The 2000 National Fire Plan and Its Ramifications for Wood Supply from Western National Forests

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Will the National Forests become a more reliable supplier of timber again in conjunction with the National Fire Plan? The National Forests represent a major potential source of wood fiber in the West. They occupy 48% of the commercial forestland, hold 63% of the region's softwood growing stock, and contribute 48% of its net annual growth. But in California, Idaho, Montana, Oregon, and Washington, timber sales have declined from an average of 8 billion board feet per year during 1960–1990 to about 1.5 billion board feet since. The new millennium saw the lowest volumes offered since the Great Depression at less than 700 million board feet. This paper looks at historical contributions of the National Forests to the region's timber supply and at contemporary prospects for supply in the context of the recently developed National Fire Plan.

CHANGES IN HISTORICAL NATIONAL FOREST TIMBER SUPPLY – INTERIOR WEST

Intermountain forests east of the Cascades and the Sierras grow in a mostly semi-arid climate and have evolved to withstand the rigors of drought, insects, and fire. Among the various species, ponderosa pine is best suited to these conditions. It is a sturdy, sun-loving tree whose deep taproot (which can reach 5 ft by the time it is 4 years old) and moderately deep lateral root system allow it to obtain moisture through dry spells that would stress other species and leave them vulnerable to insects and disease. Its thick bark protects it against most fires by about 10 years of age. This species therefore became dominant in the drier parts of the region where it tended to grow in open park-like stands amidst grass-dominated ground cover (Atkins et al., 1999).

This dominance was maintained by periodic fires (both naturally occurring and set by humans) that killed saplings of other shade-tolerant but thin-barked species. At the same time, vast areas of forest were occupied by even-aged stands of lodgepole pine, a relatively shade-intolerant, fire-adapted species. Its serotinous cones are stimulated by fire to open, spreading their seeds and often producing densely stocked stands in which few of the trees reach large sawtimber size.

For over 2,000 years, Native Americans actively managed this environment through fires, using light underburning to maintain open forest conditions or even grasslands where forests would otherwise have grown. Nineteenth century westward development led to a decrease in light burning and an increase in the intensity of wildfires resulting from land clearing and railroad expansion. Such fires threatened newly established communities and private property. Near the end of the 19 th century, predictions of a forest famine began to emerge, along with the realization that the forest resource was not unlimited.

The Forest Service took responsibility for the National Forest System (NFS) in 1905 against this backdrop of forest exploitation and fears of impending timber famine. The prevailing utilitarian management philosophy was aimed at ensuring a continuing and plentiful supply of timber, water, forage, and recreation. To accomplish the timber goal, managers set out with the idea of transforming the self-regulating natural forest they inherited into a more productive regulated forest based on intensive silvicultural practices developed and refined by foresters in more temperate climates. A central tenet was that forests could be managed for a sustained yield of timber while providing for multiple other uses.

The primary means of executing the transformation was through a timber sales program in which the large, but slow-growing, old-growth forest would be replaced over time by vigorous stands of faster growing, younger trees. Along the way, however, several compromises and management missteps altered the evolution toward the desired objective (see also Langston, 1995).

HIGH GRADING – Before WWII, National Forest harvesting was characterized by

1) relatively low levels of harvest designed primarily to meet local needs and

2) silvicultural systems that generally favored selective harvesting. However, in the case of ponderosa pine, significant annual harvests of a billion board feet or more were reached by the late 1920s on public and private lands in eastern Oregon and Washington (Moravets, 1950). After WWII, as demand for timber increased and concerns were raised that selective harvesting was leading to high grading and not meeting the silvicultural needs of some major commercial timber species, National Forest managers began to emphasize patch cutting and group selection. Plans stipulated the harvesting of all species in a sale, but among the species mix prevalent in the interior West, ponderosa pine was the most desirable. A weak market for other species led to more intensive harvesting of ponderosa pine, which tended to convert sites to a more varied mixture of conifers.

GRAZING – From the beginning of (and even predating) the National Forest System, livestock grazing was a key use of National Forests and public domain lands. For many years, it was also the main revenue generator. In spite of efforts to reduce the numbers of sheep and cattle, overgrazing continued for many decades, which reduced the grass cover and enabled greater tree seed germination. This allowed heavy thickets of shade-tolerant trees [chiefly fir and spruce) to establish themselves under the ponderosa pine canopy, thus further altering the species composition.

FIRE – Forest managers regarded fire as a destructive agent, particularly after the devastating Idaho–Montana wildfires of 1910, which scorched millions of acres and killed 78 firefighters. From the 1930s to the 1980s, forest managers maintained policies to strictly control wildfire. Rather than harnessing fire as a brush clearing and growth-thinning tool. forest managers tried to stamp it out and for many decades

succeeded in reducing its scope and intensity. In the 1970s and 1980s, policies changed. Prescribed fire became a common management tool in some areas, but in the interior West it was not used extensively enough to return the land to historic conditions. A major impediment to doing so was that by then forest conditions had changed. Exclusion of fire had transformed the forest, promoting species that were less drought, insect, and disease resistant and a stand density structure that is now thought to be substantially greater than it had been historically. The resulting dense stands of often small-diameter, stagnating, low-branched trees created conditions more susceptible to intense and uncontrollable fires than had existed in historical times.

HARVEST RESTRICTIONS – Compounding the impact of these developments, environmental groups have been successful in reducing levels of harvesting and restricting the silvicultural systems available for use, and so have greatly narrowed management options just when the flexibility to remedy the legacies of past mistakes was needed most. Although environmental planning procedures are a necessary part of business on the National Forests, as they are currently applied they tend to hamstring the discretionary decision-making capability of field managers to respond to epidemics, fuel buildups, and inappropriate stand structure and composition. In combination, these factors led to a decline in the overall health and resiliency of many forests in the interior West. Millions of acres changed from relatively hardy, deep-rooted, drought-tolerant ponderosa pine to fir and other conifers that eventually degenerated into drought-stressed, insect-besieged stands of ailing and vulnerable forests (see Gast et al., 1991). The unsustainable nature of the situation was brought home by the destructive fires of the past decade. Close to 7 million acres burned in the West in 2000. Conditions deteriorated to the point where urgent remedial action was needed.

NATIONAL FIRE PLAN

Attempts to arrest the decline of western forests and return them to a more resilient condition have taken several forms. Generally the intention has been to restore stand composition and structure to historic conditions characterized by open, pine-dominated forests in the lower elevation, drier sites. Most NFS forest restoration activities to date have focused on areas at lower elevations with histories of frequent fires rather than upper elevation, wetter sites. The means to accomplish that has been to thin the excessive woody growth and leave species most adapted to semi-arid conditions, such as ponderosa pine and western larch. Once this is accomplished, periodic natural or intentionally Set surface fires are allowed to return to carry out their historic thinning functions.

One of the first attempts at remediation took place in the form of the 1995 Budget Rescissions Act, which suspended limitations imposed by environmental laws governing harvesting on public land. This allowed activity to pick up in 1996, but it also included a rider to re-open old growth harvesting in the Pacific Northwest, which generated intense opposition from environmental groups. The Act was not renewed.

In recognition that new administrative tools and approaches were needed, Congress authorized the Forest Service to test new procedures for conducting forest management operations. Subsequently the Forest Service began a pilot program to test new vegetative management tools. So-called stewardship contracting was implemented on some 28 projects throughout the West in 1997. Notable administrative features of these included the authority to exchange goods for services and to retain receipts from sale of products to fund local non-revenue-producing restoration activities. But, unlike the Rescissions Act projects, these were not exempted from environmental planning requirements (for example, scoping, writing, public comment, decisions, appeals), and so by 2000 very few had been implemented. The effectiveness of modifying administrative tools for improving management under this program therefore remains to be proven.

The scale and intensity of the 2000 fire season overtook events and led Congress and the Administration to take more drastic action. Emergency funds were voted under the umbrella of the National Fire Plan in the amount of $1.1 billion. Much of this was targeted at fire fighting, but $200 million were specifically reserved to prevent catastrophic fires by means of "hazardous fuel reduction."

Hazardous fuels can be removed by prescribed fires, mechanical tree removal (thinning), or a combination of the two. Because of the delay imposed by planning requirements, only projects that had already been through the process could be implemented in the program's first year. This amounted to 1.8 million acres. By the fourth year, however, the program might ramp up to 4 million acres per year according to agency strategic plans, but subject to future budget allocations.

TABLE 1

Areas to be treated for hazardous fuel removal under The National Fire Plan in FY 2001 in the West, by State

	thousand acres	
State	National Forests	Bureau of Land Management
Arizona	14	3
California	18	10
Colorado	7	17
Idaho	6	20
Montana	12	3
New Mexico	9	5
Oregon	20	23
South Dakota	9	0
Utah	4	9
Washington	11	0
Wyoming	5	3
Total	116	95

Sources: National Fire Plan (200, Table D-1); Bureau of Land Management

When we strip away acreages in the East and those involving prescribed fire exclusively, the Forest Service and the Bureau of Land Management (BLM) targeted only about 210,000 acres in fiscal year 2001 involving mechanical treatment[1] *(Table 1).* Future years will likely see more mechanical treatment acres as plans work their way through the approval process.

TABLE 2

Timber Volume on an Average Acre of Timberland in the Intermountain West and Volume Removed if Residual Density is 40 Stems per Acre

	all species by size of stems						
	5-7"	7-9"	9-11"	11-13"	13-15"	over 15"	Total
Cubic feet/acre	205	320	333	301	245	825	2,229
Stems/acre	107	78	47	27	15	19	292
Stems removed/acre	107 (42%)	78 (31%)	47 (19%)	20 (8%)	-	-	252 (100%)
Cubic feet removed/acre	205 (19%)	320 (30%)	333 (31%)	226 (21%)	-	-	1,083 (100%)

A legitimate question for the forest products industry is how much and what quality fiber this program will generate. To answer that, we calculated the average stocking rate of all dead and live timber in each state and assumed that the treated acres would be so stocked.

Since BLM lands are expected to yield little usable material for product outside Oregon, we focused on the National Forest acreages only. We assumed further that thinning would be conducted so as to achieve residual stocking levels of 40 stems per acre (Table 2). We estimated the removal volume of trees 5 in. and greater in diameter at 123 million cubic feet *(Table 3)*[2]. We note that this excludes material less than 5 in. in diameter, but it represents most of the volumes that are potentially suitable for processing. One can see from Table 2 that whereas only 27% of the stem count is 9 in. or greater, such material makes up over half the total volume. Converting the quantity of this larger sized material to board feet and comparing it with recent NFS timber sales gives some idea of the potential scale of the first year's output. While regular timber sales amounted to roughly a billion board feet *(Table 3),* the estimated potential volume of material 9 in. and greater from the National Fire Program comes to about 400 million board feet.

TABLE 3

Potential Fiber Volumes Removed Under Hazardous Fuel Removal Projects (FY2001) On National Forests by State

State	Tolal•• ($\times 10^6$ ft³)	>9" ($\times 10^6$ ft³)	>9" ($\times 10^6$ bd. ft.)	Recent timber sales ($\times 10^6$ bd. ft.)
Arizona	11	6	37	44
California	20	10	68	166
Colorado	7	3	23	77
Idaho	8	4	27	162
Montana	14	7	47	80
New Mexico	6	3	20	24
Oregon	27	14	92	151
South Dakota	6	3	19	147
Utah	3	2	12	40
Washington	16	8	56	82
Wyoming	5	2	16	41
Total	123	63	417	1014

TABLE 4

Potential Fiber Volumes Removed for Different Species-Dominated Sites By Thinning Intensity

Thinning by Forest Type	Diameter Cut Limit In Inches	cubic feet per acre: Residual Volume	Removed Volume	Total
Ponderosa Pine - 21 residual stems/acre	13	728	462	1,190
Fir-Spruce - 45 residual stems/acre	13	1,324	1,244	2,568
Entire Region - 40 residual stems/acre	12	1,146	1,083	2,229

Actual volumes generated will vary by site and species Areas to be treated have not been identified by forest type but if we look at region-wide forest statistics for ponderosa pine and assume thinning regimes up to 13 in., the volume generated per acre drops substantially because ponderosa pine has lower than average stocking density and a higher proportion of volume in larger stems (Table 4) Even thinning down to 21 residual stems per acre (which corresponds to the above diameter limit) results in a 39% removal rate In contrast with 48% in Table 2 For fir–sprucesites thinning to 13 in. results in removal rates of 48% ana because these sites are more density packed greater absolute volume of removals per acre We note that diameter limit cutting IS used here only for illustration and is not necessarily how thinnings will be prescribed

[1] This was calculated as the sum of the areas that are to be (1) mechanically treated, (2) mechanically and fire treated combined, and 50% of the areas that are (3) "multiple" treated and (4) "not specified."

[2] Forest Service regional compilations of forest statistics for the West include the distribution of growing stock volume by diameter class, ownership, and their respective acreages (Smith et al., 2001). Using the volume and acreage data, we computed estimates of average volume per acre by diameter class for different species groups and by ownership (for example, National Forests). We then used standard formulas for tree height and tree volume (based on average diameter within each diameter class) to derive approximations of the numbers of trees per acre by diameter class We used Trorey's tree height formula, $H = 4.5 + bD - cD^2$, to compute the height of commercial stems *(H)* based on diameter *(D),* using coefficients of $b = 22$ and $c = 0.75$ as our assumptions We used Smalian's paraboloid frustum volume formula, $V = H/2(A_b\ t\ A_u)$, to compute tree volume based on stem height and area at the bottom of the commercial stem (A_b) and at the top of the stem (A_u). Trorey's and Smalian's formulas are discussed in texts on forest mensuration (for example, Husch et al., 1972)

Lodgepole pine also exists in large volumes in the Intermountain West, but according to regional forest statistics, nearly 85% of the volume is less than 11 in. in diameter. Most of any removals would be in the pulpwood or small log size classes. As pointed out previously, over half the removal volumes in other species such as ponderosa pine and fir–spruceare likely to be in small-diameter size classes (less than 9 in.).

Unfortunately, wood pulp and OSB capacities have declined in the West, with pulpwood demand dropping by nearly 40% since the 1980s. Much of the small-diameter material from stand treatments currently goes to regional power co-generating plants. There are just a handful of pulp and paper mills in the Intermountain region, and some wood chips have been shipped to mills near the Coast, but as for significant wood pulp capacity expansion in the region, there are no immediate prospects. Currently, roundwood in the Intermountain region appears to supply less than 1% of U.S. pulpwood needs (Forest Resources Association, 2000).

DISCUSSION

The National Fire Plan is an emergency response to increasingly hazardous conditions on western National Forests. The program has initially favored prescribed fire treatments over fuel removal using cutting. But prescribed fire is appropriate only where stocking and fuel loading conditions have been brought down to safe levels. In the West, the estimated area at moderate to high risk of catastrophic tire requiring some treatment is 67 million acres on NFS lands and 89 million acres that include state and private lands. The areas currently targeted for mechanical treatment only scratch the surface of underlying needs. Nevertheless, even with the modest area treated in the first year, about 400 million board feet of trees 9 in. or greater are estimated to be potentially available. For mills equipped to handle small-diameter stems (down to 5 in.), the volume of potentially usable wood is double that.

Concerns about the fire program include its potential to shift staff resources from traditional commercial timber sales and to substitute lower quality wood for traditional larger diameter material. This does not seem to be the intent of the plan, as almost $1 2 million was earmarked for the Fish and Wildlife Service to conduct additional planning, analysis, and monitoring for NEPA requirements. However, until the extra staff is hired, trained, and set to work, only a shifting of available resources may be possible. To minimize such disruptions while showing progress for the large amount of funds, the Forest Service has focused its initial efforts on its inventory of NEPA-ready sites.

A second major concern is the size and quality of material that the projects are likely to generate. Most of the stems removed will fall into size categories that western mills are unaccustomed to. One has to travel to Quebec or the South to see installations successfully processing logs that a few years ago were regarded as suitable mostly for pulpwood. However. the contemporary management emphasis on National Forests is on ecosystem restoration. This involves extensively thinning stands from below rather than harvesting mature trees from above. In the next few years. volumes of wood offerings from NFS lands are likely to rise from their recent lows because leaving the forests to nature is increasingly untenable given the growing risks of catastrophic fires. But an increasing proportion will be from suppressed and co-dominant trees rather than larger dominant specimens because there is no other way to accomplish the necessary stand treatment when extreme fuel loadings are the driving issue. Mills whose wood supply is heavily dependent on federal timber will have to factor this into their planning.

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