WILDLAND FIRE MANAGED FOR MULTIPLE OBJECTIVES IN SOUTHWESTERN

FORESTS: IMPLEMENTATION OBSTACLES


By Brian T. Kelley



A Thesis

Submitted in Partial Fulfillment

of the Requirements for the Degree of

Master of Science

in Forestry



Northern Arizona University

May 2017



Approved:

Andrea Thode, Ph.D., Chair

Martha Lee, Ph.D.

Sarah McCaffrey, Ph.D.

ProQuest Number: 10282665

ProQuest 10282665

**ABSTRACT**

WILDLAND FIRE MANAGED FOR MULTIPLE OBJECTIVES IN SOUTHWESTERN

FORESTS: IMPLEMENTATION OBSTACLES

BRIAN T. KELLEY

Decades of effective fire suppression and changes in climate have led to high fuel loading across the western U.S. resulting in large high-severity wildfires. Managers seek alternative treatments to reduce fire hazard and using natural ignitions to meet management objectives is one option that has recently gained support across the Southwest. However, management of natural ignitions during fire season poses some challenges to fire managers. There are both internal (within agency) and external (outside agency) challenges that fire managers must overcome for effective use of wildland fire. There has been substantial research conducted regarding external issues associated with burning treatments in the forest. Internal issues, on the other hand, have not been evaluated. Through 65 in-person interviews I evaluated agency perceived internal challenges associated with implementation of wildland fire managed for multiple objectives. This research focused on the Northern Arizona region (including Coconino and Kaibab National Forests, Grand Canyon National Park, and San Carlos Apache Reservation), as this area currently utilizes this management technique. There are multiple layers of complexity regarding ecological use of fire including collaboration of resource advisors, competing objectives, and unclear policy. External challenges are largely focused on public perception and smoke impacts. Additionally, terminology poses challenges with communication to the public regarding fire use.

ii

# ACKNOWLEDGEMENTS

## TABLE OF CONTENTS

## LIST OF TABLES

# LIST OF FIGURES

# PREFACE

This thesis is presented in journal format and consists of two manuscript chapters which will be submitted for publication to two different scientific journals. The two journals we are trying to publish in are International Journal of Wildland Fire and Environmental Management. Chapter 5 regarding management implications, is presented as a visually appealing 'fact sheet' that is targeted at land managers and will be published by the Southwest Fire Science Consortium.  I use the pronoun 'we' instead of 'I' because the submitted publication will have multiple authors.

<div align="center">

**CHAPTER 1**
LITERATURE REVIEW

</div>

Wildland fires have increased in frequency in the Western U.S. despite increases in suppression efforts. Land managers seek alternatives to treat acres and remove hazardous fuels in order to reduce future fire threat. Options have largely focused on thinning and prescribed burning; however, the use of naturally ignited wildland fires to remove fuels has increased in use. Although using naturally ignited fire to achieve resource benefits has been around for several decades, its use has been variable. Understanding the social impacts of fuel treatments has important implications for land managers. This review examines public perception of agency fuel treatments as well as the internal or within-agency obstacles for wildland fire managed for multiple objectives.

There are six themes observed throughout the literature search that are common elements pertaining to public perception of agency management. More specifically these six themes relate to the acceptance of agency fire and fuels management. These six themes include: (1) trust in the agency implementing the treatment, (2) perceived risk of the treatment, (3) location of the treatment, (4) the publics' knowledge of the treatment, (5) management of smoke, and (6) resident expectations. McCaffrey (2014) offers various factors that were found to influence acceptance of fire and fuels management.

**Trust in Agency Management**

Trust in the agency personnel implementing the treatment is a common factor that affects public perception of agency fuel treatments. Many factors have been identified as elements affecting the amount of trust the public places in an agency. A lack of trust leads to a sense of disenfranchisement amongst the public that may cause them to withhold support for management

actions (Liljeblad 2006). There are three main elements contributing to trust in agency fuel management. The main elements contributing to trust are: (1) the perceived competency of agency personnel to implement management actions, (2) communication of the ecological effects a treatment may have, and (3) past treatment outcomes which strongly influence public acceptance.

The perceived competency of agency personnel and confidence in them to implement fuel treatments, specifically prescribed fire, is a common theme that influences trust in agency management actions. Confidence is defined as the perceived ability of managers to implement the treatments successfully with an intended outcome (Toman et al 2014).Confidence in managers to implement the treatment properly influenced approval across prescribed burning and mechanical thinning. (Brunson 2008; Toman et al 2011). McCaffrey (2005) emphasizes the importance of confidence as the main factor for acceptance of prescribed burning and mechanical thinning. Confidence in successful use of a treatment is highest for mechanical thinning, followed by prescribed burning, and lastly managed fire because of the associated risk with each treatment (Kneeshaw et al 2004b; Martin et al 2011; Toman et al 2011). There is also high support for a combination of treatments such as thinning followed by burning, as risk of a negative outcome is largely reduced. Therefore, confidence and competency in managers is a key element of trust. Trust is gained only when the agency is judged to be reasonably competent in its actions over a period of time (Brunson and Evans 2005; Winter et al 2002).

Communication of the ecological effects as well as benefits and drawbacks of a treatment is important for building trust. Effective communication of the rationale for fuels management, the ecological effects of a treatment, and the outcomes is key to gaining support (Martin et al 2011). The preferred communication source is the government; however, studies show that the

2

governments communication efforts have varied success (McCaffrey and Olsen 2012). Generally, there is increased trust in agency management actions in regions where the agency has an extensive outreach and communication program. Studies suggest that effective communication allows for the community to prepare for treatments and treatment impacts (McCaffrey 2005). This pertains to communicating the potential smoke impacts from prescribed burning and managed fire.

Past treatment results have been shown to influence public trust in agency decisions and management actions. Post treatment effects influence public opinion in either a positive or negative manner that may affect treatment acceptance. Treatments that end negatively often have adverse effects on public trust (Brunson and Evans 2005). Studies suggest that unsuccessful treatments such as escaped prescribed fire and aesthetically displeasing thinning treatments can decrease trust; however, this is time dependent and may fade as time since treatment increases (Brunson and Evans 2005; Litchman 1998). Managers must strive to mitigate possible impacts from escaped burns to maintain positive relations with the public. Possible ways of building trust are to highlight successful management actions through signage and reports.

**Perceived Risk of the Treatment**

The perceived risk that the public associates with a treatment strongly influences approval for its use. The public associates different levels of risk with different treatments based on their concern for the treatment effects and this dynamic may influence support of the treatment overall. The public is more supportive with mechanical thinning, followed by prescribed burning, and lastly managed fire (McCaffrey and Olsen). On another note, managed fire has not been sufficiently examined for perceived risk among the public and therefore the trends are generalized.

There is some evidence that shows mechanical thinning as a fuel treatment has the least perceived risk among the public (Bright and Newman; Brunson and Evans 2005; Martin et al 2011). We suspect that there is reduced risk associated with mechanical thinning, mainly because of no risk of escape such as with prescribed and managed fire. This inability of the treatment to escape prescription reduces the threat to adjacent private lands and is therefore the safest option in the publics' eye. Also, mechanical thinning is controlled by operators and therefore can be shut down at any time if something goes awry. However, the risks that the public associates with mechanical thinning are often from the indirect impacts of the treatment rather than the treatment itself. Often the risks that are related to mechanical thinning are connected to erosion caused from use of machinery (McCaffrey and Olsen 2012). Another factor associated with risk is the idea that large old growth trees would be removed and that ecological processes would not be maintained (Brunson and Evans 2005). This stems from the idea that the Forest Service would use fuel reduction as a means of generating revenue and logging the forests. There is also concern that thinning alone will not be sufficient enough to reduce fire behavior in extreme conditions (Dellasala and Frost 2001).

Prescribed burning receives less support from the public; however, this support is increased when the prescribed burning is in remote areas disconnected from urban developments (Brunson and Shindler 2004; McCaffrey 2005; McCaffrey and Olsen; McCaffrey et al 2013; Winter et al 2002). The location preference appears to be due to concern about threats to life and property (Kneeshaw et al 2004), particularly if a prescribed fires goes beyond prescription and possibly burns private land (Brunson and Shindler 2004; Brunson and Evans 2005; Mccaffrey 2005; McCaffrey and Olsen 2012; Winter et al 2002). Prescribed burns have escaped prescription in the past such as the Cerro Grande Fire in New Mexico. Also, it has been shown

that there is a mentality that no fire can ever be controlled and used on the landscape, even though these results were only common in some respondents (Martin et al 2011).

The use of managed fire has not been extensively analyzed for perceived risk (Miller 2003). It is possible to relate the associated risks of prescribed fire to managed fire as these two management actions are very similar but more research is needed for more detailed information. Much like prescribed burning, managed fire is perceived as high risk when it is in close proximity to urban developments (Bright and Newman; Cortner et al 1984; Kneeshaw et al 2004b). This is attributed to the idea that the fire may cross into private land to harm life and property. This high associated risk often ends with a suppression attitude amongst the public leading to containment of many candidate fires that would've been managed for resource benefit (Kneeshaw et al 2004).

## Location of the Treatment

The location of the treatment has also been shown to influence public acceptance of treatments particularly which treatment is the preferred alternative amongst the public (Bright and Newman; McCaffrey and Olsen 2012). Although this topic has not been extensively examined, there are some trends that were noticed throughout the literature. The use of mechanical thinning is preferred near urban developments and is not widely supported in wildland areas.

The relatively safe practice of mechanical thinning makes it the preferred choice within WUI areas (Martin et al 2011; McCaffrey et al 2013; Toman et al 2011; Winter et al 2002). Residents prefer this choice directly adjacent to their property because of less risk to life and property during implementation. In contrast, mechanical thinning is not the preferred treatment to be used in wildland or roadless areas. This is due to the ecological damage that is associated with heavy

machinery during thinning operations such as creation of skid trails, landings, and roads (Sensibaugh and Huffman 2014). Additionally, members of the public may believe that these wildland areas should remain wild and that fire would maintain the natural process better.

Prescribed burning has mixed support near urban areas but is typically preferred in more wildland settings. Although these studies vary geographically, there are trends that can be generalized overall. Studies have found that there is acceptance for the use of prescribed burning in wildland and roadless areas away from urban developments. This acceptance relates to the fact that prescribed burning emulates natural processes and is essential for fuel reduction. This treatment is not supported in the WUI, as it is perceived as a risk to life and property (Bright and Newman; Brunson 2008; Brunson and Shindler 2005; Kneeshaw et al 2004; McCaffrey et al 2013; McCaffrey and Olsen 2012). The distance from urban areas that is acceptable for prescribed fire has not been examined, but generally residents become concerned when they can see the smoke and become very concerned when the fire is within a mile of their house (Brunson and Evans 2005).

Managed fire has not been extensively studied with regards to preference of location; however, relating it to prescribed fire we may suspect that it is preferred in wildland areas that are disconnected from urban developments. Similar to prescribed fire this preference for managed fire in wilderness and roadless areas is attributed to the perceived risk of escape as well as impacts from smoke and decreased visibility. Several studies reinforce the preference for managed fire to be used in wildland and roadless areas because it best emulates natural historical processes,such as seasonality of burn and nutrient cycling, while effectively reducing fuel loads (Dellasala and Frost 2001; Ingalsbee 2001; Martin et al 2011). Overall the public does not prefer managed fire to be used near urban areas because of the possibility of escape causing harm to life

and private property (McCaffrey and Olsen; Wagtendonk 2007). However, this has not been extensively analyzed and is a large information gap.

**Public Knowledge and Understanding**

The publics' knowledge and understanding of the treatment, as it relates to potential impacts, influence overall acceptance, in particular the public knowledge and understanding of the ecological effects of a treatment also has an impact on their acceptance. The knowledge of the outcomes associated with a treatment is shown to largely influence acceptance (Liljeblad and Borrie 2006). Residents are most positive about a combination of treatments that include thinning and burning. A combination is accepted because thinning is effective at removing vegetation, which is followed by burning to cycle nutrients and remove slash (Toman et al 2011).However, many studies also found that there was little difference between the perceived outcomes of thinning or burning. In fact, both treatments were supported in regards to perceived outcomes (Martin et al 2011; Toman et al 2014). Aesthetics were also noted as a factor influencing the perceived outcome of a treatment (Brenkert-Smith et al 2006; Kneeshaw et al 2004; McCaffrey 2005). Aesthetics were favored following a burning treatment rather than a thinning operation.

In general, it has often been shown that the public has a deep understanding of the role of fire in forests (Martin et al 2011). As the public knowledge of fire ecology increases, so does the tolerance of prescribed and managed fire (Brunson and Shindler 2004). Similarly, those who are more knowledgeable about a specific treatment are more willing to accept its use (Toman et al 2014). Therefore, promoting education of the benefits and ecological processes of burning is essential to gaining widespread support for a treatment (Ingalsbee 2001; Miller and Landres 2004; Parsons and Landres 1998).

**Smoke**

Smoke caused from burning in the forest is a major concern among the public for a variety of reasons, and can affect acceptance of burning as a treatment. It has been shown that support for burning decreases when individuals are more concerned about health issues or decreased visibility (Kneeshaw 2004; McCaffrey et al 2013). Although there is little specific research on duration, it has been suggested that the duration of the burn can affect public acceptance as the public may grow tired of continued smoke in the air. Managed fires typically burn longer than prescribed burns and therefore managers must be cognizant of the smoke effects on the public (Wagtendonk 2007). While smoke is an issue it does not bother the majority of the public, generally only 30% of households have health issues regarding smoke (McCaffrey 2005). Smoke only becomes an issue when there is harm to public health (McCaffrey and Olsen 2012). Smoke impacts vary geographically depending on inversion, air currents, and protected air sheds. In some areas it is the biggest concern for a treatment while in other areas it is only a minor side effect (McDaniel 2009; Winter et al 2002). Although it was not discussed in the literature it would be important for managers to consider the effects of smoke on recreation; especially in those areas that are known for their scenic beauty such as national parks as compared to remote dispersed recreation.

Given the potential health impacts, mitigating the impacts of smoke is important for the continued use of burning (McCaffrey et al 2013). Adequate warning for residents to prepare has been successful in maintaining acceptance of burning (McCaffrey 2005). Additionally, smoke impacts may be of less concern by the public if healthier forest conditions are to come (McCaffrey and Olsen 2012).

**Resident Expectations**

Understanding what the public expects is important for managers in order to target management actions. Several studies noted a shared responsibility mentality amongst the public for fuels management. This shared responsibility includes residents clearing fuels within their property and the government reducing fuels on public lands(Brenkert-Smith et al 2006; McCaffrey and Olsen). Residents also stated that those who do not live in the WUI don't fully understand the necessity of treatments to reduce fuels (Martin et al 2011). It was evident throughout the literature that higher perceived risk drove the necessity that the public placed on fuel treatments by the government (Bright and Newman). There was also the expectation that the government was responsible for educating the public about fire danger and fuels management (McCaffrey 2014; McCaffrey et al 2013;Ostegren et al 2006).

Six themes emerged from the literature as factors contributing to public perceptions of agency fuel management. Understanding these factors that affect public acceptance is key for managers to understand, in regards to implementation of treatments. While these themes are not specific to a certain region or city, they are helpful in determining social impacts of fuel treatments. A more in-depth analysis of individual aspects may be required to refine these themes to either individual fuel treatments or to a specific area. However, very little information exists regarding public acceptance of wildland fire managed for multiple objectives, otherwise known as managed fire. Also, even less information is known regarding the internal or within agency aspect of managed fire.

**Managed Fire**

With substantial information regarding fuel treatment impacts on the public, it is also important to examine these processes from the agency standpoint. Research on internal or within agency perspectives of fuels treatments is extremely limited when examining current literature.

Even considering prior iterations of this management tool such as wildland fire use, and prescribed natural fire; there is still very limited information about internal issues with wildland fire managed for multiple objectives. One study, by Miller and Landres (2004) examined internal informational needs for forest managers to conduct fuel treatments, specifically wildland fire use. Although this study examined specific informational challenges with Wildland Fire Use, there was some discussion regarding barriers to implementation. This study also examined factors for allowing a wildland fire use fire which included 1) allowing natural processes, 2) improved wildlife habitat, and 3) hazardous fuels reduction amongst others (Miller and Landres 2004). Miller and Landres (2004) identified funding, staffing, smoke/ air quality, weather, and public perceptions as most common barriers to wildland fire use.

Another study by Doane et al (2006) examined barriers to Wildland Fire Use in which many planning and implementation barriers were noted as preventing fire use. Five different barriers were identified as preventing fire use including: organizational culture, political boundaries, organizational capacity, policy directives, and public perceptions. The authors suggested changing policy for more flexibility, increasing internal support, and increasing the planning size of wildland fire use projects. While this study largely examines internal issues with wildland fire use, it does not apply to the current policy update and interpretation with a change in the process of managing fire. There have been no studies examining the effects of the policy update in 2009 in which there is only planned and unplanned ignitions with full suppression or multiple objective fires.

The current research project aims to evaluate the perceived internal and external barriers to wildland fire used for multiple objectives from an agency perspective. Below is a brief history and description of managed fire, the focus of this research project.

**History and Overview of Managed Fire**

Managed fire is the practice of using naturally ignited wildland fire to achieve resource benefits. These resource benefits typically include fuel reduction, nutrient cycling, triggering regeneration, removal of ladder fuels, and ecological services (Miller 2003). Furthermore, by having increased fire in the ecosystem, it's possible to restore the forest to more natural conditions with increased understory production and fewer trees per acre (McDaniel 2012). The history of this practice is full of fluctuation, by having changes in policy and implementation, but this management action seems to be on the rise in the last decade and is currently more common. This short review discusses the history of managing wildland fires and the current guidance for wildfire management.

This practice of wildfire use began in the early 1970's with the use of prescribed natural fires (PNF) in designated wilderness areas and national parks. In 1968 the National Park Service changed their policy to recognize fire as an ecological process as long as the fire was kept within certain management designations (Wagtendonk 2007).  Often, these fires were only allowed to burn within certain parameters set by the national park and the natural fire zone (area designated for natural fire) was restricted to certain areas. The continued success of prescribed natural fires led the Forest Service to abandon the 10AM policy of full suppression and adopt a new policy more supportive of the use of wildland fire through prescription (Wagtendonk 2007).

Three fires that went out of prescription between 1978 and 1988 caused a major policy review among federal agencies in 1989. The Ouzel Fire in Rocky Mountain National Park, the Canyon Creek Fire in the Bob Marshall Wilderness, and the Yellowstone fires instigated a review of the current fire policy and fire use programs. While the review concluded that fires are an essential part of the ecosystem, more in-depth and comprehensive fire management plans would be required for continued use of wildland fires. Information regarding decision criteria,

accountability, and interagency cooperation would be required in the fire management plans. The Secretaries of Agriculture and the Interior suspended all prescribed natural fires until more comprehensive fire management plans were created (Wagtendonk 2007).

Following the 1989 review, natural fire use was limited and reintroduction was slow amongst the agencies. The review was successful in affirming the role and function of fire in ecosystems, which slowly led to its increased use again. The fatal South Canyon Fire in 1994 lead to a major review and update to the Federal Wildland Fire Management Policy in 1995 (Wagtendonk 2007). In 1995 a change in the federal wildland fire policy brought forth the term "Wildland Fire Use" (WFU) for what was previously termed prescribed natural fire (Miller 2003). Managers became more confident to implement wildland fire use under this policy, which led to increased acres burned by both the Forest Service and National Park Service.

In the year 2000 the Cerro Grande Fire, which was a prescribed fire, crossed lines and went beyond prescription to burn more than 250 homes in Los Alamos, New Mexico. This fire triggered public outcry and yet another review of the fire management policy. The review suggested creation of a wildland fire use implementation guide. This guide mandated "wildland fire use" as the official term for utilization of naturally ignited fires for resource benefit. Additionally, this guide provides guidance, directions, and assistance for planning and implementation of wildland fire use. The Forest Service has since become a leader in the use of wildland fire with the most acres burned each year of all public land management agencies but other agencies have increased its use as well. These fires are beginning to reburn previously burned areas in some regions which is creating a mosaic across the landscape. Although the Forest Service is the leader in acres burned, the USFWS, NPS, BLM, and BIA all have wildland fire use programs in place and use fire as management tool (Wagtendonk 2007).

In 2009 the Federal Implementation Guide was released for fire management that allows for a flexible approach to managing wildfire. The previous guide did not allow for suppression and multiple objectives on the same incident whereas the 2009 interpretation does. That is, a fire may be suppressed on one side as there are values at risk and on another side the fire is managed for resource benefit. Additionally, the guide changes terminology from wildland fire use to include two types of fire, wildfire and prescribed fire. Prescribed fire is when there are planned ignitions and wildfire is everything else, which includes natural ignitions used for resource benefit (McDaniel 2012). Additionally, this implementation guide allows for active suppression efforts on one flank of the fire while the other flank is allowed to burn.

Current wildland fire management in the Southwest use both suppression objectives as well as resource benefit objectives. Typically fires that occur prior to monsoonal precipitation are suppressed as conditions are not conducive for management of fire for resource benefit. However, as monsoons begin and there is increased moisture, fires are managed for resource benefit objectives. This is outlined in the forest plan with general guidelines for implementation of managed natural ignitions. Each forest has a separate forest plan and therefore different guidelines for the management of natural ignitions.

## LITERATURE CITED

Brenkert–Smith H, Champ PA, Flores N (2006) Insights Into Wildfire Mitigation Decisions Among Wildland–Urban Interface Residents. *Society & Natural Resources***19**, 759–768. doi:10.1080/08941920600801207.

Bright AD, Newman P How Forest Context Influences the Acceptability of Prescribed Burning and Mechanical Thinning. In: McCaffrey, SM., tech. ed. The Public and Wildland Fire Management: Social Science Findings for Managers. USDA Forest, Northern Research Station Research Paper NRS-1. (Newtown Square, PA)

Brunson MW (2008) Gauging the Acceptability of Fuels Management: A Matter of Trust. *Rural Connections.*3, 2-4.

Brunson MW, Evans J (2005) Badly Burned ? Effects of an Escaped Prescribed Burn on Social Acceptability of Wildland Fuels Treatments. *Journal of Forestry***103***,*134-138.

Brunson MW, Shindler BA (2004) Geographic Variation in Social Acceptability of Wildland Fuels Management in the Western United States. *Society & Natural Resources***17**, 661−678. doi:10.1080/08941920490480688.

Cortner HJ, Zwolinski MJ, Carpenter EH, Taylor JG (1984) Public Support for Fire-Management Policies *Journal of Forestry*. 359–361.

Dellasala DA, FrostE(2001) An Ecologically Based Strategy for Fire and Fuels Management in National Forest Roadless Areas *Fire Management.* **61**, 12-23.

Ingalsbee T (2001) Wildland Fire Use in Roadless Areas: Restoring Ecosystems and Rewilding Landscapes. *Fire Management*. **61**, 29-32.

Kneeshaw K, Vaske JJ, Bright AD, Absher JD (2004a) Situational Influences of Acceptable Wildland Fire Management Actions. *Society & Natural Resources***17**, 477–489. doi:10.1080/08941920490452427.

Kneeshaw K, Vaske JJ, Bright AD, Absher JD (2004b) Acceptability Norms toward Fire Management in Three National Forests. *Environment & Behavior***36**, 592–612. doi:10.1177/0013916503259510.

Liljeblad A, Borrie WT (2006) Trust in Wildland Fire and Fuel Management Decisions *International Journal of Wilderness***12**, 39–43.

Litchman P (1998) The Politics of Wildfire: Lessons from Yellowstone. *Journal of Forestry*.

Martin IM, Martin WE, Raish CB (2011) A Qualitative and Quantitative Analysis of Risk Perception and Treatment Options as Related to Wildfires in the USDA FS Region 3 National Forests. USDA Forest Service, Rocky Mountain Research Station Research Paper RMRS-GTR-260. (Fort Collins, CO).

McDaniel J (2012) Managing Fire for Multiple Objectives : Blazing the Trail in the Southwest. Southwest Fire Science Consortium.

Mccaffrey SM (2005) Prescribed fire : What influences public approval ? USDA Forest Service, Northern Research Station Research Paper GTR-NRS-P-1 (Newtown Square, PA)

McCaffrey SM (2014) Research insights into effective smoke communication with the public. Northern Research Station.

Mccaffrey SM, Olsen CS Research Perspectives on the Public and Fire Management : A Synthesis of Current Social Science on Eight Essential Questions.USDA Forest Service, Northern Research Station Research Paper GTR-NRS-104 (Newtown Square, PA)

McCaffrey S, Toman E, Stidham M, Shindler B (2013) Social science research related to wildfire management: an overview of recent findings and future research needs. *International Journal of Wildland Fire***22**, 15. doi:10.1071/WF11115.

Miller C (2003) Wildland fire use: a wilderness perspective on fuel management. USDA Forest Service, Aldo Leopold Wilderness Research Institute Rocky Mountain Research Station Research Paper RMRS-P-29. (Missoula, MT)

Miller C, Landres P (2004) Exploring Information Needs for Wildland Fire and Fuels Management. USDA Forest Service, Rocky Mountain Research Station Research Paper RMRS-GTR-127. (Fort Collins, CO)

Ostergren DM, Lowe KA, Abrams JB, Ruther EJ (2006) Public Perceptions of Forest Management in North Central Arizona : The Paradox of Demanding More Involvement but Allowing Limits to Legal Action *Journal of Forestry* Nov. 2006.

Pasons DJ and Landres PB (1998) Restoring Natural Fire to Wilderness: How are we doing? *Fire in Ecosystem Management: Shifting the paradigm from suppression to prescription***20,** 366-373.

Sensibaugh BM, Huffman D (2014) Managing Naturally Ignited Wildland Fire to Meet Fuel Reduction and Restoration Goals in Frequent-Fire Forests. Ecological Restoration Institute.

Toman E, Shindler B, McCaffrey S, Bennett J (2014) Public acceptance of wildland fire and fuel management: panel responses in seven locations. *Environmental management***54**, 557–70. doi:10.1007/s00267-014-0327-6.

Toman E, Stidham M, Shindler B, McCaffrey S (2011) Reducing fuels in the wildland - urban interface: community perceptions of agency fuels treatments. *International Journal of Wildland Fire***20**, 340. doi:10.1071/WF10042.

Wagtendonk JW (2007) The History and Evolution of Wildland Fire Use. *Fire Ecology Special Issue***3,** 3-17.

Winter GJ, Vogt C, Fried JS (2002) Common Concerns in Diverse Regions. *Journal of Forestry***7**, 15–21.

**CHAPTER 2**

**Wildland Fire Managed for Multiple Objectives: Implementation Objectives and Barriers**

Brian T. Kelley[1], Andrea E. Thode[1], Sarah McCaffrey[2], and Martha Lee[1]

[1]Northern Arizona University, School of Forestry, PO Box 15018, Flagstaff, AZ 86011, USA

[2]Forest Service, U.S. Department of Agriculture, Rocky Mountain Research Station, 240 West Prospect, Fort Collins, CO 80526, USA

**ABSTRACT**

Decades of effective fire suppression and grazing have led to high fuel loading across the western U.S. (Westerling et al 2006). These fuel loadings in combination with changes in climate are causing large high severity wildfires. One option to treat high fuel loads is the use of wildfire started with natural ignitions. However, management of natural ignitions during fire season poses some challenges to fire managers. There are both internal (within agency) and external (outside agency) challenges that fire managers must overcome for effective use of wildland fire as a fuel treatment option. There has been substantial research conducted regarding external issues associated with agency fuel treatments including prescribed burning. Internal issues, on the other hand, have not been intensely evaluated. Through interviews we explored the internal challenges associated with implementation of wildland fire managed for multiple objectives in northern Arizona. A total of 65 interviews revealed multiple layers of complexity regarding the ecological use of fire. Internal barriers include collaboration of resource advisors, competing objectives, and unclear policy. External barriers relate to public perception and smoke impacts to the public. Challenges are found to be variable across different agencies and job positions.

## INTRODUCTION

Increases in fuel loading have caused larger higher severity wildfires over the last few decades (Westerling et al 2006). A variety of tools are utilized to reduce hazardous fuel loading, including thinning, prescribed fire, grazing, and wildland fire for multiple objectives. While a lot of attention has been paid to prescribed fire and thinning, little is known about wildland fire for multiple objectives.

Wildland fire managed for multiple objectives is a relatively new management technique; in which, land managers participate in extensive planning and collaboration prior to implementation (Sensibaugh and Huffman 2014, Wagtendonk 2007). This management technique is a continuation of previous management tools (prescribed natural fire and wildland fire use) with some alteration to allow for multiple objectives across the fire (USDA and USDOI 2009). Wildland fire for multiple objectives (WFMO) can be an inexpensive and effective way to use natural ecological processes to reduce fire risk, improve timber production, maintain water quality, and conserve wildlife habitat in the Southwest (Kauffman 2004, Miller 2003, McDaniel 2012, Parsons et al 2003 ). This management tool has been through several iterations including Prescribed Natural Fire (PNF) and Wildland Fire Use (WFU) and was changed to WFMO in 2009 with the Guidance for Implementation of Federal Wildland Fire Management Policy (USDA and USDOI 2009). Under the 2009 Guidance and Interpretation, fire managers can manage a fire with more flexibility allowing for changing objectives as the fire progresses. This management tool allows for the management of a natural ignition wildland fire on the landscape with different objectives including suppression, protection of life and property, ecosystem benefit, and fuel reduction.

*Background*

Managed fires are the best management tool for emulating natural processes on the landscape and have proven a vital part to restoration efforts (Wagtendonk 2007). A total of 293,416 acres have been treated from 2009 to 2015 using wildfire for multiple objectives in Region 3 of the U.S. Forest Service; and this total excludes national parks, Bureau of Indian Affairs (BIA), and Bureau of Land Management (BLM) lands. Yet land managers face challenges with its implementation, including both internal (within agency) and external (outside agency) factors (Kneeshaw et al 2004, Miller and Landres 2004, Zimmerman and Sexton 2014). These barriers make it difficult for land managers to implement WFMO which results in less acreage treated (Miller and Landres 2004, Parsons et al 2014, Zimmerman and Sexton 2014). Internal barriers related to WFMO likely stem from the planning and collaboration process. The extensive planning and collaboration involved may slow down the process and can create challenges for land managers. During this planning and collaboration period land managers must consult resource specialists to examine the impacts to various ecosystem entities (Zimmerman and Sexton 2014).This consultation period is an important requirement for land managers as it brings forth issues that had not yet been considered by fire managers, such as impacts to ecosystem functions including: wildlife, timber, range, and archeological sites.

Additional internal factors that may affect the implementation of WFMO relate directly to the fire management organization. National fire activity, resource availability, fire weather planning forecasts, and support from the regional level are just a few challenges for fire managers to consider for implementing WFMO (Zimmerman and Sexton 2014).We consider these issues internal as they occur within government land management agencies with little input from stakeholders.

Although land managers consider internal factors associated with WFMO, there are also external challenges to management of natural ignitions. These external challenges arise with the effects of implementation of WFMO, such as smoke production, trail and area closures, and visibility impacts (Miller and Landres 2004). These impacts affect stakeholder groups and cooperators in different ways which land managers must consider. Because these challenges are outside the realm of the agency, we considered them external barriers (Miller and Landres 2004). We suspect that internal and external barriers may differ between positions within the agencies. That is, barriers may vary depending on the job position being considered. Although there are many potential points in which the process could be impeded, it is unclear which factors are most limiting with WFMO. Through interviews with resource specialists we examined each discipline's concern with the use of WFMO as well as their perceptions of the external barriers.

Since research on WFMO is limited, prescribed fire literature provides insight into issues may be reoccurring with WFMO. Research shows public perception regards health and safety's role in fire management as implicit to any fire operation whether it's for fuel reduction or suppression. With regards to public perception, it has been well documented that the public has a deeper understanding of fires role in the ecosystem than previously thought (McCaffrey and Olsen 2012). It's also noted that prescribed fire acceptance may be location dependent, meaning that the public has approval based upon proximity to urban areas (McCaffrey and Olsen 2012). Smoke, has been documented as affecting health sensitive individuals consisting of roughly one-third of the public during prescribed fires. Smoke concerns are documented as being less likely to restrict a prescribed fire as compared to ecological concerns or possibility of escape (McCaffrey and Olsen 2012). We suspect that these same key concerns for prescribed fire may be similar for WFMO.

Although research has examined public perception with regards to managed and prescribed fire (Toman et al 2014, Ostergren et al 2006, McCaffrey et al 2013), very little information exists on agency perceptions. We searched the literature in spring 2015 and found no studies that examined internal and external barriers related to WFMO since the Guidance for Implementation of Federal Wildland Fire Management Policy was released in 2009 ( USDA and USDOI 2009). A few studies were found that examined the process prior to the latest policy update which may be relevant as the implementation process is similar.  Due to the limited amount of literature on this subject since the policy change, we may include previous studies as insight. These studies suggested that both internal and external variables were an issue to wildland fire use (Miller and Landres 2004).  Internally,  studies have found that collaboration amongst agency personnel was the largest internal barrier (Miller and Landres 2004; Doane 2006). Externally, studies have found that public perception and smoke impacts are the largest external barrier (Doane et al 2006).

This study is the first to explore the complexities of wildland fire managed for multiple objectives from an agency perspective since the policy update.Through this study we will identify the main internal and external barriers associated with WFMO and suggest solutions for its increased use in the future. Land managers within the Southwest Region of the Forest Service can use this information to improve collaboration amongst resource specialists to improve the fire management planning process.

*Research Objectives*

Through interviews with fire managers and resource specialists we explored concerns, motivators, and obstacles to implementation for wildland fire managed for multiple objectives. The specific research objectives of this study were to:

1. Identify the most common management goals for a wildfire with multiple objectives.

2. Identify the internal barriers associated with wildfire managed for multiple objectives which may include obstacles within the agency that inhibit the amount of managed fire implemented on the landscape.

3. Identify the perceived external barriers associated with wildfire managed for multiple objectives.

4. Identify respondent suggested improvements for wildfire managed with multiple objectives.

Each of the above objectives was assessed overall, by agency, and job position for multiple comparisons.

**METHODS**

*Overview*

Interviews were conducted with members of federal land management agencies located in Northern Arizona. Interviews were conducted using a semi-structured interview guide consisting of open-ended questions. We utilized a qualitative approach since our aim was to elicit concerns and explore the barriers of wildland fire managed for multiple objectives. Qualitative data analysis entails formulation of themes through analysis of qualitative data, such as transcripts, obtained through interviewing individuals who are knowledgeable about the topic of interest (Schutt 2012). A qualitative approach has the capacity to reveal the complexity of implementation of WFMO and is an appropriate approach for investigating this new topic (Dillman et al 2014). Purposive sampling was used to maximize the variety of respondents across the populations of interest to examine the range of concerns for WFMO among

professionals (Dillman et al 2014). Respondents varied in agency position allowing for analysis of concerns across multiple job positions.  Multiple agencies were included for analysis of concerns across multiple management locations.

*Sampling Frame*

Interviews were conducted across two national forests, one national park, and one indian reservation in Northern Arizona. The Coconino and Kaibab National Forests, Grand Canyon National Park,and San Carlos Apache Reservation were sampled.  All four of these land management agencies have active WFMO programs and have been implementing WFMO since 2009 (USDA and USDOI 2009).  All four agencies have personnel familiar with the management technique and have participated with it at some level.

The target population to be interviewed was those directly involved in the planning and implementing of WFMO. This included line officers, resource specialists from wildlife, archeology, timber, recreation, watershed management, silviculture, botany, range, and fire management. Interviews were conducted in spring 2016, the time when these individual are most often in the office. All individuals were notified prior to the interview and were not required to participate if they did not wish to. A sampling frame was completed in winter of 2015 and included all individuals we planned to interview (Table 1).This sampling frame contained 92 individuals from the agencies and was chosen in consultation with someone from the agency's fire organization who regularly works with natural resource specialists during managed fire events.

*Interview Guide*

A pilot study was completed during the summer of 2015 to gauge which barriers were reoccurring within the fire organization regarding WFMO. The pilot study consisted of broad

open-ended interviews with fire managers to identify the main concerns for wildfire management in the Southwest. The pilot study revealed a large information gap with wildfire for multiple objectives which guided the current project and interview guide.  This pilot study also helped determine an appropriate questionnaire length and identified the optimum way to word questions. The final interview guide included questions regarding demographics of the respondents such as number of years working in natural resource management and their experience with WFMO. The interviewguide contained fifteen open-ended questions to explore two main topics associated with Wildland Fire Managed for Multiple Objectives, as listed below.

1. **Resource Specific Concerns**. These questions sought to identify respondent concerns of using fire as a tool on the landscape with regards to certain job positions such as range, timber, wildlife, etc. Also asked were respondents top priority objectives for a wildfire for multiple objectives.

2. **Perceived Internal and External Barriers**. These questions sought to elicit responses related to the internal and external barriers associated with management of WFMO on the landscape.

*Conducting Interviews*

Prior to conducting interviews, the questionnaire was presented to the institutional review board (IRB) at Northern Arizona University for approval. Additional approval for research was required by the U.S. Forest Service and National Park Service and was obtained prior to interviews.

Interviews were conducted at the respondent's place of work to reduce burden on the respondent. Most interviews were conducted face-to-face; however, a few were conducted via phone due to the respondent working remotely. All interviews were recorded and transcribed. Interviews lasted approximately 20 to 40 minutes, depending on the respondent's depth of

answers. Two researchers were present to conduct the interviews; one read the questions and interacted with the respondent while the other transcribed the answers and interesting points to bring up later. Some limitations of conducting interviews include bias created by having an interviewer give the questions verbally (Gooode and Hatt 1952; Dillman et al 2014). This bias was reduced by using the same interviewer for each interview and limiting the amount of probing.

*Analysis*

Analysis of the interview responses entailed qualitative data analysis and coding. Qualitative data analysis involves formulation of concepts that reflect the content of the interviews and then assigning codes to main themes to reduce lengthy transcripts to brief, descriptive, summaries (Schutt 2012; Dillman et al 2014). Once all interviews were transcribed we read through each response to determine any major themes to create a codebook. Then all transcripts were uploaded into NVivo software for qualitative analysis. NVivo allows for organization and grouping of qualitative information based on certain keywords or themes (QSR 2015). Once major themes were identified, we formulated trends and reoccurringthemes. We focused on the meaning of the trends through interpretations of the text rather than quantifying phenomena (Schutt 2012).

NVivo software allows for separation of the data based on different classifications, and for the purpose of this research we used several classifications including: agency, district, and job position. With these classifications we were able to query responses by each agency and job position to determine if themes are similar throughout or are location/job position dependent. We queried by location including 1) Coconino N.F. 2) Kaibab N.F. 3) Grand Canyon N.P. and 4) San Carlos Apache Reservation to examine whether or not barriers varied by agency. We also

queried managers from three job position groups: 1) fire and fuels managers, 2) resource specialist, and 3) line officers.

**RESULTS**

*Overall Response*

A total of 65 in-person interviews were conducted across the four agencies for a 71% response rate. We had one refusal to participate while others were out of the office or did not respond to emails. A breakdown of the respondents by agency and location is represented in Tables 2 and 3. We obtained a relatively balanced number of respondents from both the Kaibab and Coconino National Forests, the limited number of respondents from the Grand Canyon N.P. and San Carlos Apache Reservation BIA are due to smaller management organizations. Examining the responses by job position show 20 fire and fuels management respondents, 40 natural resource respondents, and 5 line officers. Interestingly, natural resource respondents tended to use prescribed fire and managed fire interchangeably; however, the focus on WFMO was clarified prior to the interview.

*Highest Priority Management Objectives for Wildfire for Multiple Objectives*

*Overall.* Respondents were asked to identify their top three objectives for a wildland fire for multiple objectives and were grouped into four main categories (Figure 1). Ecological objectives were most often mentioned as the highest priority goal for wildland fires managed for multiple objectives. Respondents noted ecological objectives in many different ways particularly in relation to benefits such as watershed services, nutrient cycling, wildlife habitat, etc.

"Overall ecosystem health through introduction of fire back into the ecosystem in a natural fashion." – Fire Manager

Reduction of fuels was the second most common objective mentioned by respondents. Respondents noted that reduction of fuels would prevent future catastrophic wildfires but also discussed fuels reduction in relation to other benefits such as forage production through reduced ground cover.

"Reduction of fuels which under other conditions the fuel loading combined with fire can create adverse conditions." - Archeologist

Restoring the natural fire regime and returning fire as a natural disturbance agent was the third highest priority management objective. This is distinguished differently from ecological benefits as respondents indicated these as separate. That is, interviewees identified ecological benefits as its own entity or goal and restoration of the natural fire regime as another separate item. It was logical to separate these two items during the coding process when interpreting the transcripts. However, respondents noted that many other ecological benefits would occur through the reintroduction of fire.

"I think of the things we are getting out of it, the reasons we are doing it, and the reasons we would allow fire to perform its natural role. I think the objectives of that being, improving the resilience of the forest, especially in times of climate change, and having the ecosystem with the ability to maintain itself over time despite threats" – Public Affairs Officer

Safety, as in firefighter and public safety as well as protection of property and infrastructure, was brought up as the fourth highest priority objective. Although safety was not identified as top objective, many individuals recognized it as inherent to any fire operation and therefore did not explicitly state it.

*Agency Level Differences*.  Examining agency level differences reveals that fuel reduction and ecological objectives tended to be seen as high priorities except  atGrand Canyon N.P. where respondents  valued safety as the highest priority objective for WFMO and then ecological objectives as second (Table 4). All agencies identified restoring the fire regime as third highest priority for WFMO.

*Position Differences*.  All positions identified fuel reduction as either first or second highest priority objective. Differences among positions include fire and fuels managers varying from line officers and natural resource specialist, who identified the same three objectives of fuel reduction, ecological, and safety (Table 5). Fire managers viewed restoring the fire regime as top objective followed by fuel reduction.

*Perceived Internal Barriers to Wildfire for Multiple Objectives*

*Overall.*  Internal barriers are defined as residing within the agency and relating to the planning and implementation of WFMO. A total of 55 internal barriers were mentioned by respondents, which were condensed into 17 categories (Figure 2). Interestingly, there was a wider variety of internal barriers compared to external (44). The internal barrier brought up the most often was collaboration with resource advisors and including them in a timely manner. The next most mentioned internal barrier was the personality and knowledge of decision makers followed by addressing multiple resource concerns for a planning area, and lastly, working with personalities of those involved.

**Resource Advisor Communication and Collaboration**. Working cooperatively with resource advisors was the most frequently mentioned internal barrier noted by respondents. Resource advisors are resource specialists who become attached to the incident and act as a representative of the multiple resource values in the planning area. This relationship was brought

up frequently for several reasons. First, resource advisors often have their own projects and goals

to accomplish and when a managed fire starts they are pulled away from their projects to assist

with the incident. This means they are not accomplishing their own tasks. Respondents felt that

in places with small organizations with limited staffing this can be detrimental to these other

natural resource programs.

> "The time line as to where they can actually start their resource
> objective is really small, it's like I will get an email and they will
> say we have to start here we need to have a WFDSS meeting and
> the WFDSS meeting will literally be the next day. I will be
> prepared that's my job" – Timber Sale Prep

Another problem was the suppression mindset or the lack of fire ecology knowledge of resource

advisors. Many respondents, not only fire managers but also natural resource managers, noted a

feeling of fear amongst resource advisors regarding managed fire. Many individuals also felt as

though during a managed fire they had to educate internally as well as externally about the fire

ecology of the system.

> "I am not so sure about this forest anymore but I believe that in the
> forest service in general that [suppression mindset] is an obstacle
> internally because people just need to become comfortable with it
> [managed fire]" – District Ranger

A small number of respondents attributed the lack of internal education regarding managed fire

to specialization of programs and decreasing cross training. As one fire manager described:

> "Everybody did a little bit of everything and as budgets have
> continued to decline, our programs have become more specialized
> so we don't have as much cross training as we used to. That is a
> hurdle as we communicate about fire or talk about the risk of fire,
> or planning for fire, we have to know our audience internally and
> sometimes we have to go back to the basics and talk about the fire
> behavior triangle and what fuel moisture is. That's a hurdle, its
> taking that time to educate and if you are waiting to do that when
> that fire call comes in and you are sitting around the table, it is too
> late because you don't have time to share all of that and talk about

the potential effects of this fire because the fire is continuing to
grow" – Fire Manager

**Decision Makers.**  Decision makers were the second most frequently mentioned internal

barrier, particularly their capacity to approve or disapprove of a candidate fire which was seen to

be influenced by their knowledge and comfort with managed fire and how they handle risk. Risk,

in this context, refers to one acknowledging the possible negative outcomes and associated

effects while choosing to manage a fire.  One archeologist stated it well:

> "I'm speaking a little outside my resource area, but I'll give you a
> quote from a former ranger, "No ranger ever got fired for putting
> out a fire."-Archeologist

Ultimately the risk falls on the decision maker whether that be a district ranger,

superintendent, or fire staff which may affect their decision making process.

> "I guess its risk management is the obstacle to me. I mean I think
> many times we could do more managed fire and there is
> unwillingness on the part of either the region or the Washington
> office to allow us to do that. That seems like, I mean other than
> either just kind of conditions, weather or that sort of thing, but
> yeah I think there is a real hesitancy to letting us be able to do
> more. I think we could do a lot more but it just seems like there is
> concern and I understand that, its that risk thing, but I think when
> conditions are good we should burn" – Landscape Architect

Additionally, decision makers ultimately set the philosophy and approach to take when

managing a fire. However, as there is no guidebook as to how to manage a fire for multiple

objectives it is up to the decision makers, whether it's the line officer or the IC (incident

commander), to decide the management approach. The approach taken can vary widely from

each agency and even each zone or district.

> "There's some very gray area as far as how heavy handed you get
> with laying fire on the ground. That is the elephant in the room
> with managed fire. Whether you take it over a road, there are a lot
> of different philosophies. There is a philosophy on a district on this
> forest where those folks grab the torches and go and there is

another philosophy were they will watch it forever and there is probably something in the middle. So who is right? At the end of the day it will be the forest supervisor who is right."- Fire Manager

**Multiple Resource Concerns.** Addressing multiple resource concerns was another commonly mentioned issue. These concerns relate to impacts of the fire and fire operations on a variety of resources such as wildlife, timber, range, etc which were seen to be an internal barrier simply due to the fact that there may be many, often conflicting, resource considerations in an area that must be analyzed, prioritized, and possibly mitigated. Respondents stated that from a planning perspective, there are a variety of resources that bring forth concerns for the decision maker and fire managers to prioritize and mitigate which can be time consuming and cumbersome. There are multiple layers of complexity to consider and analyze with these resource concerns.

"It's where's range at? Where are their cattle... its where's archeology? Some fire can go through some areas; we have to protect some areas. Its recreation, how are we going to impact public use, campsites, and trails? It's always an obstacle getting that alignment. It's the same every time. It's sitting down talking about here are the impacts, here are my concerns. It's not an insurmountable obstacle but it's there every time. Having more than one objective is what makes it an obstacle."- Fire Manager

Prior to Wildland Fire Decision Support System (WFDSS) meetings for a managed fire, each resource specialist had to prepare their areas of concern or values at risk within a short timeframe. The fact that managed fires tend to be longer duration than suppression fires creates an added burden on personnel. Wildfires for multiple objectives may last longer than suppression fires which in turn cause stress on the local district to supply resource advisors and pull them away from their projects.

"I think they are time and personnel given other resource work and other priorities....a long duration event and this isn't just involving the people in fire this is involving all the resource areas and staff

30

officers and line officers . . . and what I have seen on the forest is we get to the point where people just get tired and then we have to start saying can we continue doing this long term at the same time we are still doing all this other stuff and time personnel constraints based on other workloads. I think this, for me, is one of the biggest limiting factors because there is a point where people just can't continue to do all of it and still have whatever arena they are working in they still have their required outputs that they have to meet"- Public Affairs officer

**Personalities**. Personalities of those involved in the planning process proved to be another common obstacle. Personalities may go both ways, meaning there may be some folks that are really easy to work with and other folks that are really difficult to work with. Below are two examples of the effects that different personalities can have during the planning process.

"That's the thing, we are a big machine and personalities are the cogs in the system, it's not our training, it's not our equipment, it's our system and our people that make our system go forward. If you get someone great in purchasing, it is great. You get a fire manager that is easy to work with, collaborate, and is easy approachable, it is awesome and you get a lot done."- Recreation

"Honestly, a lot of the time the personalities of the various functional areas coming together, that can be a huge barrier. Just in regards to who shows up representing a specific functional area, can really slow down the planning process or just completely shut down the entire managed fire. So that's kind of one of the barriers"- Fire Manager

Although there was some discussion of personalities as being difficult and a barrier to planning and implementation, multiple respondents noted an improvement in the personality dilemma over the last few years. Respondents suggested that working through wildfires for multiple objectives over the last decade or so has allowed them improve the process by including everyone.

"There is a lot of consultation between people on this forest. A lot of people work and understand, whether they have been here a while or have just come, they soon find out that it's an integrated district, we work together a lot to try and accomplish goals and to

31

integrate those goals into each other's departments. It's a small
district, both in acreage and people, so [they] have to be involved,
we cannot separate ourselves as much as other forests can."
Timber

*Agency Differences*. Agency differences with regards to internal barriers were evident at

all locations (Table 6). Notice the large variety from each agency with regards to internal

barriers, suggesting a large deviance in the internal challenges throughout. Notably two topics,

Risk and Funding, were only mentioned by Grand Canyon and San Carlos respondents, as key

limiting internal barriers not mentioned by Forest Service respondents.

**Funding.** The San Carlos Apache BIA identified funding as a main internal barrier for

managed fire, whereas other locations did not discuss funding. Funding was discussed by

respondents in two manners including: (1) lack of qualified fire personnel to staff necessary

modules, and (2) inability to hire personnel due to lack of long-term funding. With regards to

funding, it was evident that San Carlos respondents expressed concern that project funds were

available but no program funds were available. This means funds are available for specific

projects but the long term funding of program personnel is not.

> "If we had all the division superintendents and those overhead
> positions that we need to manage the fire line in our actual staff, I
> think that would help a lot. That way they are here every day and
> already know what our objectives are so they can implement them.
> We are having a difficult time finding people to staff our fire
> module." – Fire Manager

> "I think my biggest concern with the planning process is just that
> we can plan for what we need to do but the funding doesn't follow
> and so timing out of all these treatments is difficult. So we get a lot
> of money from the NRCS for projects on the ground but it is
> project money so we do not have the programmatic funds to have
> staff to be on the pay periods that they would need to be trained so
> we get project money and then we have to train and go through
> that process and by then we are missing our treatment window and
> they are looking at us saying we haven't accomplished what we

need to. So not having that one streamlined funding source is our
biggest challenge in the planning process" - Forester

**Risk.** Risk was mentioned by Grand Canyon respondents as a main internal barrier to

overcome for managed fire, whereas other locations did not rank risk similarly. Risk was

discussed differently by Grand Canyon respondents as compared to other locations in that these

respondents felt possible risks should be identified during the planning process. Risk was

discussed in terms of the possibility of negative outcomes arriving from the WFMO. In other

locations, respondents noted values at risk during the planning process. It seems as though Grand

Canyon personnel took the planning a further step and identified those values at risk and the

possible negative outcomes that could occur. Respondents identified the sharing of risk and the

idea of taking on long-term risk by deciding to manage a fire. Interestingly, respondents

identified mitigations for possible risks but acknowledge that all hazards could not be avoided.

> "I think people can you know two people can disagree on whether
> or not the outcomes will actually be all positive but I mean in the
> end the main go or no go barrier has to do with the risk tolerance
> of the person who is signing the paper." – NPS Respondent

> "Well we mitigate for safety of people, we mitigate for damage to
> resources like goshawk nests we line the trees or archeological
> sites we can prep, we don't burn during certain times of the year
> we don't allow fire use during nesting season or when birds are
> fledging, we don't do that. So we mitigate the most we can. But we
> can't mitigate for everything. There is always potential for
> problems or accidents or something but we do the best we can." –
> NPS Respondent

*Position Differences.* Internal Barriers were different for each position group which

likely reflects the concerns and responsibilities they have within their position (Table 7). The

wide array of barriers may be attributed to the scope of each position, meaning resource

specialists may be more concerned with time constraints of resource advisors, resource concerns

being considered, and personalities of those involved in the planning process. That is, decision

makers may be concerned about resource advisor collaboration, resources (as in staffing, equipment, etc.), and education as their position description involves a different scope than a resource specialist or fire manager.

*Perceived External Barriers to Wildfire for Multiple Objectives*

Five main external barriers were identified throughout the interviews with two outstanding. The most frequently mentioned external barrier related to public perception, followed by smoke impacts to the public. Third were impacts to public from the fire such as road and trail closures. Interestingly, respondents identified political and cooperators as external barriers to consider. The nine most common external barriers identified by respondents are shown in Figure 3.

**Public Perception.** Public perception was most often mentioned by respondents as a major barrier when deciding to manage a fire for multiple objectives rather than suppressing. Respondents noted concern over the loss of public acceptance if a fire were to result in a negative outcome. Some referred to a specific past wildland fire use fire that had become a full suppression incident which they felt had had a negative influence on public perceptions. Respondents indicated that loss of public perception (an external barrier) could translate to an internal barrier with policy constraints and reluctance to burn.

> "We did have a hurdle with the XX Fire, we lost a lot of trust with the public here and that set the program back." – Fire Manager

> "When Yellowstone in 88 burned that was a barrier for us to move further. When Cerro Grande burned in 2000 that was a barrier for us because they stopped all fire for the National Park Service west of the 46th meridian, so everything in the western United States was stopped for the entire year. Sometime I would say its other fire occurrences and the success or failure of those we all get told to stop." – Fire Manager

Respondents were also concerned that the Forest Service burning even though the public cannot

have camp fires because of fire restrictions led to negative views. Although one fire manager

stated that agencies don't burn during restrictions anymore, respondents felt it was an important

contributor to public perception and should be considered during a managed fire.

> "Also fire restrictions, a lot of times just when we are getting into
> conditions in which we can make some changes we go into fire
> restrictions and that public perception of no campfires but the
> forest service is burning. We did a few years during the fire use
> time but don't do it anymore." – Fire Manager

Likewise, respondents felt that lack of public understanding about what agencies are doing and

inaccurate news coverage might contribute to negative public views about the practice.

> "I think the same thing, fear the public has. They don't know what
> we are doing and a lot of times it is sensationalized in the news.
> You see a lot of stuff that we mis-manage things and we don't
> know what we are doing" – District Ranger

Another perceived problem with public perception is the suppression mentality with the idea of

managing fires here in the Southwest when other parts of the United States are in high fire

danger. The public may not agree with this. Some respondents felt that the idea of managing fires

for multiple objectives while there are wildfires destroying homes elsewhere can be troublesome

for the public. As one silviculturalist put it:

> "When we start to think of wildfires popping off in California,
> Oregon, and Texas and here region 3 wants to do some prescribed
> fire I think there is going to be a lot of education needed to explain
> internally and externally on the higher up level the Southwest is
> different when it comes to fire with regeneration and cutting trees
> and we should have our own rules I sure hope to god we have been
> building this reputation and relationship and I fear that it's only
> going to take one bad apple to make this go south." –
> Silviculturalist

**Smoke Impacts.** Smoke impacts were brought up very often by respondents as an

external barrier. Respondents discussed smoke impacts in terms of health concerns and affecting

smoke sensitive people such as the elderly or those with certain medical conditions. One fire

manager discussed the challenges of managing fire and the associated political impacts of smoke

on sensitive individuals. That is, smoke impacts could rise to become political impacts as

individuals raise concerns.

> ". . .they have the Verde Valley nearby and Prescott Valley and
> they have a large group of smoke sensitive or chemically sensitive
> individuals that have formed a group and they are active
> politically. It can be quite a struggle for Prescott to [conduct]
> prescribed fires just because the squeaky wheel gets the grease and
> if 995 out of 1000 have no issues but don't say anything and if 5
> people do have issues and do say something and that will be the
> only input that AZDEQ has and they are required to log it and
> investigate it."- Fire Manager

Smoke impacts as an external barrier also have a duration component, or amount of time in

which the public can tolerate it. Duration of smoke impacts may impact multiple agencies even

though only one is burning at the time. That is, multiple agencies are sharing the same airshed

and putting up smoke separately but into the same communities over time. A public affairs

officer describes the challenges of having multiple agencies putting smoke in the air:

> "…you can't stop the fact that we have all these other agencies and
> forests doing these kinds of treatments and so you can't just ignore
> the external limitations of the smoke issue." – Public Affairs
> Officer

Finally, visual impacts could be a problem, particularly in places like Grand Canyon National

Park, which is a visual and aesthetically based park in which smoke can strongly detract from

visitor experiences. It was noted in the interviews that a trip to the Grand Canyon can be a once

in a lifetime trip that can be ruined if the canyon is full of smoke.  On the flip side, a fire in the

more remote areas of the forests may draw little attention and smoke impacts are not a concern.

**Closures.**  Impacts to the public caused by fire operations were related to road, trail, and

area closures that occur because of the fire itself. These barriers are limited in duration but can

have a big impact on the public and are often considered during planning. It was mentioned

several times during the interviews that forest managers would limit burning to week days to

limit the impacts to the public visiting during the weekends.  Also mentioned were impacts to the

local community and working with community leaders during planning of burn days, as one fire

manager stated:

> "Another one of the things we pay attention to is the impacts to the
> public. Working with ADOT,[and monitoring] smoke impacts to
> major interstates, like 89. The communities have football games,
> parades, so working with those folks to the extent that's possible to
> minimize some of those impacts." – Fire Manager

**Cooperators.**  Working with cooperators and coordinating fire operations was brought

up several times as an external consideration. Cooperators were mentioned less as a barrier, but

rather as a reality that land managers must work and coordinate with. Land managers stated

having a strong relationship with most stakeholders from years of working together.  Many

respondents indicated that working with cooperators was often a positive experience and that it is

not a barrier but rather a fact of conducting these treatments.

> "…it's western area power administration and this huge 500
> kv[power] line that goes to Phoenix.That's not an obstacle that is a
> reality that you can't affect power to Phoenix.So our infrastructure
> isn't an obstacle it is just a reality that we deal with" – District
> Ranger

**Political.**  The last external barrier was the larger political realm and how that effects on

the ground management. Respondents referred to a previous year in which political pressures

removed the tool to manage fire for the whole season. Many folks worried that the tool would be

removed because of larger politics beyond their district or forest control.

> "Politics can be an external barrier to a degree. That's kind of
> internal and external. A few years ago they took the tool away
> from us due to political nature in Washington. And that was kind
> of a hurdle and we were unable to claim acres burned under

managed fire in that time. So the politics kind of inside and outside
of the agency can inflict their role on what to do with the fire." –
Fire Manager

*Agency Differences.*

With the exception of San Carlos, external barriers followed the overall trends of public

perception and smoke impacts as most limiting.  For San Carlos, education and fire operations

appear to be more important external barriers (Table 8).

**Education.**  San Carlos respondents did not discuss education of the public regarding fire

ecology but rather educating incoming fire resources to assist with the WFMO.  Education, in

terms of personnel during the fire incident, was largely discussed by respondents as a barrier to

achieving goals during a managed fire.  Educating incoming fire resources regarding objectives

and tactics was brought up by San Carlos respondents as a struggle each season as most

incoming resources were not accustomed to this type of fire management.

> "It takes a lot of time to get that message through and you don't
> have a lot of time when that fire is moving. That's another reason
> we have wanted to bring the complexity level of these incidents
> down because it gives a lot more control of how that fire gets
> implemented on the ground than trying to hurry up and train 25
> new people that showed up for two weeks. I think even at some
> point we should change the name from fire fighters to fire
> lighters"- Forester

**Fire Operations.**  San Carlos respondents felt that their small management organization

understood the objectives and reasoning for a managed fire; however, when outside resources

were brought in there was a disconnect.  A main external barrier was limiting the complexity of

these incidents to maintain local level staffing and therefore reducing the amount of resources

brought in. Maintaining a lower complexity incident allows the local unit to maintain command

of the fire without bringing in an external incident management team (IMT) that is most likely

unfamiliar with the unit, objectives, and reasons for WFMO.

> "I think the greatest hurdle is bringing in outside resources, I think we
> have it dialed at this level but bringing in outside resources and getting
> them to understand  we don't just burn it out or burn it as hot as we can"-
> Fire Manager

*Position Differences.*

External barriers were fairly consistent across position groups with public perception common

throughout (Table 9).  Smoke impacts were mentioned more frequently by resource specialists

and fire managers.  Interestingly, decision makers focused more on collaborating and

communicating with other agencies as a challenge along with internal education.

*Respondent Suggested Improvements*

Respondents mentioned 45 strategies which were condensed into 10 categories that might

improve use of WFMO. Better collaboration and cooperation with resource advisors was by far

the most frequently mentioned improvement (Figure 4). Education, for internal agency personnel

as well as the public regarding why and how managed fires are implemented, was also a frequent

recommendation. Next, respondents suggested improvement in communication between internal

folks and, lastly, better pre-season planning.


**Resource Advisors.**  There were several instances in which resource advisors requested

greater involvement of the resource advisors in the planning and implementation process.  In one

location, several respondents mentioned that their presence in a planning meeting was

overlooked or that their voice was not always heard and it was evident that resource advisors felt

they should play a larger role in managed fires.

> "Usually the meeting goes, 'the resource people are here, do you
> have any concerns'. Those are usually secondary to the strategies

39

and if indeed we have resource, ecological goals, those should be the first things that are discussed but they are not. When you get into the meeting it's all about logistics and weather and resources and lastly are there any resource concerns. We have to be very vocal and advocate for it. Usually there will be one or two resource people in the room and eight fire folks."- Resource Advisor

However, in a different location agency respondents noted that the planning process worked well with no issues. This shows the lack of consistency in the program between locations and how it may work differently for each agency. The tone and direction of each agency and their approach varies widely depending on the leadership in place but also by the land and resource management plans.

"I think it works really well. I like how things work between soils, watershed and fire. I really work well with them. It is a cooperative environment. They do engage me with any questions or concerns they have. I do fully support the process to get fire back on the ground wherever we can." - Hydrologist and Soil Scientist

One suggestion to correct this concern was to integrate the fire program with the natural resource programs. A district ranger who discussed this problem suggested having more of their resource staff "red carded" so they would be able to be on site during a managed fire. Respondents felt that by having resource staff more involved in fire, hopefully decisions are made well informed and the process might go more smoothly because of a deeper understanding of WFMO.

"I think it's a matter of true integration and collaboration. The fact that the fire program is run in one division and is not integrated with the science program is a barrier. I think if you were to actually look at an integrated fire program where you have your resource specialist as part of the program and not just brought in for the meeting but part of the team." – Resource Specialist

**Education.** Education was noted by respondents as needing improvement in two ways. Externally, respondents felt that public education could be improved with regards to the ecology of wildland fire managed for multiple objectives.

> "We should teach the ecology of it. That can actually be greatly improved and also have a whole campaign from January to June within the schools because also kids are the greatest assimilators of information"." – Rangeland Manager

Internally, respondents noted that there should be improved education of agency personnel and those involved in a managed fire as this is a fairly new technique and may be foreign to some. Respondents noted that few agency personnel understood what a managed fire was or the reasons for their use and suggested education should be focused around showing personnel the benefit of fire on the landscape as well as the type of burn being implemented. Bringing resource staff to the fire and allowing them to experience the incident was brought up as having success in the past.

> "… but I could say the same for internal folks as well that it would be education but for that its communication because we have to learn as much about impacts to resources as they want to learn about benefits of the fire I would say it's almost all communication and we work on that."- Fire Manager

**Communication.**  Communication, much like education, was brought up very often as a point that needs improvement during the planning and implementation of a wildfire for multiple objectives. Respondents felt that internal communication was lacking at times and could be improved, particularly in terms communicating as soon as a candidate fire is proposed and continuing through the completion of the fire was mentioned as important to resource staff.

> "I would just repeat what I said earlier, better communication and information sharing between the fire managers, line officers, and specialists."- Archeologist

**Pre-Season Planning.**  Lastly, pre-season planning was brought up as needing improvement for WFMO. Several respondents mentioned situations in which pre-season planning helped in the past as it ensured everyone was on the same page and knew what to expect..

"Sitting down together and saying is this something we want to manage, ultimately it is my decision but if you don't have buy-in from your folks it is a problem. Getting buy-in from our partners we usually have a preseason meeting with the other agencies and town agencies and talk about things if we do get a lightning bust and we want to look at everyone of them and see if we can manage this. I want to manage everyone that is possible that will give us positive results. We meet with those folks up front so when something happens they aren't surprised." – District Ranger

Pre-season planning with other agencies and coordinating throughout the season was also mentioned. Respondents indicated that it was important to coordinate with other agencies for sharing of resources, public outreach, smoke impacts, etc. One fire manager discusses the notable challenge of having multiple agencies implementing wildfires for multiple objectives simultaneously.

"We're working at it but even having a meeting between the Coconino, the Kaibab, the [Grand Canyon] park, what are we doing this week, what's our plan? Closer coordination could be the key, on our big plans. We're all trying to good stuff but sharing those would help. We're all competing for resources and that's on ground resources and that could be smoke resources. We can't all be filling up the air shed on one day, spread it out over a few days, or maybe it is the best day to do it all in one day." – Fire Manager

*Agency Differences.*

Respondent suggested improvements were also location dependent and related to internal and external barriers identified in each location (Table 10). For example, San Carlos respondents identified improvements with fire operations which was brought up as an external barrier for that location. Similarly, respondents from the Coconino National Forest identified improvements to involvement of resource advisors which was an internal barrier for that location.

*Position Differences.*

Improvement suggestions varied by job position group, but overall involving resource advisors seemed important by resource specialist and fire managers (Table 11). Additionally, communication was brought up by respondents as needing improvement by resource specialists and decision makers.

**DISCUSSION**

*Highest Priority Management Objectives*

It was evident that objectives for wildland fire managed for multiple objectives fell in line with what national fire policy dictates as having life and property safety as the number one objective and then resource benefit objectives (USDA and USDOI 2009). Many individuals did not explicitly state life and property as priority objectives, but rather identified them as primary to any fire operation and said that they were non-negotiable. Respondents from the Grand Canyon National Park deviated from this trend by explicitly stating safety as highest priority objective. It seems as though the tactics and strategies utilized by the Grand Canyon may create a longer duration incident, as compared to our other respondents, which therefore causes the concern with safety over longer duration exposure of firefighters and public. Beyond this, priority objectives were largely focused on ecological benefits as well as reducing hazardous fuel loading. Beyond fuel reduction was the recognition of restoring the fire regime that can be realized through fire use on the landscape. Many individuals noted ecological benefits arriving from the reintroduction of fire into a system that has largely been fire absent. That is, many other ecological benefits, such as watershed maintenance, nutrient cycling, and forage production were cited as benefits from the reintroduction of fire. These results are consistent with those of Miller

and Landres (2004) who identified Allowing Natural Processes as the main factor influencing the decision to use Wildland Fire. Fire and fuels managers deviated from this trend by identifying restoring the natural fire regime as top priority objective, which we may attribute to the prescribed burning mindset with regards to creating a return interval to maintain treatment effectiveness. We suspect fire and fuels managers realize that by restoring the natural fire regime, other ecological benefits may be realized, similar to prescribed burning treatments. Line officers and resource specialist were similar in their priority objectives.

*Perceived Internal Barriers to Wildfire for Multiple Objectives*

There is currently limited information on internal perceptions of managed fire; however, we found multiple obstacles combine to create a difficult process for fire managers, resource advisors, and line officers to operate within. The perceived internal barriers were largely associated with collaboration amongst resource advisors and fire managers during the planning process. Interestingly, agencies included in our study seemed to discuss managed fire differently in terms of the implementation, meaning some agencies were more aggressive and others were less. We suspect that because agencies differed in the ways they implemented managed fire that this may affect the variety of internal barriers for each location.

Lack of education or understanding of ecological benefits of fire has been classified before in agency personnel as contributing to barriers to Wildland Fire Use, a prior iteration of this management tool (Doane et al 2006). Doane et al (2006) identified that with suppression being the cultural norm, many individuals may not be comfortable with fire on the landscape in any fashion. The results presented here contradict that of Doane et al (2006) and suggest that fire is now reasonably well accepted among resource specialists. That is, we noticed that as resource

specialists gained experience with fire they generally became more comfortable with its use. Conversely, those resource specialists with less experience were less likely to support the tool. It seems as though inexperienced resource specialists are deeply concerned with damage to their resource; however, as treatments are implemented they become more accepting. Additionally, it was evident that respondents at the supervisor office level were less familiar with the tool due to less time in the field. District level respondents were often more field-going and were therefore more familiar with fire for resource benefit. We attribute the difference to more experience in the planning process versus experience during the fire operations as to whether or not resource specialists are accepting of fire management. This would need to be analyzed further as out methodology did not explore district level versus supervisor office level differences. However, overall respondents indicated that education, both internally and externally, could be increased. Fire managers and line officers in our study suggested having resource specialists on site to visually assess the potential effects to their job position which may help in gaining internal acceptance.  Miller and Landres (2004) also identified this problem of collaboration among resource advisors but rather a lack of personnel and a shrinking resource staff that poses challenges.  Conflicting objectives and resource concerns were commonly discussed as internal obstacles by our respondents and have been classified in previous research of wildland fire use (Black et al 2008; Miller and Landres 2004).

Another interesting dynamic that was noted was fire managers identifying guidance and direction as the largest internal barrier. Fire managers stated that policy is very loose and does not provide strong guidance for how to manage a fire for resource benefit. Line officers rely on fire manager experience and recommendations to set the management philosophy for managing a fire for resource benefit. This causes discrepancies in management across agencies.

Our project identified differences with perceived internal barriers across the multiple agencies, including funding, sharing of risk, and education. No previous studies were found that analyzed barriers by agency but the challenges found in this research were similar to other research findings. Previous research identified funding as a key limitation to Wildland Fire Use (Miller and Landres 2004); however, this barrier was only relevant at San Carlos managers. While our study only includes four different agency locations, it highlights the problem of inconsistencies and differences in management across agencies. Potential further research could expand this study to include more agencies in different locations.

Time constraints as well as early and prompt communication were noted as barriers by resource advisors and fire managers. The ability of resource advisors to have information readily available for the planning area was also noted as challenging simply due to lack of survey inventory or short time periods. Resource advisors committed to a fire are not completing their own goals and objectives for the work season which was said to be problematic. Lastly, decision makers must have the ability to function in a time compressed manner to decide upon objectives, priorities, and mitigations during a managed fire. Williamson (2005) examined line officer's decision making process with regards to wildland fire use and identified external factors, such as public perception and weather constraints, as well as resource availability as the main limiting factors. The results presented here differ to those of Williamson (2005) as we identified coordinating among resource advisors and education as barriers for decision makers. A topic not discussed in previous literature is the issue of coordinating burn days across multiple agencies. Our project identified the growing importance of multiple agencies conducting these treatments and the culmination of possible smoke impacts to the public. This may become more of an issue as these treatments increase into the future as more agencies begin to utilize natural ignitions.

Although there are many internal barriers, some situations did arise in which mitigations improved the situation. Mitigations included having a meeting with all resource advisors prior to ignition to discuss expectations, goals, and the planning process.

*Perceived External Barriers to Wildfire for Multiple Objectives*

Barriers that existed outside of the federal agencies largely focused in two main groups, consisting of public perception and smoke impacts. Although these two are apparent, they appear to be seen as most important during planning and the decision point of whether or not to manage a fire. Doane et al (2006) found public perceptions as one of the top five factors most likely to restrict wildland fire use. One nuance of our result is that it represents what agency personnel perceive as public perception and is not always true in terms of what public perception actually is. Studies have shown that the public is rather accepting of agency fuel treatments including prescribed burning, which may be a proxy for managed fire (McCaffrey and Olsen 2012). Only San Carlos respondents identified their public as knowledgeable and accepting of managed fire, which we may attribute to the long history of fire use by the Apache (Seklecki et al 1996). Miller and Landres (2004) also identified smoke impacts during workshops with forest managers as a significant challenge to Wildland Fire Use programs. While there are many similarities between these results and ours, we did not identify trust in the agency as a major contributing factor to managing fire for multiple objectives. We suggest that smoke impacts are often location dependent. That is, the Grand Canyon, being a visually and aesthetic based park, is more concerned with smoke impacts as compared to some Forest Service districts or the San Carlos Apache Reservation. Also important outside the agency, were impacts to the public from fire operations such as road and area closures, which was also considered by respondents in research

by Miller and Landres (2004).  External barriers, in terms of public perception and smoke impacts, seem to be a reoccurring theme with fire use on the landscape.

Another element that was viewed as more of a reality rather than a barrier was working with stakeholders such as utility companies and interest groups. Although working with stakeholders was not discussed in previous research, it was found to be a common theme throughout our research. Working with cooperators was largely viewed as a reality that must take place for effective use of fire.  .

The largest difference amongst the agencies with regards to external barriers was with San Carlos in which respondents identified education and fire operations as the most limiting factor.  Respondents alluded to a fire educated public as a reason for public perception and smoke impacts to be less concerning.  In this situation, respondents noted that education of incoming fire resources as well as the fire operations in general seemed to the greatest barrier for their management organization.  Very little research has examined this paradigm of educating incoming fire resources on how to manage a fire for extended periods with multiple objectives, but it may becoming a larger problem as these fires increase in use. Additionally, the tribe may want different objectives than what incoming fire resources are accustomed to and therefore there is an education period.

External barrier differences among positions were limited with the greatest among decision makers. That is, decision makers operate in a different management realm and therefore may perceive different external barriers to consider with regards to fire management. Decision makers noted working with other agencies as the greatest external barrier. That it, as a fire approaches a jurisdictional boundary, the communication and collaboration with adjoining agencies needs to be increased. Similarly, resource advisors and fire managers view external

barriers at a different rank and are therefore similar as compared with decision makers. Although, this has not been analyzed in prior research, we may suggest that this trend may be fairly common. Overall, the extent to which these external barriers impact a managed fire is comparable to that of internal barriers, as a little over half the respondents noted external barriers as most limiting

*Respondent Suggested Improvements*

It was clear that respondents felt improvements to planning and implementation of WFMO could be made, both internally and externally to facilitate greater use of WFMO. Pre-season planning and early communication seemed to be common threads as needing improvement, which was also suggested by Miller and Landres (2004). Miller and Landres (2004) suggest that pre-season planning should incorporate an assessment of the risks and benefits of wildland fire use. Additionally, having all sensitive resource information readily available for when a candidate fire is recommended would significantly reduce the time constraints during the planning process, as suggested by respondents and in previous research (Miller and Landres 2004). The purpose of the Wildland Fire Decision Support System (WFDSS) is a place where information can be kept for evaluation during planning meetings; however, respondents did not discuss its use. WFDSS serves as a strategic and tactical fire planning tool which is used very often during wildfire events and it was interesting that very few respondents even identified it. Several respondents also indicated that having more personnel red carded and visiting the planning area would benefit all involved, which has also been suggested in previous studies of Wildland Fire Use (Doane et al 2006). Doane et al (2006) found the highest support for improvements in training and education of both agency personnel and the public. Our results reinforce this training and education suggestion and we recommend teaching

the ecology of the system with regards to reintroduction of fire as well as having more resource

specialist on site. Another suggested improvement was to have more resource specialists "red

carded" and able to visit the incident. I would recommend having more individuals fireline

qualified but also participating in incident management teams and leaving their home unit as a

resource advisor. Having resource advisors exposed to fire operations and visually assessing fire

effects would prove vital for improved support and understanding of WFMO.

Improvements for external barriers are situation dependent as not all locations identified

the same barriers. However, education of the public was the most commonly suggested

improvement in terms of public perception of managed fire much like Doane et al (2006). As far

as smoke impacts, improving collaboration amongst agencies to coordinate burn days was noted

as possible progress to improve this problem.

There were many differences associated with suggested improvements by agency and

they often related to the internal and external barrier for each location. For example, respondents

from the Coconino National Forest recommended improvements with incorporating resource

advisors during the planning and implementation process which was discussed as an obstacle.

Likewise, at San Carlos, respondents identified improvements with fire operations which was

largely discussed as a barrier for that location. No previous studies were identified that

examined specific improvement needs based upon the obstacles at a specific agency or location.

One nuance of these suggested improvements is that they are based on the four agencies included

and there may be different suggested improvements if this study were expanded to include more

agencies.

Suggested improvements by job position were also variable. Each job position identified

specific improvements that were viewed to benefit the planning and implementation process. No

previous research has examined suggested improvements by job position and therefore this is the

first study to examine this. Because suggested improvements are so variable, we recommend

improved communication between all involved to improve the process a whole

*Management Implications*

This work provides qualitative analysis of internal and external barriers to wildfire for

multiple objectives in the Southwest. Results show that highest priority objectives are

ecologically based and are in line with what policy states. There is a wide variety of internal

barriers with the most frequently mentioned areas needing improvement being improved

collaboration between fire personnel, and  consultation with resource advisors could be improved

overall. Decision Makers' capacity to take on risk and set a management philosophy for the

wildfire proves to be another barrier in which improvements could be made.  It may be that

defining management strategies in land and resource management plans during pre-season

meetings, so that all personnel are on the same page with regards to implementation, could be

very helpful.

Externally, continued outreach of WFMO could further inform the public.  Educating

what a 'good' wildfire is and contrasting that with what an 'unwanted' wildfire is will prove to

be a challenge as we discuss these wildfires for multiple objectives.  We recommend discussing

these fires in terms of the multiple objectives they are managed for as well as the ecology of the

system.  Along with public outreach we feel as though smoke management will need to be

monitored into the future.  Looking further down the road, close coordination with neighboring

agencies could be crucial as these treatments increase in the future.  Coordinating burn days,

resource allocation, and public outreach would benefit land managers that operate in close

proximity to the public.  Overall, improved communication across fire and natural resource staff

could go a long way for WFMO.  Decision makers could help with this through pre-season

meetings and planning during the incident.

This study focused on agencies located in Arizona, which is largely made up of by

ponderosa pine, and is therefore limited in scope. We suspect that future research could expand

this study to include other fuel types beyond ponderosa pine such as chaparral, pinon-juniper,

and mixed conifer forests. It is possible that internal and external concerns in these other fuel

types may differ from those found in our research.

## ACKNOWLEDGEMENTS

We wish to thank all the respondents from the Forest Service, National Park Service, and

Bureau of Indian Affairs who made time to participate during the interviews. Also acknowledged

is the volunteers who helped during the transcribing process.

## LITERATURE CITED

Black, A., M. Williamson, and D Doan. 2008. Wildland fire use barriers and facilitators. Fire
Management Today68:10-14.

Bureau of Indian Affairs (BIA). 2008. Fuels Management Program: Supplement to the
    interagency prescribed fire planning and implementation procedures reference guide.
    Bureau of Indian Affairs, US Department of the Interior Report No. 08-41.

Dillman D.A., J.D. Smyth, and L.M. Christian. 2014. Internet, phone, mail, and mixed-mode surveys: the tailored design method. Fourth edition. Hoboken (NJ): John Wiley and Sons, USA.

Doane D., J. O'Laughlin, P. Morgan, andC. Miller. 2006. Barriers to wildland fire use: A preliminary problem analysis.International Journal of Wilderness 12: 36-38.

Health and Human Services (HHS). 1979. Department of Health and Human Services; the Belmont Report. Washington (DC): Department of Health and Human Services (US); [cited 2015 Nov 4]. Available from: http://www.hhs.gov/ohrp/humansubjects/guidance/belmont.html

Kauffman, J.B. 2004. Death rides the forest: Perceptions of fire, land use, and ecological restoration of Western forests. Conservation Biology18: 878–882.

Kneeshaw, K,. J.J.Vaske, A.D. Bright, and J.D.Absher.2004. Situational influences of acceptable wildland fire management actions. Society & Natural Resources17: 477–489.

McCaffrey, S., E.Toman, M. Stidham, and B.Shindler. 2013. Social science research related to wildfire management: An overview of recent findings and future research needs. International Journal of Wildland Fire. 22: 15-24.

McDaniel, J. 2012. Managing fire for multiple objectives : Blazing the trail in the Southwest. Flagstaff, AZ: Southwest Fire Science Consortium. 7 p.

Miller C (2003) Wildland Fire Use: A wilderness perspective. Pages 379-385 in: P. Omi, and L. Joyce, editors. Proceedings of the symposium: Fire, fuels treatments, and ecological restoration. USDA Forest Service, Rocky Mountain Research Station Proceedings RMRS-P-29. Missoula, Montana, USA.

Miller C, Landres P (2004) Exploring Information Needs for Wildland Fire and Fuels Management. USDA Forest Service, Rocky Mountain Research Station Research Paper RMRS-GTR-127. (Fort Collins, CO).

National Park Service. 2004. National Park Service: emergency management. Washington (DC): Department of the Interior (US); [cited 2015 Nov 4]. Available from: http://www.nature.nps.gov/rm77/emergency.cfm

Ostergren D.M., K.A. Lowe, J.B. Abrams, and E.J. Ruther. 2006. Public perceptions of forest management in north central Arizona : The paradox of demanding more involvement but allowing limits to legal action.Journal of Forestry 2006.

Parsons D.J., P.B.Landres, and C. Miller. 2003. Wildland fire use: The dilemma of managing and restoring natural fire and fuels in United States wilderness. Proceedings of Fire Conference 2000: the First National Congress on Fire Ecology, Prevention, and Management: 19-26.

QSR (2015). NVivo Data Analysis. QSR International. Retrieved on 12/14/15. Available from: http://www.qsrinternational.com/

San Carlos Apache Tribe (2013) Restoring and maintain resilient landscapes through planning, education, support, and cooperation on the San Carlos Apache Reservation. Retrieved on 12/14/15. Available from: http://forestry.scat-sn.gov/publicweb/AZ_SCA_Report_Final.pdf

Schutt, R. 2012. Investigating the Social World: The process and practice of research. Seventh edition. Sage Publications. Thousand Oaks, California, USA.

Seklecki M. T., Grissino-Mayer H.D., and Swetnam T.W. 1996. Fire history and the possible role of Apache-set fires in the Chiricahua Mountains of Southeast Arizona. United States Department of Agriculture Forest Service General Technical Resport Rm (1996): 238-246.

Sensibaugh B.M., and D. Huffman. 2014. Managing naturally ignited wildland fire to meet fuel reduction and restoration goals in frequent-fire forests. Ecological Restoration Institute. 3 p.

Toman, E., B.Shindler, S. McCaffrey, and J. Bennett. 2014. Public acceptance of wildland fire and fuel management: Panel responses in seven locations. Environmental management54: 557–70.

U.S. Department of Agriculture (USDA), U.S. Department of the Interior (USDOI) (2009) Guidance for Implementation of Federal Wildland Fire Management Policy.

US Forest Service, 2014. US Forest Service: forest management. Washington (DC): US Forest Service FM ;[cited 2015 Nov 4]. Available from: http://www.fs.fed.us/forestmanagement/aboutus/index.shtml

Wagtendonk, J.W. 2007. The history and evolution of wildland fire use. Fire Ecology Special
Issue. 3: 3-17.

Westerling A.L., H.G. Hidalgo, D.R. Cayan, and T.W Swetnam. 2006. Warming and earlier
spring increase Western U.S. forest wildfire activity. Science. 313: 940-943.

Zimmerman, T., and T. Sexton. 2010. Organizational learning contributes to guidance for
managing wildland fires for multiple objectives. Fire Management Today. 70:1 8-14.

**TABLES AND FIGURES**

Table 2.1 List of potential respondents (Sampling frame) by job position description.

| Position Description | Number of Potential Respondents |
|---|---|
| Archeology | 8 |
| Botany | 2 |
| Engineering | 1 |
| Ethnobotonist | 1 |
| Fire Ecologist | 4 |
| Fire Managers | 12 |
| Forester | 7 |
| Fuels Managers | 6 |
| GIS | 3 |
| Hydrologist | 3 |
| Lands/Minerals | 2 |
| Line Officers | 5 |
| Natural Resource Specialist | 3 |
| NEPA/Planning | 2 |

| | |
|---|---:|
| Prevention | 2 |
| Public Affairs Officer | 4 |
| Range | 8 |
| Recreation | 3 |
| Silviculturalist | 5 |
| Soils | 2 |
| Tribal Council | 1 |
| Wildlife Biologist | 8 |
| **Total** | **92** |

Table 2.2 Number of interviews by agency for a total of 65 in-person interviews.

| Agency | Interviews Conducted | Possible Number of Respondents |
|---|---|---|
| Coconino | 26 | 37 |
| Kaibab | 25 | 33 |
| Grand Canyon | 9 | 13 |
| San Carlos Apache | 5 | 8 |
| **Total** | **65** | **91** |

Table 2.3 Number of interviews by job position. Fire and fuels include all personnel from fire management, fuels management, prevention, and prescribed fire. Resource value includes personnel from archeology, biology, range, timber, lands and minerals, hydrology, etc. Lastly, line officers include district rangers, park superintendents, and forest managers.

| Job position | Number of Respondents | Percentage |
|---|---|---|
| Fire and Fuels | 20 | 30% |
| Resource Advisors | 40 | 62% |
| Line Officers | 5 | 7% |
| Total | 65 | |

Table 2.4 Agency level differences for top three highest priority objectives, these objectives are stated by keywords used for coding and actual objectives may be longer.

|  | **Coconino** | **Kaibab** | **Grand Canyon** | **San Carlos** |
| --- | --- | --- | --- | --- |
| **Objective 1** | Fuel Reduction | Ecological | Safety | Fuel Reduction |
| **Objective 2** | Ecological | Fuel Reduction | Ecological | Ecological |
| **Objective 3** | Restoring Fire Regime | Restoring Fire Regime | Restoring Fire Regime | Restoring Fire Regime |

Table 2.5 Job position differences for highest priority objectives for wildfire for multiple objectives. Objectives are stated with keywords used during coding, actual objective descriptions may be longer.

|  | Fire and Fuels | Line Officer | Natural Resource |
|---|---|---|---|
| **Objective 1** | Restoring Fire Regime | Fuel Reduction | Fuel Reduction |
| **Objective 2** | Fuel Reduction | Ecological | Ecological |
| **Objective 3** | Safety | Safety | Safety |

Table 2.6 Most frequently mentioned internal barriers by agency. Barriers are presented

by keywords used during coding and explanations of barriers may be longer.

| Internal Barriers | Coconino | Kaibab | Grand Canyon | San Carlos |
|---|---|---|---|---|
| 1 | Resource Concerns | Resource Advisors | Risk | Funding |
| 2 | Resource Advisors | Decision Makers | Decision Makers | Education |
| 3 | Competing Priorities | Personalities | Resource Concerns | Resource Advisors |

Table 2.7 Internal barriers amongst job positions. Barriers are presented by keywords
used during coding and explanations of barriers may be longer.

| Internal Barriers | | Resource Specialist | Fire Managers | Decision Makers |
|---|---|---|---|---|
| | 1 | Resource Advisors | Decision Makers | Resource Advisors |
| | 2 | Resource Concerns | Guidance-Direction | Resources |
| | 3 | Personalities | Competing Priorities | Education |

Table 2.8 External barrier differences amongst agencies.

| External Barriers | Coconino | Kaibab | Grand Canyon | San Carlos |
|---|---|---|---|---|
| 1 | Smoke Impacts | Public Perception | Public Perception | Education |
| 2 | Public Perception | Smoke Impacts | Smoke Impacts | Fire Operations |
| 3 | Public | Stakeholders | Other Agencies | |

Table 2.9 External barriers by job position.

| External Barriers | Resource Specialist | Fire Managers | Decision Makers |
|---|---|---|---|
| 1 | Public Perception | Public Perception | Other Agencies |
| 2 | Smoke Impacts | Smoke Impacts | Public Perception |
| 3 | Public | Political | Education |

Table 2.10 Suggested improvements by location. Notice that suggested improvements

relate to either internal or external barriers identified for each location.

| Improvement | Coconino | Kaibab | Grand Canyon | San Carlos |
|---|---|---|---|---|
| 1 | Resource Advisors | Education | Communication | Fire Operations |
| 2 | Communication | Pre-Season Planning | Education | Guidance-Direction |
| 3 | Public | Resource Advisors | Resource Advisors | Understanding Objectives |

Table 2.11 Job position differences with regards to suggested improvements to wildland
fire managed for multiple objectives.

| Improvement | Resource Specialist | Fire Managers | Decision Makers |
|---|---|---|---|
| 1 | Communication | Education | Pre Season Planning |
| 2 | Resource Advisors | Resource Advisors | Communication |
| 3 | Education | Public | Funding |

**Highest Priority Objectives**

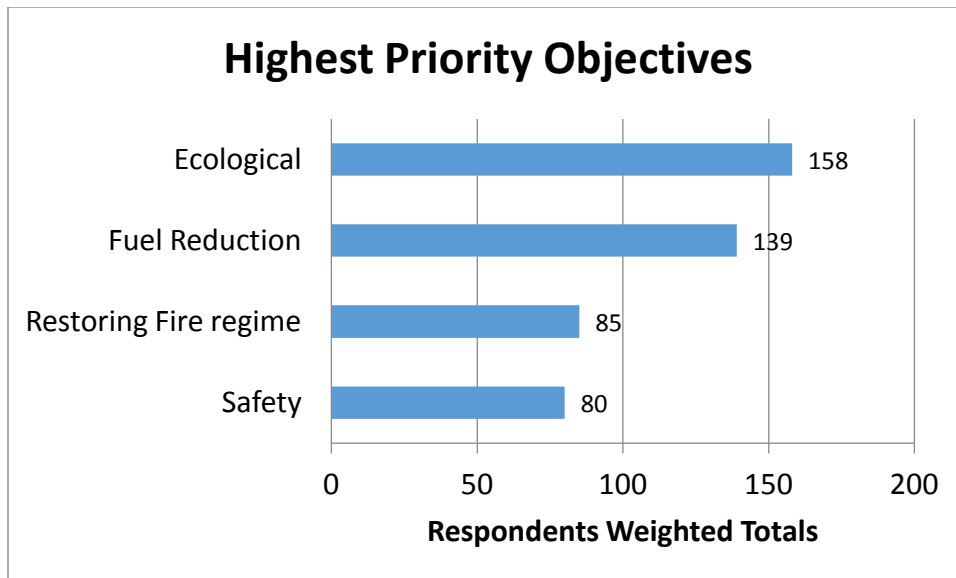| Objective | Respondents Weighted Totals |
|---|---|
| Ecological | 158 |
| Fuel Reduction | 139 |
| Restoring Fire regime | 85 |
| Safety | 80 |

Figure 2.1 Respondent identified highest priority objectives for wildfire for multiple objectives across all sites.  Priority objectives were weighted with highest priority having a weight of 3, followed by second highest priority having a weight of 2, and third priority having a weight of 1 and then each was summed.
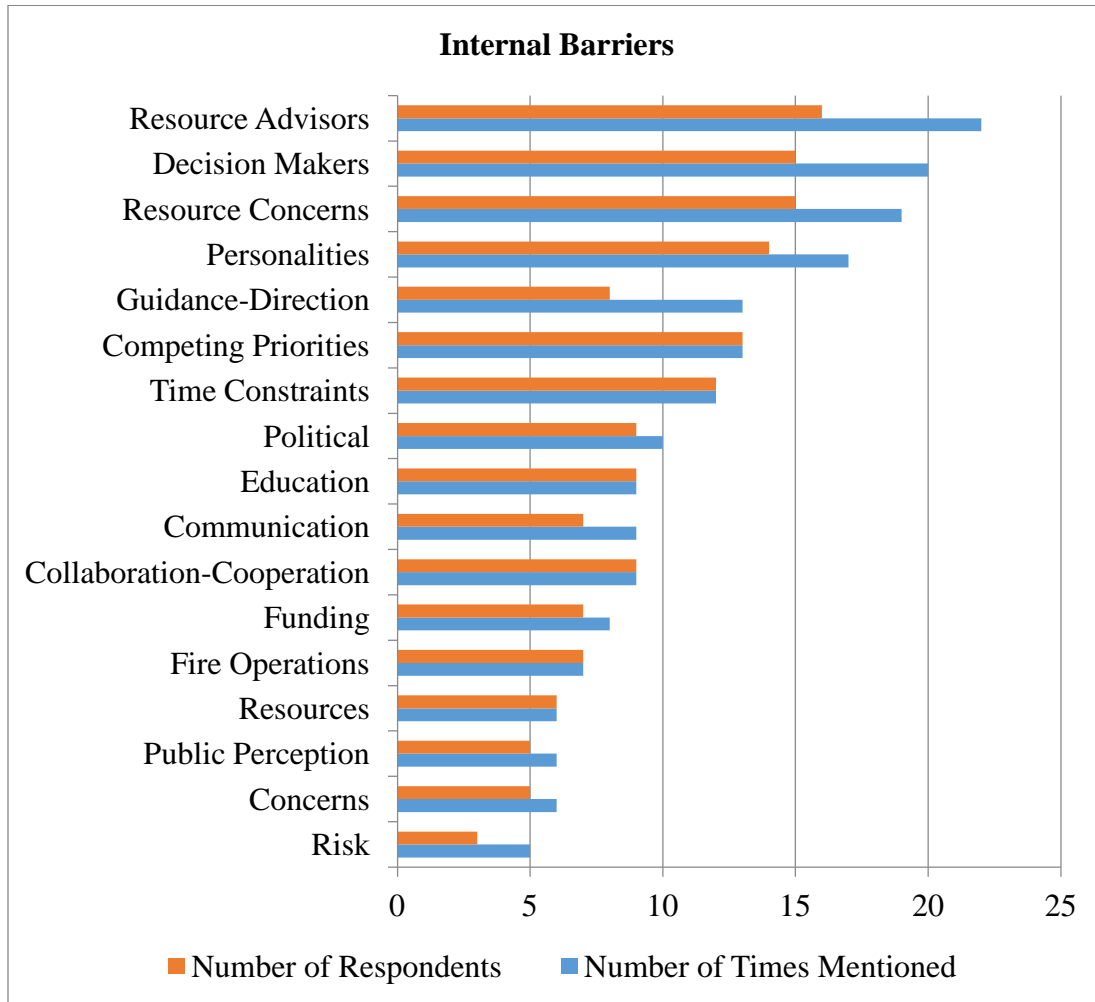
**Internal Barriers**

Figure 2.2 Majority of internal barriers identified by respondents. Note that number of times mentioned is the amount of times each barrier was brought up by all respondents and number of respondents indicates the number of individuals discussing each item. Only barriers discussed more than 5 times were included.

## External Barriers

| | | |
|---|---|---|
| Public Perception | |
| Smoke Impacts | |
| Public | |
| Cooperators | |
| Political | |
| Other Agencies | |
| Education | |
| Communication | |
| Litigation | |

■ Number of Respondents   ■ Number of Times Mentioned

Figure 2.3The nine most frequently mentioned external barriers to wildfire for multiple objectives discussed by respondents. Note that number of times mentioned is the amount of times each barrier was brought up by all respondents and number of respondents indicates the number of individuals discussing each item. Only barriers discussed more than 5 times were included.
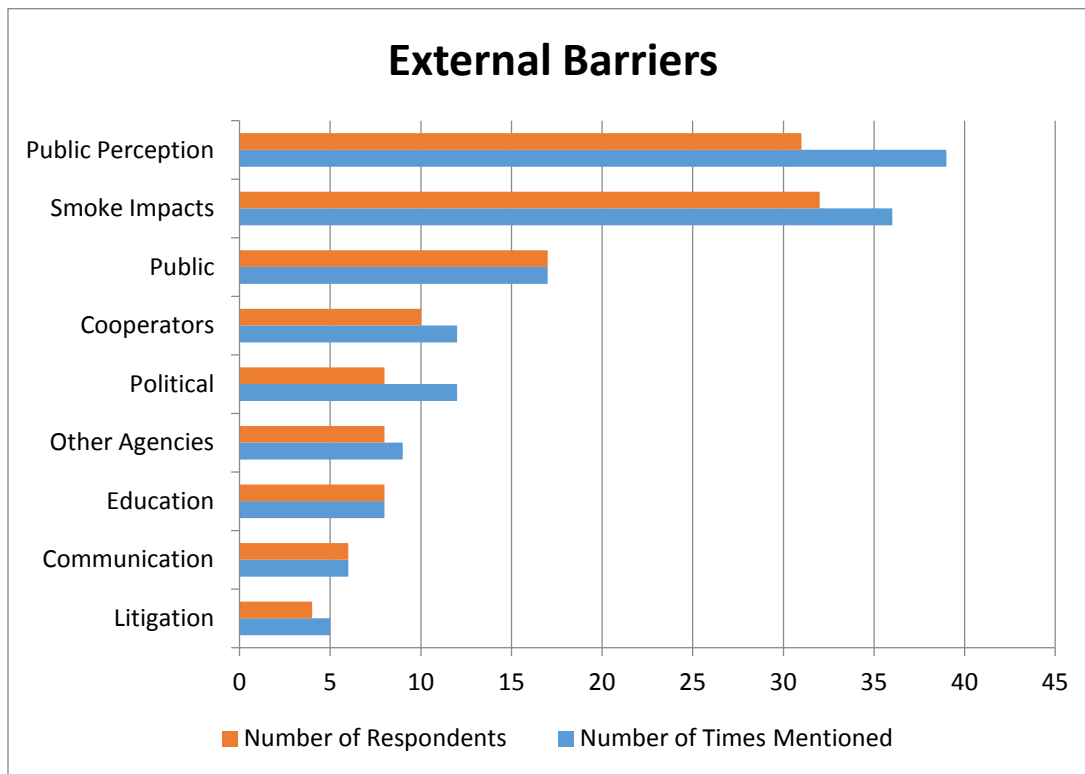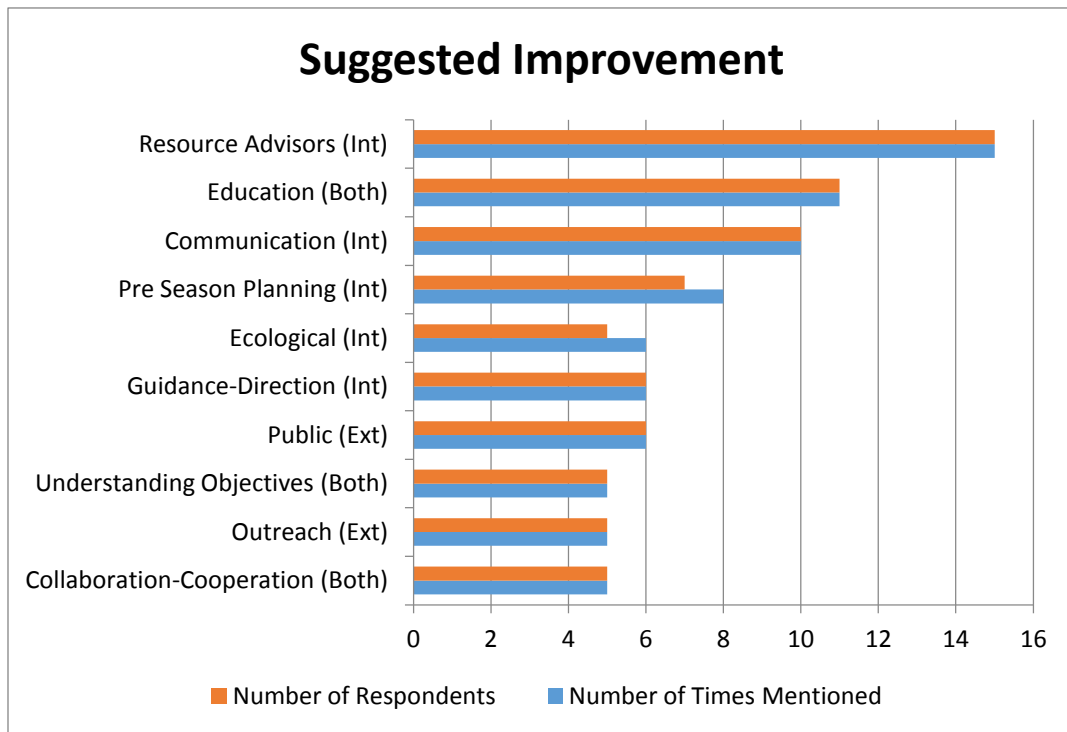
Figure 1.4 Suggested improvement to wildfire for multiple objectives. Respondent suggested improvements are aimed towards internal and external barriers as identified in the axis label as Int or Ext or both.

**CHAPTER 3**

**Wildland Fire Managed for Multiple Objectives: What do we call it?**

Brian T. Kelley[1], Andrea E. Thode[1], Sarah McCaffrey[2], and Martha Lee[1]

[1]Northern Arizona University, School of Forestry, PO Box 15018, Flagstaff, AZ 86011, USA

[2]Forest Service, U.S. Department of Agriculture, Rocky Mountain Research Station, 240 West Prospect, Fort Collins, CO 80526, USA

**ABSTRACT**

Inconsistent terminology creates challenges for land managers discussing projects on public lands, specifically wildfire. Problems with wildland fire terminology have been documented as a barrier to discussing concepts such as fire severity and fire hazard. In this research we sought to document the terminology inconsistencies with wildfire for multiple objectives, a term for wildland fire used for resource benefit, in the southwestern U.S. Multiple policy changes and updates have led to this terminology which was previously titled prescribed natural fire and wildland fire use. Through in-person interviews we documented public land management agency personnel perceptions of the current wildland fire terminology. It was evident that personnel had many concerns about the current terminology including its ambiguity and lack of clarity with regards to what the fire is being managed for. Respondent suggested terminology included terms that incorporated some sort of natural or ecological tone. A few respondents did like the current terminology for its simplicity in classifying two types of fire (prescribed fire and wildfire) but did mention the need to discuss objectives when promoting wildfire for multiple objectives.

72

**INTRODUCTION**

Decades of effective fire suppression and changes in land use have resulted in high fuel

loading leading to an increase in the high severity fire on the landscape (Westerling et al 2006).

In conjunction with thinning and prescribed burning, the use of naturally ignited fires is one

option to treating hazardous fuels. Although using naturally ignited fire to achieve resource

benefits has been around for several decades, its use and how it has been labeled has been highly

variable.

This practice began in the early 1970's with the use of "prescribed natural fires" (PNF) in

designated wilderness areas and national parks (Wagtendonk 2007). The continued success of

prescribed natural fires as well as the recognition of the ecological role of fire led the Forest

Service to abandon the 10AM policy of full suppression and adopt a new policy more supportive

of the use of wildland fire through prescription (Wagtendonk 2007).

Soon thereafter three fires that were allowed to burn for resource benefit, including the

Yellowstone fires, went out of prescription causing a major policy review amongst federal

agencies in 1989 (Wagtendonk 2007). While the review concluded that fires are an essential part

of the ecosystem, more in-depth and comprehensive fire management plans would be required

for continued use of wildland fires. Following the 1989 review, natural fire use was limited and

reintroduction was slow amongst the agencies (Wagtendonk 2007).

The fatal South Canyon Fire in 1994 led to another major policy review.  This resulted in

the 1995 Federal Wildland Fire Management Policy (Wagtendonk 2007) which change in the

federal wildland fire policy used the term "Wildland Fire Use" (WFU) for what was previously

termed prescribed natural fire (Miller 2003). In the year 2000 the Cerro Grande Fire, which was

a prescribed fire, crossed lines and went beyond prescription to burn more than 250 homes in Los Alamos, New Mexico and led to yet another review of fire management policy which suggested the need to create a wildland fire use implementation guide. This guide mandated "wildland fire use" as the official term for utilization of naturally ignited fires for resource benefit.

The next significant change to the 1995 Wildland Fire Policy occurred in 2009 when the recent Federal Implementation Guide was released for fire management (USDA and USDOI 2009). In prior iterations, such as wildland fire use, the fire could only be managed for a single objective such as suppression or resource benefit. Through the updates it became possible to manage a fire for multiple objectives simultaneously such as suppression on one side of the fire and resource benefit on another side. This implementation allows for a flexible approach to managing fire and moves from three types of fire (prescribed fire, wildfire, and wildland fire use) to only include two types of fire, wildfire and prescribed fire. Prescribed fire is when there are planned ignitions and wildfire is everything else, which includes managing natural ignitions for resource benefit (McDaniel 2012).

A main outcome of the policy review and resulting policy change was that managers identified multiple terms for various management tools such as managed fire, let burn, etc while discussing wildland fire use fires (USDA and USDOI 2009). That is, as policy changed so has the terminology used to discuss what management actions are being taken. The two main terms that have been used in the past are prescribed natural fire and wildland fire use; in addition, we identified other terms such as appropriate management response, let-burn, managed fire, and fire for resource benefit. Current policy allows for planned and unplanned ignitions of wildland fire in which different responses and objectives can be met (USDA and USDOI 2009). Although

74

changes to policy were made to clarify and reduce confusion over terminology, there are still

many problems with wildland fire terminology.


**Problems with Wildland Fire Terminology**

Although research on wildland fire terminology is limited, there are other fire

terminology inconsistencies that have been noted. Bachmann and Allgower (2001) examined the

inconsistencies and struggles associated with several terms including "fire danger", "fire

hazard", and "fire risk". Although these terms have separate definitions, agency outreach

messages can be misconstrued by the use of these terms (Bachmann and Allgower 2001).These

terms can be misconstrued because although they may seem intuitive, the definitions can be

blurred if misunderstood. . Similarly, Jain (2004) discussed how the terms "fire intensity", "fire

severity", and "burn severity" have been used interchangeably and recommended that when

terms like this are used its important to include further information for clarification. Even though

current policy dictates two types of fire, prescribed fire and wildfire, the National Wildfire

Coordinating Group (NWCG) definition of wildfire (at the completion of this research) states

nothing regarding fire use for resource benefit, as listed below (NWCG 2016).

"An unplanned, unwanted wildland fire including unauthorized human-caused fires,

escaped wildland fire use events, escaped prescribed fire projects, and all other wildland fires

where the objective is to put the fire out (definition currently under review)." Interestingly, the

definition includes a statement that says [the current definition is under review], a prime example

of the ambiguity of the current terminology used to discuss wildfire for multiple objectives. We

plan to explore the ambiguity with this title and what is suggested to improve terminology.

Parsons and others (2003) identified the challenge of a changing terminology as a barrier to land managers, especially when discussing treatments with the public. We feel as though these same issues may exist with the fire use terminology since the last policy update. Current terminology includes prescribed fire and wildfire which may be managed for multiple objectives which we will refer to as wildfire for multiple objectives (WFMO). The objectives of this project are: 1) identify the acceptance of the current terminology among land management agency personnel, 2) identify the reasoning for potential disagreement with the current terminology and 3) identify suggestions for what the terminology should be.

**METHODS**

Interviews were conducted with members of federal land management agencies located in Northern Arizona. Interviews followed a semi-structured questionnaire consisting of open-ended questions. We utilized a qualitative approach since our aim is to elicit concerns and explore the main issues of terminology with WFMO. A qualitative approach has the capacity to reveal the complexity of implementation of WFMFMO and is an appropriate approach for investigation of this new issue (Dillman et al 2014).

**Sampling Frame**

Interviews were conducted across two National Forests, one National Park, and one reservation in Northern Arizona including the Coconino and Kaibab National Forests, Grand Canyon National Park, and the San Carlos Apache Reservation within the Bureau of Indian Affairs. All three of these land management agencies have active WFMO programs and have been implementing WFMO since 2009 (USDA and USDOI 2009). .

Interviews were conducted in spring 2016, as this was the time when these individual are most often in the office and not conducting field work. All individuals were notified prior to the interview and were not required to participate if they did not wish to. .

A sampling frame was completed in winter of 2015 and included all individuals we planned to interview. This sampling frame contained 83 individuals from the agencies and is chosen in consultation with a key informant, which is someone from the agency's fire organization that regularly works with natural resource specialists. Key informants from each agency were consulted and helped to identify individuals that are often involved in the planning or implementation of WFMO.

**Interview Questions**

A pilot study was completed during the summer of 2015 to gauge which fire management issues were reoccurring. This pilot study guided creation of the current questionnaire.   The current interview guide contains fifteen open-ended questions that are aimed to identify three main components associated with WFMO. This study is part of a larger study to examine the internal and external barriers for WFMO, in which we asked two questions regarding internal perceptions of terminology. Questions regarding terminology that were used in this analysis are listed below:

What are your views of the current terminology, which dictates two types of fire, prescribed fire and wildland fire?

Do you think there is a better name for this management tool, which is currently titled wildland fire managed for multiple objectives, and if so what is it?[*Previous names include "prescribed natural fire" and "wildland fire use"*].

**Conducting Interviews**

Prior to interviews, questions received institutional review board (IRB) approval. Interviews were conducted at the respondents' place of work as this reduced the amount of burden on the respondent. Most interviews were conducted in-person; however, a few interviews were conducted via phone due to the respondent working remotely. Interviews followed the questionnaire and probing was used to obtain the most complete answer possible. All interviews were recorded and transcribed. Interviews lasted approximately 20 to 40 minutes, depending on the respondent's depth of answers. Two researchers were present to conduct the interviews; one read the questions and interacted with the respondent while the other transcribed the answers and interesting points to bring up later.

**Analysis**

Analysis of the interview guide responses entailed qualitative data analysis and coding. Qualitative data analysis involves formulation of concepts that reflect the content of the interviews and then assigning codes to main themes to reduce lengthy transcripts to brief, descriptive, summaries (Schutt 2012; Dillman et al 2014). We read through each response carefully to determine any major themes which helped create a codebook. Then all transcripts were uploaded into NVivo11 software for qualitative analysis. NVivo allows for organization and grouping of qualitative information based on certain keywords or themes (QSR 2015). Once major themes were identified, we formulated trends and issues that were reoccurring. We focused on the meaning of the trends through interpretations of the text rather than quantifying phenomena (Schutt 2012).

NVivo software allows for separation of the data based on different classifications, and for the purpose of this research we used several classifications including: agency, district, and

resource value. We queried by location including 1) Coconino N.F. 2) Kaibab N.F. 3) Grand

Canyon N.P. and 4) San Carlos Apache Reservation to examine whether or not views of

wildland fire terminology are different at various locations. We also queried by resource value

by having three groups containing 1) fire and fuels managers, 2) resource values, and 3) line

officers. With cross analyzing the responses we identified different barriers for different

locations as well as resource values.

## RESULTS

Overall respondents displayed negative views toward the current terminology (Table 1)

with 40 respondents disapproving and only 15 supporting positive views of it. This trend was

common amongst most agencies as well as across resources. We received 31 suggestions for

what it should be titled or what respondents liked in the past.

### Negative Views Towards Current Terminology

The main reasons respondents disliked the current terminology was that it was perceived

as being too vague, as well as requiring a cumbersome explanation when discussing WFMO.

Lastly, respondents expressed frustration with the multiple title changes.

*Vagueness*

Respondents viewed the current term as too vague and not including enough detail about

what the fire was being managed fore. More explanation was desired by respondents.

> "Every fire is managed and every fire has multiple objectives. I
> like the road we were going down just calling it wildland fire. We
> need to talk about the strategy." – Fire Manager

Another aspect of the vague terminology is that individuals are talking about the same treatment but in different ways. For example, some respondents related the terminology to the tactics and strategy used for a managed fire, especially fire managers, while others discussed it in terms of ecological benefits.

> "Wildland fire managed for multiple objectives is probably the most descriptive however it is still wordy and doesn't roll off the tongue. So you have your issues with that, maybe it is more descriptive of what we are doing but it is again very vague." – Fire manager

*Cumbersome*

Respondents also found the current terminology to be very wordy and cumbersome if they were to explain the tool and would often use more than just the "unplanned ignition" title. Explaining that this is an unplanned ignition or wildfire managed for multiple objectives is not descriptive enough and needs more detail according to respondents. Overall, respondents felt we should discuss what the objectives are and what the strategy is which can become cumbersome.

> "We make it harder to deliver the message of what we are doing. We get to the point where we don't even know what the hell we are doing or how to call what we are doing. I think if you just go back to the simple principles of keep it simple, when we say fire use, people understand that. wildland fire use, we are using fire." – Fire Manager

Respondents alluded that the terminology should be descriptive yet not too wordy or cumbersome to communicate. One public affairs officer describes the struggles of communicating with the public with such a vague title that causes cumbersome explanations.

> "I think it's too cumbersome when you are trying to talk with members of the public and every single time you have to say yes we are managing these fires for multiple objectives including blah blah blah blah blah I think that the terminology gets in the way of the communication." – Public Affairs Officer

Many respondents indicated they did not always use the current title and would simply call it something that made sense to them. Interestingly, many respondents did not even know what the current terminology was and would ask for clarification. Thus, many interviewees made up terms they thought conveyed the idea better when talking with the public.

> "I use prescribed natural fire because everybody understands what a prescribed burn is and so I think the addition of the word natural implies that it had a natural origin. I think that one might be cleaner and more simple for the public at large." - Archeologist

> "I don't know, none of those terms seem to fit. We say we are managing it, but they are all managed. So it's a natural fire or a managed wildland natural fire… I don't know what to call it." – District Ranger

*Multiple Terminology Changes*

Respondents, whether they approved of the terminology or not, expressed frustration with the multiple title changes over the years. Choosing one title and sticking with it was mentioned by respondents as important.

> "I don't know, we have we have danced around a lot of names but I don't know if there is really any better name. Just needs to be explained better" – Botany Specialist

Many respondents even referred to the policy changes and stated that they simply wanted one term and to stick with it. Confusion was noted with every change of the title over several iterations with policy changes and updates. Respondents were adamant that we should pick one term and stick with it.

> "I think every time we change it we make it worse. We make it harder to deliver the message of what we are doing. We get to the point where we don't even know what the hell we are doing or how to call what we are doing." – Fire Manager

> "I wish they would pick one and run with it." – Fire Manager

"It seems like every year when I was in fire information I had to find out what you were calling [it] and I yeah I think that one of the best things to do would be not change it. Yeah pick a name and stay with it. Because I mean I grew up back in the old let burn policy you know so we had let burn policy and prescribed natural fires." – Timber Manager

## Positive Views

The respondents that did have positive views of the terminology liked the change to only include prescribed fire (planned ignitions) and wildfire (unplanned ignitions). It was evident though that we should explain what the objectives are that the fire is being managed for. Relating ecological benefits was important to respondents when discussing the term, especially when talking with the public. Respondents who supported the current terminology displayed an understanding of the current policy and often referred to it.

"I like the name because we need to stop trying to categorize it. It's truly wildfire. There are a few things we have to work through internally and externally."- Fire Manager

"I like wildfires managed for multiple objectives. I think it gets the message out there that it's not just burning for the sake of consuming fuels. It's also ecology, wildlife, [multiple] objectives." – Hydrology and Soils Specialist

## What Terminology is Suggested?

Throughout the interviews individuals offered suggestions for what the terminology should be. Often times they referred to previous terms such as "Wildland Fire Use" and "Prescribed Natural Fire". Respondents seemed to like these terms and did not understand why there were so many changes to the terminology (Tables 2). One benefit to using a prior term such as prescribed natural fire or wildland fire use is that the terms are well known and would require minimal training to educate agency personnel. However, these terms may carry a connotation or

baggage such as the escaped fires that caused policy change that in-turn removed these terms. It may be difficult to use a term like prescribed natural fire or wildland fire use after a few of these fires became catastrophic and have a "history".

> "I think if you just go back to the simple principles of keep it simple, when we say fire use, people understand that. Wildland fire use, we are using fire. It's not prescribed fire everybody understands what prescribed fire is and everybody understands what wildland fire is, so I think wildland fire use is simple to understand." – Fire Manager

> "At a minimum we need an acronym that people are familiar with that's why we are always in managed fire that's why wildfire managed for multiple objectives is too long and stupid I don't understand what's wrong with WFU the public was starting to get it." – Fire Ecologist

> "Honestly, I don't know. I personally always liked the term, appropriate management response, AMR. I don't know how that would be in regards to public perception but wild land fire with an appropriate management response but I mean we get into these long descriptors of it but if its wild land fire managed for multiple objectives, everybody knows in the title that its being managed for multiple objectives." – Fire Manager

Some new terms did arrive in the interviews that respondents felt would translate the idea of this management tool (Table 2). The words "Natural" and "Resource Benefit" were common for respondents to use when discussing a new term. Benefits to having terms with Natural or Resource Benefit relate to ease of conversation and understanding. Using a term with these environmental based terms may make it easier to converse with the public and translate the goals and objectives of WFMO. However, some cons to a terminology including Natural or Resource Benefit may be the expectation that all of these types of treatments result in positive effects when in reality it may take several entries or delayed response to show positive results.

> "I don't necessarily mind fire for resource benefit"- GIS Specialist

> "I think it's a good name for agencies. It is not a good name for the public. They don't know what the multiple objectives are. I use

prescribed natural fire because everybody understands what a prescribed burn is and so I think the addition of the word natural implies that it had a natural origin. I think that one might be cleaner and more simple for the public at large." – Archeologist

"Just resource benefit. We have short handed it to RB, everyone knows what RX is so we are going RX, RB, WF." – GIS Specialist

"Managed natural fire is my idea. Wildland fire managed for multiple objectives is terrible and wordy. It is so bureaucratic which is the problem. I like managed natural fire." - Archeologist

This quote by a fire manager summarizes the variety of problems related to terminology discussed in the results.

"I wish they'd quit changing the names on us so we could go with something and be good. I like, just "wildfire" and that's the term I have been using…because I thought that was kind of the direction. If somebody asked me what I would like to name it I would just call it "Natural Fire" that's the term I use when I am talking to people. I never say "Fire for Resource Objectives" I mean that doesn't go very well. Natural fire I like, I like Wild Fire … just tell, teach everybody that they're not all bad, but that's not an easy one … that's why it's gone around 15 times. Frustrating." – Fire Manager

## CONCLUSIONS AND RECOMMENDATIONS

A larger number of respondents displayed negatives views of the current terminology which dictates two types of fire: planned and unplanned ignitions which can have suppression or multiple objectives. Respondents did not like how ambiguous the terminology is and would like to see more description of what the tool accomplishes. It was evident that many respondents did not even understand what the correct terminology was and they often had their own term for the tool. This lack of understanding creates a lack of consistency across the agencies, which translates to different messages for public outreach. Additionally, it was evident that when respondents found the current terminology to be vague, they would explain the tool in different

ways. Respondents each had methods of describing the tool whether it was using strategy and tactics, as fire managers often did, or using the multiple objectives and ecological benefits, as natural resource specialists would.

Interestingly, several individuals did approve of the current terminology for its simplicity and ease of conversation. Using the term wildfire seemed natural for these individuals as they referred to the policy change and were knowledgeable about its multiple iterations. Those that approved of the terminology often mentioned how it should be accompanied with a statement of the objectives and management approach for further explanation.

Although, a call to change national policy based upon these results is unrealistic, these results do supply a breadth of realization that the current title of this tool is insufficient. The current terminology stems from years of review and multiple iterations of policy. The current implementation of the policy, an update of the 2001 implementation and 1995 policy, was aimed to reduce the confusion between types of fire and to limit it to prescribed and unplanned ignitions. It seems as though further explanation of objectives, strategy, and tactics is required when discussing this with the public. Also, improving the definitions of our wildfire terminology would prove beneficial as the current definition supplied by NWCG states nothing regarding multiple objectives (NWCG 2017). This research focused on the Northern Arizona region although, additional research could use this framework to expand this study to a regional or national level to evaluate perceptions of terminology. We suggest that further research and terminology consideration should include members of the public. It would be key to incorporate the public when deciding which term to use for discussing fire for multiple objectives.

**Management Implications**

Interestingly, 10 respondents did not understand the current terminology and therefore were unable to express either positive or negative views. Otherwise, the current terminology is seen as problematic by most individuals but care must be given prior to any terminology changes given the frustrations expressed. However, should a new term be considered, several factors should be taken into consideration such as the need for a natural or ecological tone. A concise yet explanatory term (3-5 words) may be difficult to determine but is what may be needed in this situation. Respondents seemed to support prior terms, such as Wildland Fire Use or Prescribed Natural Fire, which are options to return to. However, it was strongly suggested by respondents to pick a single term and stick with it. Limiting the amount of terminology changes was important across all respondents. Future research could use this framework to examine agency level perceptions of terminology but we suggest that it would be imperative to include the public in some sort. Gauging public acceptance of the terms discussed in this paper would prove beneficial in further discussions regarding terminology.

## ACKNOWLEDGEMENTS

## REFERENCES

Bachmann, A., and B. Allgower. 2001. A consistent wildland fire risk terminology is needed! [including: New definitions]. Fire Management Today, v. 61, no. 4, p. 28-33. http://www.fs.fed.us/fire/fmt/fmt_pdfs/fmt61-4.pdf.

Bureau of Indian Affairs (BIA). 2008. Fuels Management Program: Supplement to the interagency prescribed fire planning and implementation procedures reference guide. Bureau of Indian Affairs, US Department of the Interior Report No. 08-41.

Dillman D.A., J.D. Smyth, and L.M. Christian. 2014. Internet, phone, mail, and mixed-mode surveys: the tailored design method. Fourth edition. Hoboken (NJ): John Wiley and Sons, USA.

Health and Human Services (HHS). 1979. Department of Health and Human Services; the Belmont Report. Washington (DC): Department of Health and Human Services (US); [cited 2015 Nov 4]. Available from: http://www.hhs.gov/ohrp/humansubjects/guidance/belmont.html

Jain, T.B. 2004. Confused meanings for common fire terminology can lead to fuels mismanagement. Wildfire.

McDaniel, J. 2012. Managing fire for multiple objectives : Blazing the trail in the Southwest. Flagstaff, AZ: Southwest Fire Science Consortium. 7 p.

Miller C (2003) Wildland Fire Use: A wilderness perspective. Pages 379-385 in: P. Omi, and L. Joyce, editors. Proceedings of the symposium: Fire, fuels treatments, and ecological restoration. USDA Forest Service, Rocky Mountain Research Station Proceedings RMRS-P-29. Missoula, Montana, USA.

National Park Service. 2004. National Park Service: emergency management. Washington (DC): Department of the Interior (US); [cited 2015 Nov 4]. Available from: http://www.nature.nps.gov/rm77/emergency.cfm

National Wildfire Coordinating Group [NWCG]. 2016 Data Standards and Terminology Subcommittee. Glossary of Wildland Fire Terminology. <https://www.nwcg.gov/glossary/a-z> . Accessed 2 March 2017.

Parsons D.J., P.B.Landres, and C. Miller. 2003. Wildland fire use: The dilemma of managing and restoring natural fire and fuels in United States wilderness. Proceedings of Fire Conference 2000: the First National Congress on Fire Ecology, Prevention, and Management: 19-26.

San Carlos Apache Tribe (2013) Restoring and maintain resilient landscapes through planning, education, support, and cooperation on the San Carlos Apache Reservation. Retrieved on 12/14/15. Available from: http://forestry.scat-sn.gov/publicweb/AZ_SCA_Report_Final.pdf

Schutt, R. 2012. Investigating the Social World: The process and practice of research. Seventh edition. Sage Publications. Thousand Oaks, California, USA.

U.S. Department of Agriculture (USDA), U.S. Department of the Interior (USDOI) (2009) Guidance for Implementation of Federal Wildland Fire Management Policy (GIFWFMP).

US Forest Service, 2014. US Forest Service: forest management. Washington (DC): US Forest Service FM ;[cited 2015 Nov 4]. Available from: http://www.fs.fed.us/forestmanagement/aboutus/index.shtml

Wagtendonk, J.W. 2007. The history and evolution of wildland fire use. Fire Ecology Special Issue. 3: 3-17.

Westerling A.L., H.G. Hidalgo, D.R. Cayan, and T.W Swetnam. 2006. Warming and earlier spring increase Western U.S. forest wildfire activity. Science. 313: 940-943.

**TABLES AND FIGURES**

Table 3.1 Respondent views of the current terminology which distinguishes two types of

fire, planned and unplanned ignitions (n=65).

| Job Position | Positive Views | Negative Views | Suggested |
|---|---|---|---|
| Resource Specialists | 11 | 25 | 14 |
| Decision Makers | 1 | 3 | 3 |
| Fire and Fuels | 3 | 12 | 14 |
| Total | 15 | 40 | 31 |

Table 3.2 Suggested terminology by resource value.

| Suggested Terms | Fire and Fuels Managers | Resource Specialist | Line Officers |
|---|---|---|---|
| Wildfire | 4 | | 1 |
| Wildland Fire Use | 6 | 3 | |
| Wildfire managed for multiple objectives | 1 | | |
| Prescribed Natural Fire | 1 | 6 | |
| Fire for Resource Benefit | 1 | | 1 |
| Appropriate Management Response | 1 | | |
| Managed Natural Fire | 2 | 1 | 1 |
| Managed Wildfire | | 2 | |
| Resource Benefit Fire | | 2 | |

**CHAPTER 5**

## Wildfire for Multiple Objectives: What do we call it?

### Introduction

Inconsistent terminology proves challenging as land managers discuss projects on public lands. Problems with wildland fire terminology have been documented before as a barrier to discussing concepts such as fire severity and fire hazard. The current terminology includes only prescribed fire and wildfire, which may be managed for multiple objectives. Multiple policy changes and updates have lead to this terminology which was previously titled prescribed natural fire and wildland fire use. Interviews of land managers in Northern Arizona were used to assess views of the current terminology. Respondents expressed concerns for the current terminology including its ambiguity and lack of clarity with regards to what the fire is being managed for. Respondent suggested terminology included terms with some sort of natural or ecological tone included. A few respondents did like the current terminology for its simplicity in classifying two types of fire (prescribed fire and wildfire) but did mention the need to discuss objectives when promoting wildfire for multiple objectives.

### History of Wildfire Terminology
- 1970's – Prescribed Natural Fire/Let Burn
- 1990's – Wildland Fire Use/Resource Benefit
- 2009 - Wildfire

### Concerns with Current Terminology
1. Vagueness – Respondents disapproved of having one term that could be used
2. Cumbersome – Due to short term, respondents noted that it often required a lengthy explanation which was seen as cumbersome
3. Frustration – Respondents indicated frustration over multiple terminology changes

### Positive Views
- Respondents liked the simplicity of calling it a wildland fire
- Respondents related their approval back to policy directives

**In Brief:**
- Although the current terminology may be seen as problematic, care should be taken when discussing wildfire for multiple objectives.
- Respondents indicated vagueness, cumbersome explanations, and frustration with a changing title as their main concerns for the current title.
- Respondent suggested terms included natural or ecological tones as a means to communicate the benefits of wildfire.

| Job Position | Positive Views | Negative Views | Suggested |
|---|---|---|---|
| Resource Specialists | 11 | 25 | 14 |
| Decision Makers | 1 | 3 | 3 |
| Fire and Fuels | 3 | 12 | 14 |
| Total | 15 | 40 | 31 |

| Suggested New Terms | Number of Respondents |
|---|---|
| Wildfire | 5 |
| Wildland Fire Use | 9 |
| Wildfire managed for multiple objectives | 1 |
| Prescribed Natural Fire | 7 |
| Fire for Resource Benefit | 2 |
| Appropriate Management Response | 1 |
| Managed Natural Fire | 4 |
| Managed Wildfire | 2 |
| Resource Benefit Fire | 2 |

# Wildfire for Multiple Objectives: Internal and External Obstacles in the Southwest

## Introduction

Decades of effective fire suppression and grazing have led to high fuel loading across the western U.S causing larger high severity wildfires. One option to treat high fuel loads is the use of wildfire started with natural ignitions. Management of natural ignitions during fire season poses both internal (within agency) and external (outside agency) challenges that fire managers must overcome. Through interviews we evaluated the internal challenges associated with implementation of wildland fire managed for multiple objectives in northern Arizona. Our results revealed multiple layers of complexity regarding the use of fire. Internal barriers include collaboration of resource advisors, competing objectives, and unclear policy. External barriers relate to public perception and smoke impacts to the public.

### *What is Wildfire for Multiple Objectives?*

Wildfire for multiple objectives (WFMO) is the use of natural ignitions to achieve resource benefit. This tool was previously titled as "Wildland Fire Use" and "Prescribed Natural Fire" in prior policy.

**In Brief:**

- Objectives are ecologically based and refer to specific resource values

- Internal barriers relate to the planning period and include collaboration of resource advisors, decision makers, and conflicting resource concerns

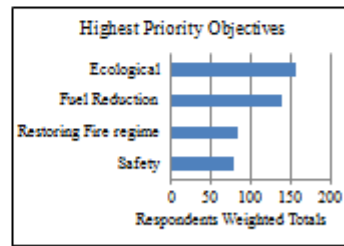- External barriers are largely made up by public perception and smoke impacts
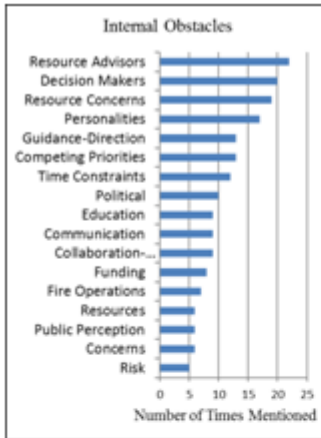
## Highest Priority Objectives

Respondents were asked to identify their priority objectives for WFMO, Figure a.

1. Ecologically Based: Respondents identified ecologically based objectives as highest priority overall including: nutrient cycling, forage production, watershed maintenance, among others.
2. Fuel Reduction: Fuel reduction was mentioned as second highest priority for Wildfire for Multiple Objectives in order to prevent future catastrophic wildfire.
3. Restoring the Fire Regime: Returning fire to a fire adapted ecosystem was important to respondents as most locations have been fire-absent for several decades.
4. Safety: Although safety was brought up as fourth highest priority, it was noted in interviews as being non-negotiable and inherent to any fire operation.



*Figure a:* Highest priority management objectives

**Internal Obstacles**

Internal Obstacles
(chart showing "Number of Times Mentioned")

1. Resource Advisors: Including resource advisors in a timely manner. Time constraints on resource advisors who have other projects beyond the managed fire.

2. Decision Makers: The capacity of decision makers to accept risk and choose to manage a fire for multiple objectives.

3. Resource Concerns: Working with multiple, often conflicting, resource concerns such as mitigating for T&E species, grazing allotments, archeological sites, etc.

4. Personalities: During the planning period, personalities can hinder the process if individuals are reluctant to work cooperatively.

5. Guidance-Direction: There is no guidebook or manual on how to manage a fire for multiple objectives and therefore the strategies and tactics are unique to each location.

6. Competing Priorities: Having multiple objectives proves difficult when prioritizing which takes precedent.

Figure b (top): Perceived internal obstacles to WFMO

Figure c (bottom): Perceived external obstacles to WFMO

**External Obstacles**

1. Public Perception: Maintaining positive public perception proved important as managers thought about these fires. Negative outcomes can drastically influence public perception.

2. Smoke Impacts: Smoke impacts will increasingly become important as these fires are increased in the future or as more agencies participate.

3. Closures: Trail, road, and area closures can have a large impact on the public and surrounding communities which must be taken into account.



External Obstacles
(chart showing "Number of Times Mentioned")