The Indefatigable Hand: Cutting, Funding, Studying Treatments, Federal Timber and Market Impacts

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Joint Fire Science Program

Fire Science Brief

RESEARCH SUPPORTING SOUND DECISIONS

Treating all the land at risk from severe wildfire would be prohibitive. Planning treatment sites based on a combination of condition severity, juxtaposition to the wildland-urban interface, and yield of merchantable wood to defray costs is considered in this study. Also considered are different time frames to treatment completion, and the impact of an infusion of woody biomass from federal lands on the timber market. (Left) Doghair Ponderosa pine stand in the Santa Fe National Forest. Credit: Robert Rummer. (Right) A torching coniferous tree. Credit: USDA Forest Service's Historic Photos photo gallery.

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Summary

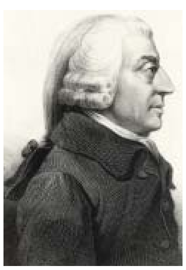
Though fuel specialists, scientists and managers have developed treatment tools to reduce fuel hazards, such as mechanical thinning by removing trees, costs to treat lands at risk can be prohibitively high. Harvesting timber and woody materials that can then be sold reduces costs, but only about 20 to 30 percent. Treatment costs average over $1,000 per acre in some areas. Spending $300 million per year in treating government lands would take over twelve decades to treat all high and moderate risk stands; $900 million per year would reduce this to four decades. Treating only wildland-urban interface areas or high risk stands further reduces this to two to four decades. To stay within acceptable risk conditions, treated stands may have to be retreated. Timber products removed would benefit timber consumers in the United States, and would harm timber producers on private lands. Effects on the international market for programs under $600 million per year would be negligible.

Key Findings

- Mechanical fuel treatments conducted on government forest lands can generate usable timber products that will lower the cost of treatment.
- Treatment costs average over $1,000 per acre, and timber products derived result in only a 20 to 30 percent reduction in costs.
- The ecological and economic benefits of treatment in terms of improved ecosystem function, reduced fire damages and lower exclusion costs would need to be more than $700 per acre to justify the program from an economic perspective.
- A treatment program of $300 million per year on government lands would take well over twelve decades to completely treat all high and moderate risk stands, while $900 million per year cuts the time down to four decades.

Introduction

When colonial Americans made their declaration in 1776, a Scot in Great Britain introduced a revolution of a different sort. In that year, *A Inquiry into the Nature and Causes of the Wealth of Nations* was published, and the theories in it brought the world the academic field of modern economics. While Adam Smith's work has been variously studied, interpreted, and misinterpreted, it gave countries a new understanding of free markets, and a value of goods as determined by the labor that went into producing them and their scarcity. "The real price of every thing…is the toil and trouble of acquiring it," he wrote. While economic theory shifted to viewing supply and demand as determining price and quantity in the marketplace, Smith's theories made lucid the three factors of production that caused, as he stated in his title, the wealth of nations—land, labor and capital.

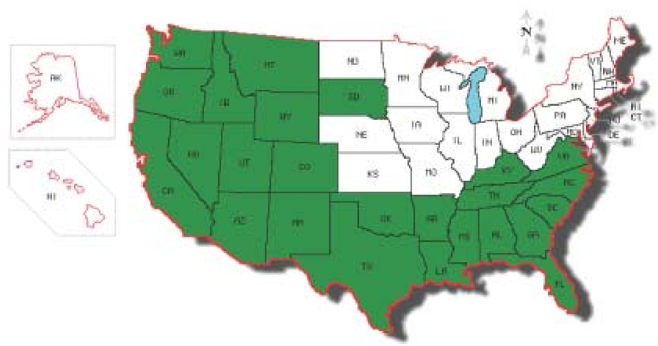


Adam Smith (1723–1790), Scottish philosopher and political economist. Credit: Wikipedia.com.

While markets themselves bear untold complexities, trying to determine the vast complexities in valuing the costs and benefits to treat forests (which involve intangible values and risks) coupled with arriving at prices for timber goods in future markets seems a task beyond computability. And on top of it all, outside the realm of rational assessment lies human emotion that can drive market gains, collapses, prices, policies, permissions, willingness to treat or aversion to action. Why would Jeffrey Prestemon, Research Forester, and Karen Abt, Research Economist, both with the USDA Forest Service's Forest Economics and Policy Unit, think through thoughts thereon?

A shopping list of concerns

Our forested lands, at risk from severe wildfire owing to conditions that have been gravely altered from their historic norms, is old news. What is recent news are ideas on funding the considerable costs required to treat the areas that face the greatest hazards. Often, decisions on policy and public support for programs are won when the costs and benefits of actions can be elucidated. Prestemon and Abt, with their team, explored pertinent questions: how much land was in critical need of treatment? How much would it cost to use different kinds of cutting treatments (mechanical or manual)? How many trees—ages, sizes, percent of ground cover—would need to be removed to ameliorate fire hazard conditions? How much would timber markets be affected by the injection of merchantable woody biomass from federal lands?



Study plots in twenty-five states of the contiguous U.S. West and South provided the team with data to run simulations on forest type and fire regime, wildfire hazard condition, proximity to the wildland-urban interface, and amount and market value of merchantable wood each plot could yield from cutting treatment. Credit: Created from a free mapping website, http://monarch.tamu.edu/~maps2/us.htm.

Using data from the Forest Service's Forest Inventory and Analysis Program and additional information from the National Forest System, the team examined the questions in this tall order using study plots in twenty-five states. Employing different simulations, the scientists looked at treatment sites based on need, on state and federal government lands.

The team selected areas as eligible for treatment using various screening procedures to run their modeling simulations. One screen looked at forest type, and whether the lands experienced surface or mixed-severity fire regimes, or high severity fire regimes. Lodgepole pine and spruce-fir forests fell into the high severity fire regime, and all other forests fell into the other type of regime.

To assess the fire hazard of each plot, the team looked at its torching index and crowning index. Torching index is the wind speed twenty feet above ground at which a crown fire can begin, and crowning index is the wind speed twenty feet above ground at which an active crown fire can be sustained. The scientists selected plots for treatment if the crowning index was less than 25 miles per hour, or if the torching index was less than 25 miles per hour and the crowning index was less than 40 miles per hour combined. "The focus on crown fires is useful because, although all stands may burn under certain conditions," the scientists explain, "stands that are likely to burn in crown fires present particular exclusion problems, and consequences of crown fires are more severe than those of surface fires." The team chose to treat plots with a crowning index of less than 25 miles per hour or torching index of less than 25 miles per hour because fires can occur more often at wind speeds between 15 and 25 miles per hour.

Prestemon, Abt and the team used data such as canopy fuels, slope steepness, fuel moisture, and fuel type—such as hardwood forest or long-needle pine litter, for example—as input for model simulations. Other criteria they used included raising the torching index and crowning index for each plot above 25 miles per hour, or only increasing the crowning index above 40 miles per hour. The goal of treatments, they explain, is to keep crown fire from starting, or to keep one from running if it has already started. They also placed limits on how many trees they would remove from a plot, as measured by the basal area, to keep the canopy closed as much as possible. While closer branches in the canopy might seem to add to fire risk, the closer upper story cover shields surface fuels from drying by sun and wind; limits light and so keeps shrub and forb growth down as well as some species of regenerating conifers that create ladder fuels—all features than can contribute to changes in fire behavior.

The goal of treatments, they explain, is to keep crown fire from starting, or to keep one from running if it has already started.

Stands allowed to grow dense through fire exclusion can succumb to pests or intense wildfires. Credit: R. James Barbour.

The team also looked at how often a plot would need to be retreated in the western and southern states in their treatment population. Treatment simulations looked at different silvicultural strategies. Moving a plot toward an uneven-aged stand with high structural diversity would push the plot to the team's targeted torching and crowning indexes by removing as many small trees as possible. On the other hand, treatments that moved plots toward even-aged stands revealed conditions that some silvicultural programs create by harvesting and replacing an existing forest.

Thinning operations to reduce hazardous fuels sometimes yield marketable timber products. Credit: Barry Wynsma.

The bottom line

With the "what" decided, the team looked at the "how." How much would it cost to pay for a treatment approach? How much combined with a harvesting approach? Using the Fuel Reduction Cost Simulator, the scientists looked at eight harvesting systems, and the number and size of trees to be removed at each plot coupled with the topographical conditions of each site. Slope pitch is important, as anyone knows who has ever worked at any chore outdoors—the steeper the slope, the harder the work. For harvesting concerns, this adds to greater costs. The team explored ground-based harvesting systems, such as manual felling that takes log-length timber or whole trees; mechanized felling that takes whole trees or cut-to-length logs and cable-yarding for each type of tree-cutting and size removed. Each variable and combination of variables has an effect on cost, and the goal for the scientists was to determine how each treatment and harvest combination could pay for itself.

In the United States, 96.9 million acres of timberland could use treatment of some kind to reduce fire hazard, according to the team. 21.2 million acres in twelve western states are in the wildland-urban interface, where people and communities face risk from wildland fire. Of those 21.2 million acres, 4.1 million are in timberland where the possibility of removing merchantable wood exists. The scientists estimate that the total wildland-urban interface area that could be treated is 0.8 to 1.2 million acres. Uneven-aged treatment, with no limit on the number of trees removed (basal area) would thin the largest area—17.5 million acres or 14 percent of all timberland in the twelve western states. Prices for wood would vary from region to region, and by the percentage of different tree species in each harvest, they explain, from $39 per thousand board feet in Arizona and New Mexico for lodgepole pine, for example, to $528 per thousand board feet in Oregon and Washington for ponderosa pine. “Treatment costs average over $1,000 per acre,” Prestemon shares, “so the cost to U.S. taxpayers is substantial. Spending at this level implies that the benefits of treatment in terms of reduced fire damages and exclusion costs and in terms of ecological enhancements would need to be over $700 per acre, on average, to justify the program from a welfare perspective.”

Thinning a dense forest may reduce wildfire severity if a fire occurs in it. Credit: Peter Ince.

Prestemon and Abt’s team calculate that a treatment program costing $300 million per year on government lands only would take well over twelve decades to completely treat all high and moderate risk stands. A $900 million dollar per year program cuts the completion time to about four decades, and targeting only wildland-urban interface areas for treatment reduces the time frame further, to two to four decades. Of course, treatments would have to be reapplied as forests regrow and conditions change. Treating only areas that are high risk would result in net costs per acre that are lower than a program that focuses on stands of all risk levels, Prestemon and Abt explain. High risk stands, thicker with trees, produce more marketable materials from treatments. Knowing where, how and how much for all this undertaking, the final question is “who”—who is affected by government timber products entering the wood products market?

Off to market

With market variables being varied, various, and often inscrutable, the team’s simulations showed them that programs funded at less than $500 million per year would have low market impacts. This finding, however, is based on the assumption that timber products removed for treatment purposes would simply replace timber products from regular harvests. The prices of softwoods in the West would fluctuate widely with different program sizes and emphases. Lodgepole pine prices would go up and most others would fall with a treatment program because of supply shifts. Prestemon and Abt explain, with a treatment program of $700 million per year, the price of lodgepole pine would rise by over 40 percent. “The increase in lodgepole and decline in other softwood prices occurs because the fuel treatment program results in higher harvests of other softwood and lower harvests of lodgepole pine than occurred under regular government harvests,” Prestemon says. “The opposite occurs for ponderosa pine: prices for this species drop for moderately sized programs ($300 million to $700 million), as large fuel treatment programs result in more of this species on the market.”

Trees can produce wood products of different value, as do different species of tree. (Top) Saw logs, that can be cut into dimensional lumber (credit: USDA Forest Service’s Historic Photos photo gallery), bear more value and therefore claim greater prices than (bottom) species that are cut into wood chips. Credit: R. James Barbour.

Harvesting trees would have different effects by region also based on land ownership, and producer and consumer welfare. In the South, most forest wood products come from private lands. Government lands there, Prestemon explains, have historically produced little volume, and doubling or quadrupling timber output on these lands would have small market price effects. Simulations show only a two percent drop in the price of southern pine timber when treatment programs reach $1.5 billion annually. In the West, on the other hand, private producers of timber products face a steady economic decline as treatment programs expand in scope, while consumers benefit. “Producers lose about 0.8 percent ($72 million) in welfare when the program is $600 million per year, and consumers gain 0.3 percent ($116 million).” The negative impacts on U.S. producers will be ameliorated, however, if timber processing capacity is expanded to handle greater timber product output from treating government lands. But any treatment program larger than $500 million will produce so much new wood that producers in western Canada will begin to experience a negative impact. In the global marketplace, consumers gain less than producers lose. Prestemon and Abt are careful to urge consideration of the potential positive benefits, as programs expand in scope, namely lowering fire risk by reducing the torching and crowning index on lands, and reducing these hazards from the wildland-urban interface. Further work is needed, they explain, on identifying the economic benefit of the treatments in terms of fire effects. And finally, they direct our attention to studies which have shown that treatments placed strategically on a landscape to reduce burning risk in fire paths are more successful than randomly placed treatments.

Fuel treatments can yield both small and large diameter timber products. Credit: Barry Wynsma.

As land ownerships in the private sector are often juxtaposed with federal lands, support and incentives to private landowners to allow treatments or to adopt a wildland fire use for resource benefits philosophy for natural ignitions is highly important.

Management Implications

- If managers target only the wildland-urban interface areas or high risk stands for treatment, the time to completion of a federal treatment program would be one-fourth to one-tenth as long as one that calls for treating all hazardous federal timberland.
- Managers may need to retreat already treated stands to maintain the conditions that reduce fire risk.
- From a timber market standpoint, policy makers should consider that removing timber products from government lands would benefit timber consumers in the U.S. but would harm timber producers on private lands. Western U.S. mills would benefit the most, and the West's private timberland owners would be harmed the most. If timber processing capacity expands in response to a treatment program, negative impacts on private timberland owners are mitigated.
- For treatment programs under $600 million per year, the effects of timber products on international trade would be negligible.

Further Information: Publications and Web Resources

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Scientist Profile

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