

Application of Wildland Fire Assessments¹

Michael A. da Luz,² William S. Wallis³

Abstract

Wildland fire assessment is an attempt to use spatial analysis to highlight priorities for program management. The techniques rely on mapping of risks, hazards, and values, which are aggregated to determine treatment or attack priorities. The process can be applied on a strategic basis in large landscapes across jurisdictional boundaries. Scaled to local situations, the assessment can ordinate fire management zones, providing the basis for tactical planning. The assessment is designed to be iterative, accommodating changes over time and refined by integrating databases from partner agencies and stakeholders. The evolution of the Federal Fire Policy formally recognizes fire as a process essential for ecosystem function and process. As such, management decisions include a wider array of options and an increasing demand for coordinated interagency responses. Wildland fire assessments employ the use of spatial analysis to highlight priorities for program management. Managers are faced with the need to choose appropriate management responses. These decisions are influenced by the need to identify areas in which it is appropriate to use natural ignitions for resource benefit, prioritize the application of prescribed fire, and help to identify priorities for suppression responses and opportunities for intervention or fuel modification.

The shift to ecosystem management dictates planning in different scales and broader scopes. Disturbance regimes will remain a driver in determining the resilience and resistance of ecosystems and an opportunity toward a more holistic approach to land management. The need remains for an ability to conduct large scale assessments that are responsive to interagency needs, adaptable to changing conditions, linked to resource stewardship, and serve as support for strategic and tactical decisions and actions.

Wildland fire assessment is an iterative process that includes the mapping of risks, hazards and values. It ranks and aggregates elements within the landscape to develop sensitivity, goals, and priorities. Ranking can be based on quantifiable and detailed data if it is available. As an ordination process, it also allows for combining databases of different standards, an important consideration for interagency planning and cooperation. Simplicity in the ranking process remains the trademark and the attraction of the process. Given a set of criteria, it relies on planners to develop a relative ranking of high, moderate, or low for each mapping layer. Layers are then aggregated to provide a comprehensive view of existing wildland fire conditions. It can be designed at various scales to provide tiered planning, linking resource needs, community values, and managerial issues.

For assessment purposes risk is defined as the potential for ignition on the basis of human or lightning activity. Occurrence data and fire records are the primary source of input. Hazards are defined as physical or biological features that result in similar fire behavior characteristics. In our experience, we used vegetative data, reduced them to fuel models, and ranked their relative flammability. Values remain the most complex element to map. They are natural or developed features within the landscape that are affected by fire. Effects can be positive or negative that vary by fire intensity, duration, or scale of disturbance. On the smallest scales, it accommodates the most detailed information and provides support for tactical decisions and responses. At the broadest scales, it accommodates a wide range of details and allows planners a strategic perspective with linkages among resource issues and an evaluation of interagency efforts across landscapes.

¹An abbreviated version of this paper was presented at the Symposium on Fire Economics, Policy, and Planning: Bottom Lines, April 5-9, 1999, San Diego, California.

²Branch Chief, Fire Ecology and Operations, Rocky Mountain Region, USDA Forest Service, P.O. Box 25127, Lakewood, CO 80225; e-mail: mdaluzr2@fs.fed.us.

³Fire Ecologist, USDA Forest Service and Colorado Bureau of Land Management, P.O. Box 25127, Lakewood, CO 80225; e-mail: bwallisr2@fs.fed.us

Colorado Statewide Assessment

In 1996, an interagency group in Colorado developed a pilot project to conduct a wildland fire assessment on a statewide basis. The project was developed in part to respond to the Federal Wildland Fire Program and Policy Review that directed Federal land management agencies to "jointly establish an accurate, compatible, and accessible database of fire and ecosystem related data" as a basis for fire management and fire reintroduction decisions. The project established a platform for agencies and States to work together to develop plans that address the needs regarding health of the landscape, the needs of affected communities, and a tool to communicate about fire management to the public. Project partners included representatives from the Bureau of Land Management, the National Park Service, Colorado State Forest Service and the USDA Forest Service. The goal of the project was to address these key land management questions:

- Where can we tolerate fire and what can we do to promote the natural role of fire?
- What are the probabilities for catastrophic fire and how can we improve preparedness?
- Are there opportunities to increase efficiency and avoid redundancy?

Project objectives included the development of a process for coordinated planning that addressed these needs:

- Recognize and accommodate the changing needs of the public and land management agencies with regard to wildland fire.
- Promote interagency cooperation, develop coordinated fire management priorities, and identify opportunities for collaborative management.
- Serve as a platform for linking fire programs with other land management functions and resource needs.

In 1996, the effort resulted in the production of the Colorado Statewide Assessment, which is the first attempt to apply assessment techniques to address fire issues at that scale. It demonstrated that agencies can cooperate, and although challenging, various databases can be integrated. Constructed in a geographical information system (GIS) database, it quickly identified key issues. For example, by viewing fire occurrence and fuel models on a large scale, an agency representative made adjustments to relocate resources to increase efficiency. The assessment continues to serve as a communication tool raising awareness for public safety in the urban interface. It served as a vehicle for discussions between land managers, legislators, and representatives of local government. It became a catalyst for identifying priorities for intervention and opportunities for the application of prescribed fire. Techniques learned and refined continue to serve as a basis for other collaborative efforts.

Front Range Assessment

Like many other areas in the western U.S., Colorado continues to experience the impact of urban growth. Expansion of the wildland-urban interface, especially on the Front Range, increased concerns for public safety, and preparedness of fire fighting agencies, and raised the stakes for agency administrators. Concurrent with the statewide effort and employing similar techniques, the Front Range Assessment was produced in 1996. On the heels of damaging wildfires, it grouped vegetation associations by disturbance regimes and used population density to identify areas of highest threat of loss to seek opportunities for

intervention. Known locally as the "Red Zone" map it served most effectively as a communication tool, reaching affected publics through the media and local community meetings. It strengthened efforts with fire prevention partnerships, served as a basis for "defensible space" presentations, and was part of a collaborative effort that resulted in the annual Colorado Wildfire Mitigation Conference. An interagency steering committee was formed to serve as a clearinghouse for efforts, and demonstration areas were sought for watershed restoration activities and the application of prescribed fire.

Winiger Ridge and the Jamestown prescribed burn, in Boulder County, were examples of Federal, State and local agencies involved in joint planning, outreach, and execution of fire mitigation projects. Public confidence was crucial to project success since control lines in some cases were literally on private property boundaries. Working relationships within the fire community have been strengthened, and in 1998 an Incident Management Team from the West Metro Fire Department supported expanded attack on a wildland fire involving mixed jurisdictions.

The South Platte Watershed Restoration Project is another product borne from the Red Zone map. It brings together the Pike National Forest, Colorado State Forest Service, and a variety of interest groups. With matching funds and cost share agreements, the goal is to continue restoration of the watershed after the Buffalo Creek Fire and to seek opportunities for fuel reduction, erosion control, vegetation management, and improvement of aquatic habitat. The Environmental Protection Agency and the Denver Water Board were also drawn as willing partners when heavy sediment loads in highly erosive soils directly impacted water quality and reservoirs in the Denver water supply.

Land Management Planning

Paul Gleason, Fire Ecologist for the Arapaho/ Roosevelt National Forest, applied the principles of assessment techniques in developing the fire element of the Forest Land Plan Revisions. Incorporating current concepts in fire ecology and fire behavior technology, he included crown fire potential, topography and aspect to refine the hazard layer. His aggregation layer delineated the forest into fire management regimes, identifying areas for direct control, perimeter control, and prescriptive control. By using this technique, he has afforded fire managers and agency administrators the opportunity to apply a wide range of management responses on unplanned ignitions. He has also positioned the forest to identify opportunities for the use of prescribed fire for hazard reduction. In addition, Gleason has accommodated fire use to meet a variety of other resource management goals such as forage production and habitat improvement.

Interagency Cooperation and Planning

In efforts to increase efficiency, the Colorado Bureau of Land Management and the Rocky Mountain Region of the USDA Forest Service have sought opportunities to share resources, personnel, and facilities. Under the auspices of pilot projects and confirmed through the "Service First" Initiative, joint organizations and authorities sought efficiency and cost effective delivery of services to the public. The Upper Colorado River Fire Management unit is a result of those efforts. It combines the fire management organizations for the Grand Junction District of Bureau of Land Management with the White River National Forest. Fire managers for one agency oversee programs for the other and resource and personnel are mixed and matched as needed to meet mission needs.

In 1997, the National Office for the BLM issued direction for all State offices to conduct a Level I Analysis. The objective for the analysis was to streamline and articulate preplanned suppression response, identify areas for application of prescribed fire, and strengthen the linkage of fire management to land

management plans. The Grand Junction District complied with that direction. Coincidentally, the White River National Forest was gearing up for revisions in its land management plan and attempting to position itself to expand its prescribed fire program. It became obvious that a common planning effort and planning criteria were in order, and the BLM process was adopted. Under the leadership of Pete Blume, Fire Management Officer, BLM, and Bob Leighty, Fire Staff Officer, USFS, wildland fire assessment techniques were employed as the basis for planning. The BLM Level I analysis served as the basis for building the Values Layer, and we believe it offers the most comprehensive definition we have seen to date. The layer is built by resource specialists, not fire planners. In summary it asks others to categorize the landscape into four classes based on the relative tolerance of fire. They range from:

- Where can you not tolerate any fire. These areas require full control in suppression actions and would not be conducive for prescribed fire.
- Where can you tolerate fire with active suppression. These areas offer a wider range of suppression options and may tolerate some prescribed fire activity aimed at hazardous fuel reduction.
- Where is fire compatible with management goals and activities. These areas have resource management objectives that are enhanced by the use of fire.
- Where is fire an essential part of ecosystem function. These are areas in which administrators can exercise the full range of appropriate management responses and represent local priorities for the reintroduction of fire.

In short, the effort demonstrated the effective use of common planning techniques and decision criteria. The process identifies joint opportunities and priorities, leverages funding, and provides stakeholders with a consistent approach to the landscape.

Other Examples

Wildland fire assessment techniques have been applied in other areas as well. The State of Utah has completed a statewide assessment. Modelled somewhat after the Colorado project, its primary goal was to identify areas of highest risk and to strengthen relationships among State and Federal partners for prevention, intervention, and suppression response. The New York Division of Forestry recently conducted an assessment of Long Island, New York, which has strengthened the cooperation among fire jurisdictions and continues to refine fire planning and suppression responses. The States of Michigan and Wisconsin, along with the Province of Ontario, used the assessment technique to refine and coordinate fire prevention and fire planning efforts. The San Bernardino National Forest remains a front runner in using the assessment technique for tactical planning, identifying priorities for suppression response in an arena of explosive fire behavior that is highly dependent on interagency cooperation. The Forest has shared its expertise to influence linkage among other National Forest and agency partners in the southern California. Chuck Dennis of the Colorado State Forest Service is currently undertaking an initiative termed a "mid-level assessment." It takes a subregional approach and attempts to refine the statewide assessment to improve coordination among local agencies. Similar approaches in Canada and Australia have been developed, although their focus remains on identifying values at risk and the efficiency of suppression responses.

Summary

We believe there are numerous benefits for using wildland fire assessments. Managers can quickly identify areas that may require additional tactical planning or where refinements may be needed. The process compiles a common database for interagency planning and allows for linkages to be made among various levels of planning resolution. Fire managers and administrators can better define sustainability, provide linkages among various resource needs and provide the basis for responses in what are often dynamic and complex situations. By using emerging technology in information systems (GIS and GPS) the process lends itself well to refined analysis of complex landscapes and fire situations. Participants can begin the process with existing data and refine it as new, better, or different data becomes available. It serves as a strong communication tool among fire and resource specialists and managers. More importantly, it provides a forum to interact with affected publics, legislators, and local agencies to surface concerns regarding public safety and the array of fire tools. In large part its simplicity and the ability to reach basic conclusions easily and the visual aspect of its products makes it easy to explain and comprehend.

Current natural resource policy continues to press for changes in approaches to land management. There is an increasing demand to view effects on landscapes and understand linkages between ecosystem functions and processes. Discussions regarding historical range of variability, concepts of lethal versus non-lethal fire, fire return intervals, severity of disturbance, and forest health, all contribute to attempts to identify acres at risk. As a result there are a wide variety of ecological assessments with varying criteria and scales. Habitat conservation, connectivity, levels of sustainability, and watershed restoration continue to press for changes and place demands and needs for differing answers. Off-site effects, downstream impacts, and the management of smoke are but a few examples of the increasing complexity of fire planning. When you factor in social concerns, values of stakeholders, and agency mission and cultures the task can become daunting.

Our continuing concern lies in the fact that many of the assessment efforts are independent of each other. There are no obvious acceptance of protocols, terminology, or common focus with respect to fire. We believe interagency planning and implementation remain crucial to successful management of both wildland and prescribed fire. Varying agency budgets, missions, and scope make it imperative that planning techniques focus on common denominators. Developing analysis techniques that allow for inclusion of differing data standards remain a key to multiple scale, multiple agency planning. We further believe that planning should be a process not a product. As such, adaptive management techniques will continue to refine a common approach. We believe the wildland fire assessment process that we have outlined offers the framework for spatial analysis, linking strategic and tactical plans. It serves as a vehicle for leveraging energy, funding, and linking mission capability to ecological need.

Adaptive management continues to reflect a fundamental change in natural resource management. It incorporates science based management in developing objectives and recognizes the need to reevaluate and revise objectives and techniques. Monitoring is the core for success of adaptive management, the feedback loop to affirm or adjust courses of action. The assessment process establishes a baseline that can be compared to historical range of variability and provides a means to develop relevant information to account for spatial and temporal variation. As planners and managers update assessments, rate and scale of change can be determined. The simplicity of the process allows for the assessment to be done on any kind of mapping system. However, in our experience GIS provides the ideal tool for analysis, simulation, and database

management. The components of the assessment can be modified to include or be overlaid with an activity database. We have seen examples where elements of tactical assessments served as the basis for Wildland Fire Situation Analysis. By incorporating data of fuel modification and mapping of prescribed fire activity, suppression operations were designed to minimize site disturbing activities, minimizing firefighter exposure and effectively using perimeter control techniques.

Future Outlook

There is continued dialog regarding the ongoing evolution of the assessment process. After the statewide assessment was done, we focused our energy to assisting forests and partners in developing local plans. We believe that our next step is to crosswalk broadscale assessments to local planning. We anticipate that aggregated efforts at local levels, will strengthen the large scale effort. We also believe that any improvements at the large scales will influence the quality and priorities for local projects, leading to a more comprehensive and coordinated approach to managing fire on the landscape. Our initial efforts taught us a lot regarding the relevance and sharing of databases. We expect continued evolution in skills and GIS technology to improve our analysis and conclusions. We foresee the infusion of real time and baseline data to drive decisions in complex and dynamic fire situations. Questions remain about how we manage the database, how to disseminate information, how data is formatted, and how we fund and manage the endeavor. The line between structural fire fighting and the management of wildland fire is growing increasingly thin in interface zones. We believe our experience with the assessments process provide us an improved understanding of wildland fire impacts and the relationships among the fire service community. We understand that application and refinement of similar techniques are occurring in structural suppression and urban fire techniques. We anticipate assessment techniques will evolve in the interface that will refine techniques, strategies, tactics, and responses within the fire service community.

In the mean time, we continue to believe that wildland fire assessment techniques have provided a common "picture" of the existing situation. Fire managers have refined and delineated fire management zones on the basis of spatial relationships for further detailed program planning, such as the National Fire Management Analysis System (NFMAS). Most importantly it serves as a means for program coordination and strengthened partnerships. It continues to be an effective tool in reaching affected publics and stakeholders. Its simplicity makes it easy to understand, and consequences of decisions are easily translated. We believe it is a tool that is anchored in an ecological setting and incorporates the human dimensions on the changing landscape. We have also been engaged with others on the application of techniques for other emergency response and disaster preparedness. We look forward to influencing the continued evolution of technique and application of wildland fire assessments.

Acknowledgments

We thank Russ Johnson, Environmental Systems Research Institute, Joseph Millar, San Bernardino National Forest, Paul Hefner, Bureau of Land Management, and Chuck Dennis, Colorado State Forest Service, for their involvement in the evolution of assessment models. In addition, we acknowledge the many hours of detailed work by Susan Goodman, Geographical Information System Specialist, Colorado Bureau of Land Management.