



# Integrating Science into Fire Management Planning: Maximizing the Benefits of Fire

## Key Points

- Fire Management Plans (FMPs) can help reduce fire costs and mitigate fire risks, providing the strategic foundation for all fire-related management activities before, during, and after a wildland fire.
- While Congress and federal agencies have provided consistent policy direction requiring the use of FMPs on “every area with burnable vegetation,” many U.S. Department of Agriculture and Department of Interior lands still have not completed FMPs.
- FMPs too often fail to provide a comprehensive overview of fire’s necessary role in the ecosystem and to integrate scientific knowledge into the planning process.

## Background

In the last decade, policymakers and forestry professionals have decried a “crisis” in forest health. Fire experts place much of the blame on a century of fire suppression that has starved fire-dependent ecosystems of regular fire cycles, created unhealthy fuel loads, and led to conditions ripe for large wildfires in some places. During that same time period, however, fire suppression on public lands has continued, growing to consume hundreds of millions of public dollars annually. Because of increasing public attention to wildfire and spiraling costs, land management agencies are under extreme political pressure both to reduce fire costs and to mitigate fire risk.

These outcomes are difficult to achieve, however, if a plan is not in place *before* a wildland fire occurs. For



PHOTO BY BRYAN DAY

Like water, trees and wildlife, fire is a natural element of most ecosystems. Wildland fire must be considered as part of broader ecosystem planning and management.

Science & Policy Brief

▼  
Land management agencies have a clear policy mandate: To develop FMPs for “every area with burnable vegetation.”  
▲

this reason, the departments of Agriculture and Interior now require that all public lands have in place a Fire Management Plan. FMPs are planning documents that provide the strategic foundation for all fire-related management activities before, during, and after a wildland fire. The plans are produced in a pre-crisis environment and as such, provide well-reasoned and comprehensive direction during the oftentimes frenetic atmosphere of a raging wildfire.

All FMPs must meet certain parameters: they must dovetail with the overall objectives of federal fire policy and local Resource Management Plans; they must delineate specific goals, objectives, options and strategies for managing fires on a given landscape; they must detail organizational structure and financial requirements to achieve those goals. Finally, FMPs must include monitoring and evaluation methodologies that help land managers determine whether those strategies are working on the ground.

This Science and Policy Brief describes federal policies that direct federal land management agencies to develop FMPs and discusses the difficulties in assessing

“compliance” with those policies. We suggest that the best way to assess the quality of an FMP is to examine its success in incorporating several

decades of scientific research showing that fire is a natural and necessary ecological process. We use examples from two National Forests along the Front Range of Colorado — the Arapaho-Roosevelt and the Pike — to illustrate successes and shortcomings along the way.

## The Problem

### Policy Direction is Clear

After the tragic events of 1994’s South Canyon fire — in which 14 firefighters lost their lives on Storm King Mountain in Colorado — federal land management agencies conducted a systemic evaluation of federal fire policy and practice. While safety was the paramount concern, the resultant 1995 Federal Wildland Fire Management Policy and Program Review also called for better coordination between federal agencies in managing fire risk before, during, and after a wildland fire by better integrating fire planning into overall forest management. The review concluded that FMPs based on a “foundation of sound science” were critical to ensuring sound fire management.

The 2000 fire season, which stretched federal firefighting resources dangerously thin, again prompted a reexamination of federal fire policy. The 2001 Review and Update of the Federal Wildland Fire Management Policy, begun even as embers from the 2000 fire season smoldered, affirmed that the recommendations from the 1995 review were sound — but lacking in implementation. The 2001 Review re-emphasized the importance of FMPs, reminding federal land management agencies: “High priority must be placed on completing FMPs,” and urging a shift in fire management emphasis from a reactive to a proactive approach.

Other independent reviews reiterated the important role FMPs play. In a series of reports beginning in December of 2000, the National Academy of Public Administration declared FMPs “key to implementing wildland fire policy.” A year later, the Government Accountability Office (GAO), the non-partisan Congressional “watchdog” agency of the federal government, urged federal agen-

“Among other things, Fire Management Plans identify the level of risk associated with each burnable acre, including areas bordering the wildland-urban interface and set forth the objectives that a local forest, park, or other federal land unit is trying to achieve with fire.”<sup>1</sup>

<sup>1</sup> Wildland Fire Management: Improved Planning Will Help Agencies Better Identify Firefighting Preparedness Needs. GAO-02-158, Washington, DC.

TABLE 1.

## Federal Agency Directives

Year	Title and Author(s) of Document*	What it says about Fire Management Plans
1995	<b>Federal Wildland Fire Management: Policy and Program Review</b> , DOI, USDA	<ul style="list-style-type: none"> <li>• “Federal agencies will develop FMPs for all areas subject to wildland fires.” (page 10)</li> <li>• “Fire Management Plans . . . are based upon the best available science.” (page 4)</li> </ul>
2001	<b>Review and Update of the 1995 Federal Wildland Fire Management Policy</b> , DOI, USDA Forest Service, DOE, DOD, DOC, EPA, FEMA, NASF	“Fire Management Plans should be developed and implemented across agency boundaries to ensure consistent approaches . . . successful implementation of 2001 Federal Fire Policy depends on the development and implementation of high-quality FMPs by all land managing agencies.” (page 12)
2002	<b>A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment: 10-Year Comprehensive Strategy Implementation Plan</b> DOI, USDA, WGA, interested stakeholders	Establishes “Goal One: Improve Fire Prevention and Suppression.” As a way to measure progress toward this goal, the document suggests measuring the “Percent of burnable acres covered in federal Fire Management Plans.”

\*Authors include: U.S. Departments of Agriculture, Commerce, Defense, Energy, Interior; Environmental Protection Agency, Federal Emergency Management Agency, National Association of State Foresters, Western Governors’ Association.

cies to “ensure that Fire Management Plans are completed *expeditiously* for all burnable acres and are consistent with the national fire policy” (emphasis added).

Looking at the last decade of federal legislation and oversight, there is overwhelming consistency in fire management policy on public lands: FMPs are critical planning tools and are required for all administrative units (Table 1).

### Compliance Is Not Clear

Unfortunately, despite nearly a decade of clear policy direction, many administrative units still have not completed Fire Management Plans.<sup>2</sup> According to the GAO, a number of explanations exist for the low rate of completion. Until recently, agencies did not receive specific guidance or technical support in the creation of their own plans. Recent publications, however, have helped to

fill this gap; most notably, a formal template for FMP creation was issued in 2002 by an interagency committee at the behest of the Western Governors’ Association.<sup>3</sup>

While adherence to the template ensures that all agencies consider similar critical elements of fire management, use of this template guarantees neither compliance nor excellence. Individual land management units have broad discretion over the scope and content of FMPs. Even if a given administrative unit does prepare an FMP that complies with the letter of the directive, it is extremely difficult to determine whether it also complies with the *spirit* of the policy: to create a proactive, science-based plan in order to maximize the benefits of fire while minimizing its costs.

Nonetheless, three fundamental fire management principles are so woven throughout federal policy that we

▼  
Land  
management  
agencies are  
under extreme  
political pressure  
to reduce fire  
costs and  
mitigate fire risk.  
▲

<sup>2</sup> Unofficial estimates of the rate of completion vary widely. The BLM has reported a 100% completion rate, but many suspect this is unrealistic; the USDA Forest Service currently reports a 40-60% completion rate.

<sup>3</sup> Forest Service Handbook 5109.19, Chapter 50, page 7.



PHOTO BY BRYAN DAY

FMPs provide the strategic foundation for all fire-related management activities before, during, and after a wildland fire.

▼  
FMPs are produced in a pre-crisis environment and provide well-reasoned and comprehensive direction during the oftentimes frenetic atmosphere of a raging wildfire.  
▲

consider them to be the key elements of FMP compliance. First, fire management and planning should place safety as the number one concern of all fire decision-making. Second, because fire does not respect jurisdictional boundaries, successful fire management and planning should be collaborative in nature, open to broad input by interested stakeholders, and founded on interagency coordination. Third, fire management and planning should incorporate the “best available science” and should reflect several decades of scientific research showing that fire is a natural and necessary ecological process. Heeding that science, plans should therefore seek to maximize the positive benefits of fire while minimizing fire risk.

### Best Available Science

In evaluating an FMP, we assume that safety considerations remain the highest priority in all fire planning and management. It is primarily during the implementation of fire management techniques that safety becomes paramount, and we expect that FMP preparation will help ensure safe protocols on the ground. Likewise, we strongly endorse collaborative fire planning as

fundamental to successful fire management; those collaborative processes, however, are part of the development of the plan itself and thus are not easily captured by reviewing the final document. Accordingly, we find that an evaluation of the quality of an FMP must explore the degree to which a Plan demonstrates reliance on the “best available science.”

Without a foundation of strong science, planning cannot be expected to produce the desired results on the land: to maximize fire’s benefit while minimizing its costs. Recognition of fire as an ecological process is perhaps most central to this scientific approach to fire management, but FMPs must also incorporate many other nuanced aspects of fire science. For example, FMPs should be heavily informed by the ecology of fire, including forest type, fire regime, and other metrics commonly used in the scientific community to determine ecological health and consequent management needs. The science must also include diverse disciplines such as ecology, wildlife biology, economics and the social sciences. There is ample scientific data relevant to fire planning and implementation in scholarly, agency and academic literature: integrating that knowledge into the planning process, however, has been, at best, uneven.

### Elements of a Compliant FMP

The interagency template used to develop FMPs is organized in five sections: (1) Relationship to Land Management Planning and Fire Policy; (2) Wildland Fire Management Strategies; (3) Wildfire Management Program Components; (4) Organization and Budget; and (5) Monitoring and Budget. Moving from the general to the specific, the template paints a picture of desired future landscape fire conditions within social and ecological contexts and then describes specific strategies to realize those desired conditions.

Following is a brief overview of each of these template sections with a short description of what a strong, science-based FMP should include. To illustrate these concepts and highlight effective and ineffective elements of FMPs, we offer examples from the Arapaho-Roosevelt and Pike National Forests in Colorado. These two forests, located adjacent to one another along the highly-populated Front Range of Colorado, have received a great deal of attention and subsequent funding in recent years because their exposure to wildfire risk is considered exceptionally high.

### **Relationship to Land Management Planning and Fire Policy**

FMPs must link, or tier, to existing Resource Management Plans (RMPs) in order to integrate fire with the land unit's more general resource objectives, such as wildlife habitat, recreation and timber management. An FMP would direct managers to respond to fire differently in a designated Wilderness zone, for instance, than in a popular recreation area where the use of fire might not be as appropriate.

**The Arapaho-Roosevelt National Forest** (ARNF) has a relatively recent Forest Plan (1997). As a result, the 2002 Fire Management Plan is able to draw on extensive and current resource data, including detailed maps, to illustrate its desired approach to fire. The two documents link together very well, with the FMP consistently referencing the Forest Plan and utilizing the extensively analyzed Geographical Units described there to organize different fire strategies. References to the 2001 Fire Policy are also prevalent throughout the FMP.<sup>4</sup>

**The Pike National Forest** (PNF), by contrast, is operating with an RMP from

1984, and the revision process for a new plan has not yet begun. Without a current RMP, the Fire Management Plan (2003) cannot effectively link to accurate resource data. The most glaring shortcoming of this deficiency is that Wildland Fire Use (WFU), or the management of natural ignitions for improved forest health, is explicitly forbidden, despite growing scientific recognition of the value of this management tool. The plan requires that "initial attack suppression action will be taken on all fires."<sup>5</sup> Although much of the land within the PNF is within the Wildland-Urban Interface and therefore not likely appropriate for WFU, the planning document should carefully consider the option in more remote areas of the forest.

### **Wildland Fire Management Strategies**

Often structured into four subsections, this portion of the FMP discusses general fire management considerations, wildland fire management goals, wildland fire management options, and descriptions of particular management strategies prescribed for individual Fire Management Units (FMU) or Zones (FMZ). Although this section of the FMP discusses fire management strategies broadly, a degree of specificity is essential. The plan should clearly identify which areas are to be managed in which ways, why, and how.

The value of these fire management strategies is directly proportional to their reliance on current scientific understanding of the process of fire on the particular landscape of interest. Unfortunately, neither the ARNF nor the PNF include a good discussion of current fire ecology in their plans. Both forests tend to focus unduly on the

▼  
Without a foundation of strong science, planning cannot be expected to produce the desired results on the land: to maximize fire's benefit while minimizing its costs.  
▲

<sup>4</sup> Arapaho and Roosevelt National Forests, Pawnee National Grassland, Fire Management Plan, 2002. Approved by James Bedwell, Forest Supervisor.

<sup>5</sup> Pike and San Isabel National Forests, Comanche and Cimarron National Grasslands, Fire Management Plan 2003. Approved by Bob Leaverton, Forest Supervisor.



PHOTO BY KARI BROWN

FMPs give fire managers specific direction on how best to respond to wildland fire threats in different locations and under different conditions.

mechanics of “what” and “how” action is to be taken without addressing “why” those actions are scientifically preferable. This is not merely an academic exercise: While FMP directives may lead readers to assume that forest managers reach decisions on operational protocols and prescriptions based on the best available science, this is not always the case. Documenting decisions with the science behind them lends transparency and accountability to the planning process.

This section of the PNF’s FMP reads as a protocol manual, relaying detailed operational instructions rather than outlining a vision for fire management; weak science in this section might be attributed to the lack of current resource data. The ARNF has not proved itself to be much better served for having a more recent Resource Management Plan. For example, despite a detailed review of management considerations specific to ecologically meaningful fire management “units” and “zones,” the ARNF FMP greatly oversimplifies fire regime types, reducing four distinct regimes into two.

## Wildland Fire Management Program Components

This section should provide a detailed overview of each dimension of the fire management program as it plays out on the ground. Discussed in this section are specific strategies, tactics, and tasks relating to: wildland fire suppression, wildland fire use, prescribed fire, non-fire fuel treatments, and emergency rehabilitation and restoration. The FMP should be as specific as possible, describing protocols and administrative procedures for all potential pre-fire landscape management, real-time fire response, and post-fire rehabilitation situations.

Both the ARNF and PNF appropriately provide operational guidance for fire management components, but fail to offer site-specific ecological information to inform those protocols. As a result, components of fire management remain broad and programmatic rather than site-specific, making informed management decisions nearly impossible.

For example, both forests do an excellent job describing how to plan and use prescribed fire and non-fire fuel treatments, but offer little, if any, guidance as to where such treatments may be most strategic. In the case of the PNF, prioritized fuels projects are listed but without a clear explanation of how those priorities were established. The ARNF does a somewhat better job providing a rationale for where fuel treatments are needed and why, referring to spatial data analysis.

## Organization and Budget

Perhaps most critical to the success of the FMP is this discussion of the capacity of the land management unit to carry out the strategies and objectives outlined. Among the components of capacity assessed in this section are personnel needs, equipment requirements and overall funding levels required to implement the plan.

It is important to note that the capacity to implement the FMP is largely

beyond the control of the land management unit, as funding allocations and personnel assignments are determined by Congressional appropriations and agency staff at higher levels. Nonetheless, the FMP is an invaluable tool that can allow managers to evaluate whether resource needs are aligned with unit capacity.

Given the outdated Forest Plan for the PNF and the subsequent exclusion of fire as an ecological process, the FMP serves largely as a suppression guidance document. Discussion of the organizational and budgetary needs during a fire is therefore limited to suppression responses, without discussion of what personnel and budget needs might be required to achieve more holistic fire-related ecological goals and objectives.

The ARNF appropriately acknowledges that the use of fire as a tool for improving forest health (WFU) is restricted because the forest does not have the requisite staffing. WFU as an essential management tool is therefore limited to the availability of outside interagency fire use specialists. When discussing prescribed fire, the FMP limits the scope of the forest's program to current agency capacity, rather than determining what capacity would be necessary to more completely address current and future resource needs. Both forests could have made much more explicit the budget and staffing conditions needed to implement holistic fire management successfully.

### Monitoring and Evaluation

Because the FMP provides guidance for a range of management actions, monitoring and evaluation of the plan's implementation offers essential insight into whether the FMP is succeeding. Lessons learned should feed back into the planning process according to adaptive management principles. Thus, the FMP should describe how it intends to monitor management actions and how it will incorporate successes, failures, and new science into future actions and planning.



PHOTO BY TOM STORY

Both the ARNF and the PNF have very short sections in their FMPs devoted to monitoring and evaluation. The ARNF describes a vague annual monitoring process to be implemented by an interdisciplinary team. According to the plan, staff is required only to monitor fuels treatment projects, such as acres thinned and burned. However, monitoring of long-term outcomes, such as the extent to which fuels reduction treatments contribute to reduced fire risk, are explicitly “not required under this fire management plan.” The PNF offers a slightly more specific monitoring system, with staff asked to track fuel-loading hazard, fuel treatment, and suppression/prevention programs on an annual basis. Additionally, the PNF offers direction on reporting requirements for monitoring, and these protocols link to budget and staffing needs. Without additional guidance, however, both of these forests will be hard-pressed to conduct regular, consistent, useful long-term monitoring; notably, no concrete adaptive management feedback loops are described in either plan.

Coupled with community fire planning, FMPs play a critical role in helping people adapt to living in fire-dependent landscapes.

▼  
The science that should inform FMPs is often remarkably clear, yet FMPs often fall well short of the ideal.  
▲

## **FMPs Balance Fire Risk With Forest Health**

Fire Management Plans are the essential link between national fire policy direction and on-the-ground implementation. There is broad consensus on the value of FMPs: effective planning that integrates the best available science into quality FMPs is critically important for informing proactive fire management decision-making. While the *definition* of formal compliance remains smoky, the science that should be used to inform these plans is often remarkably clear. Yet, even on those landscapes where wildfire is recognized as a pressing and immediate matter of concern, FMPs often fall well short of the ideal.

Along the Front Range of Colorado, National Forests with more recent Resource Management Plans clearly have an advantage in creating relevant FMPs. Still, those FMPs too often fail to provide a comprehensive overview of fire's necessary role in the ecosystem and

its relationship to affected communities. If the FMPs profiled here excel in providing detailed instructions to fire managers on the use of management tools, they fail to offer sufficient explanation as to where and why such tools are most appropriate. Work plans are dictated not by what the resource needs are, but instead by what current agency capacity can accomplish. Lastly, while the importance of monitoring and evaluation are duly noted, mechanisms to link monitoring results with future management actions lag behind.

Federal fire policy mandates FMPs, governors have endorsed them, and extra-governmental reviews have reinforced their importance. Creating FMPs rooted in sound science is one of the most important things fire managers can do to reduce the risk and capture the benefits from the inevitable wildfire. Progress is certainly being made in creating meaningful Fire Management Plans, but we can and must do better.

Editor: Hannah Nordhaus

Design/format:  
Mitchelle Stephenson

**THE WILDERNESS SOCIETY**  
1615 M Street, NW  
Washington, DC 20036  
202-833-2300

[www.wilderness.org](http://www.wilderness.org)

For more information:

The Wilderness Society, Four Corners Office  
Lisa Dale Gregory, Ph.D., Natural Resource Policy Fellow  
Phone: 303-650-5818, ext 107 • Email: [lisa\\_gregory@twso.org](mailto:lisa_gregory@twso.org)  
Tom Fry, Wildland Fire Program Coordinator  
Phone: 303-650-5818, ext 110 • Email: [tom\\_fry@twso.org](mailto:tom_fry@twso.org)