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FINDINGS

INSIDE

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"Science affects the way we think together."
Lewis Thomas

FACING THE CHALLENGE OF THE YOUNG, THE SMALL, AND THE DEAD: ALASKA'S NEW FRONTIER

Photo credit: Glenn Christensen

Data on such important issues as how much usable material can be retrieved from a stand are needed to enable managers to make better decisions about harvest planning and silvicultural treatments.

IN SUMMARY

Mandates to harvest, beetle infestations, log export restrictions, pulp mill closures, high transportation costs, ecological versus economic effects—the litany of challenges in the Alaska timber markets is sufficient to stymie land and timber managers. For decades, they have had to confront and make decisions about these conflicting issues without sufficient data about land management alternatives. To improve their decisionmaking capacity, the Ecologically Sustainable Production of Forest Resources Team at the Forestry Sciences Laboratory in Portland has completed 13 wood product recovery studies, most recently assessing timber quality and value for young-growth and insect-infested stands in southeast and south-central Alaska, respectively.

With more substantial data available, Alaska managers are better prepared to contribute to both the ecological integrity and economic health of the region.

"The best of prophets of the future is the past."
Lord Byron 1821

Consider the challenges facing the Alaska forest products industry: ongoing competition and demand fluctuations in external markets, decades-long spruce beetle infestations, young-growth timber harvest scheduled to augment old growth over the next half-century, log export restrictions (in Alaska, export means out of state, including the lower 48 states), and pulp mill closures. Conditions sufficient to make a mill or land manager's head swim.

Anticipating, understanding, and adapting to these changes is a process of finding and managing order in what others might see as chaos.

The data crucial to wise decisionmaking in this setting, however, have been notably absent. What levels of volume recovery can be attained from beetle-killed spruce? What

grades of lumber, and therefore what product values, are available from young-growth stands? What restoration activities are best designed to resolve both ecological and local economic challenges? What production or manufacturing businesses can survive in Alaska?

In other words, harvest planning decisions, along with silvicultural treatments, and product selections, can be costly shots in the dark unless managers have access to specific data: How much usable material can you get from a stand (volume recovery), and what is that usable material worth (grade yield)? And, of course, Where are the markets?

KEY FINDINGS

- Data from Alaska wood product recovery studies provide useful information for managers considering alternative management activities or silvicultural treatments, and also can indicate how product quality changes as the available resource progresses from old to young growth.
- Southeast Alaska sawmills tend to cut for high-value export grades, which reduces volume recovery. The region has traditionally relied on high prices for its old-growth spruce and cedar in export markets.
- Young-growth stands thinned at a later age are producing high-quality lumber, with mechanical properties at least as good as the traditional resource. Stands thinned earlier might not produce such high-quality lumber.
- Costs of active management can be offset by quick utilization of dead and dying trees. Trees killed by the spruce beetles have significantly less value for lumber and veneer products than do live trees, but are still suitable for log home manufacturing.

DEVELOP THE DATA, OR LIVE WITH CHAOS

"All the information we are compiling can be tapped for helping identify what the returns might be from different land management activities, how alternatives can be evaluated, how management costs can best be offset," says Eini Lowell. "As decisionmaking tools, these data can be used not just for harvest planning but also for silvicultural prescriptions, and to assess quality issues for both the present and future by using simulation tools."

Lowell is a research forest products technologist with the Pacific Northwest (PNW) Research Station's Ecologically Sustainable Production of Forest Resources (ESP) Team in Portland, Oregon, along with Glenn Christensen and Jim Stevens, both research foresters. The group recently completed several studies and analyses to provide resource and mill managers in Alaska with more efficient planning tools.

The ESP team has begun to investigate how different management strategies influence the characteristics of the resource and therefore the range of processing options available to manufacturers. "We also have considerable empirical information on the transition from an old-growth resource, to an unmanaged second-growth resource, to a managed young-growth resource that is occurring in the Douglas-fir region," says Christensen.

Both forest managers and wood products manufacturers can use this information to determine the likely course of, and plan for, the transition in southeast Alaska, he says. In southeast Alaska, the transition will be shortened and more abrupt because less unmanaged second growth, which has characteristics intermediate between old growth and young growth, is available to ease the transition.

At times, less valuable timber was sent to the local pulp mills, but there were only two of those, both of which closed in the 1990s. Thus Alaska is no longer in the volatile pulp market. Chips are still produced as a byproduct of manufacturing, adds Stevens, "but pricing is very volatile, and while Alaska chips might be able to compete when the prices are way up, it takes very little downturn to remove them from competition."

So the transition from a pulp-based industry to a smaller solid wood-based industry in southeast Alaska is another issue the industry must face. The ESP team has considerable expertise conducting wood product recovery studies that relate volume recovery and grade yield to the characteristics of the resource. Team researchers also work closely with the Wood Utilization Center in Sitka, Alaska, which makes these data accessible to mill operators, and assists them in applying this research to processing technologies and practices.

Purpose of PNW Science Findings

To provide scientific information to people who make and influence decisions about managing land.

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THE BEETLE AND THE BLADE

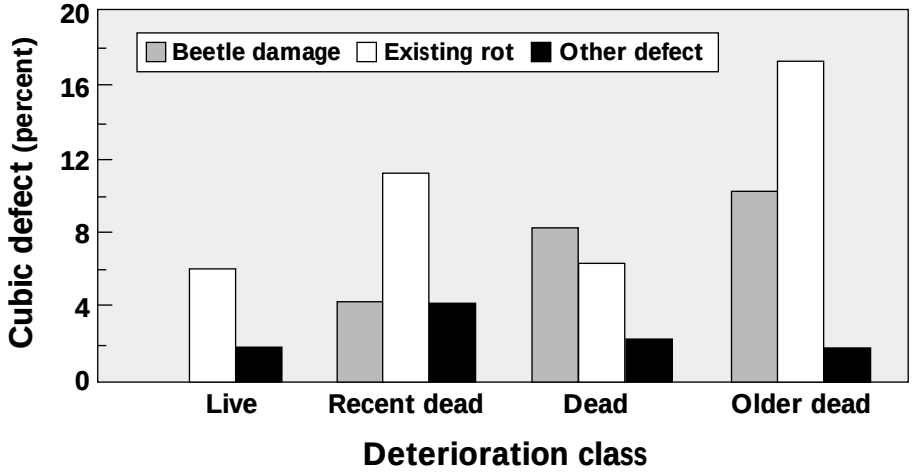
Forests in south-central Alaska have been continuously infested by the spruce beetle since the 1970s. The Kenai Peninsula is home to several species of spruce trees: white, Sitka, and the hybrid Lutz spruce, all of which have been affected by the beetle. The beetles attack dead and injured trees first but move to live if necessary to support their population. The decades-long infestation, in addition to fire suppression and lack of active management, has created forests susceptible to large-scale stand-replacement fires, and thus forests that are in need of active restoration management, according to Lowell.

The beetle-kill situation presents an immediate need for information. Can timber removals alter forest conditions to reduce the risk to human life and property, or alter landscape conditions to help control the size and course of fires that do begin? Paying for forest management activities always will be a gnarly issue on public lands, but particularly in Alaska, where margins are already pared down dramatically by the geography and infrastructure.

"Whenever possible, resource managers responsible for attaining restoration objectives want to design treatments that restore and maintain ecological integrity," Lowell says. "Realization of this goal is, to a large extent, dependent on being able to finance intermediate treatments (thinnings) in young, dense, or infected stands that often contain a high proportion of low-quality timber."

LAND MANAGEMENT IMPLICATIONS

- Opportunities to offset costs for treatment or management of the forest resource can increase through knowledge of wood quality and indentification of the appropriate end products manufactured from trees.
- Data such as these contribute to planning for future stand treatments including thinning, final harvest, and planting. Stand treatments can be designed to grow trees capable of contributing high ecological value and ultimately products that will support a range of current and future markets.
- These research results provide industry with information needed for future investments in southeast Alaska. In turn, the Forest Service, the major landholder, in the area benefits by being able to develop long-term forest plans with some knowledge of where investments will be made.



Percentage of defect caused by beetles (sap rot and weather check), existing rot (heart, but, and conk rot), or other existing (sweep, seam, scar, limb, and snowbreak) broken out by deterioration classes. Defect is averaged over all logs in each deterioration class.

The ESP team has collected information that will help resource managers and regional planners identify places where removal of wood products can provide revenues to help offset the costs of fire hazard reduction. For example, a recent PNW Station study estimated volume and value recovery for lumber and veneer from each of four levels of deterioration. Many of the logs in the study also contained defects other than the sap rot and weather check associated with beetle-kill.

"Once a tree has been killed by beetles, little further deterioration occurs from interior rot. If processed soon after death, these trees produce similar quality and quantity of lumber products," Lowell explains. "But sap rot and weather check, the defects typical of beetle-kill, deteriorate the wood from the bark inward, thereby decreasing volume recovery through time. More importantly, they decrease lumber and veneer grade recovery from the outer portion of the tree, thereby lowering value recovery as well."

Volume recovery from live, and recently infested, trees compares favorably to other product recovery studies done on spruce. Mean cubic recovery (surfaced dry product as a percentage of gross log volume) of veneer was 52 percent, and for lumber, 45 percent in a parallel study.

Beetle-killed trees, however, remain suitable for log home manufacture, and can be used locally with available technology, she says. They also can be pulped effectively, but there were mixed results on paper properties. Existing defect from other causes also significantly affects volume recovery: for every 1-percent increase in existing defect,

Photo credit: Eini Lowell

Spruce beetle-killed trees on the Kenai Peninsula.

there is a corresponding 0.3-percent loss in cubic volume recovery for lumber, and a 0.4- percent loss for veneer, she says.

Ultimately, researchers recommended using only two deterioration classes for comparisons—live, including recently infested, and dead—because the differences between the deterioration classes selected for the study were so minimal.

MEASURING YOUNG-GROWTH AGAINST OLD-GROWTH

The less urgent, but nonetheless important, issue is managing the increasing inventory of young-growth trees. Since 1950, over 400,000 acres of forest have been harvested on the Tongass National Forest in southeast Alaska. Young stands will provide the core of the future resource, although over half these acres are no longer available for commercial timber harvest, Christensen notes. Many more acres of young-growth timber exist on private land, such as that owned by Native corporations.

Although the Tongass land management plan (TLMP) calls for continuing harvest of old-growth forests over the next half century, a large resource of managed young-growth stands will start to become merchantable in about 40 years, Christensen says. Given the high cost of operating in Alaska, it is important that this transition be planned in a way that allows wood processors a maximum of options.

"Even though harvest of substantial amounts of young-growth material is still decades away, information on potential resource characteristics is needed today because forest conditions set up now largely will determine the degree of flexibility in manufacturing options available to processors in the future," Christensen says. Decisions such as whether, how, and when to thin young stands will make the difference between the ability to produce high-value appearance grade materials and lower value construction materials, he says.

The 1997 TLMP identified as high priority the need to understand the lumber product value and economic potential of young-growth timber from the region. Data from previous studies are showing how forests will respond to alternative management actions, and the most recent data by PNW Station researchers examined wood volume recovery, lumber grade yield, and mechanical properties of young-growth Sitka spruce and western hemlock in southeast Alaska.

Unique to Alaska's timber industry is that mills in southeast Alaska tend to recover low volumes, well below recoveries from typical mills in the lower 48 or Canada.

"One important reason for this difference is that Alaska mills cut for high-value export grades that might have three to five times the value of dimension lumber produced for the domestic market, but also have a higher waste component, thereby resulting in lower volume recovery," Christensen explains. Thus, he points out, two important questions for southeast Alaska mills are, Will the quality be there in the young-growth resource to cut export products? If not, what broad classes of products might be developed profitably for domestic consumption?

The sample for the PNW Station's southeast Alaska study included trees from commercially thinned and unthinned stands, and a sample of fluted (indented) western hemlock logs obtained from a sort yard.

From a lumber-manufacturing viewpoint, the news about young-growth stands in Alaska is mostly good, Christensen says. Mean cubic recovery (surfaced green lumber as a percentage of gross log volume) was 44.9 percent versus a mean recovery of 48 percent for an earlier study of old-growth hemlock and 56 percent for old-growth Sitka spruce (rough green lumber as a percentage of gross log volume). Researchers note that these levels can be affected by what the product objectives of certain mills are.

Fluting—a common occurrence in coastal Alaska hemlock—reduces volume recovery but has no effect on grade yield. Further, both species exceeded or matched published bending properties for this resource, whether thinned, fluted, or not. Other properties tested included wood density, moisture content, and rupture values.

"Mechanical testing of lumber from this young-growth resource suggests it is at least as good as the traditional resource in terms of structural properties, and compares well with lumber from the same species in western Oregon and Washington," Christensen notes. Nondestructive testing was done at the site, along with destructive testing at the Forest Products Laboratory in Madison, Wisconsin. In terms of wood strength and stiffness, this resource seems best suited for structural light framing. Its visual characteristics also make it suitable for moulding and millwork products.

THE FUTURE OF THINNING?

The effects of thinning are many and important to volume recovery. They can profoundly affect species composition, stand structure, rates of growth, and wood characteristics. Increased stem taper is a common consequence of thinning, as is expansion of the live crown ratio, which causes branches to grow larger and be retained longer, thereby affecting the size of knots. Accelerated stem growth also creates fewer rings per inch.

"There is a large backlog of stands in need of precommercial thinning, and the Tongass land management plan proposes thinning when stands reach about 20 years old," Christensen says.

In the recently completed recovery study, notably, no differences in volume recovery or grade yield owing to thinning were found for Sitka spruce logs. For western hemlock, more volume was recovered from trees in unthinned stands, and there was no difference in volume recovery between fluted and unthinned hemlock logs (These are postscaling results).

WRITER'S PROFILE

Sally Duncan is a science communications planner and writer specializing in forest resource issues. She lives in Corvallis, Oregon.

The recovery study included trees that grew from natural regeneration and were thinned as part of an unrelated stand-density study when stems were of commercial size, about age 60. Precommercial thinning, undertaken before trees reach merchantable size, is usually done on Forest Service lands at an earlier age, around age 20, to achieve multiple-resource benefits. The effects of precommercial thinning on wood properties, particularly knot size and frequency, may be more important than was found in this study. Thus the thinned component of our sample may not be representative of the regional resource that comes from precommercially thinned stands.

"Managers need to recognize the relation between age and intensity of thinning so that they don't plan for a quality level in their resource that never develops." In addition, landowners need to weigh the costs and benefits of early versus late thinnings based on their management objectives. The researchers also acknowledge that earlier thinning could possibly affect various mechanical properties in other ways.

Photo credit: Dean Parry

Scientists found no differences in volume recovery or grade yield owing to thinning for Sitka spruce logs. For western hemlock, however, more volume was recovered from trees in unthinned stands.

SYNTHESIZING FROM THE PAST TO PREDICT THE FUTURE

The past 40 years at the PNW Research Station have produced over 100 forest product recovery studies such as the ones recently conducted in Alaska. The Alaska timber industry has, to date, had difficulty generalizing across databases, as in many cases, different proprietary lumber and log grading systems were used, thereby making comparisons difficult. The ESP team has undertaken the task of compiling wood product recovery data across previous studies so that managers can more readily search and use the information.

"We believe Alaska may provide us with the opportunity to put to work some of the knowledge we gained while studying this transition in the Douglas-fir region. Specifically, it can help resource managers and manufacturers understand how product potential will change as we alter management practices to restore or maintain ecological integrity," says Christensen.

Previously, Stevens explains, individual studies were undertaken to meet immediate objectives, such as relating tree and log characteristics to wood product attributes and properties. Emphasis was primarily on the log-to-product stage of recovery. "The traditional tools of the forester were growth and yield models," Stevens explains, "but when you add utilization data to those, you begin to see what kind of quality you can expect, which gives you much clearer value numbers."

In keeping with the trend to look at larger scale planning and effects, current research questions are less likely to be directed at the log or stand level and more likely to be addressed at some broader spatial scale. Stevens says the information in this new database could allow product recovery modeling at the watershed level.

"Policymakers can definitely profit from the type of analysis we have just completed," he notes. "Projection of future stand conditions based on current management regimes implies that certain products will be available in the future. These types of analyses are crucial in determining which industries a region will be able to support."

Conversely, he explains, assessing future demand can lead to projections of the kinds of trees or stands that might provide these products. This will include analyzing the potential economic value of harvesting remaining in old-growth stands versus managed young-growth stands.

Putting the science analyses to work with the industry conditions peculiar to Alaska will give managers the best decisionmaking tools available. Future stand treatments, from thinning through final harvest to planting, can be based on these data, and stand treatments can be designed to grow forests that contribute both ecological and economic value. The health of Alaska's forests, and the success of its local industry in the future, will be as dependent on good data as any effective business.

"Things have their due measure; there are ultimately fixed limits, beyond which, or short of which, something must be wrong."

Horace 65-8 B.C.

FOR FURTHER READING

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SCIENTIST PROFILES

EINI LOWELL, a research forest products technologist with the PNW Research Station, has been involved with wood quality and utilization issues for the past 16 years. She began working on utilization and biomass energy issues in New England. Her research at the PNW Research Station has included studies on deterioration of dead and dying trees and utilization of hardwoods. Currently, her efforts are focused on identifying opportunities (with a value-added emphasis) within ecosystem management for using small-diameter trees.

GLENN CHRISTENSEN is a research forester for the Ecologically Sustainable Production of Forest Resources Team, Social and Economic Values Program, PNW Research Station. He received his B.S. and M.S. degrees in forest resources from Oregon State University. His research centers around issues related to the effects of silvicultural manipulation on wood quality and product recovery. Currently he is working on developing methods to incorporate stand-level wood quality analysis into landscape-scale management simulations and research related to product recovery for small-diameter trees from the inland west and southeast Alaska.

JIM STEVENS, at the time of this research, was a research forester with the PNW Research Station and has been involved with economics research for the past 12 years. Previously, he had worked as a forester in Alaska for 6 years. His research emphasis at the PNW Research Station was in increasing the utilization of forest product recovery databases, Alaska timber markets, and the utility of multiresource research. He received his Masters degree at Colorado State University in forest management and his Ph.D at the University of Washington in forest economics. Currently, he is employed in the private sector as a forest economist.

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Wood Utilization Center, Sitka.

University of Alaska.

State of Alaska Division of Forestry.

Kenai Peninsula Borough.

USDA Forest Products Laboratory (Robert J. Ross), Madison, Wisconsin.

Seward Forest Products (no longer in operation).

Young and Morgan, Green Veneer, Idanha, Oregon (no longer in operation).

Rayonier Corporation.

Klukwan Native Corporation.

Ketchikan Pulp Company (subsidiary of Louisiana-Pacific Company).