

# **MODIFYING WILDFIRE BEHAVIOR –**

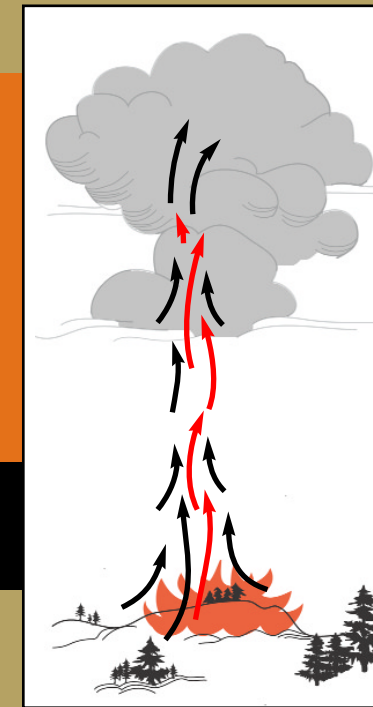
## **THE EFFECTIVENESS OF FUEL TREATMENTS**

THE STATUS OF OUR KNOWLEDGE



Summary of the report by  
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# WILDFIRE BEHAVIOR



## OUR KNOWLEDGE

The extraordinary fire seasons experienced in our western forests in 2000 and 2002 have focused tremendous public attention on forest fuels, the cycle of natural fire that has been interrupted and the capacity of public agencies to undertake remedial treatments to vegetation. Global climate change and associated drought, combined with increasing human settlement in forested areas guarantees that these issues will persist for decades to come.

The forestry community has focused considerable attention on systems for prioritizing areas to be treated. Less attention has been devoted to the appropriateness and effectiveness of alternative fuel treatment methods. There is a widespread assumption that any form of thinning will be effective in modifying fire behavior.

Recognizing that little specific information was available to forest managers, the public and policy makers to guide a choice of alternative fuel treatments, the Forest Trust, through the Southwest Community Forestry Research Center, undertook a comprehensive evaluation of the scientific literature on this topic. We reviewed over 250 individual papers covering prescribed fire, mechanical thinning, a combination of thinning and fire and commercial logging.

Our review revealed a startling lack of scientific information to guide forest managers in selecting the fuel treatments that would be most effective in altering fire behavior under specific conditions. We also found that factors other than tree density – such as ground vegetation and distance to the tree crown – play a profound role in fire behavior.

This assessment focused on ponderosa pine – a “fire adapted” forest type where periodic, low-intensity fires were the ecological norm in presettlement times. Nonetheless, studies in other forest types were reviewed if the research provided useful information on the relationship between fuel treatments and fire behavior.

This study will be of help to land owners, forest managers, scientists and interested observers in evaluating proposals emerging from the National Fire Plan, in determining treatments for specific forest areas or in preparing a research agenda in the coming years.

## FINDINGS

- tree density
- prescribed fire
- consensus of research



- Although the assertion is frequently made that simply reducing tree density can reduce wildfire hazard, the scientific literature provides tenuous support for this hypothesis.
- The literature leaves little doubt, however, that fuel treatments can modify fire behavior. Thus, other factors in addition to tree density play a key role. These factors include the distance from the ground to the base of the tree crown, surface vegetation and dead materials. Research has not yet fully developed the relationship between these factors in changing fire behavior.
- The specifics of how treatments are to be carried out and the relative effectiveness of alternative prescriptions in changing wildfire behavior are not supported by a significant consensus of scientific research at this point in time.
- Substantial evidence supports the effectiveness of prescribed fire, a treatment that addresses all of the factors mentioned above. Significantly, several empirical studies demonstrated the effectiveness of prescribed fire in altering wildfire behavior.
- By contrast, we found a limited number of papers on the effects of mechanical thinning alone on wildfire behavior. The most extensive research involved mathematical simulation of the impact of mechanical thinning on wildfire behavior. However, the results of this research are highly variable.
- A more limited number of studies addressed the effectiveness of a combination of thinning and burning in moderating wildfire behavior. The impacts varied, depending on the treatment of thinning slash prior to burning. Again, crown base height appeared as important a factor as tree density. The research community is still building a scientific basis for this combination of treatments.

- The proposal that commercial logging can reduce the incidence of canopy fire was untested in the scientific literature. A focus on the removal of large diameter trees does not address crown base height — the branches, seedlings and saplings which contribute so significantly to the “ladder effect” in wildfire behavior.
- Much of the research on the effectiveness of fuel treatments uses dramatically different methodology, making a comparison of results difficult. To provide a basis for analysis, we structured our review of the literature into four general groupings: observations, case studies, simulation models and empirical studies. Empirical studies provide the strongest basis for evaluating treatments whereas personal observations are the least reliable.
- We found the fewest studies in the most reliable class – empirical research. We found the greatest number of studies in the least reliable class of research – reports of personal observation. Several other reviews of the literature confirm this finding, stating that the evidence of the efficacy of fuel treatment for reducing wildfire damages is largely anecdotal.
- The results of simulation studies are highly variable, in terms of such factors as fire spread, intensity and the occurrence of spotting and crowning.
- Scientists recognize that large scale prescribed burning and mechanical thinning are still experimental and may yet reveal unanticipated effects on biodiversity, wildlife populations and ecosystem function.



## RECOMMENDATIONS

applied research

optimize learning

return on investments



- Systematic field research, in combination with synthesis from existing knowledge, is needed to provide a sound scientific basis for evaluating and designing fuel reduction treatments.
- The notion that mechanical thinning, or a combination of thinning and prescribed fire, reduces the incidence of catastrophic fire should be viewed as a working hypothesis. Specific combinations of treatments need to be tested through experimentation using site – and weather – specific data.
- Priority should be given to locating fuel treatments in areas that include a well-constructed, experimentally driven design, so that agencies can optimize their ability to learn, providing a higher return on future investment.
- In 2000, our nation embarked on an emergency \$1.6 billion program to reduce fuels on millions of acres. The Western Governors Association calls for sustaining this level of investment over the next ten years. Based on the findings of this paper, a comparable investment must also be made in primary and applied research to provide a credible scientific basis for the design, implementation and evaluation of alternative treatments.

The full report is available at [www.theforesttrust.org](http://www.theforesttrust.org), or call 1-800-803-0025.