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Forest Density Management

Recent History and Trends for the Pacific Northwest Region

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COVER ILLUSTRATION

This photograph shows the Mud Creek Summit thinning and fuel break project, Entiat Ranger District, Wenatchee National Forest. It was taken in 1998, four years after the Tyee wildfire burned through the area. The wildfire burned upslope as a crown fire of lethal severity. When it reached the Mud Creek Summit thinning and fuel break, the fire dropped to the ground and became a non-lethal surface fire. Most of the thinned trees have now recovered from the 1994 wildfire. [Photograph from: "Strategy for management of dry forest vegetation, Okanogan and Wenatchee National Forests" www.fs.fed.us/r6/wenatchee/news/newsmain.htm]

CITATION

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KEY FINDINGS

Following severe fire seasons in 2000 and 2001, thinning and other forest density management (FDM) treatments are being considered for millions of acres with overly dense forests because these areas are vulnerable to destructive crown fire. This white paper describes the FDM program of the Pacific Northwest Region of the U.S. Forest Service. It reviews the program's recent history and explains how thinning can be used to reduce fire susceptibility and to accomplish a variety of other land management objectives. Some key findings are:

- The need for timber stand improvement work (thinning, release, fertilization, and pruning) was estimated as 626,085 acres in fiscal year 2000—87% higher than 12 years before (FY1988).
- Timber stand improvement (TSI) attainment was 56,913 acres in fiscal year 2000—60% lower than 12 years before (FY1988).
- The trend for TSI funding has been downward over the last 12 years.
- The trend for TSI unit cost (treatment cost, in dollars per acre) has been upward over the last 12 years. Unit cost increased substantially during the last 2 fiscal years.
- The need for forest density management work (thinning and release) was 423,646 acres in fiscal year 2000—61% higher than 12 years before (FY1988).
- Forest density management attainment was 50,670 acres in fiscal year 2000—55% lower than 12 years before (FY1988).
- The net result of these trends is that a backlog of FDM work accumulated on Pacific Northwest national forests. Projections indicate that if recent trends continue, the FDM backlog will increase by at least 50,000 acres (13%) between fiscal years 2000 and 2005.
- One implication of these trends is that not enough acres are receiving a forest density management treatment to have a noticeable impact on fire risk at a landscape scale.
- A recent, decade-long spate of conflagration wildfire in the interior Pacific Northwest removed FDM need whenever fire destroyed dense forest. However, reducing need in this way does not meet society's expectations for healthy ecosystems (biodiversity, late-successional ecosystems, aquatic and terrestrial habitat, etc.).
- Thinning offers advantages as an FDM treatment because it affords control over forest composition and structure, it is not constrained to unpredictable weather windows, it does not result in air pollution or escaping fire, and it may be economically self-sustaining.
- Analysis indicates that data stored in the TRACS-SILVA database may significantly underestimate FDM need, suggesting that on-the-ground need for thinning and release may be much greater than reported in this white paper.

The trends examined in this white paper do not bode well for the future. If recent historical trends continue, not enough thinning and release will occur on national forests of the Pacific Northwest to reduce wildfire risk, eliminate fuel ladders, ameliorate insect and disease hazard, and meet societal objectives regarding forest health and ecosystem integrity.

INTRODUCTION

"We are not allowed to thin the forest, but we are called upon to fight the flames," said Bruce Vincent, president of Alliance for America, when commenting on the uncharacteristic severity of the 2000 wildfire season in western Montana. The 2000 wildfires came at a time of increasing debate about forest management policies. And although destructive, the fires need to be understood as a product of both the region's ecology and the disruption of native wildfire cycles.[1]

One result of the 2000 and 2001 wildfire seasons is that forest density management is being considered for millions of acres with overly dense forests because these areas are vulnerable to destructive crown fire. Forest density management is defined as the manipulation and control of tree density to achieve one or more resource objectives.[2] This white paper describes recent forest density management trends for the Pacific Northwest Region of the U.S. Forest Service.

Traditionally, forest density management was referred to as timber stand improvement. We use the term 'forest density management' for two reasons—the judicious control of tree density is much more than just a timber issue, and timber stand improvement includes two silvicultural activities (fertilization and pruning) that are not directly related to density management.

In the context of this white paper, forest density management refers to thinning and similar active restoration treatments that can be used to address a variety of ecosystem goals:

- Reduce fire risk and improve forest health;[3]
- Develop or protect vertical and horizontal forest structure;
- Encourage undergrowth vegetation and wildlife forage;
- Develop shade and large wood for aquatic habitat;
- Develop large trees, snags and down wood for terrestrial habitat;
- Promote patch- and landscape-level diversity;
- Improve water yield and hydrologic function;
- Promote late-successional characteristics and biological diversity.

BACKGROUND

The last seventy to one hundred years saw a period of rapid ecological change for literally millions of forested acres in the western United States.[4] Some of that change was related to normal growth and maturation (for example, plant succession), but much of it resulted from abnormally high levels of insects and diseases and a proliferation of stand-replacing wildfires. Many of the wildfires occurred in areas where previous damage from insect or disease outbreaks contributed to uncharacteristically high fuel accumulations.[5]

WILDFIRE RISK. The Forest Service has stewardship responsibilities for about 9 percent of the land in the United States. Of the 192 million acres under its administration, about 56 million are considered to be at high risk of catastrophic fire—primarily due to over-crowded trees and deteriorated forest health.[6] As Russ Gorte of the Congressional Research Service commented, it is widely believed that "the extent and severity of the fires [of 1994] was largely due to the poor health of the national forests of the West."[7]

When the U.S. General Accounting Office recently evaluated catastrophic wildfire risk in the western United States, its report concluded that "the most extensive and serious problem related to the health of national forests in the interior West is the over-accumulation of vegetation." GAO estimated that about 39 million acres of national forests in the West have high fire risk due to excessive fuel buildup; they estimated that $12 billion would be needed between 1995 and 2015 to reduce excess fuel accumulations, an average expenditure of $725 million annually.[8]

Of the 47 million acres of federal land in the Pacific Northwest, approximately 47 percent (22.6 million acres) were historically affected by short interval fire (these are dry sites once dominated by ponderosa pine, shrubs, or bunchgrasses). The majority of these lands are located east of the Cascade Mountains in Washington and Oregon. Of the acres with a short interval fire regime, 71 percent (16 million acres) currently possess a higher fire risk than would have existed historically (figure 1).[9] The primary reasons for heightened fire risk are related to a long period of fire suppression.

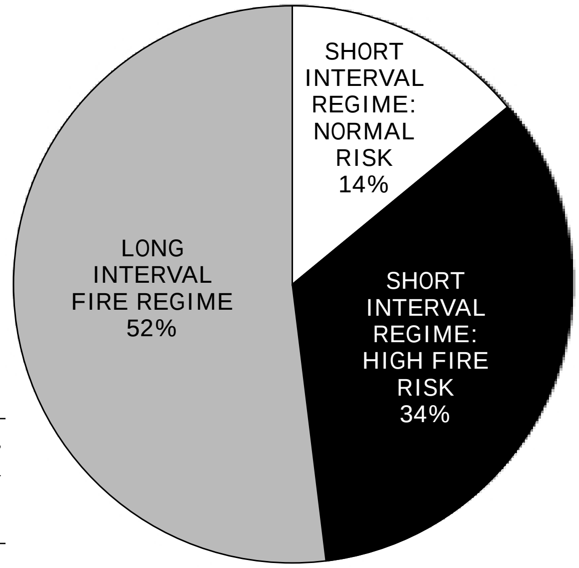


Figure 1*—At least 34% of federal land in the Pacific Northwest currently has a fire risk that is higher than normal (see note 9).*

EFFECTS OF FIRE SUPPRESSION. Prior to Euro-American settlement, many western forests had a resilient composition and structure that posed little or no risk of conflagration fire.[10] The ecological integrity of these forests was sustained by a fully functioning disturbance regime. Fire was often the most important component of the disturbance regime, particularly for dry sites.[11] Following Euro-American settlement, fires were suppressed and the disturbance regime was altered in other ways. One result of an altered disturbance regime is the recent proliferation of insect outbreaks and wildfire; both currently occur at levels that apparently exceed the historical precedent.[12]

After a disturbance regime has been altered, changes occur in ecosystem components that are influenced by the regime. An example is provided by a recent U.S. Fish and Wildlife Service analysis of 146 threatened, endangered, or rare plant species for which fire effects information was available. They found that 135 of these plants (92%) either benefit from fire or are found in fire-adapted ecosystems, suggesting that fire suppression may have contributed to a decline in their abundance or persistence.[13]

In eastern Oregon and Washington, the presettlement fire regime created a stable old-growth type referred to as ‘parklike’ pine forest. These ecosystems featured big, widely spaced ponderosa pines above a dense undergrowth of herbs.[14] This system owed its stability to frequent visits by relatively benign wildfire (figure 2).[15]

Following at least 75 years of fire suppression in the West, we now have millions of acres where the fire-resistant ponderosa pines are surrounded by younger trees that grew to 40, 50 or even 75 feet tall, but only because they escaped fire when just three or four feet high. If man had not altered the disturbance regime, these younger trees would have perished during low-intensity wildfires.[16]

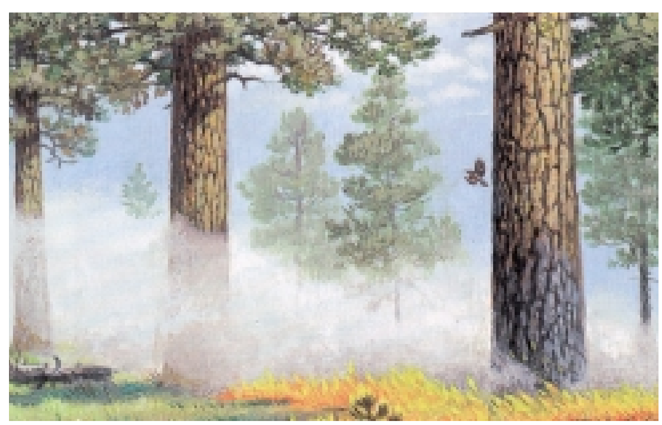


Figure 2*—Low intensity surface fire in ponderosa pine.*

WILL PARKLIKE PONDEROSA PINE BECOME EXTINCT? As a result of substantial reductions in parklike ponderosa pine forests throughout the western United States, they were recently designated a 'threatened ecosystem' of the United States. As Reed Noss and others noted in their report: "conifer forests that depend on frequent fire, notably longleaf pine in the southeast and ponderosa pine in the west, have declined not only from logging but also from increases in tree density and from invasion by fire-sensitive species after fire suppression. These kinds of changes can cause the loss of a distinct ecosystem as surely as if the forest were clear-cut."[17]

Although it is not expected that parklike pine forest can be fully restored to its historical abundance, it is widely recognized that thinning, or a combination of thinning and prescribed fire, is needed to help recover the ecological integrity of this important ecosystem.[18] However, fire can be highly stressful to old-growth ponderosa pines, particularly on sites where existing tree density is many times greater than presettlement stocking levels. In these crowded forests containing low-vigor trees, it may be wise to thin first and allow the old-growth pines to recover or release before subjecting them to the additional stress of a prescribed fire.[19]

There are three possible outcomes for the 'over-accumulation of vegetation' resulting from fire suppression (figure 3[20]): (1) in some situations, it can be removed using prescribed fire; (2) in others, it can be cut or removed by thinning; or (3) it can be left to burn in unplanned and uncontrollable wildfires like those experienced over the last twenty years.[21] In the near term, thinning or stewardship harvest might have to serve as a modern substitute for the historic workings of low-intensity fire.[22]

ACTIVE RESTORATION TREATMENTS. Thinning, pruning, release, stewardship harvest, and prescribed fire are active restoration techniques that can address the 'vegetation accumulation' issue. They could be used independently or in combination. Often, land management objectives are best accomplished when several techniques are used in tandem.[23] For example, recent watershed assessments found that in many instances, fuels have accumulated to a degree where prescribed fire cannot be applied safely unless preceded by a mechanical treatment.[24]

Some critics of active management view thinning or any other incarnation of 'logging' as less natural (and therefore less desirable) than prescribed burning. Their expectation is that prescribed burning should serve as the primary tool to remove excess fuel, preferring to see a forest burn rather than receive protection from a chain saw.[25] The main problem with this expectation is its incompatibility with ecosystem changes wrought by fire suppression over the last 75 years.[26]

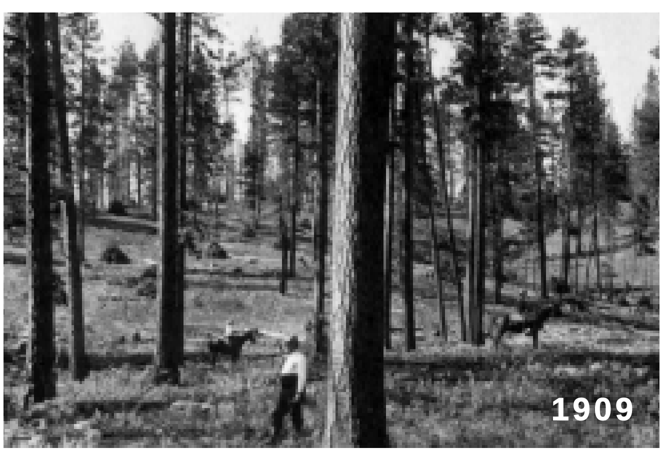


Figure 3*—Eighty years of accumulating tree density caused mainly by fire suppression (see note 20).*

Apparently simple and straightforward terms such as 'thinning' often mean different things to different people. Some people believe that thinning is logging, and logging means timber sales, and since timber sales are responsible for many of our existing problems, then any increase in thinning would only make things worse.[27]

What would happen if prescribed fire, rather than thinning, was applied to our contemporary forests? In general, the outcome would be undesirable whenever a cohort of post-fire-suppression trees is present. This post-suppression cohort serves as 'ladder' fuel, allowing a low-intensity surface fire to climb into the upper canopy and kill the trees, including fire-resistant species.[28] Fire was nature's most common way to reduce excess vegetation, but we can't pretend we're dealing with a 'natural' situation now.

Fire suppression alone did not create our current problem, and fire's reinstatement will not cure it. Fire is an ecological catalyst that takes its character from whatever surrounds it. Ecosystems that are ecologically 'out of whack' will yield fires that are out of whack. To successfully reinstate fire, we first need to craft suitable habitat for desirable fire regimes. We'll have to weed the woods (thin) but it's not just the trees that matter, it's also the grass. Without grazing management, it may not be possible to fully restore a short interval fire regime on dry sites.[29]

MECHANICAL FUEL TREATMENTS. When comparing active restoration alternatives, mechanical thinning offers several advantages. It provides the most control over species composition, vertical structure, tree density, and spatial pattern for the residual forest; it is not constrained to short, unpredictable weather windows like prescribed fire; and it may produce economically valuable products that could help recover the cost of restoration treatments. However, much of the byproduct from fuel-reduction thinnings will be too small or too poor in quality to be merchantable, at least from the perspective of conventional wood products.[30]

Many thinnings on national forests of the Pacific Northwest are 'noncommercial' because the cut trees are too small to be merchantable by conventional standards. These thinnings are typically accomplished using service contracts where a contractor is paid to cut the unwanted trees and leave them on-site. Several efforts are underway around the western United States to develop processing methods and markets for ever-smaller material. If these efforts succeed, then future thinnings may eventually become 'commercial' by producing biomass material for energy technologies such as ethanol production from cellulose or electricity generation.[31]

In the early 1990s, Bob Mutch and other fire scientists recommended that prescribed fire use be increased tenfold for national forests in eastern Oregon.[32] This recommendation raised immediate concerns about the potential impacts of such a proposal on forest productivity, wildlife habitat, and biodiversity. One response to their recommendation was that mechanical fuel treatment might be preferable to a dramatic increase in prescribed fire because it offers more control than fire, and more control translates into better protection for dead trees (down logs and snags).[33]

When considering fuel treatment options, mechanical methods might be more expensive than prescribed fire in the short term but are probably more economical over the long run, especially if wildlife habitat (snags and down logs) must be mitigated or replaced after burning.[34] Due to smoke concerns and other factors, local residents may prefer mechanical treatments instead of prescribed fire—in a recent survey of attitudes about fuel buildup and what should be done in response to it, 76% of Blue Mountain residents preferred mechanical thinning, 16% preferred prescribed fire, and 8% opted for doing nothing.[35]

WHY DO WE THIN? To be healthy, trees need a place in the sun and some soil to call their own. When crowded by too many neighbors, trees may not have enough soil and sun to maintain their vigor. Trees die after their vigor level drops so low that they can no longer heal injuries, resist attack by insects and diseases, or otherwise sustain life.[36]

Once a forest stand occupies all of its growing space, trees compete with each other for sunlight, water and nutrients. As competition causes some trees to die, the survivors immediately claim the growing space relinquished by their dead neighbors. In nature, this process results in relatively few large trees eventually occupying the growing space that once supported many small trees.[37]

Managers can emulate this natural competition process by intentionally reducing the number of trees on a site, a treatment called thinning. Thinning has been used to describe practices ranging from light removal of small understory trees to moderate removal of large overstory trees. In this paper, any reference to thinning is assumed to be 'understory thinning,' 'thinning from below' or 'low thinning,' all of which refer to cutting or removal of understory trees only.[38]

Natural processes and their silvicultural analogues can be grouped into two distinctly different categories: releasing disturbances such as wind or insect outbreaks that kill from the 'top down,' and maintenance disturbances such as low-intensity fire that kill from the 'bottom up.'[39] Thinning emulates natural processes that kill trees from the bottom up. Therefore, thinning supports this central axiom of ecological forestry: any manipulation of a forest ecosystem should mimic the native disturbance processes of a region, as they existed prior to extensive human alteration.[40]

Thinning makes more sunlight, water and nutrients available for the remaining trees, which quickly improves their physiological condition and vigor. High-vigor trees produce more resin and defensive chemicals than low-vigor trees, allowing them to better repel insect and disease attacks.[41] For that reason, thinning is emphasized in Governor Kitzhaber's recent strategy for restoring eastern Oregon forests: "Understory thinning of green trees to restore forests to a healthy condition more representative of historic conditions is an important component of active management for forest health."[42]

Much of the enjoyment that people receive from being in a healthy forest comes from what they see and how it makes them feel.[43] People often think of forests as tranquil places that never change. But forests do change, although change in old forests occurs so slowly that it has been referred to as the 'invisible present.'[44]

THINNING AS ECOLOGICAL LEVERAGE. Unlike old forests, young forests change rapidly.[45] Silvicultural intervention can influence the speed and direction of that change to accelerate development of desired forest structure, reduce fire risk and, at the same time, produce some of the utilitar-ian goods and services desired by society.[46] This fact illustrates that silviculture is little more than application of ecological leverage. Thinning, a purposeful application of ecological leverage, is designed to achieve a wide variety of land management objectives.[47]

During the 1970s and 1980s, regeneration cutting contributed to establishment of dense conifer forests. Recent research suggests that thinning and other restoration techniques may be needed to accelerate development of late-successional characteristics in these young forests. Today, a mosaic of young forest patches with heightened fire and insect hazard surrounds many old-forest remnants. In these situations, forest density management would not only speed up development of large-diameter trees, but could also help protect remnant old-forest patches from stand-replacing wildfire and insect or disease outbreaks.[48]

Using burlap to beat out a surface fire in ponderosa pine forest, Wallowa National Forest, about 1910. As Thornton Munger noted in 1917, "Light, slowly spreading fires that form a blaze not more than 2 or 3 feet high and that burn chiefly the dry grass, needles, and underbrush start freely in yellow pine forests. Practically every acre of virgin yellow pine timberland in central and eastern Oregon has been run over by fire during the lifetime of the present forest."[49]

Dense ponderosa pine forests developed after the influence of fire was suppressed on dry sites during the past 100 years. On many dry sites, fire suppression had the unintended consequence of allowing late-seral tree species (grand fir, white fir, and Douglas-fir), none of which are adapted to a recurrent fire regime, to replace the ponderosa pines.[50]

Thinning and prescribed fire treatments can be used in tandem to restore sustainable and resilient forests on dry sites. Changing a dense forest condition (middle frame) to one that more closely approximates the historical (presettlement) composition and structure will go a long way toward helping us restore the native disturbance regime—short interval fire—on dry sites.[51]

THE TIMBER STAND IMPROVEMENT PROGRAM

In the Pacific Northwest Region of the Forest Service, forest density management occurs primarily within the context of the larger timber stand improvement (TSI) program. Timber stand improvement includes four silvicultural activities: precommercial (noncommercial) thinning, release, pruning, and fertilization.

TSI NEEDS AND ATTAINMENT. Figure 4 summarizes timber stand improvement needs for fiscal year 2000.[52] It provides an estimate of how much TSI work needs to be done, expressed both in acres and as a percentage. It also shows that TSI need was not distributed equally among the four activities—thinning comprised 60 percent of total need, followed by fertilization, pruning, and release in that order. Total TSI need in fiscal year 2000 was 626,085 acres. When compared with fiscal year 1988, acres of TSI need increased by 87 percent over a 12-year period.

Figure 5 summarizes timber stand improvement attainment for fiscal year 2000. It shows how much of each TSI activity actually got done, expressed as a percentage. It also shows that attainment is like need in that it was not distributed equally among the four activities—thinning comprised the overwhelming majority of TSI attainment (80%), followed by release, pruning, and fertilization in that order.

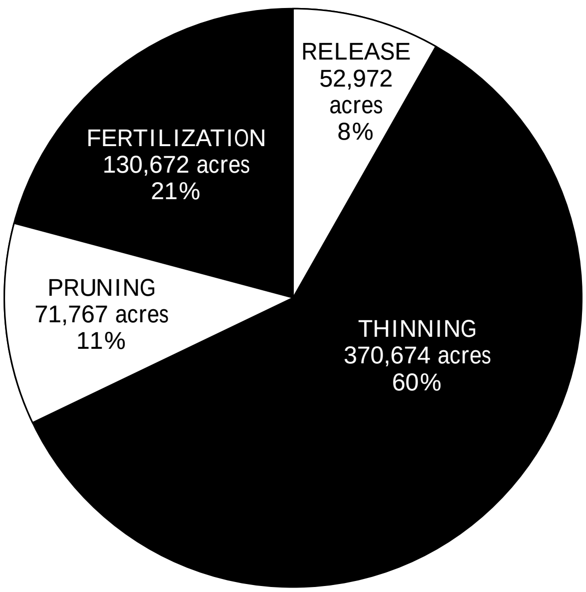


Figure 4*—Timber stand improvement (TSI) needs for fiscal year 2000. This figure provides an estimate of how much TSI work needs to be done. Total TSI need for the Pacific Northwest Region was 626,085 acres in FY2000, 87% greater than twelve years before (fiscal year 1988).*

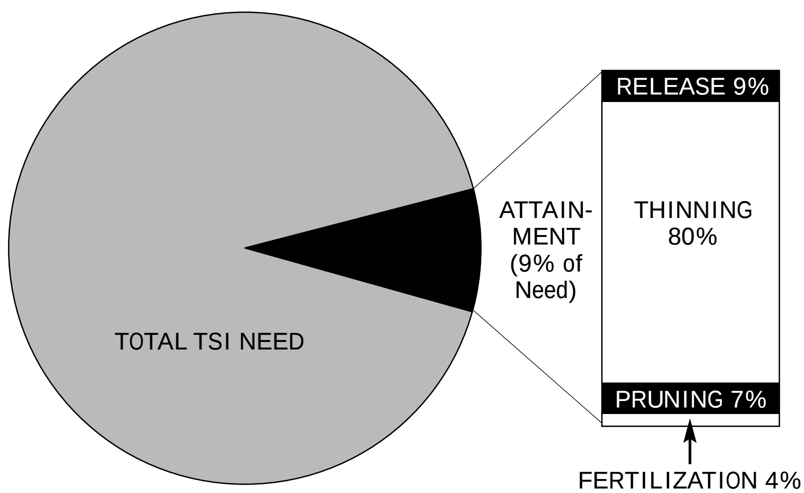
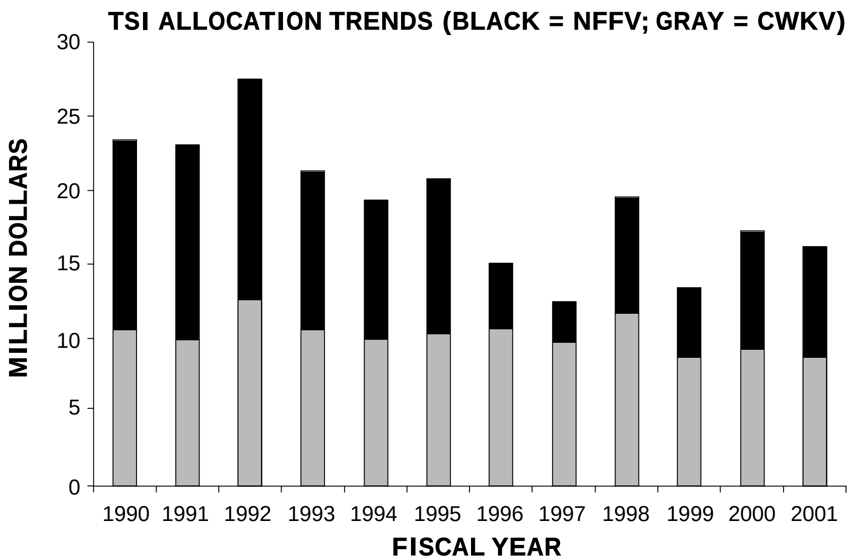


Figure 5*—Timber stand improvement (TSI) attainment for fiscal year 2000. This figure shows how much TSI actually got done, expressed as a percentage. Total TSI attainment was 56,913 acres in FY2000, 60% lower than twelve years before (FY1988).*

During fiscal year 2000, national forests in the Pacific Northwest Region accomplished 56,913 acres of TSI (thinning, release, pruning, fertilization). This acreage was only 9 percent of the area reported as needing a TSI treatment at the start of fiscal year 2000 (figure 5). FY2000 attainment was much lower than 12 years before when 142,752 acres were treated. FY1988 attainment represented 43 percent of the TSI need existing at the start of that fiscal year.

TSI FINANCIAL TRENDS. Perhaps no factor has more influence on TSI attainment than the Forest Service's budget because it controls whether sufficient financial resources are available for thinning and other TSI treatments. Figure 6 summarizes recent trends for TSI allocations (e.g., how many dollars were allocated during the budget process for TSI treatments).

Figure 6 shows that the TSI allocation trend over the last 12 fiscal years has generally been downward. It also shows that until very recently (the last three fiscal years), the trust fund portion of the allocation (Knutson-Vandenberg or CWKV funds) has been relatively stable. K-V trust funds are derived from timber sale collections. For national forest lands in eastern Oregon and eastern Washington, timber harvest levels (and associated trust fund collections) declined by more than 70 percent since 1990.[53] This means that K-V funding for TSI work may be sharply curtailed or not available at all, at least for the foreseeable future.



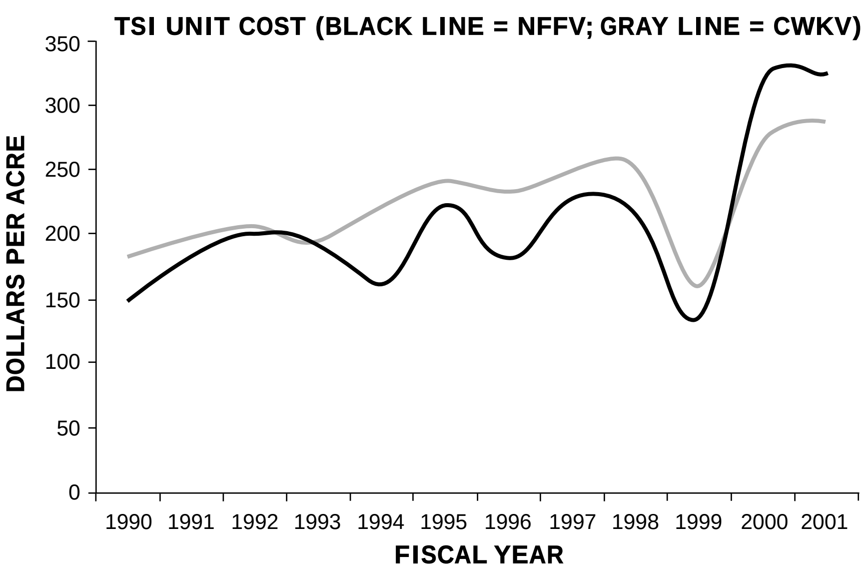


Figure 6*—Timber stand improvement (TSI) allocation trends (top half) and unit cost (bottom half) for the Pacific Northwest Region. The top half shows that the TSI allocation trend for the past 12 fiscal years was generally downward, and that trust-fund allocations (CWKV) were relatively stable until three years ago when they began to decline. The bottom half shows that TSI unit cost (dollars per acre needed to complete a TSI treatment) increased steadily over the 12-year timeframe, with one notable exception—1999. Unit cost increased substantially in the last two fiscal years. Until recently, Knutson-Vandenberg (CWKV) unit cost was higher than appropriated (NFFV) unit cost. It is likely that CWKV unit cost is now lower because of Congressional direction limiting the proportion of CWKV funds that can be used for indirect (overhead) costs.*

Figure 6 also provides a TSI unit-cost trend for both the appropriated (NFFV) and Knutson-Vandenberg (CWKV) fund sources. Unit cost refers to the number of dollars, per acre, that were required to complete a TSI treatment. Figure 6 shows that in general, the trend for unit cost has been upward over the last 12 fiscal years, with substantial increases occurring in the last 2 fiscal years. Knutson-Vandenberg (K-V) unit cost (CWKV) was higher than appropriated unit cost (NFFV) until very recently. It is believed that the recent drop in K-V unit cost is primarily related to Congressional direction limiting the proportion of trust funds that can be used for indirect (overhead) costs.[54]

What are some reasons for an increase in TSI unit cost? Although a wide variety of factors contribute to that trend, several are particularly noteworthy.

1. Almost all TSI work is now affected by consultation and other requirements associated with the Endangered Species Act (ESA). Biological evaluations, assessments, opinions and other ESA requirements affect unit cost whenever TSI funds are used to pay for them, resulting in less money being available for on-the-ground treatments.
2. TSI unit cost is affected by National Environmental Policy Act (NEPA) standards. Although environmental analysis requirements have been around for over 30 years now, NEPA standards recently rose to a higher level, causing more TSI funding to be used for analysis and documentation than occurred in the past.
3. Travel management restrictions may limit access to TSI treatment units. For example, road and trail closures often require a long 'walk in' by project crews carrying heavy thinning equipment (chain saws, etc.). Access limitations result in higher bid rates on silvicultural contracts, thereby increasing TSI unit cost.
4. Inflation also has an influence on TSI unit cost. Forest Service costs have increased about 40% over the last 10 years. Contract costs also rose during that time period, although not quite as much as Forest Service costs.

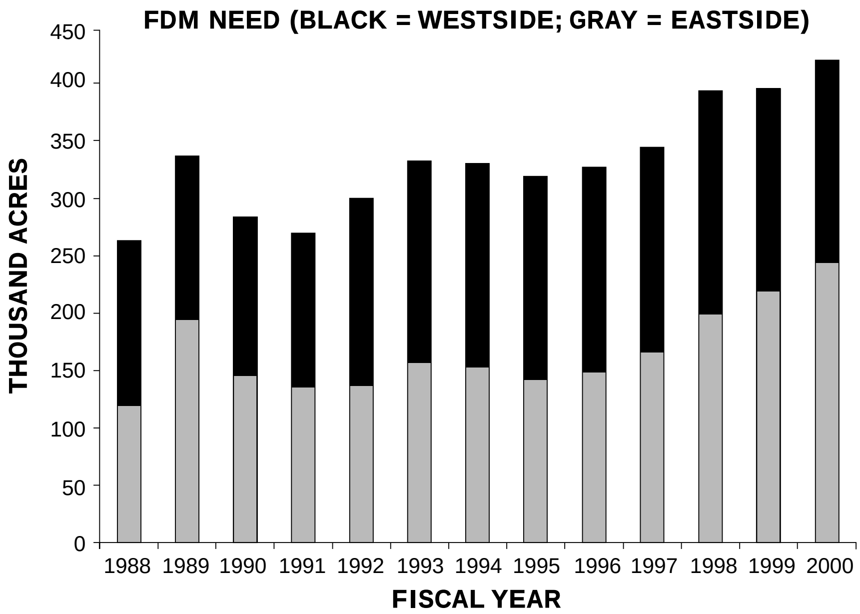
THE FOREST DENSITY MANAGEMENT PROGRAM

As described in the introduction, the main objective of this white paper is to describe recent history and trends of forest density management (FDM) for the Pacific Northwest Region. *For the purposes of this white paper, forest density management is defined as the combination of two timber stand improvement activities—thinning and release*. Therefore, all discussion from this point on excludes any consideration of the fertilization and pruning components of timber stand improvement.

FDM NEEDS AND ATTAINMENT. Figure 7 summarizes the recent history of forest density management need. It provides a 13-year trend for thinning and release need in the Pacific Northwest Region. FDM need has generally been evenly balanced between eastside and westside national forests,[55] although eastside need grew more quickly than westside need over the last three fiscal years. Figure 7 demonstrates that FDM need increased substantially during the 13-year time span—FY2000 need was 61 percent greater than in FY1988.

Figure 7 summarizes the recent history of forest density management attainment. It provides a 13-year trend for how much thinning and release actually got done in the Pacific Northwest Region. More FDM attainment occurred on eastside national forests than on westside forests. Figure 7 also shows that FDM attainment has been steadily declining through time—FY2000 attainment (thinning and release) was only 45 percent of the FY1988 amount.

Figure 8 summarizes the recent history of FDM need and attainment. It clearly shows steadily increasing need during the last 13 fiscal years, whereas attainment trended downward for the same time period. FDM need has obviously been growing faster than attainment (treatments). The projections displayed in figure 8 indicate that if recent trends continue, FDM need will increase by at least 30,000 acres between fiscal years 2000 and 2005 and that attainment will drop by at least 20,000 acres during that same period. This means that FDM backlog would increase by at least 50,000 acres (13%) between FY2000 and FY2005.



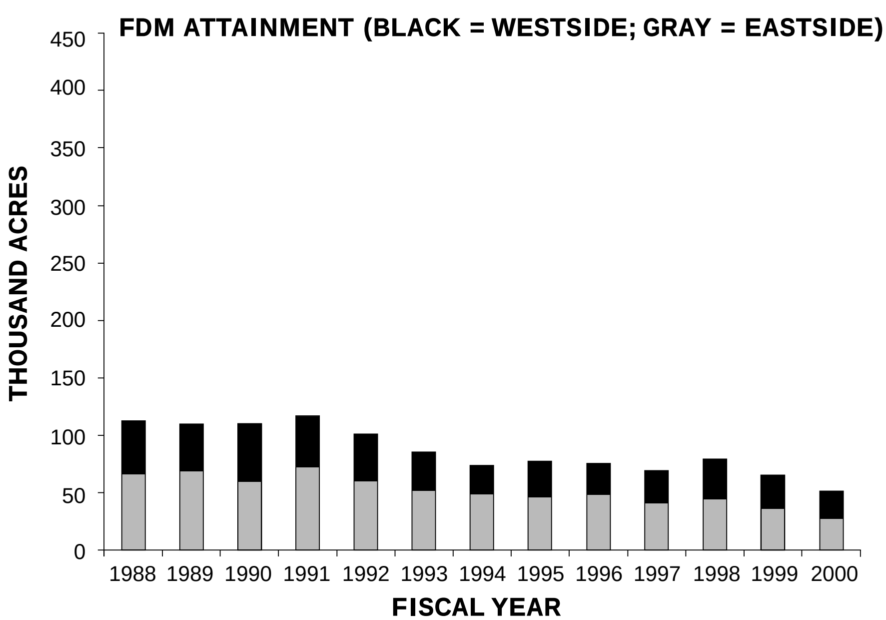


Figure 7*—Forest density management (FDM) need (top half) and attainment (bottom half) for the Pacific Northwest Region. This figure shows that until recently, FDM need and attainment have been evenly balanced between eastside and westside national forests. For fiscal year 2000, total FDM need was 423,646 acres and total FDM attainment was 50,670 acres, which means that only 12% of need was removed by completing an FDM treatment. This figure shows that FDM need increased by 61% between fiscal years 1988 and 2000, whereas FDM attainment declined by 55% for the same period.*

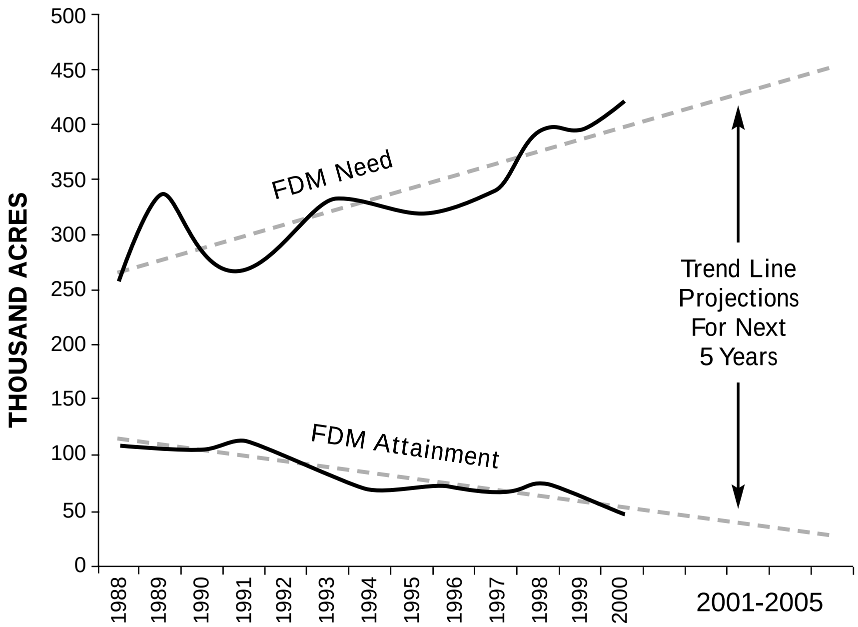


Figure 8*—Forest density management (FDM) need and attainment for the Pacific Northwest Region. This figure was based on the same information in figure 7, but does not differentiate between eastside and westside national forests. It clearly shows steadily increasing FDM need during the last 13 fiscal years, whereas attainment trended downward for the same period. Obviously, new FDM need is being added faster than existing need is being removed. The net result of these trends is a rapidly growing backlog of FDM need. Trend line projections indicate that if recent trends continue, FDM backlog will increase by at least 50,000 acres between fiscal years 2000 and 2005.*

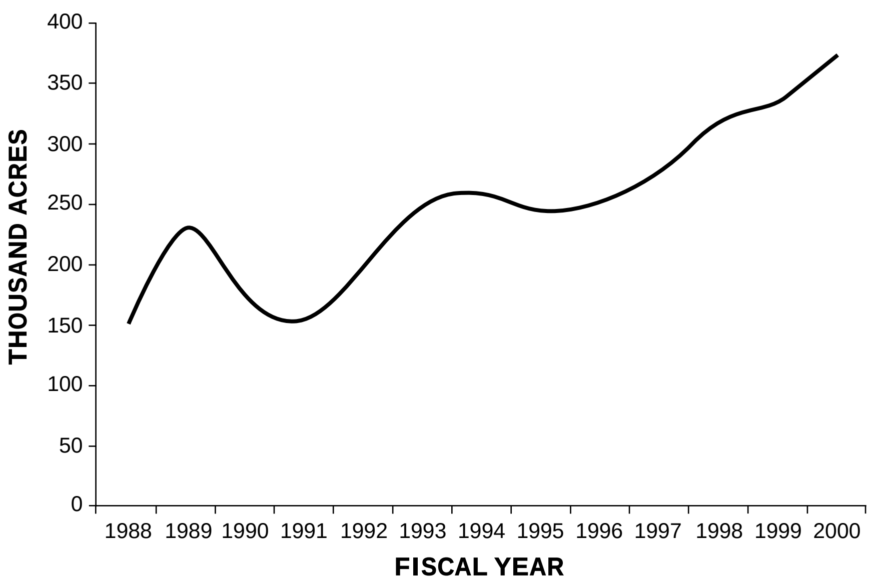


Figure 9*—Forest density management backlog for the Pacific Northwest Region, fiscal years 1988-2000.*

Figure 8 shows that new FDM need is being added faster than attainment (treatments) can remove it. The difference between need and attainment is referred to as 'backlog.' For the Pacific Northwest Region, FDM backlog has been accumulating steadily over the past 13 fiscal years (figure 9).

ARE FDM NEEDS UNDERESTIMATED? Although figure 8 shows steadily increasing FDM need for the Pacific Northwest Region, further analysis indicates that the true amount of need may be substantially greater than suggested by figures 7 and 8. This situation is illustrated using a 'step-down' approach that summarizes the results of a stocking analysis for an eastside national forest (figure 10).

Figure 10 shows that of the forested lands administered by the Umatilla National Forest, 51 percent would be considered overstocked—a condition suggesting that tree density is too high to sustain forest integrity and resiliency.[56]

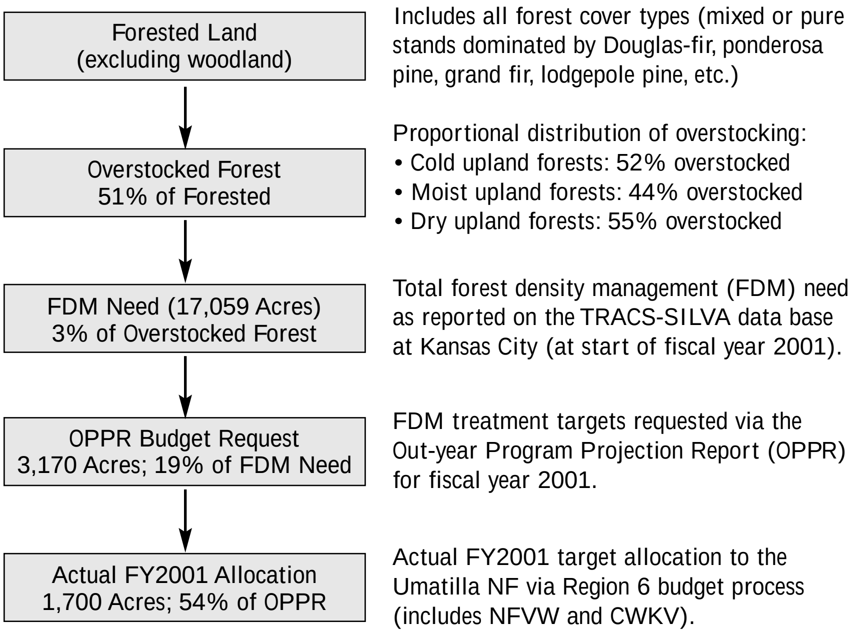


Figure 10*—Relationship of FDM need to total overstocked area for the Umatilla National Forest. This figure shows that 51% of the forested area is overstocked, indicating that it needs to be thinned to establish sustainable tree density levels. Only 17,059 acres of the overstocked area is shown as a thinning or release need in the TRACS-SILVA database. The analysis described above indicates that a more accurate estimate of FDM need for the Umatilla National Forest is closer to 209,800 acres.*

Figure 10 shows that current FDM need (as reported in the TRACS database) is only 3 percent of the overstocked forest acreage. By definition, all overstocked forest is assumed to represent a biological thinning need, so this result indicates that FDM need may be significantly underestimated in this instance. If so, then what is the actual FDM need?

A recent analysis indicates that no more than one third of the Umatilla's land base would be available for implementation of active restoration techniques such as release or thinning.[57] If the same percentage applies to a subset of the land base, then we can assume that a more accurate assessment of FDM need for the Umatilla National Forest would be at least 209,800 acres (33% of the overstocked forest) rather than 17,059 acres (3%).

The apparent underestimation of FDM need described in figure 10 is a common situation for the Pacific Northwest Region. As Chad Oliver and others commented in a 1994 assessment of eastside management practices: "Many forest stands have not been reported as silviculturally in need of thinning by local national forest managers; consequently, funding has not been considered by higher-level managers for treating these stands. Reasons for not reporting these stands are unclear."[58]

CONCLUSIONS AND RECOMMENDATIONS

This section provides conclusions and recommendations derived primarily from analyses presented in previous sections. It follows this format: a conclusion is stated, and then one or more recommendations that logically follow from the conclusion are provided. Whenever possible, recommendations specify who would be responsible for implementing the recommended actions (or facilitating their implementation). When appropriate, an implementation timeframe is suggested for the recommendation.

1. The Pacific Northwest Region has a substantial backlog of forest density management (FDM) need. Furthermore, if recent trends carry on into the near future, the backlog will increase by at least 13% (50,000 acres) between fiscal years 2000 and 2005.

   RECOMMENDATION: The Pacific Northwest Region should attempt to increase forest density management (FDM) treatments (thinning and release) to a level where at least 10 percent of the current backlog is treated each year, with an objective of eradicating the entire backlog over a 10-year period.

   Note: When using the most recent backlog figure as a baseline (FY2000; 372,976 acres), at least 37,500 acres of additional thinning and release must occur each year to eradicate the FDM backlog over the next 10 years. This acreage would need to be above and beyond the 'normal' FDM attainment level (50,670 acres in FY2000).

2. Analysis indicates that the true amount of overly dense forest on Pacific Northwest national forests is much greater than indicated by the TRACS-SILVA backlog figures.

   RECOMMENDATION: National forests in the Pacific Northwest Region should evaluate their FDM needs in the TRACS-SILVA database at Kansas City and update them, if necessary, to reflect the actual amount of need that exists on the ground.

   RECOMMENDATION: Prior to a TRACS-SILVA update process, the Pacific Northwest Region should provide the national forests with a consistent definition of 'need,' thereby ensuring that what is considered need on one national forest is similar to need on other forests.

3. Funding available for FDM treatments has declined over time, causing a 55% drop in FDM attainment between fiscal years 1988 and 2000. Based on current and expected budget figures (FY2001 and 2002), the FDM funding decline is ongoing.

   RECOMMENDATION: The Pacific Northwest Region should attempt to increase funding for FDM treatments (thinning and release). One way to accomplish this is to allocate funding previously used for reforestation to FDM work. This is appropriate for at least two reasons: 1) much of the current FDM need resulted from reforestation treatments completed several decades ago; and 2) without thinning to help reduce wildfire impact, reforestation treatments will remain at a high level as a post-fire rehabilitation treatment.

4. A steady decline in FDM attainment means that not enough acres are receiving a density management treatment to have a meaningful impact on fire susceptibility at a landscape scale.

   RECOMMENDATION: Although the 'Vegetation and Watershed' budget line item (NFVW) provides flexibility by combining soil, water, range and forest vegetation activities into one allocation, the Region should strive to not only resist erosion of historical FDM funding levels (thinning and release) but to increase those levels whenever possible, particularly when an increase would appropriately address worsening wildfire risk.

5. A recent spate of conflagration wildfire in the interior Pacific Northwest resulted in FDM need being removed whenever fire destroyed dense forest. However, removing need in this way does not meet society's expectations for healthy ecosystems (biodiversity, late-successional characteristics, aquatic and terrestrial habitat, etc.).

   RECOMMENDATION: Society expects many wildland benefits that are not provided by dead or fire-blackened forests. FDM treatments need to be emphasized in the Region's program of work as a preventative tool, thereby ensuring perpetuation of healthy forests and the variety of values and benefits derived from them.

6. Mechanical thinning offers advantages over prescribed fire as an FDM treatment because it provides more control over vegetation composition and structure, it is not constrained to short, unpredictable weather windows, and it does not produce smoke or otherwise degrade air quality.

   RECOMMENDATION: Before using fire on some sites, it would be prudent to complete one or more mechanical treatments to address an over-accumulation of woody fuel. The Region should emphasize the use of mechanical treatments in those instances where wildlife objectives (snags and down wood), hazardous fuel levels, and other circumstances indicate that a mechanical 'pretreatment' should occur before prescribed fire.

7. In the Pacific Northwest, 73% of dry sites administered by the federal government currently have a higher fire risk than would have existed historically. This white paper shows that FDM treatments have been unable to keep up with accumulating forest (stand) density, especially on dry-forest sites.

   RECOMMENDATION: Fire is a keystone ecosystem process, particularly for dry-forest sites that evolved with a short interval fire regime. In many instances, these sites missed multiple fire cycles and consequently have impaired forest health. Because dry forests are often not functioning properly, the Region should emphasize that FDM treatments be completed on dry sites before those on moist or cold sites.

8. Demographic data for Pacific Northwest Region employees indicates that at least 35 percent of the certified silviculturists will be eligible to retire by 2005.[59] These impending retirements, in combination with a progressive skills erosion in the silviculture workforce caused by FDM funding declines over the last decade, has the potential to seriously constrain the Region's capability to increase FDM treatments in the future.

   RECOMMENDATION: Thinning and other silvicultural treatments cannot be prescribed and implemented without a silviculture workforce. The Pacific Northwest Region should initiate an incremental hiring program designed to recruit a reasonable number of new hires in silviculture, perhaps by using the cooperative education program.

GLOSSARY[60]

ATTAINMENT. In the context of this white paper, attainment refers to the award of a contract or the actual (physical) accomplishment by a Forest Service (force account) crew of timber stand improvement treatments (precommercial thinning, pruning, fertilization, and release). At the start of a fiscal year, attainment objectives are allocated as acreage 'target.' When attainment is reported at the end of the year, the attainment acreage is used to reduce the timber stand improvement need by an equivalent amount (see 'need' description below).

BACKLOG. In the context of this white paper, backlog refers to the difference between 'need' and 'attainment.' If 100,000 acres of thinning need exists at the start of a fiscal year, but if only 25,000 acres are actually thinned during the year, then the difference (75,000 acres) is considered to represent a backlog (also see 'need' and 'attainment' descriptions).

BIOLOGICAL DIVERSITY (BIODIVERSITY). Biological diversity refers to the diversity and variety of all fauna, flora, and microbes and their habitats. Biodiversity is hierarchical, ranging from genetic diversity to species diversity and then ultimately to ecosystem diversity.

COMPETITION. The extent to which each organism maximizes fitness by both appropriating contested resources from a pool that is not sufficient for all, and adapting to an environment altered by all participants in the community or population. For trees, competition results in a density-related scarcity of certain environmental factors that are important for tree growth and survival.

ECOLOGICAL INTEGRITY. In general, the degree to which all ecological components and their interactions are represented and functioning; the quality of being complete; a sense of wholeness. Thus, areas of high integrity are those where ecological functions and processes are better represented and functioning than for areas rated as low integrity.

FERTILIZATION. Deliberate addition of nutrient elements to increase tree growth rate or to overcome a nutrient deficiency in the soil. Fertilization treatments provide a means of maintaining or improving soil productivity, and improving tree resistance to certain root diseases.

FOREST (TREE) DENSITY. A quantitative measure of stocking expressed absolutely in terms of numbers of trees, basal area, or volume per unit area (such as trees per acre).

FOREST DENSITY MANAGEMENT. Cutting or killing trees to increase inter-tree spacing and to accelerate growth of remaining trees; the manipulation and control of tree density to achieve one or more resource objectives. Forest density management is often used to improve forest health, to open the canopy for selected trees, to maintain understory vegetation, or to promote late-successional characteristics for biological diversity.

FOREST HEALTH. The perceived condition of a forest based on concerns about such factors as its age, structure, composition, function, vigor, presence of uncharacteristic levels of insect or disease, and resilience to disturbance. Note that perception and interpretation of forest health is influenced by individual and cultural viewpoints, land management objectives, spatial and temporal scales, the relative health of stands that comprise the forest, and appearance of the forest at a particular point in time.

MECHANICAL TREATMENT. In the context of this white paper, mechanical treatment refers to the use of tractors or other machines to remove trees in a timber harvest operation (stewardship harvest), or to the use of hand-operated tools (chain saws, axes, etc.) to cut, clear, thin, girdle or prune woody plant species.

NEED. In the context of this white paper, 'need' refers to national forest areas where a need for timber stand improvement treatment has been identified. Need is typically created when young forest stands grow into a condition where they need to be thinned, pruned, fertilized, or released in order to meet land management objectives. The amount of need is considered when allocating timber stand improvement 'target' to national forests (see 'attainment' description above).

PRESCRIBED FIRE. Deliberate burning of wildland fuels in either a natural or modified state, and under specified environmental conditions, in order to confine the fire to a predetermined area and to produce a fireline intensity and rate of spread that meets land management objectives.

PRUNING. Deliberate removal of side branches (live or dead) and multiple leaders from a standing tree. Pruning is often done to improve the aesthetics or health of a forest, to reduce fuel ladders and associated wildfire risk, or to produce economically valuable wood.

RELEASE. A treatment designed to free young trees from undesirable, usually overtopping, competing vegetation. Release treatments include silvicultural practices termed cleaning, liberation cutting, and weeding. Release and weeding treatments are similar to forest density management in that they provide an opportunity to ensure high levels of tree vigor and forest health.

RESTORATION. Holistic actions taken to modify an ecosystem to achieve desired, healthy, and functioning con-ditions and processes. Generally refers to the process of enabling a system to resume acting, or continue to act, following disturbance as if disturbance had not occurred.

SILVICULTURE. Applying techniques or practices to manipulate forest vegetation by directing stand and tree development and creating or maintaining desired conditions. Silviculture is based on an ecosystem concept that emphasizes the need to evaluate the many abiotic and biotic factors influencing the choice and outcome of silvicultural treatments and their sequence over time, and the long-term consequences and sustainability of management regimes.

STEWARDSHIP HARVEST. Any harvest treatment completed for reasons other than production of timber commodities. Tree harvest where the primary objective is to improve forest health or reduce wildfire risk by removing woody biomass is an example of stewardship harvest.

STOCKING. The amount of anything on a given area, particularly in regard to what is considered optimal; in silviculture, stocking is an indication of how much growing space is occupied by trees in relation to a pre-established standard (standards are typically provided by stocking guides).

SUSTAINABILITY. The enhancement of human well-being by using, developing and protecting resources at a rate and in a manner that enables people to meet their current needs while also providing future generations with the means to meet their needs as well; sustainability requires simultaneously meeting environmental, economic, and community aspirations (from Society of American Foresters).

THINNING. A treatment in immature forests designed to reduce tree density and thereby improve growth of the residual trees, enhance forest health, or recover potential mortality resulting from inter-tree competition. Two types of thinning are recognized—commercial thinning where the trees being removed are large enough to have economic value and can be sold to a timber purchaser, and precommercial (noncommercial) thinning where trees are too small to be sold for conventional products and the excess trees are left on site after being cut.

TIMBER STAND IMPROVEMENT. Treatments in immature forests designed to improve the composition, structure, condition, health, and growth of tree stands. The goal of timber stand improvement (TSI) activities is to improve forest health and to accomplish other resource objectives by regulating stand density, removing competing vegetation and fuel ladders, and maintaining soil productivity.

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