# A Multi-Disciplinary Approach to Fire Management Strategy, Suppression Costs, Community Interaction, and Organizational Performance

Anne E. Black, Krista Gebert, Sarah McCaffrey, Toddi Steelman, and Janie Canton-Thompson

Wildland fire management must balance the multiple objectives of protecting life, property, and resources; reducing hazardous fuels; and restoring ecosystems. These Federal policy imperatives, varied yet connected, must be met under an increasingly constrained budget. A key to management success is effectively exercising the full range of management flexibility in responding to wildland fire.

Over the past several fire seasons, there has been increasing emphasis on strategies to achieve fire management objectives using less than full perimeter control, such as more prescribed burning and focused point and area protection. While the strategies and tactics themselves are not new, wider use by Federal agencies, particularly on multi-jurisdiction events and in areas adjacent to private lands, has raised concerns among partners and stakeholders. How effective

*Anne Black is an interdisciplinary ecologist/social scientist at the Forest Service's Aldo Leopold Wilderness Research Institute, Missoula, MT. Krista Gebert is an economist at the Forest Service Rocky Mountain Research Station in Missoula, MT; Sarah McCaffrey is a social scientist at the Forest Service Northern Research Station in Evanston, IL. Toddi Steelman is an associate professor in the Department of Forestry and Environmental Resources at North Carolina State University in Raleigh, NC. Janie Canton-Thompson is a social scientist at the Forest Service Rocky Mountain Research Station in Missoula, MT.*

is the new emphasis? Is it affecting the bottom-line, and if so, for whom? How successful are we regarding land management objectives or safety? How well are we communicating intent with our key partners and the public, and what message is being received?

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Answering these questions in a generalizable way has its challenges. For example, the current financial system can inhibit accurate capture of daily costs. Incident managers have different interpretations of wildland fire response strategies and different meanings for "cost effectiveness." The fire community lacks agreed-upon metrics to measure performance (such as degree of success in meeting objectives: resource benefits, protection, efficiency, and internal and external relations, for example), which inhibits comparison across cases.

Furthermore, highly contextual observations, such as perceptions of community relations, quickly deteriorate with time.

In this article, we describe our current work to assess the utility of available data to reflect on the performance of fire management. To date, the available data—which include objectives and strategies captured by decision documents, daily plans, final narratives, and GIS imagery—have not been systematically captured or analyzed.

## Using a "Balanced Scorecard"

In summer 2008, we embarked on a Joint Fire Science Program (JFSP) project to develop and field-test a "balanced scorecard" of organizational performance suggestive of outcome, impact, and trend. The "balanced scorecard" framework outlines four critical aspects of management necessary for developing a robust picture of an organizations' performance: customers, financial health, internal business perspective, and innovation and learning (Kaplan and Norton 1992). For use with fire incidents, we translated those aspects to community relations and public sentiment; fiscal efficiency; safety, ecological health, and tactical effectiveness; and organizational learning.

We sought to use this "balanced scorecard" to investigate how tradeoffs are made in the decision-making process, including how community interaction increases or decreases the opportunity to exercise different responses to wildland fire and how management flexibility may or may not contribute to cost and organizational performance. In close partnership with the Northern Rockies Coordination Group (NRCG) and the National Incident Management Organization (NIMO) teams, we are collecting information running the gamut from tangible and measurable (safety, ecology, and costs) to less tangible but still perceptible (suppression effectiveness, community interactions, and efficiency) and fully process-based (organizational learning) through interviews, cost analyses, and the incident key decision log (KDL, see The Key Decision Log: Facilitating High Reliability and Organizational Learning, in this issue).

The benefits derived from this research will include: (1) a clearer description for fire managers of the relationships among costs (to Federal, State, and local entities), community interaction, safety, ecology, organizational performance, responses to wildland fire, and fire management strategies; and (2) a protocol that allows monitoring of and learning from organizational performance trends, both process (agency-team relations) and outcome (the impact of a given fire on human safety, values at risk, community relations, and ecosystems).

## Community Relations and Public Sentiment

Fire managers must take into account both public expectations and the degree of public acceptance for different strategies and tactics. Therefore, it is critical to understand how agency/community interactions shape both public acceptance and managers' perceptions of what is acceptable. Much of the recent research related to community response to wildfire has focused on prefire mitigation actions on public and private land. This research indicates that increased understanding of the purpose and effectiveness of mitigation measures is associated with greater acceptance (McCaffrey 2006).

Partnerships and collaboration with communities and agencies are also tied to effective mitigation measures (Steelman and Kunkel 2004; Steelman and others 2004). Additional research indicates that fire mitigation efforts are more effective when wildland managers not only understand and address the factors that may influence stakeholders' acceptance of management practices but also work to engage them in risk management decisions (Winter and others 2002; Zakzek and Arvai 2004). Unfortunately, research related to community and public understanding of fire management during a fire event is limited, particularly as that understanding relates to the use of alternatives to full suppression. Consequently, we do not know much about how agencies reach out to the public, what communities or the public understand about strategies and tactics, or how the public can facilitate or obstruct the use of different options for responding to wildland fire.

One specific objective under the JFSP project is to gain an understanding of the relationships between pre-fire and during-fire community interaction and fire management flexibility. To meet this objective, our research design uses quantitative and qualitative methods to address the following questions:

- Do outreach and interaction with the public prior to the fire, including involvement in land management and fire management planning and hazard mitigation, increase acceptance of alternative strategies (i.e., less than full suppression) during a fire and decrease post-fire conflict?
- How does provision of information during a fire, both in terms of content and presentation, influence acceptance of alternative strategies? Are there particular types of information that are more or less important in shaping acceptance?
- How does public reaction to fire management efforts during an event affect fire management decisions?

In 2008, we collected data on community outreach, interactions, and responses from three fires: the Gap Fire on the Los Padres National Forest in California (full suppression with perimeter control), the Cascade Fire on the Custer National Forest in Montana (modified suppression), and the Gunbarrel Fire on the Shoshone National Forest in Wyoming (prescribed burning). We interviewed participants from incident management teams, host agencies, and key community members. We plan to test the importance of some of the dynamics identified in these discussions on a wider audience as the research continues.

## Fiscal Efficiency

Many policy and decisionmakers hoped that the use of less-aggressive suppression strategies, where appropriate, in 2007 would result

in lower costs (OIG 2006; USDA and USDI 2007; NRCG 2007). However, the interplay of wildland fire management decisions and cost containment is not well understood, and research designed to assess the factors affecting suppression expenditures has been limited due to a lack of data. Early research by Gonzalez-Caban (1984) estimated suppression expenditures based on the number and type of the different resources used on the fire. More recently, Donovan and others (2004) used regression analysis to identify variables affecting suppression expenditures for 58 fires that occurred in Oregon and Washington in 2002. The Forestry Sciences Lab in Missoula has conducted research on large fire suppression costs since fiscal year 1998 (Gebert and others 2007; Canton-Thompson and others 2006; Canton-Thompson and others 2008). Still, much remains to be learned about fiscal efficiency related to fire management.

We hope to extend this work by focusing quantitative and qualitative assessments on how wildland fire management strategies and tactics influence wildland fire costs and vice versa. Quantitative techniques include economic assessments of previous fires. Qualitative assessments include interviews with agency officials, cooperators, and stakeholders about their experiences with the interplay of response strategies and costs. Our two major questions are:

- Does point protection/monitoring, rather than full perimeter control, affect suppression costs for Federal agencies?
- Do strategies and tactics aimed at less than full perimeter control reduce the costs of fire management or simply shift the cost burden to non-Federal entities?

Preliminary economic work suggests that the data and regression models used to derive the "stratified cost index" (a current performance measure for both the Forest Service and U.S. Department of the Interior Bureau of Land Management, Gebert and others 2007) may also be useful for assessing the effect of responses to wildland fire on suppression expenditures per acre. Early analysis of interviews shows that State and local cooperators, in most cases, are quite concerned about their costs increasing as Federal policy shifts toward more prescribed burning, monitoring, and point protection strategies. The general assumption is that less-aggressive strategies will result in cost savings for the agency. However, some interviewees argue that less-aggressive strategies cause

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fires to last longer and increase chance of escape to private land, culminating in higher private costs and prolonging costs to local stakeholders, particularly with respect to personal health and tourism losses. We are hoping that our analyses (both qualitative and quantitative) will shed light on this issue or at least that we will start to collect the type of information necessary to answer this question over the next few years.

## Risk Management and Organizational Learning

To fully understand the mechanics of the current decisionmaking process, we need to know how decisionmakers frame their decision space and how they weigh potentially conflicting objectives within that space. Indepth field interviews in the fall of 2008 helped us to better understand the full context and impact of other factors on the relationship between response and cost, due to the fact that contextual information is not captured in financial records. These interviews focused on understanding:

- How does an increasing emphasis on cost containment influence the strategies and tactics used on wildland fires?
- How does the use of the new Wildland Fire Decision Support System (WFDSS) influence the strategies/tactics or costs of suppressing fires?
- How do decisionmakers weigh potentially competing fire management objectives and risks (long- versus short-term risks, safety, cost, probability of success, and public opinion), and are there patterns to these weights across strategies?

We are also building and testing a Web-based system in which fire managers (both line officers and team members) can document their key decisions and decision rationales. This effort recognizes that while Federal fire management policy (1995) outlines four major objectives—safety, property and resource protection, hazard reduction, and ecological restoration—as yet, there are no consistent assessment criteria or data collection

protocols through which to measure progress. Not only is a system important for program reporting; it is critical for organizational learning (Garvin 2000). Thus, we also want to evaluate:

• How consolidated and comprehensive a story of fire management can we tell by capturing currently available incident data in a central location and through a log of key decisions during an incident?

• How effective is maintaining the log at facilitating organizational learning?

In consultation with NRCG and NIMO, we developed and launched a Web-based database for use by incident and management units. Originally envisioned for use only in the Northern Rockies, the effort generated substantial interest and was utilized on all types of fires (type 5 to type 1 and wildland fire use events) in six Forest Service regions and by both National Forest Systems units as well as the U.S. Department of the Interior Fish and Wildlife Service and the State of North Carolina. We are currently assessing progress and outcomes of this effort and anticipate additional work in 2009: particularly, extending capabilities to include inter-agency partners. A key question we are addressing is the extent to which such a system can and should function as a tool for both documentation and rigorous organizational learning.

## Conclusion

Changes in the wildland fire environment—climate change, hazardous fuels buildup, and rising human populations in the wildland-urban interface—are resulting in longer fire seasons and wildfires that are increasingly resistant to control and expensive to suppress. Under these conditions, the tactics relied upon in the past now often pose unacceptable risks to firefighter safety. This has led to the call for changes in the way we manage wildfires. Flexible management means less emphasis on putting fires out, no matter what the cost, and more emphasis on using our scarce firefighting resources to effectively meet multiple objectives. To help land managers and policy makers succeed in this new arena, information is needed on the interplay of fire management strategy, suppression costs, Forest Service/community interaction, and organizational performance. We hope this project will provide some of this missing information and lay the groundwork for information collection systems to consistently capture the information fire managers need to adapt to our changing environment.

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