Developing an Interagency, Landscape-scale Fire Planning Analysis and Budget Tool

Report to the National Fire Plan Coordinators:
U.S.D.A. Forest Service
U.S. Department of the Interior

Executive Summary

A review of the federal agencies' wildland fire budget and planning models was suggested by the Office of Management and Budget to the Department of the Interior and the Department of Agriculture. The models currently in use are inadequate, for reasons which are outlined elsewhere in this report. In September of 2001, the two Departments authorized the review, with the ultimate purpose of providing a basis for "development of a single, uniform, performance-based system for preparedness and fire management program planning."

A review team was assembled. Members of the team represented all five of the federal fire-management agencies, plus the National Association of State Foresters, and the University of Montana's School of Forestry. The team's final report was to be completed by November 30, 2001.

Findings of the team included:

1. A comprehensive interagency fire planning and budget analysis identifying the most cost-effective program to achieve the full range of fire management goals is possible and desirable.

2. Full development and deployment of a new system will take four to six years.

3. Implementing interim components, will take one to two years, resulting in increasingly improved analysis and budget formulation over time.

4. A fire planning analysis process development team should be established by the end of January 2002, to meet the system development timelines recommended in this report.

5. Immediate steps can be taken to improve the consistency and appearance of wildland fire budget requests for the Departments of Agriculture and the Interior using information generated by existing analysis systems.

Recommendations of the team included:

The review team recommends that the Departments of Agriculture and the Interior develop and implement a common interagency fire management analysis process within the next five years. The working name for the analysis is Fire-MAP, standing for Fire Management Analysis Process. Fire-MAP will be objective driven and performance based. Fire-MAP will also focus on achieving a full scope of fire management activities. These activities include protecting life and property; using fire and other treatments to restore and maintain ecosystem health; and reducing hazardous fuels in fire-prone ecosystems. It will also identify resource needs and the efficiencies of sharing available fire management resources across jurisdictions. Furthermore, Fire-MAP will provide land managers with the ability to determine the most cost-effective wildland fire management program that meets program objectives. Fire-MAP will enhance current fire program analysis systems by incorporating new technology and modifying existing components.

The intent is to develop Fire-MAP on an interagency basis, involving all five federal wildland fire management agencies. When practical, Fire-MAP could be implemented across administrative boundaries on a landscape scale. States, tribal governments and other stakeholders will be partners in developing this system, and will have the opportunity to use Fire-MAP to determine their wildland fire program needs. However, the intent is not to impose a uniform analysis system on states and tribes. In locations where federal and non-federal entities share common wildland boundaries, especially in the wildland-urban interface, it may be mutually beneficial to include land managed by both parties within a landscape-scale, multi-jurisdictional analysis. When the analysis is limited to federal land, it will also be designed to recognize the availability of adjacent state, tribal and local wildland fire resources for mutual assistance and interagency planning.

Fire-MAP can greatly improve upon the current analysis process by incorporating a host of new technologies and models. By using technologies such as Geographic Information Systems (GIS), the effects of alternative fire management strategies can be analyzed and displayed spatially and temporally. This technology will vastly improve strategic fire management planning. Managers will have the ability to graphically display the effects of their planning choices on natural and cultural resources, the wildland-urban interface, air quality, recreation, and risks to life and property. Wildland fire suppression and fire use affect many resources and communities. Therefore, successfully developing and implementing Fire-MAP will require interdisciplinary commitment (such as natural and cultural resource specialists, land management planners, and economists) as well as collaboration with state, tribal and local stakeholders.

The design and implementation of Fire-MAP will complement the principles and goals identified in the “10-Year Comprehensive Strategy - A Collaborative Approach for Reducing Wildland Fire Risks to Communities and the Environment,” published in August 2001. This document called for developing an improved planning model that identifies a cost-effective fire management program among the federal agencies and states. Fire-MAP will also address the House and Senate Appropriations Committees’ direction that the Departments develop a coordinated and common system for determining the most effective wildland fire management program.

While Fire-MAP is under development, immediate steps (within two months) must be taken to improve and coordinate the development and presentation of budget requests for federal fire management agencies. The Review Team recommends that each agency initiate complementary fire budget requests. These requests must reflect the same principles and similar budget organization, and contain cross-cutting initiatives and actions that cover all federal wildland fire management responsibilities.

The team recognizes that while four to six years to fully implement Fire-MAP represents aggressive scheduling, interim improvements are needed sooner. Interim components, such as models for hazardous fuels, wildland urban interface projects, merging attributes of the existing analysis processes, dropping MEL (Most Efficient Level) and net value change, and becoming objective driven and performance based will occur in the next one to two years.

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Introduction

Over the past decade, the scope and complexity of fire management has increased. These changes include an increasing emphasis on the wildland urban interface, integrating the role of fire in ecosystem management, and reducing hazardous fuels. The USDA Forest Service (FS), Bureau of Land Management (BLM), Bureau of Indian Affairs (BIA), National Park Service (NPS), and the U.S. Fish and Wildlife Service (FWS) all use planning analysis models to determine the desired staffing and budget required for wildland fire programs. However, the architecture of various existing fire program analyses was not designed to address the current complexity of fire planning and budget requirements. Increasing fire program complexity is outpacing the adaptability of current analysis models, giving rise to the need for a new, common, fire management program analysis system.

A variety of internal and external stakeholders and experts have long recognized the need to employ newer technologies to enhance fire program analysis and make it easier to use. These stakeholders include the fire management organizations of the Departments of Agriculture and the Interior, as well as the Office of Management and Budget (OMB), the General Accounting Office (GAO), congressional appropriations committees, state forestry agencies, and the research and academic communities.

In recent years, the five federal land management agencies conducted studies to examine the feasibility of developing a single, interagency fire program analysis system to replace the individual systems currently in use. These recent efforts resulted in an interagency proposal to create an objective-driven, performance-based fire program analysis and budgeting system. The proposed system will cover the full scope of fire management activities, be useable both at the unit and landscape level, and across federal and non-federal administrative boundaries. The recommendations in this report build upon that earlier work. The new analysis would use a structured design process that incorporates new technologies for modeling the effects of alternative fire management strategies over time.

In September 2001, the Secretaries of Agriculture and Interior, through their National Fire Plan Coordinators, issued a delegation of authority to the Colorado State Forester to conduct a review and advise the Departments about developing a single, uniform, performance-based system that covers the full scope of fire management activities. The Colorado State Forester serves as the liaison from the National Association of State Foresters to the National Fire Plan. In order to carry out this mission, the agencies established a review team to complete a report by November 30, 2001. The review was to ensure that current budget planning processes and protocols are in compliance with the directions contained in the 2001 Federal Fire Policy, and from congressional and executive direction.

The scope of the review includes:

- Assessing the current “most-efficient-level” or “MEL” model;
- Considering the full range of fire management responsibilities;
- Exploring the efficiencies of linking the various fire program components; and,
- Addressing the merits of a seamless federal approach across administrative boundaries to accomplish fire and ecosystem goals at the landscape level.

The report contains recommendations to address three primary issues consistent with the group charter:

- The steps and resources needed to develop a single, interagency, landscape-level fire management program planning framework and analysis tool that is based upon quantified, interdisciplinary land and ecosystem management objectives;
- The items needing adjustment or changing regarding current budget planning processes and protocols, including appropriate rationale; and,
- A strategy for developing and implementing the proposed changes, including which entities would be best suited to this task and a schedule for implementation and operational deployment.

In addition to these recommendations, the team recommends several immediate actions be taken. These immediate actions will result in complementary wildland fire budget requests between the Departments of the Interior and Agriculture. The budget requests will reflect the same principles and similar budget organization, and incorporate common performance measures. The actions will be stepping stones toward achieving the broader recommendations in the report.

The resulting fire management program analysis will provide fire and resource managers with a process that links the elements of fire management goals and objectives and program performance with agency budgets and management activities. A system that clearly links these elements also will improve program accountability.

Members of the review team and oversight group included representatives from the USDA Forest Service (Howard Roose and Stewart Lundgren); National Park Service (Amanda Kaplan, Jeff Manley, and Steve Botti); Bureau of Land Management (Bill Mitchell and Andy Smith); U.S. Fish and Wildlife Service (Mike Phillips and Roger Spaulding); Bureau of Indian Affairs (Scott Bradshaw); National Association of State Foresters represented by Colorado State Forestry (Paige Lewis and Jim Hubbard); and the School of Forestry at the University of Montana (Hayley Hesseln). An independent contractor served as the review team manager (Gardner Ferry).

Section 1

History of Existing Fire Program Analysis Systems

Prior to 1980, all five federal wildland management agencies were using different fire planning systems, based on subjective methodologies, to determine organizational and financial needs. Since that time, all agencies have developed and periodically improved their fire planning systems. The genesis of current fire planning systems, and the analysis strategies within those systems, can be tied back to two primary factors: Congressional direction for budget accountability and agency missions.

In this Section:

- Differences in agency missions
- Fundamentals of National Fire Management Analysis System (NFMAS) and Interagency Initial Attack Analysis (IIAA)
- Fundamentals of FIREPRO/FIREBASE

Differences in Agency Missions

The federal agencies developed separate analysis systems because their fire management programs emphasized different mission values. The BLM, BIA, and FS missions emphasize resource utilization and commodity values; yet also include managing for some non-commodity values and public enjoyment of resources. Conversely, the NPS and FWS missions emphasize public enjoyment and preservation of natural and cultural resources, wildlife habitat, and naturally functioning ecosystems, rather than resource use and commodity values.

Fundamentals of the National Fire Management Analysis System (NFMAS) and Interagency Initial Attack Analysis (IIAA)

To improve budget accountability, the House and Senate Appropriations Committees provided specific direction to the FS in 1978 relative to wildland fire planning. They directed the FS to support future fire program budget requests with analytical data demonstrating the benefit-cost relationship between the amount of the fire budget (preparedness funding) and the performance of the proposed program, as measured by suppression expenditures and resources losses. The resulting program provided field units with a process to estimate the economic efficiency of proposed program alternatives. The process was based on a marginal cost analysis function that related the cost of preparedness, suppression, and net value change of resources damaged or improved using the unit's average annual fire workload. This marginal costs analysis function, called C + NVC, (cost of preparedness and suppression [C] plus net value change in resources [NVC]), was incorporated within the National Fire Management Analysis System .

The relative efficiency of alternative programs is estimated by comparing the marginal changes in total C+NVC that occurs with marginal changes in budgets. The most efficient program budget alternative (Most Efficient Level, or MEL) results in the lowest C+NVC. Because the analysis output gives an indication of the relative efficiency of incremental changes in funding for the individual units, this efficiency data provides an indication of how to allocate funding for any given appropriation level. This benefit/cost analysis depends on placing market values on resources affected by wildland fire.

In 1985 the BLM, followed by the BIA in 1991, adopted the analysis portion of the FS's National Fire Management Analysis System. Throughout the 1990s the three agencies coordinated their efforts to make continuous improvements to the analysis system and currently use one common analyses process called, Interagency Initial Attack Analysis (IIAA). Concurrently, the three agencies developed a separate set of programs to prioritize hazard fuels reduction projects. However, fuels program analyses and IIAA were not integrated and do not address the full range of fire management goals and program activities.

Fundamentals of FIREPRO/FIREBASE

The NPS developed FIREPRO (Fire Program Analysis) in 1983, which the FWS adopted in the early 1990s and customized to meet its own objectives. The resulting FWS system is known as FIREBASE. Due to the focus of the NPS and FWS missions, wildland fire was less in conflict with most of their management activities. Therefore, the average annual wildland fire initial attack and

suppression workload for NPS and FWS was smaller than for other agencies, and the emphasis on the use of fire to maintain and restore natural ecological processes was greater. As a result, the analysis system developed by NPS and FWS does not identify as many rapid response resources such as fire engines, retardant aircraft, and firefighters, and the most effective placement of these resources to protect commercial resources at risk from fire.

FIREPRO and FIREBASE quantify staffing and financial support requirements for fire management activities at all organizational levels through an analysis of the combined workload and program complexity of initial attack readiness, wildland fire use, and fuels management. These two systems defined the level of staffing and program funding for preparedness and fire use to meet their natural resource mission, based on the average annual workload. However, like the FS, BIA, and BLM, they also have not identified potential program efficiencies by analyzing the integrated activities of fuels management, wildland fire use, initial attack and suppression, and fire prevention and education. These processes also do not adequately quantify the full range of fire management goals, and program activities.

Section 2

Factors Driving the Need for Change

Changes in fire management and computer technology, economic and ecological objectives, and administrative needs, are giving rise to the need for better fire management analysis systems. Furthermore, there are many internal and external factors indicating the timing is right to develop a performance-based program analysis system integrating all facets of wildland fire management. The following sections define the factors driving the need for change.

In this Section:

- Limitations of existing analysis systems
- Previous planning and budgeting effort
- Policy, appropriation and accountability factors
- Changing needs of fire management programs

Limitations of Existing Analysis Systems

Researchers and agency personnel have recognized that fire program analysis systems need to expand beyond initial attack analysis to identify total organizational needs for program management and fuels management. The agencies have developed hazard fuels needs assessment programs but they are not fully linked with suppression modules to identify trade-offs that would result in program efficiencies. Some academic studies also have challenged the economic theory incorporated in the Interagency Initial Attack Analysis (IIAA) being used by the BLM, BIA, and FS, and elements of the FIREPRO/FIREBASE analyses being used by NPS and FWS. Data has shown it is theoretically possible the IIAA model may not minimize Cost + Net Value Change. In addition, it is now recognized that C+NVC provides too limited a framework within which to evaluate the success of wildland fire management programs to help achieve overall land management goals and objectives. This limitation is especially true with respect to ecosystem management. Alternative strategies for achieving fire management goals and objectives are best analyzed through cost-effectiveness analysis rather than marginal-cost analysis.

Although not economically driven, FIREPRO/FIREBASE have been challenged because they do not provide fire managers with the ability to engage in sensitivity analysis and simulations to determine a most efficient level and location of wildland fire management resources for wildland fire response or prescribed fires. They also fail to provide fully integrated links between fuels management strategies and wildland fire response organizations. FIREPRO and FIREBASE do not consider the contributions of fire management resources from other federal and state agencies to overall initial attack readiness capability.

Previous Planning and Budgeting Effort

In 1997, an Interagency Fire Planning and Budgeting Team was established to recommend steps to develop a more consistent approach to wildland fire management planning and budgeting. In 1999 this group developed a statement of vision, goals, and objectives to guide eventual development of more compatible interagency planning and budgeting procedures.

Vision — The federal fire management agencies use a compatible fire program analysis and budgeting process that incorporates cost efficiencies and effectiveness while addressing the full spectrum of fire management activities.

- **Goal** — Within five years (2004), the federal fire management agencies will implement a compatible fire program analysis and budgeting analysis system to facilitate planning and program analysis on a landscape scale, across agency boundaries.
- **Objective** — Create a compatible, objective-driven, performance-based fire program analysis and budgeting system using a structured analysis and design process covering the full scope of activities, useable at a landscape level and across administrative boundaries.

Based on the recommendations from the Fire Planning and Budget Team, the fire directors for the five agencies that make up the Federal Fire and Aviation Leadership Council (FFALC), initiated an assessment of the program analysis systems then currently in use. This assessment included a report outlining actions that would lead to the creation of a common interagency fire program analysis system. The team defined the attributes of the new system and laid the groundwork for beginning development. However, action on this group's proposal was delayed due to the severe 2000 fire season and subsequent focus by all the agencies on implementing the National Fire Plan.

Policy, Appropriation and Accountability Factors

Federal Wildland Fire Policy

The 2001 National Wildland Fire Management Policy, contained several statements affecting planning and budgeting activities:

> *"Fire, as a critical natural process, will be integrated into land and resource management plans and activities on a landscape scale, and across agency boundaries."*
>
> *"Fire management planning, preparedness, prevention, suppression, fire use, restoration and rehabilitation, monitoring, research, and education will be conducted on an interagency basis with the involvement of cooperators and partners."*
>
> *"Agencies will use compatible planning processes, funding mechanisms, training and qualification requirements, operational procedures, values-to-be-protected methodologies, and public education programs for all fire management activities."*
>
> *"Fire management programs and activities are economically viable, based upon values to be protected, costs, and land and resource management objectives."*
>
> *"Agencies will ensure their capability to provide safe, cost-effective fire management programs in support of land and resource management plans through appropriate planning, staffing, training, equipment, and management oversight."*

These policy statements require a fundamental shift from traditional methods of analyzing program needs and effectiveness. Agencies must transition to a new, common analysis system that identifies a cost-effective program for achieving goals and objectives to comply with the intent of federal wildland fire policy.

Congressional and Executive Directives

The 1998 Interior Appropriations bill provided the first federal budget authority and specific funding mechanism for fuels management activities. The language also called for common fire management planning methods and procedures across the five federal wildland fire agencies. The House also stated the need for "assessing priorities, and for evaluating treatment alternatives," relative to fuels management activities. Up to this time, fuels management was part of the preparedness budget and had to compete against readiness resources and activities for funding. As a result, it was a minor part of the overall fire program and was addressed separately in the planning analysis process. By recognizing the growing importance of hazardous fuels, Congress mirrored and reinforced the agencies' concerns that past fire program emphasis on suppression had, in part, created a hazardous fuel situation that threatens lives and property, natural ecosystems, and other natural and cultural resources. This concern also stimulated the agencies to begin evaluating how to more effectively analyze fuels management and prescribed fire needs, and how to link these analyses with those for initial attack suppression to achieve a more cost-effective total program.

In fiscal year 2002, congressional appropriators reaffirmed their concerns about the "variation in methods by which the Departments calculate wildfire fighting readiness and how the Departments plan their distribution of firefighting resources to attain efficiency." They directed the two Departments to "develop and implement a coordinated and common system for calculating readiness which includes provisions for working with the shared fire fighting resources of the States and other cooperators and considers values of various resources on both Federal and other lands."

Recently, OMB requested all five agencies to develop a common program analysis system that is more transparent and easy to understand, scientifically-based, peer reviewed, performance oriented, and based on specific protection goals rather than on theoretical resource values. OMB also emphasized the importance of developing a system for use across agency boundaries that meets land management goals, considers benefits of fire to ecosystems, and incorporates protection of life and property.

Program Accountability Through Performance Measures

Until recently, the objective of FS, BLM, and BIA fire management activities focused on protection of commercial commodities, such as timber and forage. It was relatively simple to quantify the benefits and costs of achieving this objective by comparing the value of timber at risk from fire to the cost of protection. However, many newly adopted land management objectives, such as maintaining ecosystem health and protection of the quality of life in the wildland/urban interface, are not easily evaluated using a benefit/cost analysis that places monetary values on resources. Consequently, the next generation of program analysis should focus on measuring performance through achieving specific fire management objectives at least cost.

Research on ecosystem function has given land managers the ability to measure key components of ecosystem change. As a result managers can establish objectives for ecosystem management and quantify the effects of activities on ecosystem change. A fire program analysis must develop the capability to evaluate how well alternative management strategies achieve these objectives. Modeling the relationship among ecosystem change, resource and property protection, and fire management strategies can identify cost-effective solutions that achieve land management goals. These models can also identify the cost of implementing solutions. In addition, managers now have technologies to assist in this evaluation. Performance-based fire analysis should provide greater accountability by linking accomplishments to expenditures for specific fire management activities.

Changing Needs of Fire Management Programs

Expanded Scope and Complexity of the Fire Program

The “Symposium on Fire Economics, Planning, and Policy: Bottom Lines,” in April 1999, clearly indicated that none of the known existing analysis systems — international and national — adequately address the full spectrum of fire management business occurring on federal land. The full spectrum consists of fuels management, fire use, fire protection (initial attack, extended attack, large fires, simultaneous ignitions, rural fire assistance) and fire education and prevention. Existing analysis systems determine the specific needs for each of the fire business activities, based on historic and projected changes in workload and program complexity. However, they fail to integrate these activities to determine efficient staffing levels and program strategies. The integration of these strategies will have further importance and value when the analysis is conducted across administrative boundaries and at the landscape level as opposed to analyzing each individual land planning unit.

Throughout the United States, population is growing rapidly, but nowhere greater than in the West, particularly in the wildland-urban interface. The juxtaposition of residential areas with wildland makes fire suppression significantly more complex and expensive. In the past decade, eight of the

ten fastest-growing states were in the West. Many cities in these states are encroaching upon fire-dependent ecosystems. Where federal fire management responsibilities were once focused on the wildlands within their jurisdiction, the operational role of federal agencies, as partners in wildland-urban interface protection, now includes: wildland firefighting; management of vegetative fuels to minimize risk to people, property, natural and cultural resources; cooperative prevention and education; and technical assistance to state, local and private landowners. The new program analysis system needs to evaluate coordinated federal/state/local actions to address this problem.

In addition to the wildland-urban interface, other issues have added to complexity of fire programs. Nearly one hundred years of wildland fire suppression, coupled with land- management practices that did not promote healthy ecosystems, has caused unnatural accumulations of vegetation in fire-dependent ecosystems. Historically, periodic natural fires maintained these areas. It is now recognized that fire suppression must be balanced with application of prescribed fire and mechanical treatments to reduce hazardous fuel loadings and restore natural conditions. Corrective action raises concern about impacts on air quality resulting from the prescribed fire smoke. Smoke management models need to be integrated into the analysis to assess impacts and effectiveness of accomplishing expanded prescribed fire treatment workloads. Invasion of noxious weeds and non-native vegetation stimulated by fire also has become a major issue. When existing fire program analysis models were developed, few could envision that millions of acres would be converted from complex native perennial grassland communities to vast seas of highly flammable monocultures of non-native annual grasses. Now that such factors have become important, fire managers spend increasingly more time addressing the effects of fire on social and non-commodity values than on commodity values.

Planning Across Administrative Boundaries

Through increased knowledge of the role of fire in ecosystems, agencies realized that restoring and maintaining healthy ecosystems consisting of natural plant and animal communities, requires a coordinated approach across administrative boundaries. For example, restoring native sagebrush/grassland communities in the Great Basin and reversing the invasion of noxious alien species requires coordinated treatments over extensive areas of public and private land. Consequently, fire managers have begun to develop interagency fire management plans that cover the full range of fire management activities including prevention, fuels management, prescribed fire, and wildland fire use. These plans need to be supported by a fire program analysis system that incorporates quantified ecosystem goals on a landscape scale. Such an analysis tool can become more powerful by integrating these ecosystem management concerns with protection of life and property across administrative boundaries.

Advances in Scientific Understanding

Through research and education, society's knowledge about the environment has increased dramatically. In the past few decades resource managers and the public increasingly have become aware of the role of wildland fire as a beneficial natural ecosystem process. Thirty years ago, the use of fire and mechanical treatments to maintain the health of vegetation was a minor portion of the overall federal fire management workload. Land managers now recognize that the risk of wildland fire to commodity resources often equals the risk of fire exclusion to natural resources. Conversely, while fire is a key process in restoring and maintaining the balance of ecosystem

components in many forest, shrub and grasslands, scientists now recognize that excessive fire can assist in the promotion of unwanted invasion of non-native fire-adapted species that can be detrimental to natural ecosystems. Research on fire spread and combustibility of wildland fuels and structures also has helped managers understand how to mitigate the risks in the wildland-urban interface. Such knowledge now can be incorporated into fire program planning to quantify goals and objectives.

Availability of New Fire Management Technologies

Tools such as Geographic Information Systems (GIS), remote imagery, global positioning systems, and large fire growth models are now widely available at reasonable expense. In addition, there have been significant improvements in modeling vegetative change over time resulting from ecosystem disturbances. Such tools provide the capability to analyze fuels, resources needing protection, fire history, fire regimes, climatology and vegetative change at very broad scales, across agency boundaries; however, they have not been incorporated into the existing fire planning systems. The effects of alternative fire management strategies can be analyzed and displayed spatially and temporally. Integrating GIS and remote imagery with fire behavior and fire effects prediction models, and smoke management models where prescribed fire is used, will provide a means to identify the most cost-effective strategy alternative for meeting land management goals and objectives. Spatially displaying the consequences of fire management strategies will allow visual comparison of alternative outcomes, providing managers with better information to utilize in decision-making.

Section 3

Conceptual Model for Fire Management Analysis Process (Fire-MAP)

Ecological, social, and political factors are changing fire management program goals and objectives. Developing a new fire management analysis process will enable federal fire managers to better address these changing program goals and objectives. Current fire program analyses are unable to fully address such objectives and identify the resources required to implement a cost-effective program. The following section defines the overall purpose of a new system, and outlines the desired attributes to achieve that purpose.

In this Section:

Purpose of Fire-MAP

The purpose of Fire-MAP is to provide managers with a common interagency process to evaluate the effectiveness of alternative fire management strategies to meet land management goals and objectives. Fire-MAP will be based on quantified goals and objectives that encompass the full scope of fire management activities. The process will link workloads with performance measures to ensure that goals and objectives are measurable, and can be met. Fire-MAP will use modeling to display trade-offs among various goals to help managers select the fire management scenario that achieves all goals to the greatest extent possible. Fire-MAP also will incorporate adaptive management feedback so that agencies could revise objectives and performance targets if monitoring indicates that fire effects are not compatible with those predicted by the model.

In locations where non-federal entities share common management goals and objectives with federal partners, it will be mutually beneficial to include land managed by them within a landscape-scale, multi-jurisdiction analysis. State, tribal and local governments could adopt Fire-MAP or continue to use any other system of choice. Even if Fire-MAP is limited to federal land, it is important for it to identify the location and availability of non-federal fire resources that can assist in suppression and other fire management activities. Further, the analysis process should be scalable so that the full analysis can be run on a single, federal land management unit. In addition, land management units with a small area and/or a low fire-management workload would use a streamlined, simplified version of Fire-MAP.

The full-scale Fire-MAP analysis will model the effects of various strategies through time. Each strategy will consist of a combination of fire management activities, such as initial attack response, hazardous fuels management, wildland fire use, and wildfire prevention. Managers would analyze the cost-effectiveness of each strategy to select a preferred strategy. Cost-effective solutions would achieve a given level of effectiveness at least cost. However, the relationship between cost and effectiveness in achieving objectives may not be a linear one (see Appendix B, page xi). Strategies that maximize all objectives within constraints may be substantially more costly than those that achieve a high percentage of all objectives or emphasize some objectives over others. Managers may want to establish a funding cap that represents a point of diminishing returns. All strategies lying above that point on the cost-effectiveness curve as depicted in Appendix B, page xi; could not be justified from the standpoint of the incremental cost to achieve added performance. In determining the preferred strategy, line managers have to recognize that for strategies lying beyond the point of diminishing returns, achieving a small incremental increase in effectiveness would require a very large incremental increase in costs.

The preferred fire management strategy identified by Fire-MAP will be used to define programmatic fire management needs for each land management unit. These needs will then be aggregated at state, regional and national levels. As land management units engage in more joint fire management planning and employ more strategies spanning administrative boundaries, Fire-MAP will be used to identify the most cost-effective program to achieve fire management goals at landscape scales. As the role of wildland fire in ecosystem health is quantified, Fire-MAP models will be used to identify the best strategies to achieve those goals over broad areas.

Fire-MAP will also serve as an allocation tool. The process will be used to determine the most cost-effective allocation of resources for any given budget level. Although Fire-MAP will determine the most cost-effective wildland fire strategies to meet goals and objectives for each planning unit, it would also display the relative cost-effectiveness of other strategies and their outputs at different budget levels. That will assist managers and appropriators in selecting the appropriate strategies within budget limitations. However, there can be no objective basis for allocating funds among agencies and units within the agencies without first determining the funding needed to achieve the goals and objectives. A subjective allocation, not based on quantified program needs, cannot ensure that funds will be allocated efficiently. A subjective allocation provides no relative measure of how well various fire management programs accomplish their goals.

Desired Attributes of Fire-MAP

The following section describes the desired attributes of Fire-MAP based on operational complexity, administrative needs, and economic theory. The attributes were determined based on each department's needs and increasing complexity of wildland fire management.

Objective-Driven and Performance-Based

Land management plans define outcome goals, or objectives, based on the mission of each agency. Managers use these goals to develop strategies that can be modeled in Fire-MAP. Modeling these strategies will help managers determine the preferred alternative at the least cost for program implementation. The preferred alternative identifies the workload for each unit, including the staffing, budget and resources required for implementation of that workload. Specific, measurable performance targets will be defined for each program based on the level of effectiveness that can be achieved with the resources provided in each annual appropriation.

Performance targets will shift based on adaptive feedback from monitoring and evaluation. Objectives and performance targets may also need to be revised due to large-scale events (e.g. fires, insect and disease epidemics) and changes in laws and social values that were not included in the original model.

Address the Full Scope of Fire Management Activities

Strategies modeled by Fire-MAP should consist of a combination of fire management activities and provide an integrated analysis. The full range of fire management activities includes fuels management (e.g. prescribed fire, mechanical and biological treatments), fire use, fire protection (initial attack preparedness, extended attack, large fires support, simultaneous fire occurrences on a planning unit), rural fire assistance, fire research, and fire education and prevention. The fire protection component of the analysis would be designed to address a normal year planning target. The analysis would be based on the normal rather than the greatest workload year because it is not cost-effective to staff for the worst-case scenarios on each fire planning unit. Staffing for the worst-case scenario could cost several times more than the normal year program, with minimal added value in most years. Some unwanted wildland fires always will escape initial attack under severe weather and drought conditions, especially where extremely hazardous fuels exist. Such conditions lie beyond the point of diminishing returns for fire protection planning, and should be addressed through severity funding. Severity funding will still be necessary to supplement as appropriate the normal year funding levels identified by the analysis.

Model the Effects of Different Strategies Over Time

The full-scale Fire-MAP analysis will be accomplished by modeling the effects of various strategies through time. Each strategy must consist of a combination of fire management activities, such as initial attack response, hazardous fuels management, wildland fire use, and wildfire prevention. The process should integrate simulation models for initial attack response, large fire growth, and vegetation change in response to various fire regimes, fuels treatments including wildland urban interface, and smoke impacts. This simulation technology allows managers to predict the outcome of alternative fire management strategies and select the most cost-effective method that meets land management goals and objectives.

The new analysis process must incorporate the best available science for modeling and understanding ecosystem function, such as the effects of fire on natural and cultural resources and social values. For example, managers will be able to use GIS to display fire occurrence, burning patterns and intensity, and the resulting changes in vegetation, habitats, and hazardous fuel through time. Visual displays of how well resources are being protected and whether vegetative changes are moving in the direction defined in goals and objectives will be a powerful decision tool. Managers will be able to see if hazardous fuels are being reduced or increased and relate these changes to risks in the wildland-urban interface. The models will provide fire managers, land managers, and budget analysts with the ability to easily understand intermediate and end outcomes of alternative fire management strategies. These outcomes will be measured across the landscape and over various periods. Depending on the ecosystem and fire regime, the time periods required to achieve end outcomes might extend from a few years to decades.

Identify Fire Management Resources

Fire-MAP will identify fire management resource (i.e. support personnel, equipment, aircraft, facility and other fixed costs, and supplies) and funding needs based on the workload and program complexity of all organizational levels within each agency. It will also be important to identify the best mix and location of fire management resources (federal, state, local) to achieve the land management goals and objectives. This resource information could be identified for individual administrative units and, when applicable, for multiple planning units at a landscape level, across administrative boundaries.

Contain A Cost-Effectiveness Analysis

Fire-MAP must be able to identify, at the least cost, the fire program that meets fire management objectives, including ecosystem health and protection of life and property. Since most fire management plan objectives are not easily assigned monetary values, traditional benefit/cost analyses are no longer applicable.

The new program analysis will be based on a Cost- Effective Analysis (CEA), which focuses on the relative importance of goals and objectives over time. Examples could include ecological health and protection of life and property. Specifically, the economic model must identify the relationship between suppression and preparedness activities, along with fuels management in the wildland-urban interface, and ecosystem restoration actions. The economic model must encompass the full range of fire management activities. It must also include suppression costs since the success and economic value of preparedness and fuels management costs are evaluated, in part, on their ability

to reduce present and future suppression costs (including direct suppression costs and wildfire damage. See Appendix B, page xi for a more detailed explanation of CEA.

Provide Analysis at a Range of Scales

Fire-MAP will enable managers to run fire program analyses at a variety of scales, from the landscape level to the individual administrative unit. By analyzing fire management program needs at landscape-scale and across administrative boundaries, Fire-MAP will facilitate development of interagency, landscape-scale fire management planning. This attribute also will facilitate the implementation of integrated and collaborative program management in areas where fire regimes transcend administrative boundaries.

However, applying Fire-MAP at the landscape scale may not be feasible or appropriate given the size and configuration of some land planning-units. All five agencies have land-management units with relatively low levels of fire management activities. Many of these units are also isolated from other federal and state wildlands and are surrounded by commercial operations such as farms and ranches. In these situations, landscape planning and managing across administrative boundaries does not apply. These units do not need to run Fire-MAP's full analysis capabilities. Units below a pre-determined threshold will use a streamlined and simplified version of Fire-MAP. These units would still produce the common report data for those relevant aspects of their programs.

Section 4

Steps to Develop the Fire Management Analysis Process (Fire-MAP)

In this Section:

- ☞ Oversight and scoping
- ☞ Finalize a conceptual design
- ☞ Develop fire management objectives
- ☞ Develop interim components
- ☞ Evaluate existing models
- ☞ Assess information needs
- ☞ System development
- ☞ Validate and test system
- ☞ Implementation

Oversight and Scoping

Establish program oversight and scoping under the Federal Fire and Aviation Leadership Council (FFALC).

* *The FFALC Planning and Budget Team will provide oversight and continuity between interim steps and final development of Fire-MAP. Scoping for the interim and final development needs to be initiated concurrently to allow for interim products to transition into the final Fire-MAP system.*

Finalize a Conceptual Design

Identify the basic architecture and function of all system components for Fire-MAP.

* *It is possible to develop and implement some components within the next two to three years based on the preliminary conceptual model and system attributes contained in this report. During the developmental phase it will be important to identify reporting needs and provide clear definitions of each component of the reporting system.*

Develop Fire Management Objectives

Define and quantify fire management goals and objectives relating to resource protection, ecosystem management, and protection of life and property.

* *Fire management objectives are derived from the goals contained in land management plans. Some current land management plans do not adequately address the role of fire in managing wildlands and protection of life and property. Because national schedules for updating land management plans exceeds the time constraints for developing and implementing Fire-MAP, a process for developing fire management objectives in this interim period is needed. (Appendix C, page xiii provides and example of how this can be accomplished.) Fire and resource managers must work together to initiate this step early in the process in order to have it completed by the time Fire-MAP simulation models are available. Land management units will develop quantifiable fire management goals and objectives. Land management units also will develop indicators and measures to monitor whether they are meeting their fire management goals. Managers will define indicators for each fire management goal, and measures for each indicator. By measuring changes in the indicators through time, managers will be able to determine if their program is moving their unit toward or away from its desired fire management goals.*

Develop Interim Components

Develop system components that could be implemented before Fire-MAP is completed.

* *It is not necessary to wait for the Fire-MAP project to be completed before changes in the current fire program analyses can be made. The agencies must take steps within the next two to three years to establish more uniform methods for analyzing their initial attack preparedness, program staffing, and hazard fuels program needs. If these interim steps are carefully designed, they could be taken without compromising the ultimate architecture of Fire-MAP, and improvements can evolve, with further modifications, into final Fire-MAP components. However, interim stand-alone components would not be used in lieu of completing Fire-MAP.*

Interim components will include further refinements of wildland/urban interface and other hazard fuels management project prioritization methods identified in the federal Cohesive Strategy For Protecting People and Sustaining Natural Resources. Also included will be an integration of existing preparedness analysis components from IIAA and FIREPRO/FIREBASE. Integrating these components would allow the agencies to generate more consistent budget requests and common outputs. Interim components should be based on meeting goals and objectives, such as performance targets for initial attack success, at the least cost. This process would allow the agencies to eliminate the C+NVC function and begin moving toward a system based on goals and objectives. Integrating IIAA simulations with FIREPRO/FIREBASE workload and program complexity thresholds for program management staffing, and basing this new preparedness analysis on meeting land management goals and objectives, will provide the agencies with a uniform program and budget needs assessment. The lessons learned from this interim step should also provide valuable insight into development of the final Fire-MAP.

Evaluate Existing Models

Identify methodology for integrating existing models (e.g. IIAA, FIREBASE, FIREPRO, cost effectiveness analyses, smoke emission/transport, vegetative change, fire growth simulator, etc.) into Fire-MAP.

* *This step is also necessary if new models are developed. Use of the Internet for consolidating unit files into agency aggregates, as currently used by the FWS, also will be evaluated for use by all the agencies.*

Assess Information Needs

Determine types of information needed

Identify common data elements and definitions that will be used for the new/revised fire program model (e.g. vegetative condition classes, vegetative communities, and natural and cultural resource values needing protection).

* *These data elements will include quantified and measurable fire management objectives derived from land management plans.*

Develop plan to obtain information

Develop a plan to ensure data elements will exist for each land management unit when the new system is ready for implementation.

* *Data elements are needed to quantify and measure land management goals and objectives across administrative boundaries, and to run Fire-MAP. This effort will require cooperation and coordination with other disciplines involved in setting land management goals and objectives.*

Develop GIS capability

Develop capability for each land management unit to display data elements and themes and use this information in the graphical display of simulation model outputs.

System Development

Develop components and integrate them into a complete system.

Validate and Test System

Perform extensive operational testing on Fire-MAP, including peer review.

Implementation

Develop a schedule for implementing and documenting the final Fire-MAP system on each land management unit and for training managers/users.

Section 5

Estimated Timelines for Development of Fire-MAP

The timeline outlined on the following pages reflects a linear development schedule. However, actual development will follow a more iterative process in which the original development conceptual design will be modified based on feedback from the testing and integration of components.

A. Scoping, assessing feasibility, and developing the conceptual design for Fire-MAP will take about five months **(December 2001-April 2002)**. It will include development of a Project Charter to be issued by the National Wildfire Coordinating Group (NWCG). Some Fire-MAP conceptual design work already has been completed by previous workgroups between **1999 and 2001**.

B. Developing and quantifying fire management goals and objectives will take about two years **(January 2002-December 2003)**.

C. Developing, testing and implementing interim components and budget allocation tools will take about two years **(January 2002-December 2003)**. Some components, such as the interagency prioritization system for hazardous fuels and wildland-urban projects, are already being developed and should be available well before **December 2002**. Others activities, such as developing a synthesis between the initial attack and program management staffing components of IIAA and FIREPRO/FIREBASE, might take two years.

D. Evaluating existing models that could be used as components of Fire-MAP, identifying gaps in current modeling capability, developing a blueprint that will include both designing new models (if needed) and integrating existing and new models into one system will take about six months **(April 2002-September 2002).** Many models currently exist that potentially can be incorporated into Fire-MAP. A complete survey of these models is necessary to avoid duplication of effort. Once the required models have been identified, considerable work will be needed to determine how to link them as components of one system.

E. Identifying the types of information needed to drive Fire-MAP will take about two months **(September 2002-October 2002)**. This step is contingent upon completing the final conceptual design of Fire-MAP, as well as evaluating the data needs of existing and new models that can be components of the system.

F. Developing a plan to gather data required to run Fire-MAP and then collecting the data will take between one and three years **(November 2002-November 2005)**. Some of the data already have been collected for existing systems, but much new data and greater resolution of data will be required for items such as vegetative condition classes, vegetative communities, fuel types and loadings, and values needing protection. Much of the existing and new data will need to be digitized for use in GIS analysis.

G. Developing appropriate GIS hardware and software capability on each land management unit will take about two years **(October 2001-October 2003)**. Many units already have this capability in place.

H. Identifying the budget and personnel required to develop and implement Fire-MAP is contingent upon several previous timelines and therefore would take about eight months **(January 2002-August 2002)**. Agency personnel to serve on development teams can be identified early in the process, but accurate budget projections are contingent upon final evaluation of existing models and defining a task to link existing models and develop new ones.

I. The final business requirements plan should be completed by **September 2002**. At that time the development schedule and timelines should be in place.

J. Developing, validating, testing, and documenting the software and creating the final Fire-MAP process instructional interagency handbook would take at least three years **(October 2002-November 2005)**. This process will include advertising and selecting contractors and developing, testing and documenting all modules of Fire-MAP.

K. Training personnel on all major land units and fully implementing Fire-MAP will take about 18 months **(November 2005-March 2007)**. This schedule will provide an analysis to support the FY 2009 budget. Use of the interim components and the process of creating one interagency Fire-MAP handbook that will be updated annually as new steps and models are completed and tested, will reduce the time and cost of final implementation by all agencies.

Section 6

Staffing Requirements for Initiating Fire-MAP

In this Section:

- ☞ Core staffing
- ☞ Additional staffing

Core Staffing

Experience indicates that undertaking a project of this magnitude with an aggressive completion schedule cannot be accomplished by assigning employees who already have full workloads. At a minimum, the business leader, project manager, and core development team must work full time for the duration of development and initial implementation of Fire-MAP. This project should be developed using NWCG project management protocols; however, it will be funded by the five federal wildland fire management agencies. A proposed organization and schedule is:

1. The business leader should be established by early January 2002. This position reports to the FFALC's Planning and Budget Team.
2. The project manager should be established by early January 2002. This position will report to the business leader.
3. The core development team, consisting of one person from each agency, with the understanding that the business leader could represent one agency, should be established by early January 2002. The development team will report to the project manager.

Additional Staffing

Project experts will be assigned and contracted as needed for developing various components. The full spectrum of skills from federal agencies, states (the National Association of State Foresters' liaison at the National Interagency Fire Center) , universities, and consultants should be considered.

Section 7

Immediate Actions

The following immediate actions, to be accomplished by January 31, 2002, will improve the fiscal year 2003 budget presentation for the five agencies. These actions will also improve coordination among the agencies and lay groundwork for developing Fire-MAP.

In this Section:

Identify common performance and workload measures

Performance and workload measures are needed to develop the fiscal year 2003 wildland fire management budget request and subsequent program management activities.

Responsibility: This action will be completed by the Department of the Interior's Office of Wildland Fire Coordination, in conjunction with the USDA Forest Service's Office of Fire and Aviation Management, Performance Management Institute and members of the review team. It is recognized that this initial effort will provide the agencies with some common measures of program performance, but most likely they will need further refinement and expansion when Fire-MAP is completed to adequately measure the full scope of fire management activities identified in this report.

Deadline: The product will be provided to the Federal Fire and Aviation Leadership Council and its planning and budget team early January, 2002.

Develop a uniform FY 2003 budget request

The wildland fire management programs of the BLM, BIA, NPS, FWS and FS will create a FY 2003 budget request using a common format, tables, terms, definitions, and performance measures. The common effort will also contain crosscutting initiatives and actions that cover all federal wildland fire management responsibilities.

Responsibility: The Federal Fire and Aviation Leadership Council's planning and budget team, in concert with the BLM budget office, will accomplish the action.

Deadline: The completion date is the last day available for agency revisions to the FY 2003 Budget Requests document, anticipated to be January 31, 2002.

Section 8

Conclusion

Development of an integrated fire planning and budget analysis system is possible and desirable. A fully functional system should be developed in logical and independently useful modules that will contribute and integrate with the fully functioning system. This analysis should take four to six years to develop and implement. While a new system is being developed and deployed, immediate steps should be taken to improve consistency and appearance of budget submissions and develop and implement common performance measures and terminology across all five agencies.

In this Section:

Appendix A: Example of Fire-MAP Process

Hypothetical Example of Fire-MAP:

The following hypothetical example shows how Fire-MAP might be used on a land management unit:

Step 1: Managers quantify long-term land management goals that are affected by the fire program, such as protection of life and property and ecosystem restoration. They will also identify critical constraints, such as unacceptable smoke impacts from prescribed fire, that may limit their ability to fully achieve these goals. (See goals definition boxes at top of page on flow diagram. The five categories of goals listed in the diagram are examples only; a unit may have different goals.)

Step 2: Managers define indicators for each goal, and measures for each objective. An objective for protection of economic resources might be a 30% reduction in timber losses to wildfire over the next ten years, and the measurement might be board feet of timber burned by wildfire over the next ten years. An objective for ecosystem restoration might be landscape-level pattern and age distribution of patches of vegetation produced by a natural fire regime in a mixed conifer forest. The measurement might be the percentage of the designated vegetation type in desired patches. (In the flow diagram, indicators for ecosystem restoration goals are the natural fire process, forest structure, biodiversity and critical habitat protection. These are examples only; a unit might have different indicators.)

Step 3: The land management unit builds GIS layers required to model fire program strategies and assess its success in meeting long term goals, e.g. vegetation type, fire history, fuel models, resource values to be protected. (This step is the beginning of the fire program simulator depicted on pages 2-4 of the flow diagram. The GIS themes are examples only; a unit might have different themes.)

Step 4: The fire management officer and resource specialists define fire management strategies that will be tested in the cost effective analysis (CEA). These strategies are combinations of initial response and project management resources to manage a predicted number of wildland fires and, where appropriate, a planned array of hazard fuels reduction treatments and ecosystem restoration prescribed fires, and education and prevention activities. For each fire management strategy, the user-defined available resources, dispatch strategies, annual prescribed burn unit plan, and so forth, are combined with appropriate GIS data layers. (See the fire management strategies box in simulator flow diagram)

Step 5: The fire program simulator models the cost and effectiveness of each strategy in accomplishing land management goals defined in Step 1. Each simulation would use separate models for wildland fire, hazard fuels reduction, and ecosystem restoration/maintenance prescribed burning, depending on the strategy selected. Each simulation would run for a designated number of annual time steps, depending on the ecosystem. Wildland fire ignitions would be modeled from the historic record, and would encompass enough years to capture significant variation in location, season, and weather

conditions. Wildland fires would be modeled through the use of a large fire growth simulator, such as FARSITE. Each successive annual fuels management plan would be modeled, and the cumulative effect of wildland fires and prescribed fires in each previous time step would influence the outcome of each successive time step. For example, if a management goal is to restore the natural role of fire in 20 years to a short fire return interval forest, the simulation might have to run through 20 time steps to assess the effectiveness of the strategy. Strategies would not be allowed to produce unacceptable smoke and cultural resource impacts, as defined in land management goals and constraints. Vegetative change would be analyzed using existing vegetation succession models, or by developing new ones based on the results of historic and current fire effects monitoring projects. Models for smoke impacts, cultural resource impacts, vegetative change, fuels change, and fire growth through time would be used for simulations of wildland fire, hazard fuels reduction, and ecosystem restoration. (See theoretical inputs for these three types of simulations on page three of the flow diagram.)

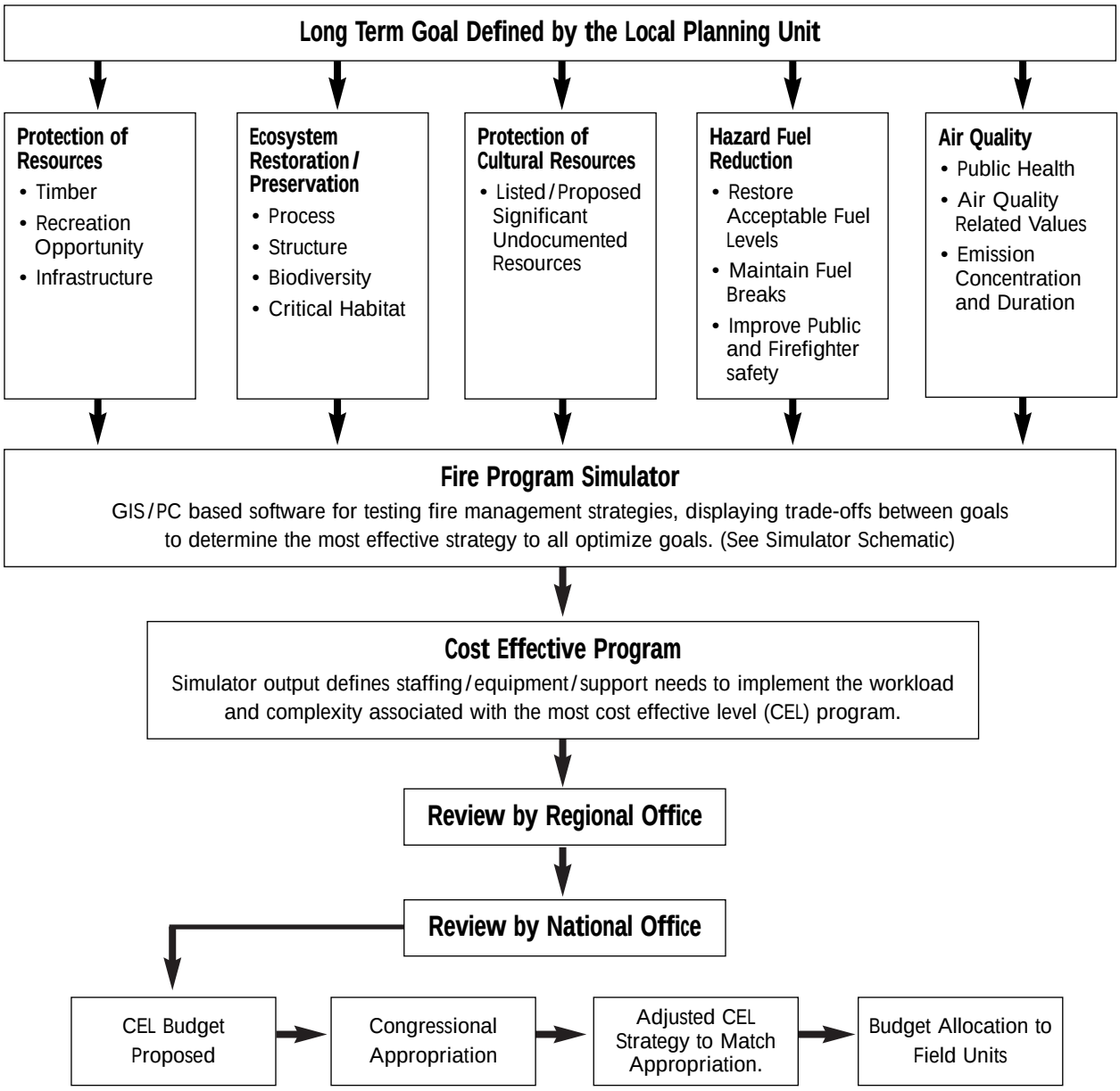
Step 6: A common set of staffing and funding rules would be used for each simulation module. For example, wildland fire initial response would have standard cost factors based on length of fire season, array of grade levels for each crew, salary and benefit tables, locality pay, etc. Hazard fuel reduction projects and ecosystem restoration prescribed fire projects could have similar rules. (See page 3 of the simulator flow diagram.)

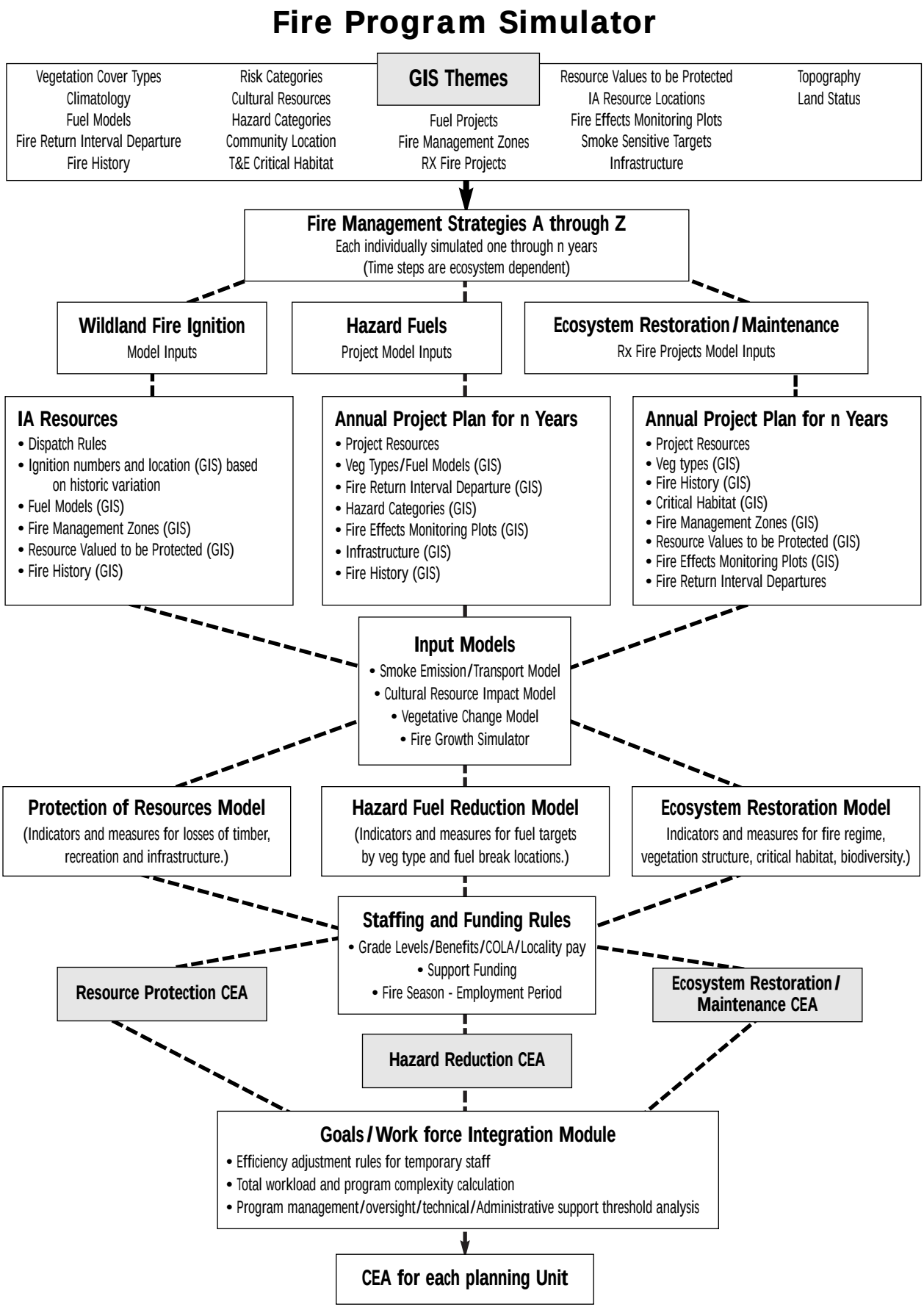
Step 7: The staffing, equipment, and support costs from the cost-effectiveness analyses for hazard fuels reduction and ecosystem restoration and maintenance would be integrated into an analysis of total program workload and complexity. This analysis would include efficiency rules for integration of various temporary work forces and contractors, and would build the management, oversight, technical, and administrative components of the fire organization based on thresholds of workload and program complexity. (See page 3 of the flow diagram.)

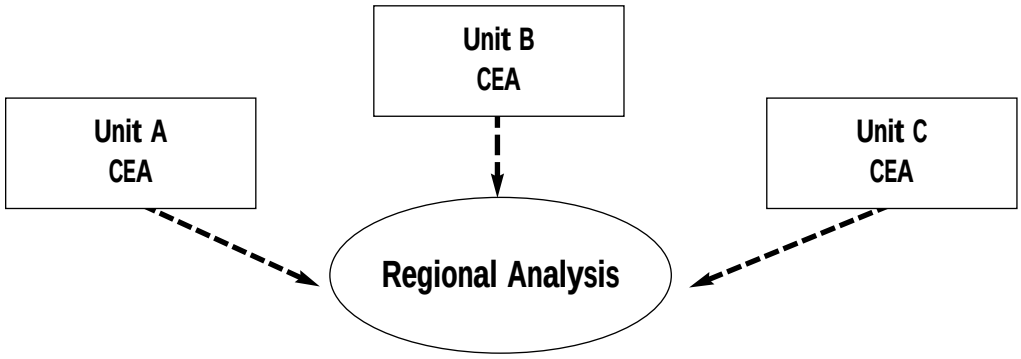
Step 8: The output from the Fire-MAP would identify the associated budget costs for all alternatives including the most-cost effective ones. The preferred alternative would represent the cost-effective level fire management program for the planning unit. This unit might be an individual administrative unit or a combination of units for various agencies.

Step 9: The analyses for individual planning units within an administrative region or state would be combined into an analysis of program workload and complexity for that area. Thresholds of workload and complexity, perhaps reflected by point scores would determine regional or state level staffing. A similar process could be used to define a national organization. The aggregation of local unit, regional/state and national analyses would comprise the cost-effective level fire management program for an agency.

Interagency Fire Program Analysis

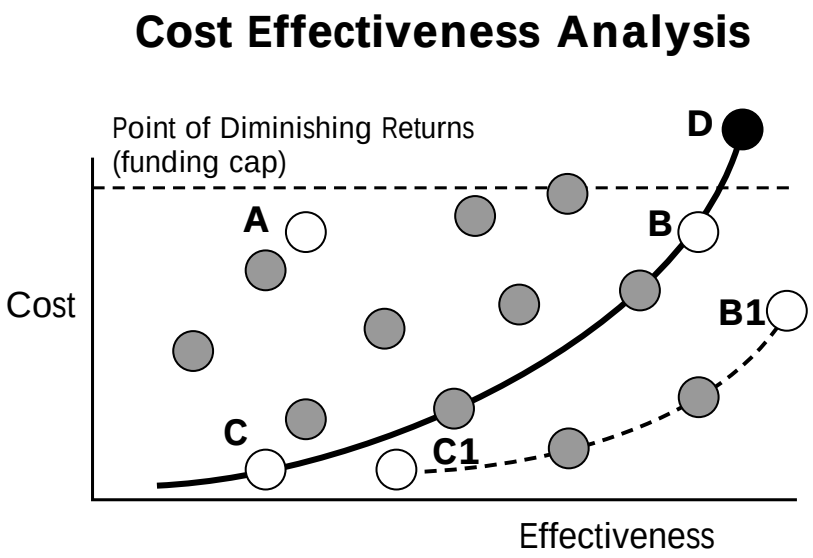



Fire Program Simulator
GIS Themes
Vegetation Cover Types
Climatology
Fuel Models
Fire Return Interval Departure
Fire History
Risk Categories
Cultural Resources
Hazard Categories
Community Location
T&E Critical Habitat
Fuel Projects
Fire Management Zones
RX Fire Projects
Resource Values to be Protected
IA Resource Locations
Fire Effects Monitoring Plots
Smoke Sensitive Targets
Infrastructure
Topography
Land Status
Fire Management Strategies A through Z
Each individually simulated one through n years
(Time steps are ecosystem dependent)
Wildland Fire Ignition
Model Inputs
Hazard Fuels
Project Model Inputs
Ecosystem Restoration / Maintenance
Rx Fire Projects Model Inputs
IA Resources
• Dispatch Rules
• Ignition numbers and location (GIS) based on historic variation
• Fuel Models (GIS)
• Fire Management Zones (GIS)
• Resource Valued to be Protected (GIS)
• Fire History (GIS)
Annual Project Plan for n Years
• Project Resources
• Veg Types/Fuel Models (GIS)
• Fire Return Interval Departure (GIS)
• Hazard Categories (GIS)
• Fire Effects Monitoring Plots (GIS)
• Infrastructure (GIS)
• Fire History (GIS)
Annual Project Plan for n Years
• Project Resources
• Veg types (GIS)
• Fire History (GIS)
• Critical Habitat (GIS)
• Fire Management Zones (GIS)
• Resource Values to be Protected (GIS)
• Fire Effects Monitoring Plots (GIS)
• Fire Return Interval Departures
Input Models
• Smoke Emission/Transport Model
• Cultural Resource Impact Model
• Vegetative Change Model
• Fire Growth Simulator
Protection of Resources Model
(Indicators and measures for losses of timber, recreation and infrastructure.)
Hazard Fuel Reduction Model
(Indicators and measures for fuel targets by veg type and fuel break locations.)
Ecosystem Restoration Model
Indicators and measures for fire regime, vegetation structure, critical habitat, biodiversity.)
Staffing and Funding Rules
• Grade Levels/Benefits/COLA/Locality pay
• Support Funding
• Fire Season - Employment Period
Resource Protection CEA
Ecosystem Restoration / Maintenance CEA
Hazard Reduction CEA
Goals / Work force Integration Module
• Efficiency adjustment rules for temporary staff
• Total workload and program complexity calculation
• Program management/oversight/technical/Administrative support threshold analysis
CEA for each planning Unit


Unit B
CEA
Unit A
CEA
Unit C
CEA
Regional Analysis

Appendix B: Description of Cost-Effectiveness Analysis

The following chart and description illustrates how a Cost-effectiveness Analysis (CEA), such as Fire-MAP, could be used to select a preferred fire management alternative:



Fire management strategy C is preferred over A because it has the same effectiveness but is less costly. Effectiveness is a measure of the ability of a strategy (integrated fire management activities) to accomplish fire management objectives. Strategy B is preferred over A because it cost the same but is more effective. Strategies B and C both lie along the cost effectiveness frontier as defined by the solid red line. All points along the frontier theoretically are cost effective, however, selecting a preferred strategy along the frontier depends on availability of funds and other considerations, such as selecting a strategy that lies below a manager-defined point of diminishing returns.

Strategies that would achieve all objectives may be substantially more costly than those that achieve a high percentage of objectives. Managers may want to establish a funding cap that represents a point of diminishing returns. Initially, that could be the point at which the slope of the curve equals a one to one ratio. Above this point, an increment in cost no longer produces a comparable increment in effectiveness. The Fire-MAP development team, together with line managers, may refine the initial criteria for the point of diminishing returns after testing in an array of land management units.

continued on next page

Continued from previous page

All strategies lying above that point on the cost-effectiveness curve could not be justified from the standpoint of the incremental cost to achieve added performance. In determining the preferred strategy, line managers may have to recognize that for strategies lying beyond the point of diminishing returns, achieving a small incremental increase in effectiveness would require a very large incremental increase in costs. In the diagram, point D lies beyond the point of diminishing returns because a large increase in costs results in a small increase in effectiveness.

The dotted line from C1 to B1 depicts the potential evolution of the cost effectiveness frontier through time as a preferred cost effective strategy is implemented. The curve should flatten and shift to the right as strategies become more effective and/or less costly through time. For example, hazard fuel reduction projects and ecosystem restoration prescribed fires should become more effective in reducing the probability of catastrophic wildfire and restoring forest structure and biodiversity as more of them are implemented. The costs may decrease as units become more efficient in implementing projects and as the risks of escape and smoke impacts decline due to lower fuel loading.

Appendix C: A process to develop fire management objectives and constraints

This is an iterative process. It is initiated with a general discussion of the Interdisciplinary Team (ID) process.

1. **Development of the polygon map**
   - Utilization of 4th and 5th level HUCs (Hydrologic Unit Code) to create polygons for the land management unit or units involved in the fire management analysis process.
   - Use of any other acceptable unit to create polygons.

2. **Assigning polygon designations**
   - "A" Polygons. Areas where fire (wildfire and prescribed fire) is not desired.
   - "B" Polygons. Areas where wildfire is not desired.
   - "C" Polygons. Areas where fire (wildfire and prescribed fire) is desired but there are constraints to its use.
   - "D" Polygons. Areas where fire (wildfire and prescribed fire) is desired with few, if any, constraints.

   Development of the Data Table
   - Data table elements
   - Current condition
   - Desired Future Condition — resource management objectives
   - Potential negative impacts from unplanned wildland fire

     The above three data elements are used to determine the polygon designation (A•D)
   - Fire Management Opportunities (objectives) and/or constraints. These items are developed by the ID team utilizing the information provided by ID team members (e.g. fire, cultural resources, biologist)
   - Prioritize the fire management workload

3. **Uses of Polygon Map and Data Table**
   - Ease with which fire managers can keep track of resource and fire management objectives (hot link from data table to map).
   - Immediate usefulness for prioritization of multiple fires.
   - Usefulness in identification of proposed action for scoping and further NEPA work.
   - Documenting change over time.
   - Additional information on this process is available from the BLM National Office at the National Interagency Fire Center, Boise, ID.

Appendix D: Delegation of authority for review team

September 23, 2001

To: Jim Hubbard, Colorado State Forester

From: Lyle Laverty-*USDA Forest Service National Fire Plan Coordinator*

Tim Hartzell-*Department of the Interior National Fire Plan Coordinator*

Subject: Delegation of Authority - Review Of Wildland Fire Management Budget Planning Analysis Models

Pursuant to the directions provided by the Office of Management and Budget in its discussions with the Departments of Agriculture and the Interior regarding the fiscal year 2002 wildland fire budget and beyond, you are hereby authorized to conduct a review of the budget planning models currently in use by the various land management agencies to allocate the mix of personnel and equipment for fire management. Results of your review will be used to advise the two Departments on development of a single, uniform, performance•based system for preparedness and fire management program planning.

The review is to ensure that current budget planning processes and protocols are in compliance with the directions contained in the 2001 Federal Wildland Fire Policy and the National Fire Plan. The review will focus on the current "MEL" model, consider the full scope of fire management responsibilities, explore the efficiencies from linking the various fire program components, acknowledge a seamless federal approach across administrative boundaries, and accomplishment of fire and ecosystem management goals at the landscape level.

Your review should also consider other contemporary fire management policies, procedures and protocols as needed, such as wildland urban interface protection and account for values to be protected in both monetary and non-monetary terms. Your review must also consider how to incorporate state and local preparedness resources into the equation for overall fire management.

Within this framework, we expect three products:

- Recommendations on what is needed to develop a single, interagency landscape level budget planning framework and analysis tool that is based upon quantified, interdisciplinary land and ecosystem management goals and objectives;

- Recommendations on what needs adjusting or changing regarding the current budget planning processes and protocols, including appropriate rationale; and,

- Recommendations for how to develop and implement the proposed changes, including which entities would be best suited to this task and a schedule for implementation and operational deployment.

You should use the Federal Fire and Aviation Leadership Council's Planning and Budget Team members to assist you with this task. You are also encouraged to seek outside participation on your work group from state and tribal governments and the academic community. You must include input from resource management professionals within the various agencies, outside of the fire community. Within the time frames provided you should seek appropriate peer review and incorporate this into your final report and recommendations. Should you need other additional support, please request it directly from the various agency fire directors.

We expect a draft report by 11-01-01 with the final report due 11-30-01.

cc: Fire Directors: BIA, BLM, FWS, NPS, USDA/FS

cjcj