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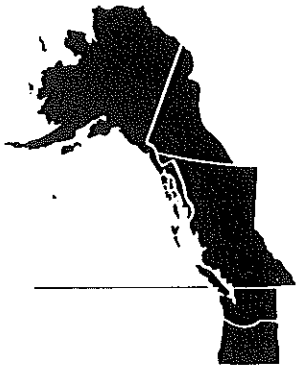

Northwest Fire Council

Forest Health and Protection on the Eastside of the Cascade Mountains and Education and Training of Fire Personnel

1992 Annual Meeting Proceedings

November 16-18 • Tyee Hotel • Olympia, Washington

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Prescribed Fire Versus Wildfire: What Are The Tradeoffs? Two Case Examples

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Major wildfires have affected millions of acres of forest lands in the continental United States during recent years. Many believe the increase in wildfire activity may be the result of fuel accumulations caused by 80 years of fire suppression, combined with drought and trees dying or dead from insects and diseases. For instance, the 5-year running average of wildfire acreages burned in Region 6 from 1926 through 1990 (compiled by Aviation and Fire Management, Region 6) shows periodic jumps that are increasingly larger (figure 1). Is managed fire a viable option for reducing the effects of wildfire? This summary will discuss tradeoffs between the use of managed fire versus eventual wildfire with respect to immediate fire effects and air quality. Two case examples are presented here.

Shady Beach Wildfire

The Shady Beach Wildfire occurred on the Willamette National Forest in 1988. The fire burned through both untreated logging slash areas and areas that had been treated by broadcast burning. Visual evidence suggested that immediate site effects from the wildfire were more severe in untreated areas. The objective of this study was to quantify this difference (Vihnanek and Ottmar 1991).

Sixteen clearcut units affected by the Shady Beach Wildfire were selected for the study. Eight of these units were prescription burned before the wildfire; the other eight were not. Through the use of surface and aerial photographs, available ground inventories, biomass profiles, and smoke management reports, reconstruction of post-logging biomass profiles were made. Planar intersect inventory and soil severity plots were used to estimate post-wildfire fuels and soil severity (Vihnanek and Ottmar 1991). Fuel consumption and emission production models developed for the Pacific Northwest were used to construct the amount of biomass consumed during the prescribed fire treatment and to construct the amount of emissions produced during both the wildfire and prescribed fire.

Post-logging woody fuel loadings and duff loadings were similar for treated and untreated units (figure 2). The reduction of fuel components accomplished by prescribed burning was reflected in pre-wildfire mean loadings: woody fuels measured 48 tons per acre on treated units, and 72 tons per acre on untreated units; duff measured 7.5 tons per

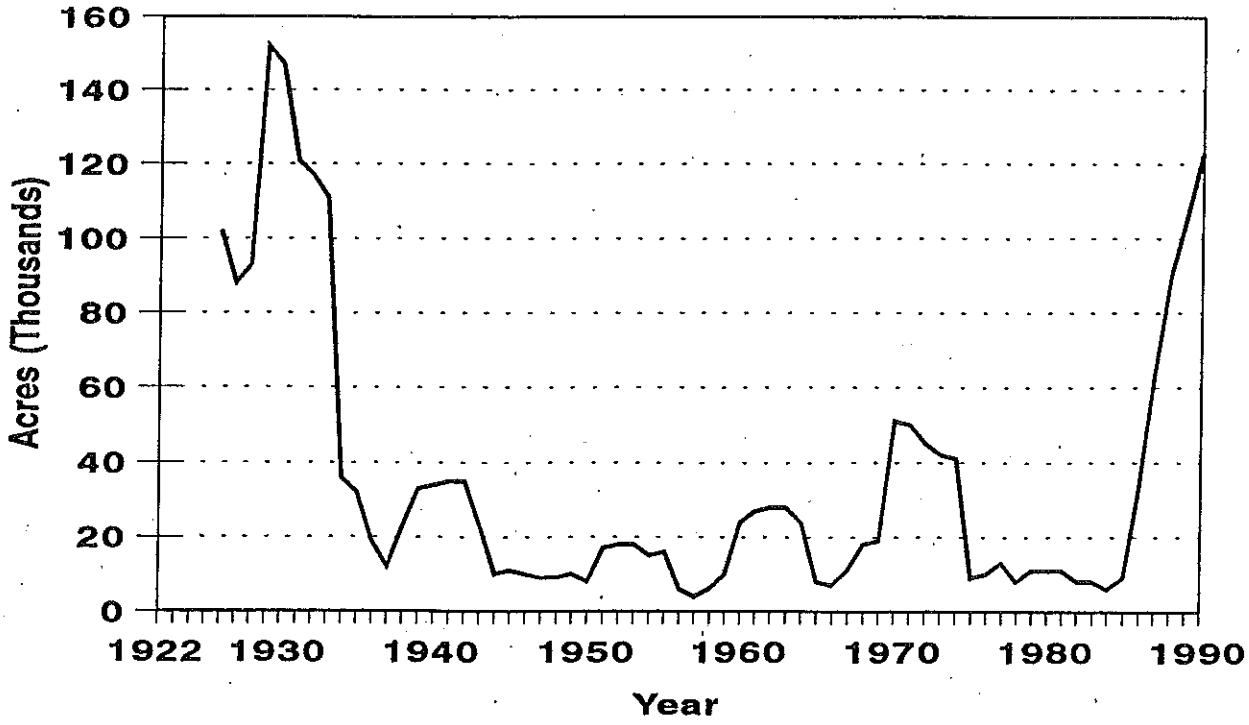

Figure 1. Wildfire acreages in Region 6.

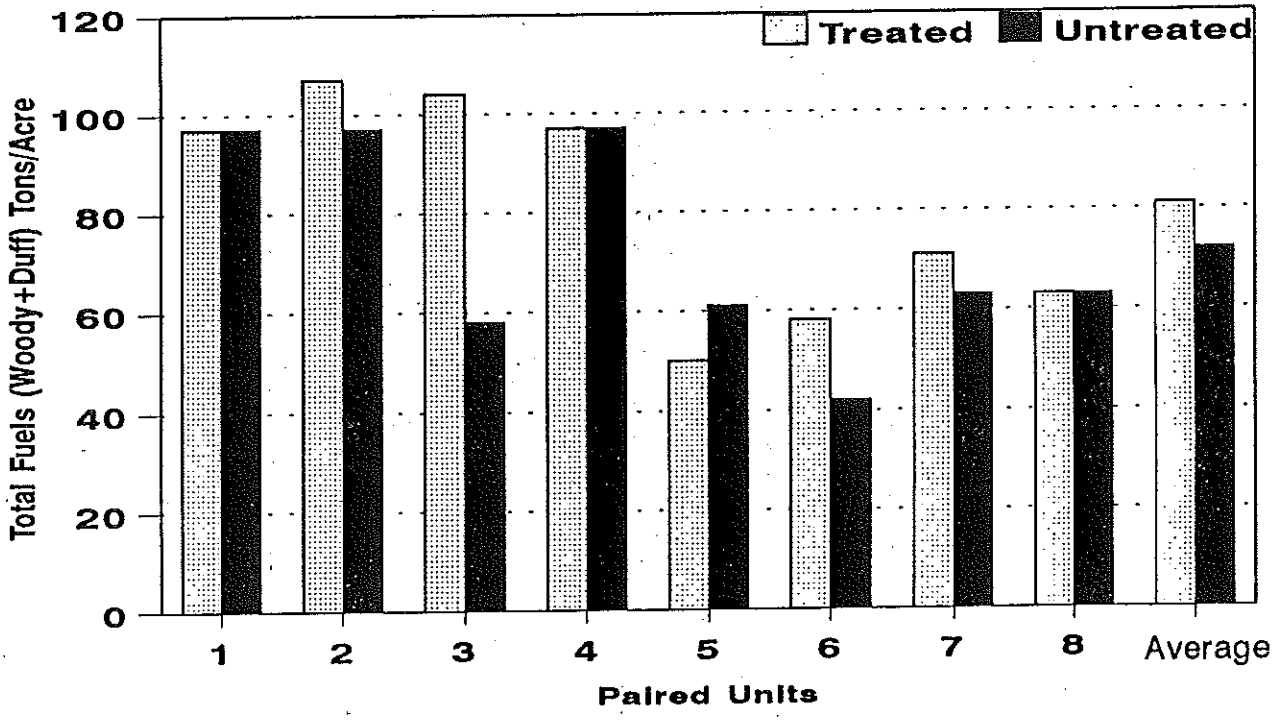

Figure 2. Pre-logging fuel loading by unit pairs.

acre on treated units, and 35.5 tons per acre on untreated units. Total fuel (woody and duff) consumption during the wildfire on treated units was less than half the consumption on untreated units (figure 3).

Average mineral soil exposure was nearly 100 percent on both the treated and untreated units after the wildfire. This indicates that the duff which remained after the prescribed fires was consumed in the wildfire. Though treatment with prescribed fire did not succeed in preserving the organic layer, a difference was seen in the impact of the wildfire on treated versus untreated sites. Lower soil fire severity ratings on treated units are an indication of less severe impacts from the wildfire (figure 4).

Significant reductions in emissions accompanied reduction in fuel consumption on treated units in the wildfire. Total emissions on treated units during the wildfire were 59 percent less than emissions on untreated units. Though treatment produced no cumulative savings in smoke production, over one third of the smoke was produced during treatment when conditions for favorable smoke dispersal were prescribed (figures 5 and 6).

Reintroduction of Fire in the Blue Mountains

Since the turn of the century, land use and climate of the pine ecosystems have changed, perhaps irreversibly. Successful fire exclusion over the past 80 years has interrupted several fire cycles, contributing to a shift in species composition and a build-up of fuels. Douglas-fir and true firs assumed dominance over the ponderosa pine and western larch; overstocked sites competed with pine and larch for limited water and nutrient resources, and encroached on meadow and rangelands. This human-altered ecosystem has proven susceptible to insect infestation, disease epidemics, and catastrophic wildfire, and is less adaptable to climatic change. As a result, many scientists, land managers, politicians, and local residents have come to the conclusion that the forests of the Blue Mountains are unhealthy and may increase risks to people, property, and natural resources.

Do we believe that the earlier forest ecosystem structure, which was dependent on fire, was healthier and is more desirable? If so, what are the tradeoffs in air quality with a managed prescribed fire program versus inevitable wildfire?

Prescribed fire has the potential to degrade ambient air, impair visibility, and expose the public to concentrations of smoke. These negative effects of prescribed fire contradict current state and national air quality regulations. Scientists will need to describe--and the public will need to understand--the tradeoffs among increased prescribed fires, wildfires, ecosystem health, visibility degradation, and public exposure to smoke.

Because managed fires are planned in advance, four mitigation techniques available to reduce air quality impacts can be implemented. Managed ignitions can be planned for situations when (1) smoke will disperse quickly, (2) smoke will avoid sensitive air sheds,

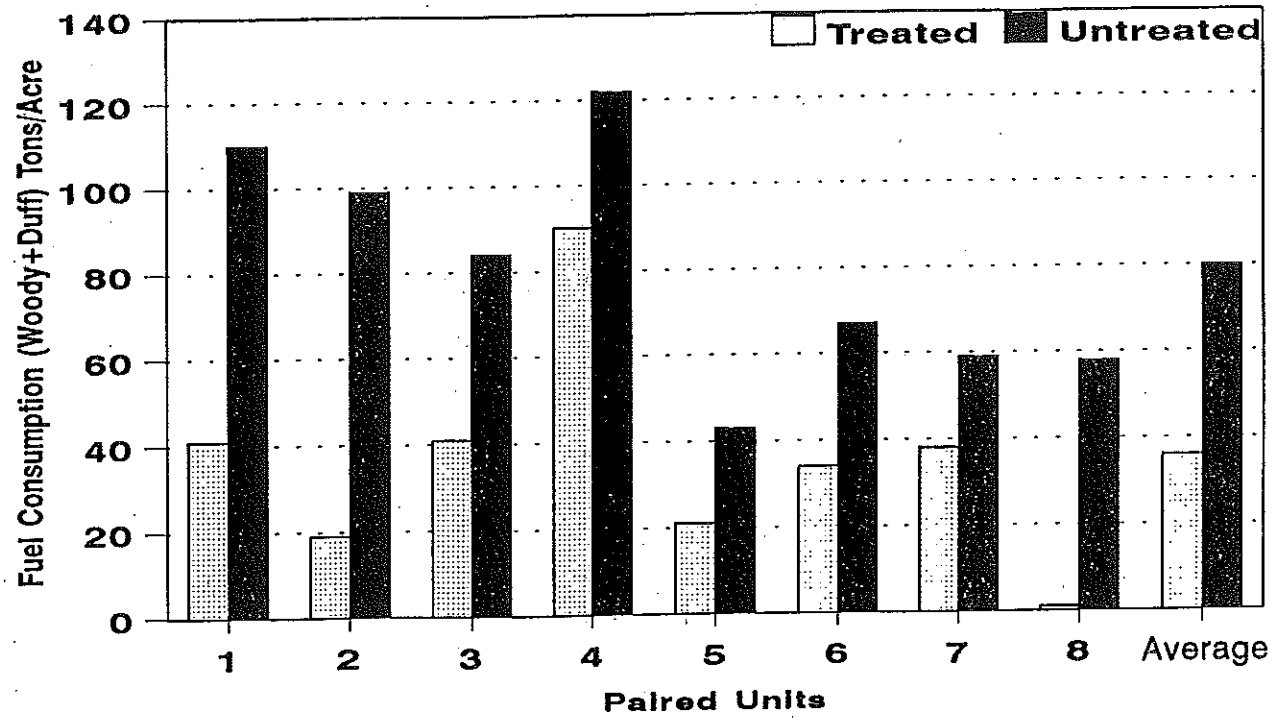

Figure 3. Fuel consumption by unit pairs.

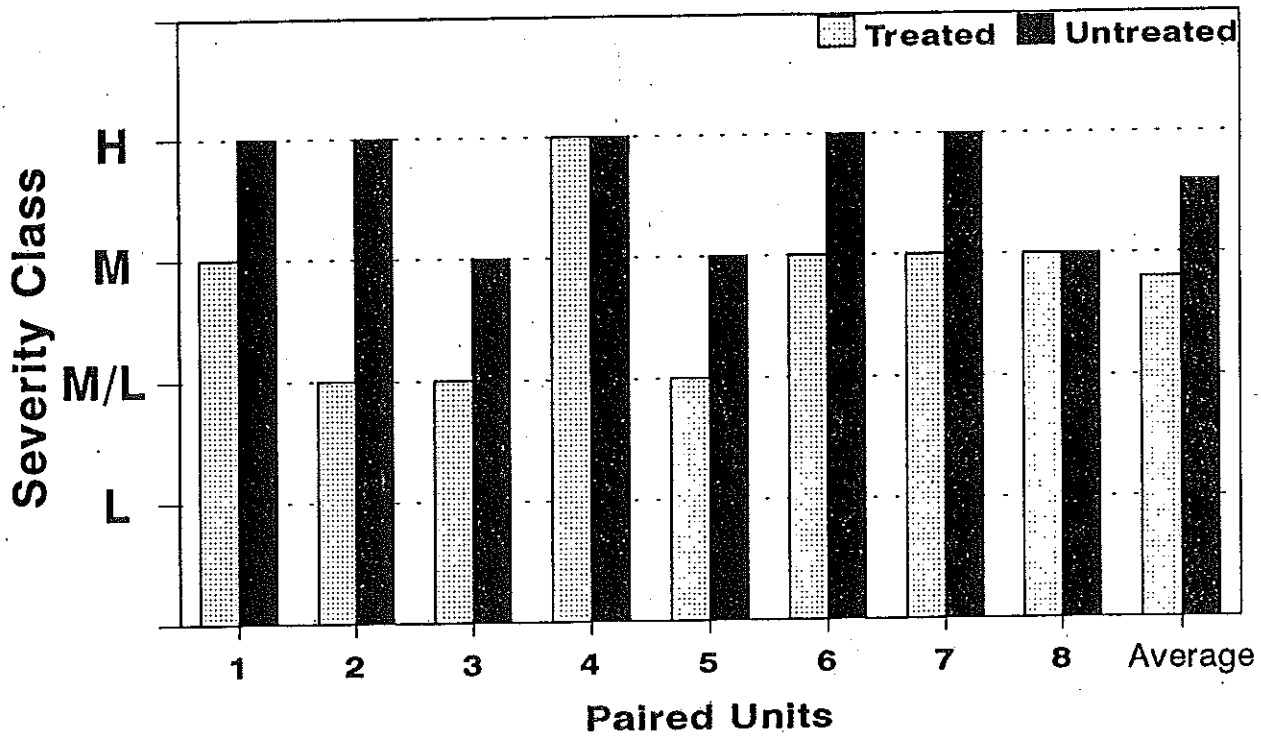

Figure 4. Severity class by unit pairs.

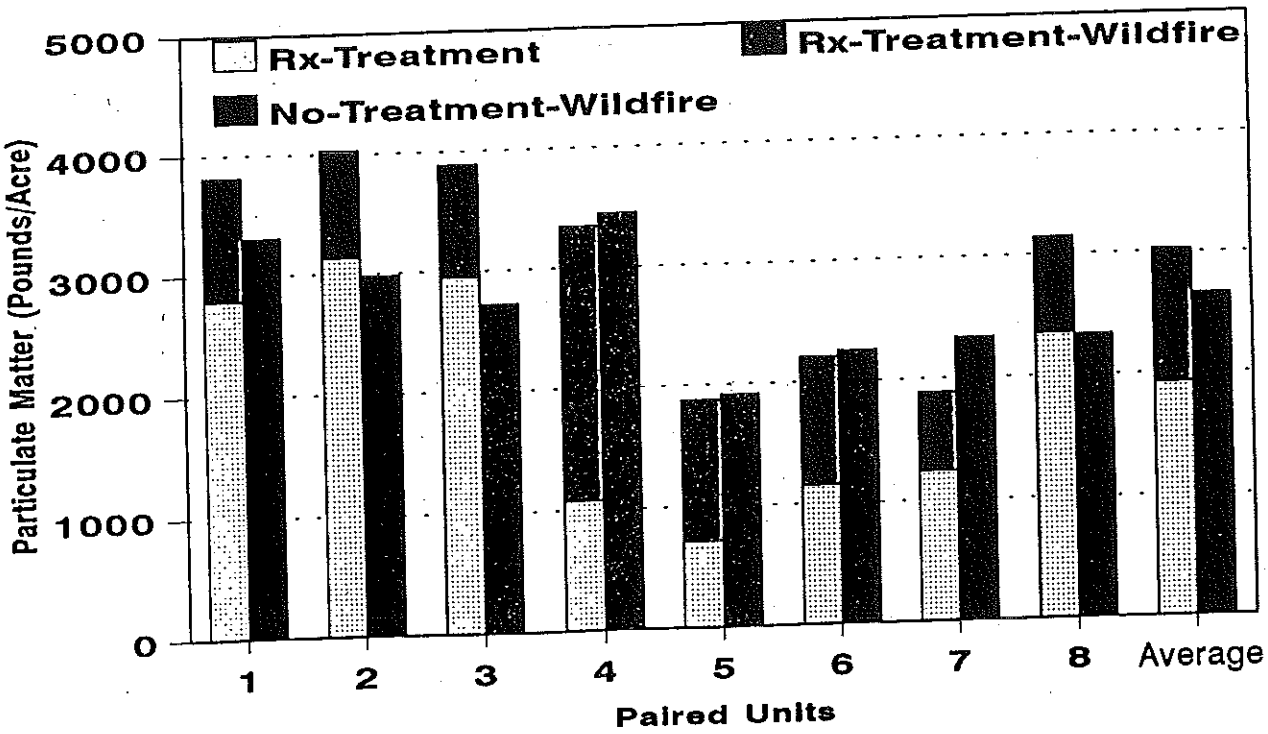

Figure 5. Emissions by unit pairs.

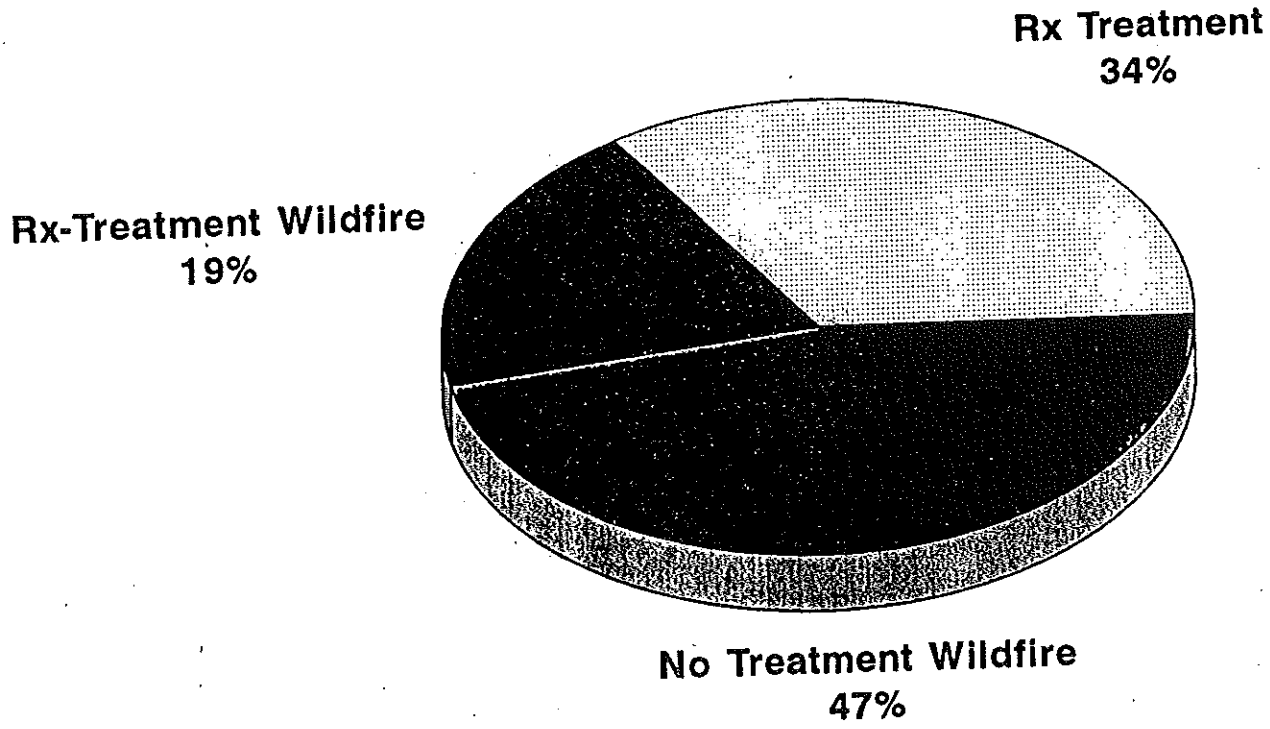

Figure 6. Emissions distribution.

fuels have been removed or reduced, eliminating the need to burn. In cases where specific objectives are to be met, some of these mitigation techniques may not be employed to the fullest extent possible.

Wildfires are not planned; therefore, there is little opportunity to employ mitigation techniques except to suppress the fire as quickly as possible. The smoke generated will be directed and concentrated according to the prevailing wind and atmospheric stability. This will often occur during the summer and fall months when fuel moisture is low, fuel consumption and smoke production is high, and stable atmospheric conditions often persist. Wildfire does have one advantage over prescribed fire: it may never occur. Will the public be willing to accept smoke from prescribed fires spread over a period of years, or is it preferable to gamble that a catastrophic wildfire, which sends out large amounts and greater concentrations of smoke in a few months, will not occur?

The amount of smoke produced by reintroducing prescribed fire into the Blue Mountains can be estimated by projecting the number of acres to be burned, modeling the fuel that will be consumed, and applying an appropriate emission factor. Let us assume that 3 million acres of the Blue Mountain region will need to be treated with fire during the next 20 years to transition the forested areas from the 100 years of fuel accumulation and dead or dying trees. This would result in a managed fire target of 150,000 acres per year. This is five times the 30,000 acres reported to have been burned on the Wallowa-Whitman, Umatilla, Malheur, and Ochoco National Forests in the 1989 smoke management reports (figures 7 and 8.)

If we assume 20 tons per acre of biomass will be consumed and apply an emission factor of 25 pounds of particulate matter 2.5 microns or less in diameter (PM2.5) per ton of fuel consumed, the increase in smoke produced would be substantial. This would result in an increase from 7,500 tons of PM2.5 to 37,500 tons of PM2.5 per year. A portion of the PM2.5 could be reduced and the impact lessened by burning when less fuels consume, by mechanically treating fuels so that burning is not needed, and by burning when dispersion conditions and wind directions are favorable.

In comparison, a 250,000-acre wildfire would produce over 50,000 tons of PM2.5 over a relatively short period of time, and these emissions would be at the mercy of current wind and dispersion conditions. The potential to severely impact a sensitive air shed would be much greater. For example, the Silver Fire burned over 96,000 acres on the Siskyou National Forest during a 72-day period. The fire produced over 27,000 tons of PM2.5 emissions (Hardy 1992) which caused severe smoke impacts on local and regional air quality and exposed communities and firefighters to high concentrations of air pollutants.

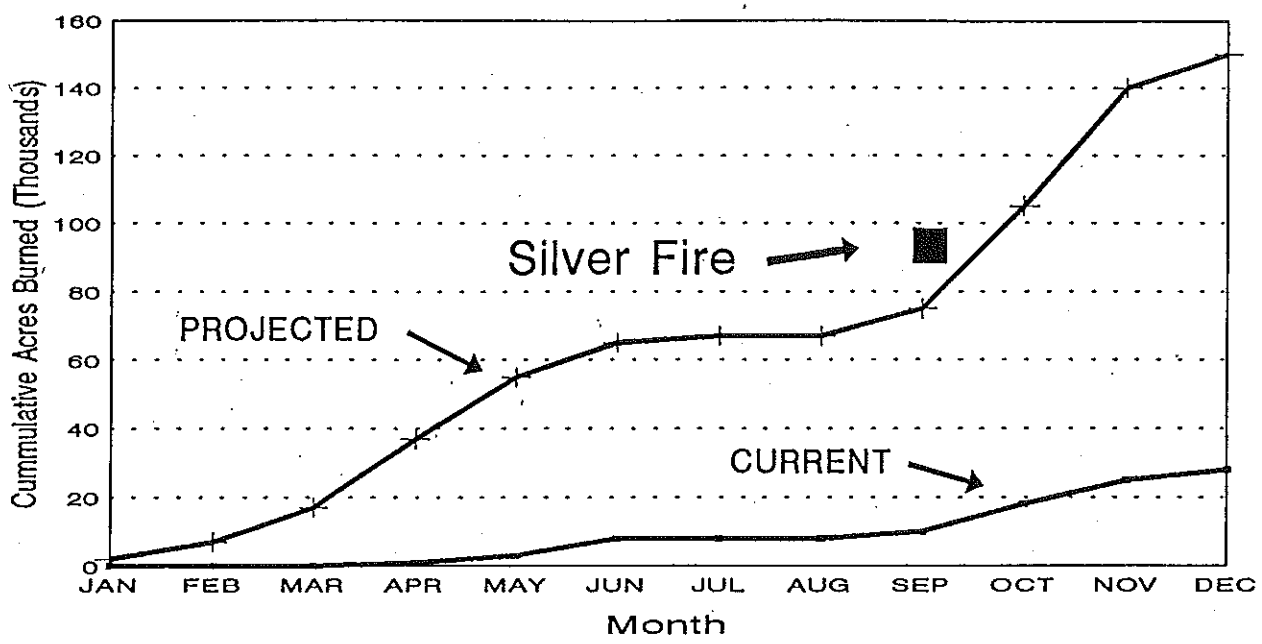

Figure 7. Cumulative acres burned for Umatilla, Wallowa Whitman, Malheur, and Ochoco National Forests. The acres burned during the Silver Fire have been placed on the graph for comparison.

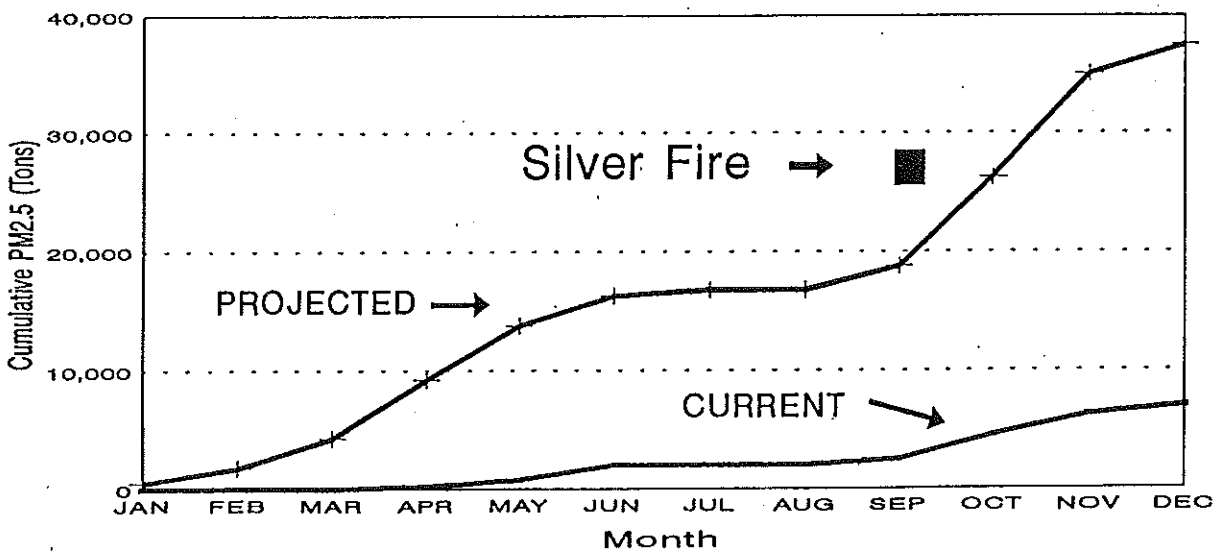

Figure 8. Cumulative particulate matter (PM2.5) production on the Umatilla, Wallowa-Whitman, Malheur, and Ochoco National Forests. The estimated particulate matter produced during the Silver Fire have been placed on the graph for comparison.

The public has previously chosen to bear the costs associated with clean air. Will the public rate air quality values higher than forest health values by choosing to accept wildfire in place of managed fire? Probably yes, unless (1) a strategic plan is developed to address all regulatory requirements such as PSD guidelines, visibility, emissions reduction, and health risks associated with prescribed fire; (2) the public understands the tradeoffs; (3) the public regulatory agencies are involved with fire-management planning; and (4) a strong research program is provided.

Fire is not a tool which should be used on all sites or situations. It is, however, a tool that should be available and understood when designing a management strategy for our natural resources. Proper application of fire, in harmony with other management techniques, may often be the best option for meeting specific objectives while creating the least amount of adverse environmental damage.

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