Investments in Fuel Removals Avoid Future Public Costs

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As a consequence of large intense forest fires in the inland west over recent years, considerable public attention is being directed at the question of how to reduce hazardous fuel loads from the overly dense forests that characterize the region. Removal of the many small trees that make up these fuel loads is known to be costly. While large trees can be removed for lumber and other product values as reflected in the market, the market value for the smaller logs may be less than the harvest and hauling charges, resulting in a net cost for thinning operations that are needed to lower fire risk. However, failure to remove these small logs results in the retention of ladder fuels that support the transfer of any ground fire to a crown fire with destructive impacts to the forest landscape. A recently completed cost/benefit analysis conducted by the Rural Technology Initiative (RTI) as part of a broad investigation of fire risk reduction indicates that the negative impacts of crown fires are underestimated and that the benefits of government investments in fuel reductions are substantial.

There are many market and non-market values associated with reduction of fire risk that should be important to forest managers and to society at large. An analysis of fire risk and hazardous forest fuels on the Fremont (OR) and Okanogan (WA) National Forests indicates that the negative impacts of crown fires are underestimated and the benefits of government investments in fuel reductions are substantial. Perhaps most obvious is the escalating cost of fighting forest fire, which nationally has been in the billions of dollars during recent years. Similarly, there is the value of avoiding facility losses and fatalities that result from forest fires. Communities value a lower fire risk and reduced smoke. Forest fires destroy visual aesthetics and limit recreational opportunities. The United States Congress has historically placed a very high value on species protection as evidenced by laws such as the Endangered Species Act or the National Forest Management Act yet irreplaceable habitats for threatened and endangered species may be lost when forests burn. Valuable timber resources are destroyed. Fires also convert the carbon stored in forest biomass to smoke reducing the opportunity to produce long lasting pools of carbon stored in forests and products while adding to atmospheric carbon and global warming. Fires consume biomass that otherwise could be used for clean energy conversion and green energy credits.

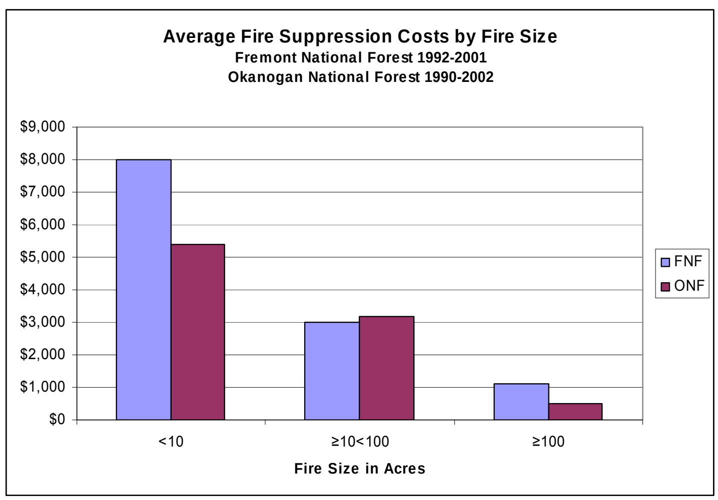

Figure 1. Average fire suppressions costs - Fremont and Okanogan National Forests.

Regeneration after fires is problematic and costly and rehabilitation investments are often needed to avoid serious erosion, sedimentation, and water contamination. If forests are thinned, the resulting increase in available surface water could benefit salmon habitats, municipal reservoirs, and agricultural irrigation. Rural economic development benefits would result from the taxes and rural incomes generated by fuel reduction activities. Since economic activity in these regions has been in decline as a consequence of lower federal timber harvests, any reduction in unemployment has higher than normal leverage on state and local finances by lowering assistance costs.

Many scientific studies have shown that forests thinned to remove fuel loads are unlikely to experience crown fires. Accounting for the full value of this reduced risk exposure, however, must take into consideration both the predicted costs and the timing of future fire events. While it is impossible to predict exactly when a future fire might occur in a specific location, we do know that due to decades of fire suppression, the time since last ignition in many forests is well beyond previous fire return cycles and that present fuel loads are well outside of historic levels. Fire ecologists agree that the question is not whether these forests will burn but when.

To illustrate how the relative costs and benefits of investments in hazardous fuels removal treatments to reduce risk of crown fires might be considered, a parametric table can be constructed to display the present value of anticipated future costs associated with failure to reduce risk.. For this example, we will assume that that all acres of forests with a present high risk, if left untreated, will burn sometime in the next 30 years while all those forests considered at moderate risk will burn sometime in the next 60 years. If there is an equal probability of each acre burning in any year during the assigned interval then for approximation purposes we can assume that an average time for all acres to burn is equivalent to one-half the interval.

Non-market Valuations

$$V_0 = \frac{V_n}{(1+i)^n}$$

Where:

V_0 = present value at time 0

V_n = future value after n periods (years)

i = interest rate

n = number of periods (years)

Parametric Present Value Estimations of Fire Risk Costs with Assumptions of $1000/acre to Fight Fire and 5% as the Discount Rate.

For this Exercise Assume all High Risk acres burn in 30 years (15 year midpoint) and all Moderate Risk acres burn in 60 years (30 year midpoint).

Year	5	10	15	20	25	30	35	40	45	50	55	60
Method 1. Present cost/ac of a forest fire at specified future year	$784	$614	$481	$377	$295	$231	$181	$142	$111	$87	$68	$54

Figure 2. Parametric present valuation estimation of non-market values.

In other words, an equal probability that all acres burn sometime in 30 years means an average time to burn of 15 years and correspondingly, given a 60-year interval, the average burn time will be 30 years. If we further assume, as is often done for financial analysis, that an inflation-adjusted interest rate of 5 % is representative of the average anticipated cost of money throughout the risk interval then we have what we need to discount future cost estimates to present dollars. In the example above, an estimated future average fire fighting cost of $1000 per acre is used to demonstrate the present value of a future liability. This example shows that every dollar that will be needed to fight forest fires during the 30-year period for high risk represents $0.48 of anticipated cost exposure today and during the 60-year period for moderate risk represents $0.23 today. Conversely, investments in fuels removals today are worth the savings represented by these present value estimates of costs avoided if fires do not occur. Other values of interest can be similarly assessed and then summed to estimate broad present benefit from investment in risk avoidance.

The following table shows present value estimates of avoided future losses associated with a number of market and non-market values. Also displayed for comparison are Forest Service contract preparation costs and operational costs. Future values are taken from a variety of governmental and non-governmental information sources while contract and operational estimates are derived from figures provided by the Okanogan and Fremont National Forests as well as from interviews with harvest contractors. Treatments are assumed to be forest thinnings within the understory that leave approximately 40-100 of the biggest trees per acre (TPA). A more rigorous explanation of this estimation methodology and source information can be found on the RTI web site, www.ruraltech.org , in the Market and Non-Market Values section of the RTI report entitled *"Investigation of Alternative Strategies for Design, Layout, and Administration of Fuel Removal Projects"*. Printed copies of the full report are available upon request or can be downloaded from the website.

Table 1. Summary table of costs and benefits from fire risk reductions.

Treatment Benefits	Value per acre	
	High Risk	Moderate Risk
Fire fighting costs avoided	$481	$231
Fatalities avoided	$8	$4
Facility losses avoided	$150	$72
Timber losses avoided	$772	$371
Regeneration and rehabilitation costs avoided	$120	$58
Community value of fire risk reduction	$63	$63
Increased water yield	$83	$83
Regional economic benefits	$386	$386
Total Benefits	$2,063	$1,268
Treatment costs		
Operational costs	($374)	($374)
Forest Service contract preparation costs	($206)	($206)
Total Costs	($580)	($580)
Positive Net Benefits from Fuel Removals	**$1,483**	**$688**

Additional benefits from fuels reductions such as habitat restoration, water quality protection, carbon credits, and others are more difficult to estimate but are generally considered to be of high public value. Further research is needed to quantify such benefits; however, it should be apparent that addition of such considerations will serve to increase further the net value of public investments in forest fire risk reduction.

Potential negative costs associated with harvest activities to reduce hazardous fuel loads might include environmental impacts of soil compaction, damage to leave trees, and road sediments. However, these costs are difficult to estimate and may be avoided with due diligence. Compromises to habitat quality for some species may decline while others increase, creating tradeoffs that are difficult to evaluate, but these changes are not likely to be as harmful as the impacts of catastrophic wildfires.

While the values assigned to the benefits from fuels reductions that have been listed above can rightly be considered coarse estimates, they have been shown to be legitimately defensible and intentionally conservative. These figures suggest that the benefits of fire risk reduction are of high value and generally of much higher value than any market losses resulting from thinning to reduce the fire risk. It is worthy to note that many areas of the forests studied in this investigation showed positive net returns from log sales after thinning simulations when some larger trees were removed as part of the fuels reduction activity. However, even with an assumed net cost of fuel reduction operations, the results of this cost/benefit analysis clearly show that the future risk of catastrophic fire on the National Forests of the inland west is far costlier to the public than investments made today to protect against such eventuality.

An analysis of Fremont and Okanogan National Forest inventory data indicated that 1,307,667 acres (greater than 75% of the total forest area) are at moderate to high risk of crown fire. Based upon present value estimations above, the total no-action liability for these at-risk forests is greater than 2 billion dollars. The net public benefit of hazardous fuels reductions after subtraction of operations costs for just these two National Forests is estimated to be greater than 1.3 billion dollars.

The Rural Technology Initiative (RTI) was created in 2000 as a partnership between the University of Washington, College of Forest Resources, and Washington State University, Department of Natural Resource Sciences and Cooperative Extension, to aid in the transfer of technology for managing forests for increased forest products and environmental values in support of rural forest-resource based communities. This work was made possible by a Community Assistance and Economic Action Program Grant WNFP-01-015 within the Multi-Agency National Fire Plan administered by USDA-Forest Service. The Freemont and Okanogan National Forests collaborated by providing forest inventory data and operational data on fires and management costs. Base funding for the Rural Technology Initiative is provided by the Cooperative Forestry Program of the USDA Forest Service.

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