity is to develop and implement new tools that apply the latest findings from basic research to the problems being faced by rural timber communities. This generally requires three phases:

(1) translating basic research findings into forest management, habitat protection, harvesting, and processing support tools,
(2) training on these new tools and techniques, and
(3) providing technology information links including technical assistance to better service existing outreach channels at the regional level.

Every program needs accountability, including technology, suggesting an additional need for monitoring the success of applications to enhance the scientific and management credibility and acceptability of new methods, while also assessing whether the rural community is being better served.

The technology transfer process has been first to enlist the support of the research community for the development of tools to put new science into practice. The Landscape Management System developed under Professor Oliver at the University of Washington (McCarter et al. 1998) represents our boldest step. The Landscape Management System is a computer system that enables even small owners to simulate future forest and habitat conditions across their lands and to evaluate the economic and environmental impacts of these alternatives. Other tools include road layout algorithms and culvert placement software along with the full array of GIS and GPS assisted tasks such as mapping buffer zones.

The second step of training users has resulted in the development of short courses for each tool and application. Courses on the Landscape Management System, GIS & GPS applications, and even web training have been organized across the state. While surveys show forest owners are not enamored with technology, they are intensely interested in anything that can help them deal more effectively with regulations. Forestry and forest engineering consultants see the new technology as an opportunity to enhance their capacity. The secret to providing better technical assistance has been to take the best and brightest graduates that have been trained on new technical tools and get them in the field working with rural constituents. To make sure the system is targeting real needs, the task list was developed, prioritized, and periodically reviewed by a rural advisory group. The group provides the accountability on whether the right problems are being worked and whether they are a success.

## RESPONDING TO RURAL PRIORITIES

The initial priorities of RTI's Rural Advisors included case studies on the impacts of the new Forest and Fish Rules in Washington state. Case studies using the Landscape Management System were to include dry-site management regimes to reduce fuel loads. Recognizing that nonindustrial owners are a very diverse group and are not impacted uniformly, a survey of rural forestry consultant and landowner needs was suggested. They also suggested a sequence of courses on new tools starting with the Landscape Management System. And, in response to the need to create incentives to motivate new management methods, a demonstration on carbon sequestration protocols was also requested.

Ten westside case studies on nonindustrial private landowners, analyzing the impact of the recent Forest and Fish Agreement in Washington State to protect salmon, were completed (Zobrist 2002). Scaling the results up to total westside stream miles suggests small owners could lose $1.3 billion with forest value losses ranging from zero to almost 100%, if there was no mitigation effort. With full participation in the state's 50 year riparian easement program, forest value losses could be reduced to generally under 10% of their preregulation value, but the state has so far only authorized $1.9 million per year which if continued would fall 93% short of the full participation need.

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An even more serious unintended consequence is that the easement program does nothing to mitigate against the loss in bare land values for continuing to manage the land as forestland. The change in land value associated with maintaining the land in forestry ranges from no impact on some land to as much as 100% loss in land value or other. In effect, the motivation for land conversion out of forestland becomes the highest for the acres of greatest importance under the new rules.

Another unintended consequence of the regulations is the loss of economic motivation to precommercially thin or commercially thin stands in the buffer zone. These stands were being managed with the anticipation of thinning, thus leaving them overly dense and not on a path to restore the old-growth like "desired future conditions" (DFC). The intent of the regulations look to restore riparian zones to old-growth-like conditions.

The owners best course, short of selling out for conversion uses, may be to develop alternative plans allowed under the regulations that can lower the cost and put their stands on a better restoration path to reach DFC. These case studies are serving as examples for best management alternatives in the training courses using the power of the Landscape Management System to analyze both environmental and economic impacts. Case studies on required road improvement are underway to be used in conjunction with road management and harvesting techniques and the substantial cost increase to forest landowners, even using the best technology.

## TECHNOLOGY AND MANAGEMENT CREDIBILITY

One of the more difficult aspects of technology transfer in forest management is to establish the credibility of the forest treatments. There is a substantial gap between building models that show the impact of changes in forest structure caused by active or passive management and the basic research studies on the creatures believed to be most at risk. Habitat and instream functionality models are being developed for this process, but it takes the pressure of a multi-disciplinary team and well-stated objectives to get past hypothesis testing on sampling populations to the development of model responses to forest management change. There are still large gaps to be filled in data, models, model verification, and monitoring the consequences of treatments.

The bottom line is that technology can have a big impact. Existing outreach mechanisms without increased tech transfer cannot adequately respond to the increased pressures from regulatory change. Technology transfer can contribute to lower cost through better equipment, training, and management plans. It can contribute to increased revenue by managing for value and customization for markets. Managing for value may need to include values not currently available in the market even though they clearly reflect real social values. That frequently may include recognition of the environmental values, some being implicit in the regulation, but it can also include other environmental values and even costs that have been shifted to other markets whether intended or not.

## LESSONS FOR EASTSIDE DRYSITE THINNING

While our eastside case studies are not as far along, the preliminary findings show that much like the westside, there are unintended consequences. There is not enough flexibility under the regulations to manage forests on a pathway to restore a "desired future condition" which in this case would likely be a ponderosa pine Savannah like overstory with much less density than current stands.

Current conditions include 1 to 2 million acres of over-dense stands (Fig. 1) in Washington alone. These stands are ripe for hot-catastrophic fires. The fuel load is too high for controlled burns. The endemic problem for removing sufficient amounts of small diameter material include high logging and handling costs, low quality material with low market values, long distances to market, below scale volumes for economic processing, environmental perceptions that management is bad and that doing no management will ultimately return the stand to the desired condition, and unintended regulatory consequences. Included in those unintended consequences are fish protection rules that prevent restoration pathways while making the economics of restoration infeasible, permit processes that impede scale activities, and reduce the predictability making investments too risky.

- Thousands of acres of intensive wildfires per year
- Habitat loss
- Post burn regeneration failures
- Sediment and erosion
- Aesthetic disaster over-dense or burned

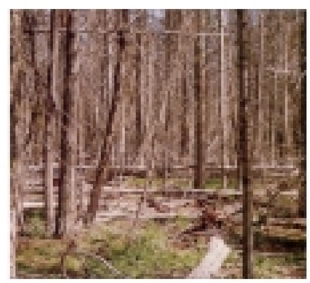

Figure 1.—Overly-dense inland forest.

To get to the desired future condition shown in Figure 2, substantially more small material must be removed than is currently practical given current market values. Technology to lower logging and handling costs can contribute. Finding better markets to use the low quality material can contribute. Analysis of samples within the 1 to 2 million acres of inland stands just in Washington that are currently classified as high risk for hot (catastrophic) fires will generally show that some of the larger material can be removed economically but not enough small material.

- Habitat restoration
- Sustained over-story and leave trees
- Reduced magnitude of extreme disturbances
- Aesthetic restoration
- Reach the desired future condition

Figure 2.—Desired restoration in inland forest.

As an example of current conditions (Table 1), we could remove about 3000 mbf/acre of material about half in diameters that have a reasonable market value ($450/acre), but the other half will likely be unmerchantable without a pulp or co-gen user, yet to reduce the fire risk they must be removed. The smaller logs have substantially higher logging cost and even with a positive market value at a co-gen plant the costs of logging and hauling turn the net returns for the operation negative, -$345 per acre shown in the example.

Table 1.—Negative current economics for thinning. (Thinning – 3000bft/acre)

| | $ Revenues | $ Harvest Cost | $Net/Acre |
|---|---|---|---|
| Large logs | 450 | -225 | +225 |
| Small logs | 90 | -450 | -360 |
| | | Haul cost | -210 |
| | | | -345/acre |

## GETTING THE VALUES RIGHT

But there are many other costs and benefits that should be considered in this decision. At the top of the list (Table 2), fighting fires is very expensive, $500–$1000 per acre based on recent experience in eastern Washington and Oregon. The model to estimate the savings from restoration treatment with thinnings for the next several decades will be complicated and the savings are not 100%. For a quick model, one block of overly dense stands with fire history data showed the area to be almost completely burned over in 30 years. A discount rate of 5% on the mean time to burn of 15 years suggests the savings might be close to 50% of the fire fighting cost. The $200 savings shown in the table should be conservative with our simple discounting models showing the savings more like $400/acre.

Table 2.—More complete economic accounting. Total value exceeds cost per acre.

| | | | |
|---|---|---|---|
| 1) | Net thinning cost | $ -345 | |
| 2) | Reduced fire fighting | +200 | Other >> Cost |
| 3) | reduced fatalities (EPA value of life | +23 | |
| 4) | Reduced facility losses | +15 | |
| 5) | Community value for fire reduction | +20 | |
| 6) | Carbon emission at $5/ton | +45 | |
| 7) | Electrical transmission cost reduction | +50 | |
| 8) | Green energy credits | +50 | |
| 9) | Regeneration savings | +200 | |
| 10) | Tax receipts from economic activity | +100 | |
| 11) | Water saved | +100 | |
| | **Net Value $/Acre** | **+458** | |

While the numbers should ultimately be important to decision making, the purpose here is not to dwell on the quality of the estimates, but rather to demonstrate the importance of what are now consistent nonmarket values to best management practice decisions. Reduced fire fighting costs are not really nonmarket values, they are real costs that have been shifted to other parties by inadequate accounting. Reduced human fatalities or injuries and reduced losses in time and productivity resulting from fires provide similar values that should be included. A nonmarket value of prime importance would be the rural and city community values placed on reduced fire risk and smoke reduction. And there are the nonmarket values associated with forest restoration and health, including restored habitat lost as the forest stands became too dense.

Forest fires remove carbon sinks that if processed into electricity in a co-gen plant reduces fossil fuel use and carbon emissions, a double benefit to the global warming equations. While estimates vary widely on the price for carbon credits needed to produce meaningful reductions in carbon emissions; even using a low value of $5/ton contributes significantly to the nonmarket value. Green energy credits provide another contribution. While forest regeneration is very likely over some period of time, hot dry site inland fires often leave difficult regeneration problems. Planting cover crops to reduce sediment in streams can make regeneration even more difficult. Increased regeneration costs of $200/acre may be needed. Overly-dense stands remove water from the landscape through evapotranspiration. Some estimates for dry country show this water loss to be worth $100/acre.

The economic activity created by thinning treatments, wood processing and electrical generation provide important contributions to the economic vitality of rural communities, regions that have been economically depressed in recent times. Considering these activities in the spirit of rural development, we should note that the tax receipts supported by the increased activity are substantial, and while not likely to be sufficient to suggest a win-win solution exists based solely on the tax receipts exceeding the incentive needed, it adds considerably to the opportunity at hand.

## TAKE HOME MESSAGE: LOOKING AT THE WHOLE PROBLEM POINTS THE WAY TO SOLUTION

While there is no doubt that estimates of nonmarket values will be situationally dependent and while the estimates shown in Table 2 are not the result of a lengthy study, they do suggest the likelihood that if we knew these values accounted to them in the interest of social benefits, it would be economic to thin many stands that currently remain overly dense. In effect, the solution to the small diameter problem seems to adjust for a better accounting for value system and policy changes that take these values into account.

The bottom line message is simple enough—technology changes can facilitate small diameter economics. A better technological understanding of nonmarket benefits and values may be sufficient to justify the activity. Policy changes will be needed to facilitate such a valuation system and to allow technology to work. Investments that could be made will not be made as long as risk and uncertainty overwhelm the opportunity to apply technology.

## WORKING ON NEXT STEPS

What is needed is more training to customize dry-site treatments that respond to local cost and market conditions. RTI is working on such a training program. We will be including the impact of nonmarket values. But better estimates of nonmarket values will likely be necessary before policies will consider these values. More demonstrations on the environmental consequences through landscape management simulations are needed to get past the perception problems that no-management, especially no-management except fire suppression, is natural or desirable. The conditions of our forests are far from natural and cannot be restored to the desired future condition without substantial change in management.

## REFERENCES

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