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Thinning is the Answer: What was the Question Again?

BY JOHN BAILEY

Density regulation is one of the fundamental tools used by foresters to mold stands and forests to meet various land management objectives—and one of the easier ones. Stand density influences: 1) tree and wood characteristics; 2) biotic and abiotic stand dynamics (e.g., insects and fire behavior); 3) wildlife habitat and other ecosystem services; and 4) just how the forest looks and feels. Any change in stand density affects all of these one way or another. Effects are all three-dimensional, and fortunately, fairly predictable over time and space. As such, our history as a profession is rich in the manipulation of stand density via initial regeneration spacing, and more importantly, early stocking control and regulation of stand density and species composition over time: "thinning."

Thinning has traditionally been viewed as an intermediate treatment in evenaged management systems geared toward capturing the imminent mortality of overtopped trees ("salvage"), while concurrently promoting the development of residual trees ("improve growth") and their associated stand conditions ("enhance forest health"). The latter can be accomplished with chemical and/or fire tools, but mechanical thinning is by far the most common and spans all three objectives. Note that many of these terms are straight from various textbooks and the SAF *Dictionary of Forestry*, and they largely agree with each other.

PHOTO COURTESY OF JOHN BAILEY

A BLM thinning site at Sand Creek in the Oregon Coast Range.

Knowing the terminology

For much of the 20th century, we focused almost exclusively on thinning to promote the development of higher-value crop trees through a rotation, ending in some final regeneration harvest. Most of the interest and research has been on commercially important conifers, but there are applications to thinning in hardwoods and non-commercial species. This economic focus, however, shaped the development of our thinning choices and the language that we use to describe various approaches:

Thinning from below (a.k.a. "low thinning"): Removing most or all suppressed and intermediate trees, and often some smaller co-dominant trees, in order to harvest volume that will otherwise be suppressed and die in the near future, thereby making those site resources available sooner for dominant and preferred co-dominant trees. In this way, the radial growth of those desired crop trees is not needlessly slowed by the natural self-thinning dynamic, and the stand as a whole spends less time in early dense stages of "stem exclusion."

Geometric thinning (a.k.a. "spacing," "row" or "strip," and "mechanical" thinning): Removing trees almost regardless of size and crown position in order to establish and maintain a particular geometric pattern. This approach is common when the trees

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are all about the same anyway (e.g., very early in stand development) and when spacing is the best predictor of future tree performance and stand development; simpler marking guides and mechanical equipment operations are an obvious advantage to this kind of thinning.

Crown thinning (a.k.a. "from above" and "high thinning"): Removing some of the dominant and co-dominant trees from the main canopy in order to stimulate better trees in those same crown classes. This one is more about improving spacing, species composition and tree form ("tending" the main canopy), rather than capturing mortality or releasing smaller trees.

Selection thinning (a.k.a. "dominant thinning"): Removing some or all of the dominant trees from the main canopy in order to stimulate the growth of trees in lower crown classes. The idea here is that larger trees are sometimes in the way of your desired crop trees given stand history, form issues or species composition. But beware of two problems: 1) selection thinning becomes "high grading" if you are more interested in what is being removed than what is left on the site; and 2) the word "selection" is more commonly used in unevenaged management systems, and actually, plucking big scattered individuals or clumps of dominant trees create the kind of stand dynamics associated with "individual tree selection" and "group selection" silviculture. These latter unevenaged approaches are focused on regeneration for multi-storied stands, whereas selection thinning definitely is not.

Free thinning: Blending all approaches and purposes and advantages as best fits a particular site for a given objective.

These thinning choices have financial implications as well as ecological goals. Chemical and fire thinning will always cost money without yielding a product. Mechanical thinning operations also sometimes begin before the material removed gets very large, meaning the operational costs must be carried by an owner (i.e., "precommercial"); however, it is ideal to wait until said material has value beyond the cost to handle and remove it, which creates a win-win-win situation.

The good, the bad and the ugly

So who can argue with a silvicultural treatment that simultaneously generates money early in a rotation, stimulates growth rates and desirable characteristics in residual crop trees (of the desired species), and enhances a handful of desired stand characteristics associated with things like understories, fire risk and wildlife habitat? Indeed, my students might tell you that I present thinning as the answer to all our forest management problems! And the research clearly shows that thinning among stands within a larger landscape can be used to meet many land management objectives, though not every acre can meet every objective all the time.

But there are limits and issues with thinning, as with all forest operations, I know. Thinning has only limited impact on total site productivity; rather, it reallocates that productivity to fewer numbers of individuals with different sizes and architecture. Heavier thinning treatments will further reallocate some of the growth

Western Forester
Society of American Foresters
4033 S.W. Canyon Rd. • Portland, OR 97221 • 503-224-8046 • FAX 503-226-2515
rasor@safnwo.org • michele@safnwo.org • www.forestry.org/wf

Editor: Lori Rasor • **Assistant:** Michele Docy

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potential of a site from the trees to the understory for some length of time over some amount of the stand area—this may be considered good or bad depending on your objectives. The heaviest thinning treatments actually begin the late-successional process of understory re-initiation, a leap from evenaged management (a single cohort) to "two-story" management and, perhaps later, to "multi-story" management. I'll come back to this point in my concluding thoughts.

Thinning can get plenty ugly as well, since it is an entry into the stand and creates mechanical and/or other disturbance to soils, plants and animals. This disturbance can range from negligible to tolerable to problematic-but-reparable to permanently destructive; the latter is never worth the effort and advantages of thinning. Road proliferation, spread of invasive plant species, soil compaction and erosion, and residual tree damage (with associated tree value and forest health losses) top the list of potential disadvantages of thinning when improperly done. However, our profession generally understands when and how to thin, and does it well across ownerships.

Looking to the future

Chemical thinning will likely continue to have limited, but important applications for specific situations (e.g., thinning with control of re-sprouting hardwoods). Thinning with prescribed fire will have application for "weeding" fire-sensitive species out of stands of fire-resistant species, but wildfire risk and smoke production will likely limit this application, particularly in the absence of some prior mechanical thinning treatment of the entire fuel profile.

Mechanical thinning will undoubtedly continue to play a major and fundamental role in forest management throughout the West for decades to come, and across all ownership categories. Density regulation in fast-growing conifer and hardwood plantations (for fiber and biomass) is crucial, but may not require thinning per se; however, to extend very many decades into mid-length rotations will require mechanical thinning(s) in order to develop desired tree and stand characteristics. For even longer rotations (e.g., federal lands), though, will it truly be "thinning" anymore?

Many federal land managers now find themselves entering younger, largely evenaged stands with very broad objectives related to developing complex structure and late-successional habitat character beyond a century. Objectives include:

1. Harvesting some volume while developing larger trees (a thin from below);
2. Creating a clumpy spatial arrangement (a variation on geometric thinning);
3. Stimulating mid-canopy trees to maintain large crowns and rapid growth (sounds like a crown thinning); and
4. Releasing smaller, overtopped trees to create deeper, richer canopies and complex vertical structure (selection thinning).

We could stop at this point and call this "free thinning," but we typically have even more objectives:

5. Stimulate understory development, including multiple tree species (now we have to talk about regeneration methods well beyond evenaged management);
6. Reducing fuel accumulations and continuity (this is beyond thinning); and
7. Creating large, early-seral openings for more complex horizontal structure (did someone say "clearcuts?").

Therefore, thinning has become an abused term—extended far beyond its intent and now used to mean almost any partial harvesting activity. For the general public, perhaps, "thinning the forest" is a fine term…as sufficient for trees as it is for the top of my head. However, as professionals, we should strive to be more precise and accurate. Our objectives are and will be more complex; our management will be more complex. Our language, and inseparably, how we think about the topic of stand density should follow these trends. There's a lot more to it than just thinning the forest. ◆

John Bailey is associate professor at Oregon State University's College of Forestry, Forest Engineering, Resources and Management Department in Corvallis. He can be reached at 541-737-1497 or john.bailey@oregonstate.edu.

Operational Considerations of Thinning

BY LOREN KELLOGG, JOHN SESSIONS AND JEFFREY WIMER

Loren Kellogg

John Sessions

Jeffrey Wimer

Operational considerations in thinning often determine whether the thinning will be successful or not. A successful thinning must not only achieve the silvicultural goals, but also the economic goals of the manager. Modern techniques have improved both the silvicultural and economic aspects of thinning. In addition, recent research has helped to define value losses resulting from thinning operations such as residual stand damage and reductions in stand productivity resulting from creation of skid trails and forwarder trails. We describe the common thinning systems for ground-based and aerial systems, including factors that affect the silvicultural and economic outcomes. We close with a discussion of factors that determine whether a given thinning will yield a net revenue.

Thinning with ground-based harvesting systems

Ground-based thinning systems can be divided between whole tree systems, long log and cut-to-length (CTL) systems. With whole tree systems, the tree is cut, usually with a feller-buncher, placed in bunches for skidding by a grapple skidder to the landing where trees are then processed by a dangle-head or stroke-boom delimber in 32- to 40-foot logs, and then loaded by hydraulic loader onto stinger-steered log trucks. With long log systems, trees are usually cut, delimbed and bucked by chainsaw, and then extracted by cable skidder. With the cut-to-length systems, logs are felled and processed by a mechanized harvester and forwarded in 16- to 24-foot logs to the roadside. Logs are later loaded into short-log trailers. In the United States, whole tree operations, particularly in smaller trees, yield the lowest stump-to-truck cost except for long skidding distances. For all systems, felling costs are highly affected by tree size, since trees are handled individually. In whole tree systems, tree-to-tree rubber-tired carriers are less expensive than swing-to-tree tracked carriers if the terrain is less than 10 percent ground slope. At longer distances, forwarders in CTL operations are more efficient (lower cost) than whole tree or log-length grapple or cable skidders due to their larger payloads. Regardless of system, the ability to bunch trees or logs for skidding or forwarding is very important in controlling stump-to-truck costs.

PHOTO COURTESY OF LOREN KELLOGG

Melcher Logging Company single-grip harvester felling and processing trees in a restoration thinning.

Residual stand damage is a function of thinning intensity, species, season, log length, operator technique, felling pattern and logging plan. Damage occurs during both felling and skidding. Stand damage from cut-to-length operations is lower than whole tree operations, particularly for trees damaged along the skid trail. Damage is most severe near the skid trail.

PHOTO COURTESY OF JEFF WIMER

OSU Student Logging Training Program yarding with Koller 501.

Whether residual stand damage from long log thinning is greater or less than cut-to-length is not clear. Cut-to-length thinning trails are often 60 feet apart where long log thinning trails are 100 to 150 feet apart, so cut-to-length has a greater proportion of the area in forwarder trails, but CTL avoids turning longer logs into the skid trail. Some have estimated a two percent loss of future stand value 50 years after a Douglas-fir thinning if 20 percent of the residual stand was damaged. For shorter rotations in Douglas-fir, recent work suggests that earlier estimates of reduction in residual stand value were too conservative.

Potential soil impacts from ground-based operations include soil compaction, rutting and displacement. Early concern about soil impacts focused on reduced growth on planted seedlings, but there was also concern about effects on residual stands after thinning. Effects of logging traffic on soil properties and tree growth depend on the depth of slash, soil texture, soil moisture content, vehicle pressure and vibration, and the rate of natural remediation. Recent observations in commercially thinned Douglas-fir using ground-based logging vehicles and planned skid trails have shown that tree growth on adjacent residual trees was not reduced and probably increased. Similar observations have been made in other regions with respect to forest roads and strip roads. Although tree growth of the corridor trees is higher, the increase in volume does not usually make up for the trees removed from the corridor, although if the corridor is narrow, the difference can be small.

Thinning with aerial harvesting systems

Aerial harvesting systems (cable and helicopter) are more expensive than ground-based systems; however, they are needed on steep terrain or where other management objectives require less soil disturbance than ground skidding or mechanized operations. A number of technology advances and harvesting innovations have occurred to make aerial harvesting systems today more economically feasible than earlier clearcut harvesting practices with cable and helicopter systems.

Cable Thinning. As cable systems have changed from predominately highlead and live skyline to second growth harvesting, some key logging equipment changes and operational practices have evolved. The biggest change has been the introduction of both manual and mechanical slack-pulling carriages. These carriages allow skyline corridors to be spaced approximately 100-150 feet apart. Also, log control and movement past residual trees is greatly improved with mechanical slackpulling carriages because the rigging slinger is able to reposition the carriage along the skyline while pulling in logs and avoid scarring the remaining trees. Most carriages used in skyline thinning today are designed to work with intermediate supports. Multispan skyline yarding (with intermediate supports), when needed due to terrain conditions, can provide additional benefits in cable thinning.

Instead of large yarders, there are now a wider range of small or mid-size mobile yarders that are well suited for working from roadside landings or small central landings. These yarders have either a swing boom for landing logs alongside it or a fixed boom. Non-guyline machines such as the "yoader"

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are advantageous in short yarding distance situations and when limited guyline anchors are available. Some yarders are designed for one person to operate while standing on the ground and completing other activities on the landing that were typically completed with at least two workers on larger yarders. Other roadside innovations to help speed up operations and lower costs include the use of radio-controlled chokers for faster unhooking of logs, pull-through delimbers or tree processing equipment for mechanical delimbing, and bucking trees at the landing.

Operational planning and field layout for cable thinning is crucial for success as evaluated by safety, productivity, economics and resource protection requirements. Harvesting layout is different for skyline thinning compared with cable clearcut operations. For instance, in skyline thinning, we typically plan for partial log suspension, and use tailtrees and/or intermediate supports to obtain needed skyline deflection. However, in clearcut operations, it is more common to use single-span skylines and stumps for anchoring skylines that are sometimes located outside of the harvesting unit to obtain the needed deflection.

Another major difference between cable thinning and clearcutting is the benefit of locating and flagging skyline corridor locations on the ground prior to felling in thinning operations. Skyline corridor layout is an art, where logging experience is beneficial and involves some relatively simple engineering design for flagging straight corridors and understanding the basic principles for tailtree and intermediate support layout. The felling pattern in cable thinning is important for reducing residual stand damage and involves either a herringbone pattern when felling short trees or a contour pattern in taller timber.

Skyline thinning production and cost varies with different operating conditions such as yarding distance, tree size and thinning intensity. In addition, a bigger cost factor in today's harvesting operation is the equipment mobilization cost for moving equipment in and out of operations around different seasonal restrictions such as those associated with wildlife habitat requirements and sap flow, as well as typical wet weather and fire precaution level restrictions.

Helicopter Thinning. While helicopter harvesting is typically more expensive than cable harvesting, helicopters provide advantages over other harvesting alternatives and they are suited to thinning with small to mid-size aircrafts…approximately 5,000 to 10,000 pound lift capacity at sea level. Similar to cable systems, there have been some new innovations with helicopter operations that have improved the economics and safety aspects for helicopter thinning. Just as in ground-based systems, bunching logs improves yarding productivity. Columbia Helicopters (via personal communication with Max Merlich) has had good success in reducing thinning costs where a CTL harvester could be used to process the trees into logs and bunch them into loads for the helicopter. Experiences to date have resulted in cost savings as much as approximately $100 per MBF over traditional chainsaw felling, delimbing and hand choking individual logs. CTL trails are laid out perpendicular to the slope before felling. Trees are felled conventionally with chainsaws and processed, scaled or weighed, and bunched with the CTL operation. A single-pass with the machine, combined with not having to maneuver to each tree in the stand and often working on top of slash, results in minimal soil disturbance. Safety in the felling, hooking and landing operations are also improved.

The cutting prescription for helicopter thinning is important from both a harvesting safety and economic perspective. Prescriptions that only target removing suppressed trees make it difficult to obtain the mills' preferred harvesting lengths. Light thinning treatments that result in nearly a full canopy closure make it difficult and dangerous to fall trees with chainsaws or maneuver in the stand with a CTL machine, as well as difficult to extract trees through the canopy. For example, Columbia Helicopters' experience with government thinning prescriptions are that a residual tree spacing of approximately 20-24 feet typically provides enough operating room for safety and lowers harvesting cost. Small openings in the stand for wildlife and structural diversity development will also make the helicopter thinning operation more economical.

Helicopter flying distance remains a critical factor affecting the harvesting cost. Downhill thinning is preferred over uphill. A landing with a good approach is better than a landing with a small opening in the stand that must be descended into nearly vertically. However, when flying processed logs in bundles, it is possible to fly directly to a roadside landing with enough space to unhook and deck the logs.

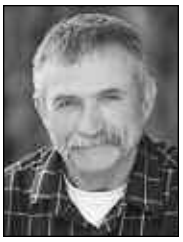
Will a thinning pay for itself?

The most important factor that determines net revenue for landowners is the log market. Log prices cycle widely; therefore, the number one factor is the timing of the operation in the longer-term log price cycle. Many industrial forest owners will not thin unless the market is high. Species is also important. Douglas-fir is generally more valuable than true firs, hemlock, spruce and ponderosa pine in almost all markets. Market values also vary by season. Mills do not like to build (and pay for) large log inventories. A late-winter log or an early-spring log delivery usually brings a premium. Logging system is the next largest variable, with ground-based being less expensive than cable and helicopter. Small tree size, low removal volume per acre, long distance to roadside, road construction and high round-trip truck haul can also be deal breakers. Most thinning operations are conducted from existing roads. Coupling thinning operations with other commercial operations on the same road system help spread road reconstruction and road maintenance costs. Similarly, larger units are more economical than smaller units due to move-in costs. ◆

Loren Kellogg is Lematta professor of Forest Engineering, John Sessions is Strachan chair of Forest Operations Management, and Jeffrey Wimer is manager of the Student Logging Crew, all with Oregon State University's College of Forestry Forest Engineering, Resources and Management Department in Corvallis. They can be reached, respectively, at loren.kellogg@oregonstate.edu, 541-737-2836; john.sessions@oregonstate.edu, 541-737-4952; and jeffrey.wimer@oregonstate.edu, 541-737-5044.

Port Blakely Tree Farms: Thinning for High-Quality Logs and Habitat Enhancement

BY DUANE EVANS



Port Blakely Tree Farms was established in the Pacific Northwest nearly 150 years ago. As a family-owned company we take a hands-on approach to managing our forestland, much like small nonindustrial landowners. Our management structure supports this hands-on approach: Our forestland in Washington and Oregon is divided into three tree farms, each managed by a district forester that is responsible for the overall management of the land and timber, including timber harvests and marketing. Each district forester is supported by other foresters with specialized areas of knowledge and skills. Since our foresters are managing specific areas that they come to know intimately, they manage the forest as if it were their own.

We believe this close connection to the land allows our foresters to make not only good economic decisions, but also better decision making when it comes to environmental and social issues. The creativity of our foresters, combined with the proactive attitude of management, has led the way in the creation of two conservation agreements with state and federal agencies: the Habitat Conservation Plan (HCP) on the Robert B. Eddy tree farm near Brooklyn, Wash., and the Safe Harbor Agreement, Landowner Option Plan and Creative Habitat Enhancement Agreement on the James G. Eddy tree farm near Morton, Wash. Both agreements are based on habitat development and enhancement through commercial thinning operations along with other negotiated prescriptions.

Port Blakely's management strategy allows for a longer-than-industry average rotation, which is helpful in habitat development. Timbered stands are considered qualified for regeneration-harvest based upon a number of conditions. Generally our stands reach these conditions at an average age of 60 years, with a range from 55 to 70 years of age at time of final harvest. Port Blakely utilizes several different silvicultural practices or regimes to ensure the proper growth and health of forest stands. The primary silvicultural management regime as the timber becomes merchantable includes mid-rotation management. This option is determined by steepness of slopes and the feasibility of using ground-based logging equipment along with favorable economic conditions. Through proper application, stand structure and wood quality can be increased over a shorter period of time.

PHOTO COURTESY OF STEVE SCHMITT

Ken Wilson, owner and operator of Ken's Kustom Kutting, operates his Rottne H-20 processor in a 28-year-old Douglas-fir plantation near McCleary, Wash.

Decisions to enhance stands begin when stand ages reach 10 years old and continue through age 50. Timber stands are continually monitored for stocking, relative density, health and mortality. Under this management regime, stands develop through various stages until they reach the quality and structure desired for final harvest. Timber quality is improved by creating stand conditions that promote radial growth while limiting the retention of green limbs. The target stand structure at age 60 has an average stocking of 130 trees per acre, although actual stocking will vary within stands as well

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as from site to site and may range between 120 and 150 trees per acre for individual stands. Stand conditions vary across the ownership due to changes in aspect, elevation, exposure to damaging agents and species composition. Some of these elements (e.g., disease) help create small-scale openings in the forest canopy and enhance structural diversity within stands, which is believed to promote biodiversity. Other openings are created during thinning operations as storm-damaged or weak and suppressed trees are removed. The desired stocking levels are generally achieved on "tractor ground" through commercial thinning. Commercially thinned stands will generally average about 18-19 inches in diameter at breast height (dbh) by the age of 60. Stem diameter also varies within and between stands with stand averages ranging from 16-21 inches dbh. Port Blakely also targets an average post-thinning relative density (RD) of 40, ranging from 35-45 for residual stand conditions.

At Port Blakely we use precommercial thinning (PCT) to reduce density, thereby increasing radial growth. We have found that stands that have been precommercially thinned can be entered earlier for commercial thinning as opposed to stands with no early thinning treatment. Candidate stands for enhancement are those that are located on slopes less than 35 percent, within the 10-12-year age class, and have stocking levels between 550 and 650 or more trees per acre. For slopes greater the 35 percent, the thinning is triggered when stocking is 450-550+ trees per acre. Trees of this age will generally be 3-5 inches dbh. After a precommercial thinning application, stands will have 300-325 residual trees per acre. This stocking allows for increased radial growth and short-term woody debris creation since the cut trees are not removed from the stand.

When stands reach ages between 30 and 40 years, they are reviewed for relative density, stocking, wood-quality characteristics and health. Stands of this age will typically average 10-14 inches dbh. On slopes less than 35 percent, stands with RDs greater than 55 and stocking greater than 285 trees per acre (TPA) will be selected for commercial thinning, provided favorable market conditions exist. During commercial thinning activities, spacing and vigor of trees determine which trees are retained and which are cut. Large, healthy, dominant and co-dominant trees are generally selected for retention as future crop trees. However, if they are too closely spaced to each other, some larger trees will be removed. Suppressed, intermediate and dead/dying trees are generally removed from the stand. Spacing may result in retention of some intermediate trees, and some defective trees are retained for future wildlife trees. Some smaller sub-merchantable trees, especially shade-tolerant species, will be retained to accelerate habitat conditions by contributing to the development of the understory. The target stocking of overstory trees for these stands is 185-225 trees per acres after the commercial thinning operation, but may vary within and between stands. Generally, commercial thinning will increase the average diameter of the residual stand.

During commercial thinning, extraction corridors (e.g., skid trails and cable-yarding corridors) create openings in the canopy allowing for improved solar penetration. Extraction corridors average 60 feet apart, although this spacing is dependent on topography. Corridor spacing may vary from 50-80 feet apart. Corridors are generally 12-18 feet wide to allow for equipment movement. Landings are also required to facilitate thinning activities. Landing placement varies from 400-800 feet apart; again this is dependent on topography and soil conditions. Landings generally range from 40-60 feet in diameter. Extraction corridors and landings have the effect of creating variable-density stocking throughout the thinned stand when combined with the skips and gaps from normal operations. Together, landings and corridors may occupy 8 to 15 percent of a thinned stand. Soil disturbance combined with the increased solar penetration encourages understory and groundcover development.

Although Port Blakely has used

many methods in the thinning process, including horses, most thinning operations utilize modern processing machinery capable of felling, delimbing and bucking trees into various lengths for shipment to markets. Significant amounts of coarse woody debris are created during commercial thinning activities. The actual amount of woody debris created varies and will depend on pulp prices and market conditions at the time. However, as a general rule of thumb (based on the criteria set forth above), the difference between our initial stocking of 285-350 TPA and our target residual stocking of 185-225 TPA are approximately 110 stems per acre. Thus, we estimate that the removal of approximately 110 stems per acre during commercial thinning will create at least 110 tops measuring from 2-4 inches in diameter and 8-16 feet in length per acre. This debris is in addition to any existing residual downed logs already available within the stand.

Extraction corridors and landings provide openings for understory development and adjacent trees tend to retain lower branches longer or develop epicormic branching. Areas between extraction corridors that are beyond the reach of equipment (greater than 30 feet) will have additional trees and will further add to canopy diversity. Areas surrounding trees and snags left for future wildlife trees may have additional trees strategically retained. Within many stands, rocky or wet locations will result in natural "holes" within stands that will also contribute to canopy and within-stand diversity. Larger areas that may fall within harvest units, such as unstable slopes, riparian areas and logistically unreachable lands, may develop into larger pockets of habitat that serve as foraging and roosting locations.

At Port Blakely we feel commercial thinning provides a quality product at final harvest. As a small industrial landowner we have carved a niche in the market place for our products. However, our management activities are required to demonstrate a profit. Every thinning opportunity goes through a cost/benefit analysis before we proceed.

What we've determined, through analysis, is the ratio between sawlogs to pulp is the key to profitability, which is highly dependent on market conditions. We calculate the expected pulp to sawlog ratio using our inventory and results of recent thinning activities in the local area within the same age class or stand conditions. We then factor in total logging costs, which include on board truck and haul costs. Currently, we do not consider haul route improvement by recognizing them as a capital investment to the tree farm infrastructure. That said, we rarely construct new roads to access thinning opportunities. Normally we are only upgrading or performing routine maintenance. In Washington, the Forest and Fish laws require road upgrades through the Road Maintenance and Abandonment Plan (RMAP), so we would be performing the work anyway.

Our math is relatively simple. Our basic formula is: [Harvested Sawlog Volume x ($ value/mbf – Logging cost/mbf)] + [Harvested Pulp Volume x ($ value/mbf – Logging cost/mbf)].

If this number is favorable, we thin to the specifications listed previously. We have a customized application to assist us in working through the economic analysis.

Port Blakely believes our marketing strategy supplies the demand in the global niche market for high quality logs. In order to produce these types of products and capture some mid-rotation revenue we need to thin; however, we need to thin smart. A thinning activity needs to cover the cost of the operation and it needs to stimulate the growth of quality timber for final harvest. Additionally, there is one more objective that has no real quantitative value: habitat development and enhancement. We believe our hands-on stewardship approach aligns with our operations, including thinning to result in multiple benefits for our business, as well as society and wildlife. ◆

Duane Evans is vice president, U.S. Forestry Operations, Port Blakely Tree Farms, L.P, in Tumwater, Wash. He can be reached at 360-596-9423 or devans@portblakely.com.

Thinning on Federal Lands in Oregon and Washington

BY NORM MICHAELS AND JEANNETTE GRIESE

Norm Michaels

Jeannette Griese

This article will explore the practices of thinning on federally managed stands in the Pacific Northwest, specifically the national forests managed by the USDA Forest Service and the public lands managed by the USDI Bureau of Land Management.

There are about 2.9 million acres on the national forests in Oregon and Washington, providing a very diverse landscape to manage. For any one stand, there are usually many objectives that drive the thinning prescription, including maintenance of tree vigor, diversity of stand structure, reduction of ground fuels and providing for small openings. Some stands are selected to be thinned with an objective to provide a more diverse habitat for animals, including leaving more hardwoods, leaving some small openings and varying the density within a stand. This approach provides a variety of habitats and tree species that will continue to offer diverse habitats. These treatments are designed to provide a number of values including wood products, a variety of habitats and increased resilience to fire.

From the 1950s into the 1990s, the national forests were harvesting on the westside of the Cascade Range primarily with clearcut or shelterwood systems. The prescription was for intensive management of these stands to provide wood products, were planted at densities that ranged from 400 to 700 trees per acre (TPA), and included the intention to thin the stands as they approached densities that would lead to inter-tree mortality with a philosophy of room to grow, but no room to spare. As a result of this management, the national forests now have a large number of plantations that need thinning.

The Forest Service has been and continues to precommercially thin these stands to a variety of densities designed to promote individual tree growth, as well as stand volume growth and a number of other objectives such as stand diversity and wildlife habitat. Maintenance of tree species diversity, including hardwoods, is a major objective in most stands. Precommercial thinning is accomplished through contracts that have successfully implemented the stocking and variability prescribed for the stand. This work is typically accomplished with a service contract that specifies the type and spacing of trees to remain, and relies on the contractor to select the trees to cut. Tree spacing is generally in the 12- to 14-foot range, but can be higher for some wildlife objectives. The national forests in Oregon and Washington precommercially thinned almost 182,000 acres in 2007 through 2009.

Commercial thinning of stands in the national forests of Oregon and Washington began in the 1970s as a result of a change in management philosophy. This was a time when clearcutting was being questioned, leading to the region trying commercial thinning treatments in fire-regenerated stands to evaluate the results. Most of these stands responded favorably, if not enthusiastically, with increased diameter growth. However, since clearcutting was more economically efficient, commercial thinning of fire-regenerated stands was not widely practiced.

As the young plantations age, they have become overstocked as the trees grow in size and become merchantable. Significant numbers of plantations started to reach merchantable size in the 1990s, and commercial thinning became a viable option for managing our forests. Most of the harvest, perhaps 95 percent, from national forests now comes from commercial thinning, as we stopped planning for regeneration harvests in the mid 1990s. Post-harvest densities are determined for each stand based on the values and opportunities provided in that stand. The prescriptions provide for maintaining a variety of tree species to enhance the value of habitat for animals and to provide a natural diversity of tree species.

Prescriptions for commercial thinning are incorporating climate change projections into the treatment of the stands. These predictions include ranges in precipitation from a reduction to an increase, as well as an

increase in temperatures. While we cannot accurately predict what the climate will be in the future, we do know that stands can be made more resilient to stress from drought and other extreme climate events by reducing the stocking and maintaining species diversity. The typical reentry interval is about 20 years, and densities are prescribed to maintain stands below the levels at which inter-tree competition would lead to mortality. Prescribed stocking levels are typically 25-40 percent of maximum stand density index (SDI), depending on the objectives for a particular stand.

In young uniform stands, trees are designated to remain after harvest by a process called "designation by description." With this process, we determine the number of trees per acre to leave, and then determine the designation distance that will give us that stocking level. This contract clause specifies that the largest tree will be left and all trees within a specified distance will be removed. The requirement that the largest tree be left ensures that the selection of the tree to remain can be determined after the trees are felled, making contract inspection relatively easy with reduced subjectivity.

Designation by description eliminates the need to mark individual trees, which reduces our costs significantly. This works well in a uniform stand, but it does limit thinning prescriptions to simply described criteria and reduces the flexibility in designating types of trees to leave or remove.

On the eastside of the Cascade Mountains, the plant communities led to a different management regime. With a different mix of species and a droughtier condition, the stocking densities are generally much lower in terms of trees per acre. The iconic ponderosa pine can support just one-fifth of the leaf area per acre that Douglas-fir can maintain and still remain healthy. Because of this, the eastside has traditionally relied much more on single tree selection than it has on evenaged management systems such as clearcutting. The issues on the eastside are familiar to many of us: the suppression of wildfires and a lack of young stand management have led to a situation where dense understories have developed. These understory trees have placed a competitive stress on the larger trees, which are more susceptible to successful attack by bark beetles. Much of the thinning on the eastside is focused on restoration, returning the stocking levels to pre-European densities to meet a number of objectives.

Stands with a large component of young trees are being precommercially thinned to reduce competition and to provide for increased growth on the remaining trees. Prescribed spacing is typically 16-18 feet due to the lower productivity of these sites and the presence of dryer site species such as ponderosa pine. Often these stands have merchantable trees present, which complicate the prescription process. This work is typically accomplished with a service contract that specifies the type and spacing of trees to remain, and relies on the contractor to select the trees to cut.

The difference between a commercial thinning and a single tree selection regeneration harvest is usually not clear in these stands. The thought process is similar for either objective: reducing density to maintain vigor, removing merchantable products and preparing the stand for the next entry. At typical stocking levels, natural regeneration will occur and needs to be planned for and addressed in the prescription. While the prescribed stocking levels as a percentage of max SDI are similar to the westside, the much lower max SDI for the eastside results in much lower numbers of trees per acre. Fire history and frequent fire regimes encourage lower stocking levels and more attention to ladder fuels when prescribing treatments since these will result in lower intensity fires and high survivorship of the trees.

On the eastside of the Cascades, trees are generally designated for either cutting or leaving by marking with tree paint. While marking to leave is generally a better method because it focuses the attention of the marker on the trees to remain, cut trees are often marked when it will result in fewer trees being marked.

(CONTINUED ON NEXT PAGE)

BLM Lands

The BLM's forested lands in western Oregon consist of approximately 2.2 million acres or just under nine percent of the federal lands. These BLM lands are governed by the Oregon and California (O&C) Lands Act and must also be managed in accordance with other environmental laws. Management on these forested lands is directed by the Northwest Forest Plan and District Resource Management Plans. These lands are managed to produce the desired stand conditions in order to meet the need for forest habitat (functioning forest ecosystems) and the need for sustainable forest products.

BLM silvicultural thinning practices include precommercial thinning, commercial thinning and density management to facilitate the growth of forest stands that will be available for future generations.

Precommercial thinning (PCT) treatments are preformed mostly in young evenaged stands to modify stand composition and to promote growth rates of desirable tree species to meet desired future stand structure objectives. Typical ages of PCT stands are 10-20 years old. Over the last five years, Western Oregon BLM completed precommercial thinning on approximately 55,000 acres.

The BLM maintains small-log thinning treatments that focus on slightly older (20-30 years old) dense single species stands at risk for elevated levels of competition mortality. These trees have value at the mill, but not at the stump due to harvest and transportation costs. If these stands can be thinned and the wood moved to market for less than the typical PCT cost, it is in the best interests of the government and O&C Counties to thin these stands to reduce the risk of loss and improve the vigor of these stands.

BLM generally uses the terms commercial thinning (CT) and density management (DM) to distinguish between land use allocation goals. For example, harvest in the General Forest Management Area is referred to as commercial thinning and harvest in the Connectivity Diversity Blocks, Riparian Reserves and Late-successional Reserves is designated as density management. Over the last five years Western Oregon BLM completed CT and DM on approximately 41,200 acres.

Intensity of treatment varies by land use allocation goals, with higher densities and more uniform spatial arrangements of retained trees being the target in the Matrix, and more variable density thinning that includes areas of low density in the Reserves.

Tree vigor and stand stability are improved through density reduction of both trees and other competing vegetation, which contributes to the maintenance of a wider range of future management options.

Commercial thinning is timber harvest that reduces stand density in stands as young as 30 years old and up to 120 years old (depending on the district) to maintain or increase individual tree vigor and/or increase total merchantable timber yield over the timber rotation by harvesting volume that would otherwise be lost due to mortality before the next planned harvest.

The principal focus of commercial thinning is on maintaining tree vigor and high volume production of the dominant stand component. Large remnant overstory trees or small understory trees may be present, but their development or maintenance is not the principal objective of the treatment.

Relative density guidelines are most commonly used to plan and implement thinning treatments and vary by land use allocation. Thinning prescriptions for land use allocations with timber production emphasis are generally thinned from below to maintain relative densities between 35 and 55 (Curtis RD). The number of thinnings in a rotation depends on stand structure and site productivity, which interact to determine the stand's capability of relative density recovery to a minimum of 55 RD at planned rotation ages.

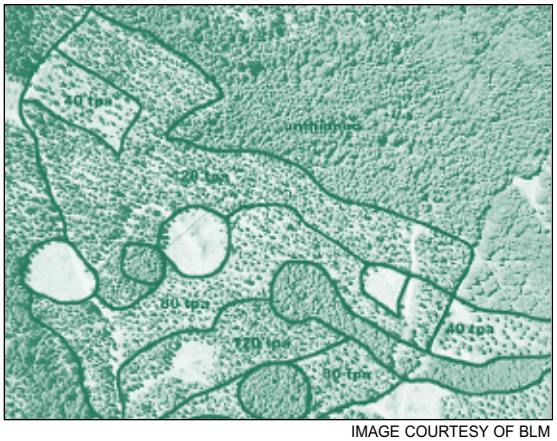

IMAGE COURTESY OF BLM

Figure 1. Variable-density thinning including low density areas and patch cuts to foster new tree regeneration and understory initiation.

Density management is timber harvest that reduces stand density in stands ranging from as young as 30 years up to 150 years old (depending on the district) to maintain or place stands on a developmental trajectory towards late-successional forest condition. This type of treatment is considered a hybrid treatment by combining elements of both commercial thinning and group selection regeneration harvest (see Figure 1).

Density management thinning prescriptions focus on the management of all stand cohorts and usually include variable spacing (i.e. variable-density thinning) such that the residual relative density varies considerably between treatment areas.

These diverse thinning practices on federally managed stands provide or maintain structures, species composition and growth rates that contribute to forest management goals. These practices vary considerable because of the broad variety of forest species and ecosystems in the Pacific Northwest, thus they contribute to a diverse landscape. ◆

Norm Michaels is forest silviculturist, Willamette National Forest, in Springfield, Ore. He can be reached at nmichaels@fs.fed.us or 541-225-6323. Jeannette Griese is forest development forester, BLM Oregon State Office, in Portland. She can be reached at jeannette_griese@blm.gov.

Calendar of Events

TimberValue Seminars, Oct. 12, Tualatin, OR. Contact: FEC Consulting, 503-612-9952, tjhanson@forestmgt.com.

1st Annual Pacific Northwest Reforestation Council, Oct. 21, Vancouver, WA. Contact: WFCA.

3rd Fire Behavior and Fuels Conference, Oct. 26-29, Spokane, WA. Contact: Anna Trott, 888-440-4293, info@lawfonline.org.

Cable Logging Workshop, Oct. 26-29, Corvallis, OR; Nov. 30-Dec. 3, Vancouver, B.C; Feb. 22-25, Corvallis, OR; March 28-31, Coeur d'Alene, ID. Contact: FEI.

SAF National Convention, Oct. 27-31, Albuquerque, NM. Contact: Society of American Foresters, 866-897-8720, www.safnet.org.

Carbon Credits, Nov. 5, Portland, OR. Contact: The Seminar Group, 800-574-4852, info@the seminargroup.net.

Basic Road Design Workshop, Nov. 15-18, Corvallis, OR; Jan. 25-28, Corvallis, OR; Feb. 8-11, Las Vegas, NV; April 18-21, Boise, ID. Contact: FEI.

Operational Management of Swiss Needle Cast in Douglas-fir, Nov. 17, Woodburn, OR. Contact: WFCA.

Washington Forest Protection Association annual meeting, Nov. 17, Olympia, WA. Contact: 360-352-1500, info@wfpa.org.

LoggerPC V4, Jan. 11-12, Corvallis, OR and March 15-16, Corvallis, OR. Contact: FEI.

2011 Oregon/Washington State SAF Leadership Conference, Jan. 21-22, Hood River Inn, OR. Contact: Shaun Harkins, 541-267-1855, shaun.harkins@plumcreek.com.

2011 OSAF/WSSAF joint annual meeting, May 11-13, Portland, OR. Contact: Bob Deal, general chair, 503-808-2105, rdeal@fs.fed.us.

Contact Information

FEI: Forest Engineering Inc., 620 SW 4th St., Corvallis, OR 97333, 541-754-7558, office@forestengineer.com, www.forestengineer.com.

WFCA: Western Forestry and Conservation Association, 4033 SW Canyon Rd., Portland, OR 97221, 503-226-4562, richard@westernforestry.org, www.westernforestry.org.

Send calendar items to the editor, *Western Forester*, 4033 SW Canyon Rd., Portland, OR 97221; fax 503-226-2515; rasor@safnwo.org.

Policy Scoreboard

Editor's Note: To keep SAF members informed of state society policy activities, Policy Scoreboard is a regular feature in the Western Forester. *The intent is to provide a brief explanation of the policy activity—you are encouraged to follow up with the listed contact person for detailed information.*

Position Statement Updates. An updated position statement on "Managing Riparian Forests" is expected to be adopted by the OSAF Executive Committee by the time you read this. The previous statement had expired in April—SAF position statements normally have a five-year lifespan, which helps keep their content timely and current. The revised riparian statement, for example, has a modified title and content that reflect its broader theme of active management for diverse resources and for reducing natural hazards such as wildfire. The OSAF Policy Committee has been working on an update of the statement on "Managing Mature and Old-growth Forests," which is set to expire on October 31. All OSAF position statements are available online at www.forestry.org and draft updates may be posted in the "members only" section. Contact: Paul Adams, OSAF Policy chair, 541-737-2946; paul.adams@oregonstate.edu.

Coos Chapter Speaks Up About Federal Forestry Proposal. In August, the Coos Chapter sent a letter of concern to Sen. Wyden and three other federal legislators about S. 2895, the "Oregon Eastside Forests Restoration, Old Growth Protection, and Jobs Act of 2009." Why did a westside SAF group comment on an eastside bill? Because Sen. Wyden had publicly stated that S. 2895 would serve as a model for a similar westside bill and the chapter was concerned about: a) its highly prescriptive directives (e.g., specific diameter limits); b) its lack of contribution to more clear and consistent national or regional policies for federal forests; and c) its omission of local socio-economic stability among its stated goals for forest management. The letter also strongly endorsed earlier testimony about the bill by Stephen Fitzgerald on behalf of SAF (see www.eforester.org/fp/documents/s_fitzgerald_testimony_3-10-10.pdf). Contact: Paul Adams, OSAF Policy chair, 541-737-2946; paul.adams@oregonstate.edu.

Collaborative Forest Landscape Restoration Program. A federal advisory committee has recommended 10 projects around the nation for funding to Secretary of Agriculture Tom Vilsack, who has asked for $40 million in total for these projects each year through 2019. One project is in northern Idaho on the Clearwater and Nez Perce national forests, another is in central Oregon. The Clearwater Basin Collaborative proposes to remove old logging roads, fight noxious weeds, and restore fish and wildlife habitat. Republican Sen. Mike Crapo of Idaho says the plan would create 300 good-paying jobs while improving the land and habitat in the region. The committee ranked the Deschutes Skyline Landscape Project first among the five submissions from Oregon and Washington. If selected, funds will be provided for forest restoration work on 100,000 acres between Bend and Black Butte Ranch. Forest debris from the project would be used for biomass energy. Contact: Jay O'Laughlin, IESAF Policy chair, 208-885-5776; jayo@uidaho.edu.

WSSAF Looking for Input and Engagement. About the same time as you read this you will receive a ballot to vote on the WSSAF biomass position paper that was recently approved by the executive committee. Using wood to generate power is receiving much debate both locally and nationally. Please give this careful attention. In last issue's Policy Scoreboard, the following topics were presented as potential position statements: conversion of working forests into Wilderness; recognizing the differing management goals of federal, state and private forestlands; defining the role of scientists in policy development; and defining the role of WSSAF at Forest Practices Board and Board of Natural Resources policy meetings. To date no comments have been received. Are you there? Do you care? If you want WSSAF to be relevant, YOU need to engage. Please send your thoughts to Harry Bell, WSSAF Policy chair, harry@greencrow.com. ◆

Resource Supply LLC Announces the Ashtech Mobile Mapper 100 GPS

Resource Supply LLC, the Pacific Northwest distributor for Ashtech GPS products, announces the Ashtech Mobile Mapper 100, the ultimate, next generation handheld GIS unit for real-time sub-meter, to centimeter accuracy in a handheld weighing only 22 ounces.

The MobileMapper 100 integrates an open operating system, built-in communications and Ashtech's powerful BLADE technology. BLADE allows the MobileMapper 100 to deliver the high accuracies desired by GIS professionals, even in extreme GNSS environments, including under dense canopies.

"The MobileMapper 100 tracks both the U.S. (GPS) and Russian (GLONASS) satellites. By tracking nearly twice as many satellites as GPS alone, the MobileMapper 100 provides excellent tracking and accuracy under dense tree canopy," said Resource Supply LLC President Jon Aschenbach. "We've conducted initial testing on the U.S. Forest Service Clackamas GPS test course with the MobileMapper 100 and the results were better than anything I've seen in 20 years."

The MobileMapper 100 includes a built-in GSM modem, Bluetooth, USB and RS232 ports and multimedia features like Internet access, E-compass, G-Sensor and a 3M-pixel camera. Combined with either Ashtech's MobileMapper Field software or ESRI's new ArcPad Ver. 10, the MobileMapper 100 offers the openness, flexibility and scalability needed to answer any mobile GIS application requirement in forestry operations.

For additional information, contact Jon Aschenbach at 503-707-6236 or jon@resourcesupplyllc.com. ◆

Green River Students are Tops in the Nation

The Green River Community College Student Chapter has been named the SAF Student Chapter of the Year. The chapter, which is very active in Washington State, placed first in the competition against universities such as Northern Arizona, Penn State and Mississippi State, and Canadian schools, for the honor.

Categories for competition included membership, service to members, service to SAF, service to the forestry school, involvement with other natural resource organizations, service to the community, outside recognition, and chapter management.

Student representatives, led by Chapter Chair Drew Paganucci, and advisors Rob Sjogren and Dick Hopkins will attend the national convention in Albuquerque to receive the award. Student Tess Pinkney, who authored the award nomination, will be presenting a poster in the science symposium on working with laminated root rot; she is also the Quiz Bowl captain for the chapter.

In addition, Dick Hopkins was asked to present a talk on "Student Chapter Management" to students, advisors and young professionals. Dick will also be recognized as being named an SAF fellow.

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