Science Information for Informing Forest Fuel Management in the Dry Forests of the Western United States

Sarah McCaffrey and Russell Graham

ABSTRACT

Land managers need timely and straightforward access to the best scientific information available for informing decisions on how to treat forest fuels in the dry forests of the western United States. However, although there is a tremendous amount of information available for informing fuels management decisions, often, it is in a form that is difficult to use or of limited applicability. To improve access, interpretability, and use of the full body of research, a pilot project was initiated by the USDA Forest Service to synthesize relevant scientific information and develop publications and decisions support tools that managers can use to inform fuels treatment plans. This article provides an overview of the project and briefly discusses key lessons learned as an introduction to a series of articles, to be published in future *Journal of Forestry* issues, on different topic areas addressed by the project.

Keywords: wildland fire, fuels planning, National Environmental Policy Act (NEPA) of 1969, technology transfer

Recently, large and often destructive wildfires have highlighted the need to facilitate efforts to reduce fuel loads and restore fire resiliency on the national forests and other public lands (Graham et al. 2004). During the summer of 2000, 122,827 wildfires burned 8.4 million ac, and during the summer of 2002, 73,457 fires burned 7.1 million ac (National Interagency Fire Center 2006). Such large and often severe wildfires put a number of important values at risk as exemplified by the destruction of more than 3,600 homes in the wildfires that burned in southern California in 2003. With an increased emphasis on treating fuels to reduce wildfire impacts in the United States, the need for well-documented, accessible scientific information has become increasingly more crucial.

In 2003, the USDA Forest Service initiated a project—Applied Wildland Fire Research in Support of Project Level Hazardous Fuels Planning (or Fuels Synthesis Project)—to accelerate the delivery of research information to fuels specialists and others involved in project planning. This science synthesis and integration effort is an interagency research/management partnership to support the 10-Year Comprehensive Strategy for reducing wildland fire risks. The Fuels Synthesis Project worked to

- Develop accessible analyses, protocols, and tools.
- Produce peer-reviewed documents that synthesize and integrate the ecological and social science relevant to fuels treatments.
- Deliver these products in a user-friendly format.

Target audiences include fuels management specialists, resource specialists, National Environmental Policy Act (NEPA) team leaders, line officers in the Forest Service and Department of the Interior, community leaders, private landowners, and educators.

Background

To keep the size of the project manageable, the geographic focus was limited to the dry forests of the western United States. These forests are, in most cases, dominated

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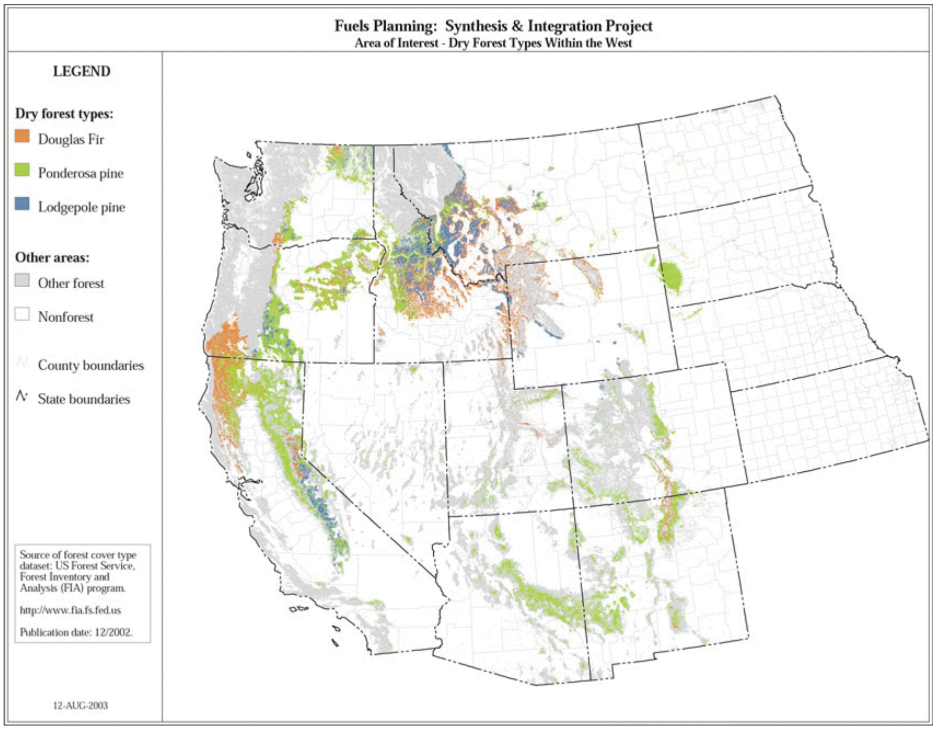

Figure 1. Extent of the dry forest, represented by the range of ponderosa pine.

or potentially dominated by ponderosa pine (*Pinus ponderosa*) and/or Douglas-fir (*Pseudotsuga menziesii*) and occur throughout the western United States, southern Canada, and northern Mexico (Figure 1; Little [1971]). Through a combination of historic livestock grazing, tree harvesting, fire exclusion, climate change, and other factors, these forests are now, in many places, significantly different from the ponderosa pine forests that existed in the mid 1800s (Rasmussen 1941, Pearson 1950, Cooper 1960, Barrett 1979,Van Hooser and Keegan 1988) In many locales grand fir (*Abies grandis*) and/or white fir (*Abies concolor*) and Douglas-fir have colonized sites, while in other stands have become overly dense. These conditions contributed to increased insect and disease epidemics, further altering the composition and structure of these forests compared with the conditions that occurred historically (Harvey et al. 1999).

Any effort to reduce fire hazard will require a great deal of work by research, management, policymakers, and interested stakeholders. Recent estimates indicate that nearly 100 million ac (an area roughly equivalent to that of the state of California) of the dry forests that were historically burned by frequent surface fires in the western United States may benefit from the restoration of surface fire and 11 million ac of forests need to be treated to protect communities from wildfire (Aplet and Wilmer 2003). Rummer et al. (2003) estimate that over 66 million ac of forestlands could benefit from fuel reduction. Even with uncertainties in these estimates and arguments as to their precision and accuracy, the numbers clearly illustrate that the potential treatment needed to modify fire behavior and burn severity are staggering.

Meeting this challenge will require managers to greatly increase the amount of land treated. Resource assessments are a necessary part of the environmental analysis process needed to develop fuel management options. However, the ability of interdisciplinary planning teams to make full use of existing information can be limited because, often, a key area of expertise is unavailable or team members lack the time and/or training to interpret new findings. The problem is compounded by the attrition of experienced specialists over the past several decades. Without easy, centralized access to the latest information and interpretation of the science basis for decisionmaking, planning teams may miss important findings or decision support tools inhibiting their ability to develop effective strategies for addressing the uncertainties and sometimes-conflicting results that are characteristic of most bodies of science. These deficiencies are becoming more evident as the flow of scientific information and science-based tools being generated by the Joint Fire Science Program and the National Fire Program increases.

Thus, land-management leadership and field managers need timely and straightforward access to the best scientific information available for informing decisions on how to treat forest fuels, but identifying and integrating diverse scientific findings often is a barrier to timely decisionmaking. Even though there is a tremendous amount of information available for informing fuels management decisions for these forests, often, it is in a form that it is difficult to use or is of limited applicability for addressing fuel management options in the dry forests of the western United States. Improving access, interpretability, and use of the full body of research will result in better-informed decisions; more proactive and consistent analysis of environmental issues in the planning process; and a stronger science base for communication with Congress, the administration, the media, and the public.

Process

To address these issues, a joint pilot project was initiated within the Forest Service, between Fire and Aviation Management and Research and Development, to supply timely and relevant scientific information that can be used for planning fuels treatments and develop products to deliver this information to managers. Information produced by the project can be used for planning and executing fuel treatments throughout the dry forests (ponderosa pine and Douglas-fir) on lands managed by the Forest Service, Bureau of Land Management, state agencies, and private landowners in the western United States. In addition, the products will be applicable to the dry forests of Canada, and many of the products, especially those dealing with the social aspects of fuels treatments, will be applicable throughout the United States.

Four core teams—forest structure and fire behavior, environmental consequences, fuels treatment economics, and social science—were established (Table 1). Composed of scientists from the North Central, Pacific Northwest, and Rocky Mountain Research Stations, each team developed a set of key questions for their topic area. These were presented to a group of managers at a 2-day workshop for discussion and refinement. Each team then identified partners to help synthesize information relevant to the questions and, again in consultation with managers, identify the best products and

Table 1. Core project members.

Team	Team leads
Project management	Russell Graham, Sarah McCaffrey
Fire behavior and forest structure	David Peterson, Morris Johnson
Environmental consequences	Elaine Kennedy-Sutherland, Anne Black
Economics	Jamie Barbour, Roger Fight
Social science	Pam Jakes, Sue Barro

formats to transmit the information to on-the-ground practitioners. Over 50 scientists and professionals from throughout the United States have been involved in developing the products. Midway through the project, two beta test workshops were held in which a group of 10–20 managers—including NEPA coordinators, silviculturists, wildlife biologists, hydrologist, fuels specialists, fire management officers, and district rangers—were brought together to use the various products and provide feedback. These interactions were critical to the success of the project because the team was able to have real-time review of the products. For example, the practitioners were able to try the economic and wildlife analysis tools and see how results could be effectively communicated to interested stakeholders. On completion of these workshops the products were modified and improved where necessary and peer-reviewed drafts were prepared.

Although the nature of products varied across teams—from computer-based decision support tools to scientific synthesis provided in general technical reports—each team developed products that fit into a three-level information model. At a basic level, a series of fact sheets (www.forest.moscowfsl.wsu.edu/fuels/factsheets.HTML) were developed. The fact sheets are two-page, color summaries that provide managers the essence of the synthesized information. At the middle level, a more detailed product was developed—such as My Fuel Treatment Planner and the Wildlife Response Model—that managers can use for specific situations. Finally, both the fact sheets and middle-level products are supported by more detailed peer-reviewed documents on which the first two levels are based. Where appropriate, annotated bibliographies were developed also. In addition, a website was developed to provide a single location where all the products could be accessed (www.forest.moscowfsl.wsu.edu/fuels/). Approximately 20 Forest Service general technical reports and 50 research notes (fact sheets) are being published.

A key goal of the project has been to not only produce the synthesis and tools but package them in a manner that makes the information readily available to all interested parties. As such, once a sufficient body of products had developed, a technology transfer team was created to identify the best ways to make the tools available and the level of support needed for their effective use. Efforts are being made to systematically transfer the information to users and stakeholders and work with field-test partners to apply the tools, assess their utility, and provide feedback to developers.

This issue of *Journal of Forestry* contains a more detailed article (Johnson et al. 2007) describing the efforts of the forest structure and wildland fire behavior team. Subsequent issues will contain articles on the remaining teams. The following is a brief description of each team's focus and products.

Wildland Fire Behavior and Forest Structure. To plan forest treatments, managers need to understand how different fuel treatments may modify wildfire behavior and burn severity. There is a tremendous amount of knowledge available on forest development and the majority of it is capable of being generated with computer programs. However, for local decisions specific data and expertise available for running the often complex computer programs may not be available. To address this concern, the team produced photo guides that can be used to estimate fire hazard in range of representative stands and then display various alternatives for modifying both the surface and the aerial fuels and display their potential impact on modifying forest structure and fire behavior.

Environmental Consequences of Fuels Treatments. In addition to knowing how forests have changed and how wildfires may impact fire behavior, treatments aimed at modifying fuels also have environmental impacts. These impacts can be short-lived such as producing smoke from a prescribed fire or long-lived by inadvertently introducing an exotic weed. Water, soil, and vegetation are impacted by fuel treatments, which in turn often alter the habitat of birds, mammals, and fishes. To address these issues, the environmental consequences team created new or enhanced existing Web-based and stand-alone decision support tools that can be used to assess the impacts of fuels treatments on understory plants, wildlife, soil erosion, smoke, and tree root diseases.

Economic Uses of Material and Costs of Fuels Treatments. Managers must not only consider environmental impacts of a treatment but the costs of fuels treatments, often a major consideration. The economics team developed a computer tool (My Fuels Treatment Planner) that can be used to evaluate the costs of alternative fuels treatments that can be adjusted to local forest and economic conditions. Because the nature of treatment choices will depend on current forest conditions and the extent and intensity of treatments needed to produce desired conditions, information developed from the forest structure and fire behavior guidebook can be incorporated into My Fuels Treatment Planner (Johnson et al. 2006) to estimate the costs of the treatments.

Public Understanding and Behaviors Related to Fuels Management. No matter how ecologically and technically sound and well planned a treatment is, its ultimate implementation will be highly dependant on public acceptance of the efforts. Without public support, fuels management decisions on public lands are likely be challenged and potentially litigated in court. Therefore, some of the most valuable products produced by the project deal with the interaction of decisionmakers and planners with forest stakeholders and interested publics. Collaboration, acceptability of fuel treatments, how aesthetics shape acceptance, communicating with property owners about fuels management and defensible space, and the importance of working locally are the main topic covered by the team to help facilitate fuel treatment planning and implementation.

Lessons Learned

As a pilot project with no clear path to follow, naturally, there were a few bumps in the road and several key lessons were learned in the process.

The main key to success of such projects is assembling competent people and letting them do their job. Members of the target audience also need to be involved throughout the entire process to ensure the project fulfills its goal. The variety and number of people involved does necessitate the dedication of a significant amount of management time for one to two people who must ensure forward progress, facilitate communication across teams, organize meetings as needed, and assure funding availability. Ideally, a project of this size could require the near full-time attention of one person specifically for project management.

The pilot nature of this project meant that the exact goal, cost, and timelines were uncertain on initiation, with different participants having different notions of what was expected. This highlighted the importance of clearly identifying goals at project initiation and establishing realistic expectations—for budget, timeline, and expected end results—for both the people completing the project and the people receiving the project information. If technology transfer is an integral part of the project, then the process, timeline, and budget for transfer, evaluation, and delivery of the product must be considered and formally included. A key part of staying within the constraints is to design and constrain the scope of the project in a way that prevents external or internal forces from causing mission creep.

A challenge with this effort was the desire for a quick turnaround coupled with the need to produce useful, peer-reviewed products, which takes time. Ensuring that products were usable meant there was a need to test and refine the items several times and peer review (which in most cases was double blind and handled through a third party) also is dependant on timely response of reviewers and the need to make changes based on reviews. Hence, in such an effort it is important that planned timelines balance the need for immediate information with the time necessary for creating a quality product.

Finally, a key question asked throughout the process, for which only a partial answer has been developed, is the question of maintenance. The project team was chartered to produce the synthesis and products. However, for the tools to remain useful they need to be technically supported. In addition, to keep them relevant and useful, many products will need to be updated. Currently, intermediate arrangements have been made for the maintenance of the Website (www.forest.moscowfsl.wsu.edu/fuels/) and the economics tool (www.fs.fed.us/fmsc/index.php); however, a long-term solution to these issues has not been finalized.

Conclusion

Timely, relevant, and synthesized scientific information is crucial for all land-management decisions but those dealing with conditions that contribute to uncharacteristically severe wildfires in the western United States are of paramount importance. As dramatic as the wildfires themselves are, the forest treatments aimed at modifying their behavior and burn severity invariably invoke argument and disagreement as to their necessity, application, efficacy, and effects among forest stakeholders, biological disciplines, decisionmakers, managers, and policymakers. To inform this debate and the decisions directed at modifying forest fuels, the Fuel Synthesis Project synthesized scientific information related to fire behavior, economics, environmental consequences, and social issues of fire management and developed products to transfer that information to managers planning fuel treatments in the dry forests of the western United States. This project exemplifies bringing together a disparate group of scientists from across the country in cooperation with land managers to provide relevant scientific information in a timely manner yet ensuring it stands the rigor of science. An additional article in this issue (Johnson et al. 2007) and future articles in the *Journal of Forestry* will display the information and products developed. The lessons learned by the project and its success will be judged by the number of decisions the information informs and if the fuel treatments planned and executed make a difference in how wildfires burn and the damage they cause.

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