ABSTRACT:

Historical fire suppression efforts have led to the alteration of forest structure and fuel conditions across the United States. Correspondingly, managers are now faced with higher fuel loads and denser vegetation as well as growing forest communities and wildland-urban interface. While managers recognize the ecological benefits of fire and work to implement techniques that introduce fire back onto the landscape, lack of public acceptance and concerns have become a prominent management challenge. The principal objectives of this project were to: 1) Examine factors that were considered influential on public perceptions of smoke and 2) Identify management strategies that were regarded as useful for improving public acceptance and support for fire and smoke management. This was the first phase of a three year on-going study which will examine in-depth how communication programs and fire and fuel-related partnerships influence public perceptions and acceptance of smoke management practices. Phase one was designed as an opportunity to gain familiarity with research locations, meet and learn from individuals who had experience and knowledge relating to smoke and fire management, and gain a better understanding of the challenges and opportunities managers faced with public acceptability of smoke. Analysis of thirty-five semi-structured interviews with fifty-five participants conducted across four U.S. locations: the Fremont-Winema N.F. (south-central Oregon), the Kootenai N.F. (northwestern Montana), the Shasta-Trinity N.F. (north-central California), and the Francis Marion N.F. (central coast South Carolina) revealed common factors that contribute to public perceptions of smoke. Three broad categories emerged that were regarded as useful to managers for building awareness of smoke and fire management programs and improving tolerance of smoke emission. These categories include: 1) communication strategies, 2) local partnership involvement, and 3) inter-agency collaboration. The central conclusion from this study was that in order to improve acceptance and support for forest management, genuine dialogue and interactions with both the public and between managers needed to occur.

TITLE:

Influencing Public Perceptions of Smoke Management and Prescribed Burning Programs: An Analysis of Opportunities Existing in Communication Tactics, Community-Based Partnerships and Interagency Decision Making

Professional Science Masters Program Report

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INTRODUCTION

The operational practice of preventing and suppressing nearly all wildland fires described as the fire exclusion paradigm (Cohen 2008) has led to the alteration of forest structure and fuel conditions across the United States (NIFC 2009). Correspondingly, many forests have developed higher fuel loads, denser vegetation, and heightened levels of insect and disease outbreak (Schwilk et al. 2009). This forest change phenomenon has required managers and scientists to become more aware of the beneficial ecological role of fire on the landscape and thus management efforts are now shifting from strict suppression to a more holistic fire management strategy (Toman et al. 2006).

Even as management philosophy shifts, the decades of suppression efforts have inherently engrained fire exclusion principals into the cultural mindsets of much of the American public (Donovan and Brown 2007). Advertisement campaigns that depict fire as bad (most notably Smokey Bear) led to a public viewpoint that all fire is negative and therefore must be suppressed. Congruent to a lack of support for fire on the landscape is a marginal tolerance for smoke (Weisshaupt et al. 2005). Because smoke often travels distances further than that of fire, there is a great potential for societal impact beyond the actual ignition zone. Smoke production impacts air quality and aesthetics and because of this the public may be less likely to support fuel reduction activities which may include smoke impact such as prescribed burning (Weisshaupt et al. 2005, Winter et al. 2002 Loomis et al. 2001). While studies have shown a slow improvement in public understanding and support for fire as a management technique (Toman et al. 2004), the nature of public opinion and acceptability is unstable (Yankelvich 1991). In other words, acceptance is conditional and provisional and varies tremendously across management programs and scenarios. This deep-rooted public aversion to fire and associated smoke continues to be a very real barrier for managers.

A growing literature base suggests that public concerns relating to prescribed fire are a driving factor in determining social tolerability of smoke (Weisshaupt et al. 2005, Winter et al. 2002). Of notable concern are health implications (Ryan and Wamsley 2008, Brunson and Evans 2005, Loomis et al. 2001, Shindler and Toman 2003), diminished air quality, and lack of communication from management agencies (Weisshaupt et al. 2005). Identifying techniques that improve communication, enable the public to become more prepared for smoke impact, and mitigate concerns about fire and smoke may in fact prove instrumental for garnering public tolerance for fuel reduction methods that involve smoke emission (Shindler and Toman 2003, Manfredo et al. 1990, Loomis et al 2001, Winter et al. 2002).

Shindler and Cramer (1999) contend that dialogue with the public is an integral part of achieving social and political acceptance of forest practices. Yankelovich (1999) agrees with this stance and poses the theory that there is potential to change public opinion through dialogue because the process allows individuals to develop a grounded understanding of the issues. Whereas the concept of dialogue infers a component of communication, this does not mean that communication alone is enough to form a genuine dialogue among individuals. In order to do so, people must form relationships and endeavor to work together (Innes and Booher 2010). Resolving differences goes from simply solving a singular issue to actually working through the problem so that it does not resurface. Throughout the dialogue process, a context is formed in which parties in the future may be able to more effectively collaborate and work through new agreements (Isaacs 1999). Overtime, dialogue enables conflicting opinions or views to evolve into shared meaning and understanding (Innes and Booher 2010).

Although there is no uniform methodology for establishing open communications with the public about fire and smoke emissions, dialogue may be the most important part of any fire prescription for gaining long-term public support for fire management practices (Weisshaupt 2005). Innes and Booher (2010) suggest a set of necessary

conditions for dialogue to occur (Table 1) but contend that genuine interactions cannot be achieved through these conditions alone. Authentic dialogue is required in each new situation, a skill which typically requires training for both managers and participants (Innes and Booher 2010). Ultimately the responsibility of knowing how and when to engage the local public and promote awareness for fire and fuel related activities falls to managers. The ability to do so may be based on the capabilities and opportunities that exist within a specific region. However, it is through on-going and dedicated management efforts that the potential exists for meaningful dialogue to develop with a community which may in time improve public tolerance and support for fuel reduction methods.

Table 1: Conditions for Dialogue

1.) Incentive structure that encourages stakeholders to work toward agreement
2.) Effective leaders and sponsors
3.) Inclusionary decision making
3.) Dedicated staffing
4.) Negotiating text and evolving agreements
5.) Adaptive-ness

Project Goal

This project is the first phase of a three year on-going multi-regional study funded by the Joint Fire Science Program (JFSP) and Western Wildland Environmental Threat Assessment Center (WWETAC). Over the course of phase one, an in-depth analysis took place which focused on the structures and strategies that managers in various regions were utilizing to connect with the pubic regarding prescribed and wildland fire and corresponding smoke impacts. The particular goals of this project were to: 1) Examine factors that were considered influential on public perceptions and tolerance of smoke, and 2) Identify strategies that were perceived as the most beneficial and conducive to improving public acceptance for smoke producing forest management practices.

RESEARCH SITE DESCRIPTIONS

This study was conducted in communities in and near four U.S. National Forest locations (See Appendix B): the Fremont-Winema N.F. (south-central Oregon), the Kootenai N.F. (northwestern Montana), the Shasta-Trinity N.F. (north-central California), and the Francis Marion N.F. (central coast South Carolina). Detailed descriptions of the research sites follow.

South-Central Oregon and the Fremont-Winema National Forest

The communities of Chiloquin, Chemult and Klamath Falls (Klamath County) and Bly and Lakeview (Lake County) are encompassed by the 2.3 million acre Fremont-Winema National Forest (FWNF). The forest affords residents and visitors a wide range of recreational opportunities including but not limited to fishing, hunting, backpacking, hiking, camping, boating, snowmobiling and skiing (Freemont-Winema National Forest 2011).

Figure 1: Oregon Research Site

Klamath County is located in south-central Oregon, bordered on the southern side by California. The 2010 U.S. Census Bureau reported a population of 66,380. Nearly three-fourths of the county is forested land and over half of the entire county is publically owned (Klamath County Public Records 2011). Historically the economy relied on the timber and agricultural industries. By 1930, Klamath Falls had become the fastest growing city in Oregon and sawmills began to spring up around the region (Klamath County Museum 2010). However, environmental laws and revisions to national forest

management policies in the 1990's reduced timber harvests to a small fraction of what they were twenty years prior. Today only two mills remain in Klamath County. While agriculture and wood products are still important to the local economy, recent increases in manufacturing, tourism and technology have assisted in offsetting impacts from a reduction in timber practices (Klamath County Museum 2010).

Lake County, which covers roughly 8,275 square miles, is located directly east of Klamath County in the high desert region of Oregon (Lake County Facts 2011) and is home to 7695 residents (U.S. Census Bureau: Lake County 2010). The Economy is based primarily on agriculture, timber, livestock and government (Lake County Facts 2011). Over 78% of the land in Lake County is owned and managed by federal, state and county governments (Lake County Facts 2011). Similar to Klamath County, the forest products industry has experienced a decline over the last few decades.

The topography in and around Klamath and Lake Counties creates a pre-disposition for air inversions and stagnation, especially during the cold winter months. Klamath Falls is currently designated by the U.S. Environmental Protection Agency (EPA) as 2.5PM non-attainment. Once this label is in place, any type of smoke emission is heavily regulated, including wood stove use. Wood stoves provide a primary heating source for many homes in this region. High efficiency and pellet stove change-out incentive programs are being utilized to address the challenge of meeting air quality standards in both counties. Lakeview is actively working with the U.S. EPA to avoid receiving the non-attainment label.

Figure 2: Lakeview, Oregon

Vegetation in this area varies from mixed conifer forests on the eastern slope of the Cascade Mountains and transitions into a high desert ecosystem characterized by western juniper, sagebrush, forbs and grasses. In addition, there are two notable wetland areas, 51,000-acre Warner Wetlands in Lake County, and the 3,200-acre Wood River Wetlands in Klamath County. Fire season in this region normally runs from mid-May through mid-September (BLM Lakeview 2012).

North-Western Montana and the Kootenai National Forest

Libby and Eureka are encompassed by the 2.2 million acre Kootenai National Forest which is located in the upper northwest corner of Montana and northeastern Idaho, and is bordered by British Columbia, Canada (Kootenai National Forest 2011).

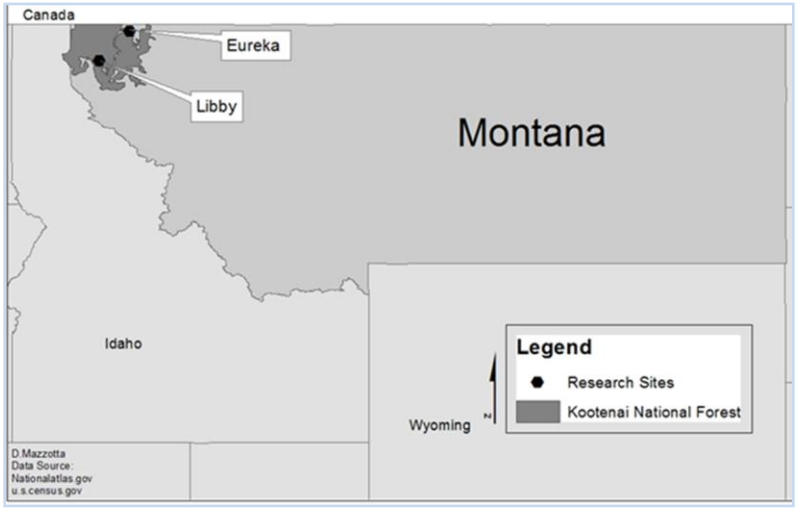

Figure 3: Montana Research Site

The town of Libby (Lincoln County) is home to 2630 individuals according to the 2010 U.S. Census Bureau. Historically, the community relied heavily on traditional industries such as mining and logging but has since shifted into a more service-based economy built around tourism and recreation (Libby Chamber of Commerce 2011). Yet, as of March 2011, Libby had a very high overall unemployment rate of 19.3%, a result of a series of local timber mill closures (City Data: Libby 2011). The most recent closure of Stimson Lumber Mill in January 2003 was the town's largest single employer (Libby Logging History 2011).

The local topography in and around the town of Libby puts this area at a predisposition for air stagnation and inversions, especially during cold winter months. This has contributed to a U.S. Environmental Protection Agency (EPA) air quality PM 2.5 and PM 10 non-attainment listing for this region (U.S.E.P.A 2012). Nevertheless, longtime residents reported significant improvement in air quality over the last decade.

Eureka, also located within Lincoln County, had a population of just under 1000 individuals as of 2009 (City Data: Eureka 2011). Situated seven miles south of the Canadian Border, Eureka is known for its mild weather, thus the nickname "the Banana Belt" of Montana (Eureka Chamber of Commerce 2011). Local topography in and around the town include both flatland and mountainous regions, but unlike Libby, air stagnation and inversions are not as problematic here and the town of Eureka is within EPA air quality guidelines. Eureka has a rich history imbedded in the timber and natural resource industry and similar to Libby, a decline in timber harvest and mill closures over the last twenty years has made substantial negative impacts on the local economy.

Spanning the distance between Libby and Eureka is Lake Koocanusa, a 90 mile-long reservoir which reaches northward into the Canadian Rockies. This region of the National Forest is designated as a scenic byway and is dominated by high craggy peaks, rugged terrains and deep river valley. The region expanding toward Eureka is more open with gently rolling timbered hills (Kootenai N.F. 2011)

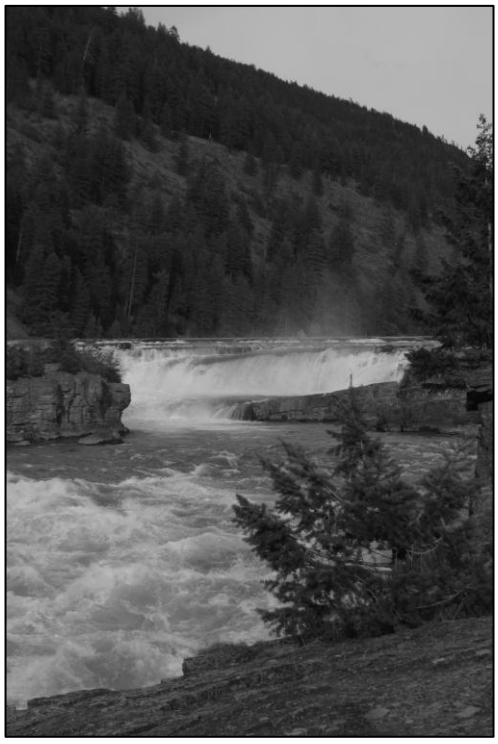

Figure 4: Kootenai River, Montana

Northern California and the Shasta-Trinity National Forest

The communities of Mt. Shasta, Redding, Weaverville and Hayfork are located in Shasta, Trinity and Siskiyou Counties in California. Over half of the land base across these counties is under state or federal ownership; Trinity County as high as 72%, while Shasta County is 40% public lands (California DOT 1995). The largest urban center, Redding, is centrally located to the Shasta-Trinity National Forest in Shasta County.

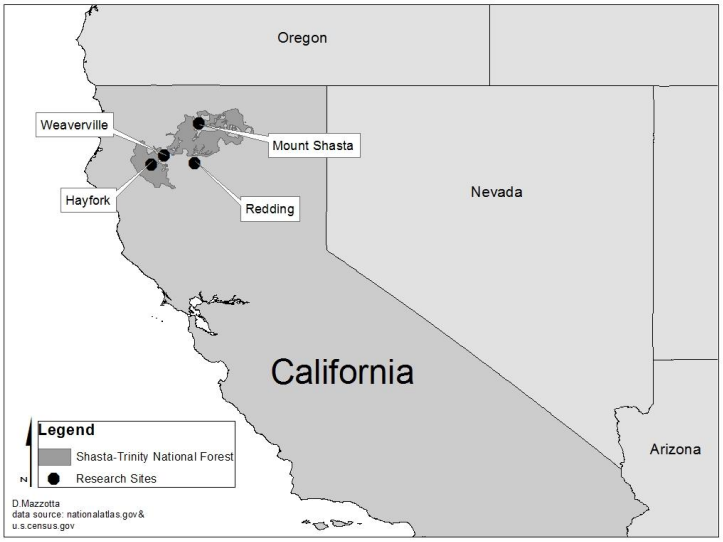

Figure 5: California Research Site

This region is surrounded by the Shasta- Trinity National Forest (STNF) and is the largest in California, at nearly 2.1 million acres. The STNF is managed for multiple objectives including enhancement of wildlife habitat, timber production, healthy watersheds and mitigating wildfire risk. The STNF supports activities such as hiking, horseback riding, camping, boating, fishing, snowmobiling and skiing; making the forest an economical and recreational asset to this region (Shasta-Trinity National Forest 2011).

Air quality is managed in California across three governance levels; the Federal Environmental Protection Agency, the State of California Air Resource Board and local air pollution control districts (California DOT 1995). In conjunction with national governance, fire protection and fuel management is administered through the California Department of Forestry and Fire Protection's CAL FIRE program which responds to more than 5,600 wildland fires that burn over 172,000 acres each year (CALFIRE 2011).

Environmental laws and revisions to national forest management policies in the early 1990's have reduced timber harvest in this region. The resulting loss of timber industry jobs has subsequently depressed many of the rural economies.

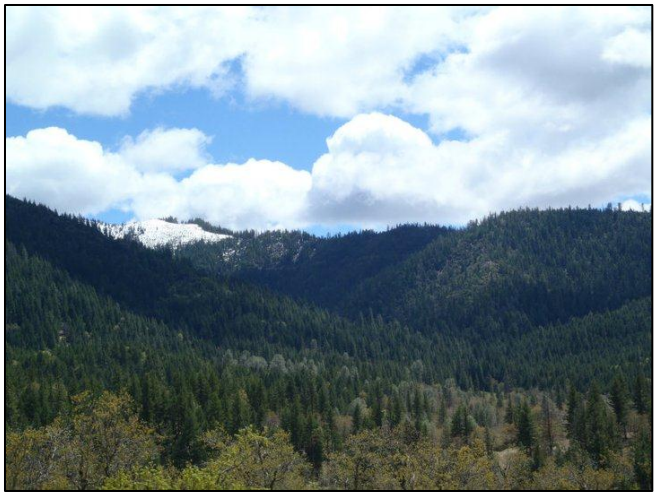

Figure 6: The Shasta-Trinity, California

Dry summer months frequented by lightning storms makes this region especially prone to wildfire events. The average return interval for large scale wildfire is approximately every ten years in the Shasta-Trinity region. The National Forest is marked by roadless wilderness areas, steep gradients and thick forests making fire management particularly challenging.

Central Coast South Carolina and the Francis Marion National Forest

Charleston, Awendaw, and Mount Pleasant (Charleston County), Columbia (Richland and Lexington County) and Cordesville (Berkeley County) are located in and around the Francis Marion National Forest (FMNF). The Forest was officially designated in 1936 and encompasses more than

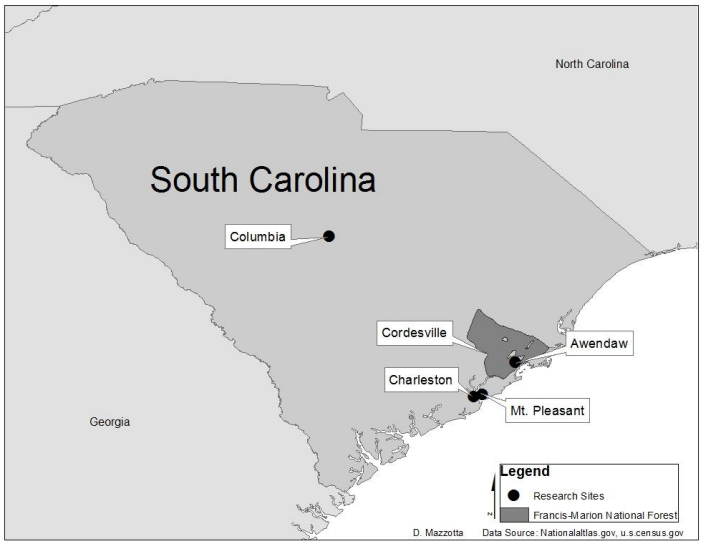

Figure 7: South Carolina Research Site

259,000 acres across the coastal plain of South Carolina. Served by the Francis Marion Ranger District, this region is situated between two major metropolitan areas: Myrtle Beach and Charleston. The Francis Marion exhibits an extremely diverse ecosystem, ranging from pine stands to bald cypress forests that are characteristic of the region's swamps and marshlands. This National Forest offers an array of recreational opportunities for the public including hiking, biking, motorcycle riding and canoeing (Francis Marion National Forest 2011).

Unlike the west coast research locations, three of the towns selected in South Carolina are heavily populated and are considered urban. The capital city of Columbia is the largest city in the state with a population of 129,272 (U.S. Census Bureau: Columbia 2010). Following in population size are: Charleston at 120,038 (U.S. Census Bureau: Charleston 2010), Mount Pleasant at 67,843 (U.S. Census Bureau: Mount Pleasant 2010), Cordesville at 4,362 (city data: Cordesville 2007) and finally Awendaw at 1,215 (city data: Awendaw 2009).

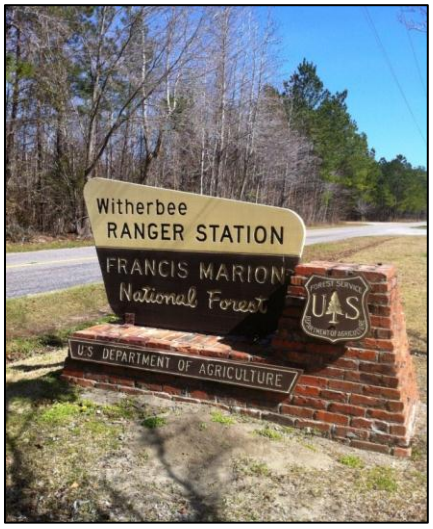

Figure 8: The Francis Marion, South Carolina

In 1989, winds from Hurricane Hugo leveled more than a third of the forest in this region. The resurgence of young trees and understory shrubs after this event heightened the threat of catastrophic fire. Faced with the unprecedented problem of disposal of the dense vegetation, management agencies have implemented chipping operations. Today the excess material continues to be utilized as a biomass energy source for local power production (Francis Marion National Forest 2011). Prescribed burning is also frequently used in FMNF for longleaf pine restoration (USFWS 2012).

METHODS

The methods described here were those utilized in the first phase of the three year study. Phase one consisted of one calendar year and was designed as an exploratory study in which possible project sites were researched and selected, site visits were performed and interviews were conducted with key individuals. The first phase of this project was designed as an opportunity to gain familiarity with research sites and communities, to meet and learn from individuals who had experience and knowledge relating to smoke and fire management, and to gain a better understanding of the challenges and opportunities managers in these regions faced in regards to public tolerance of smoke. Data collected during this stage will be utilized to design the second and third project phases. Information on the second and third phases is located in the full project proposal (Appendix A). From this point forward, reporting will be focused on project phase one only and will not reference later phases.

Selection of Study Sites

Specific criteria were developed (Table 2) as groundwork for the identification of suitable research locations. Once possible locations were identified, key informants at each location assisted the research group in validating the appropriateness of the site for the study. The research team intentionally targeted sites where managers used a variety of communication strategies, the communities had varying degrees of preparedness for wildfire, and community-based partnership efforts for forest health existed. Final locations selected represent a variety of geographic, ecological, economic and social regions.

Table 2: Criteria for Research Site Selection

Region had not been intensively studied in fire or fuel related research
Communities within or in close proximity to a large national forest
There had not been a recent major wildland fire event

Visits to each of the research locations occurred over a five month period in 2011. The dates for these visits are as follows:

1. January 23 - January 27 Klamath and Lake Counties, OR
2. March 2 - March 5 Charleston, Richland, Lexington, and Berkeley Counties, SC
3. April 19 - April 22 Lincoln County, MT
4. May 17 – May 20 Shasta, Trinity and Siskiyou Counties, CA

Sampling Design: Selection of Research Participants

Participant selection followed a critical-case sampling approach (Robson 2002). Based on this approach, individuals were chosen who possessed key knowledge, were able to address the research topics and provided variability in perspectives and experiences with smoke. A snowball sampling technique was utilized to connect with additional key individuals. Interviews were conducted at each research location until no new information was being discovered, suggesting that the necessary data to answer the research questions had successfully been collected (Robson 2002).

Interview participants had either forest and land management backgrounds, air quality or policy regulation backgrounds or were involved directly with citizen engagement and communication. In all, thirty-five interviews were conducted with fifty-five participants across the four research sites (Table 3).

Table 3: Interview Participant Roles

(5) Environmental Non-Governmental Organization
(6) Air Quality
(2) Local Governance
(29) State or Federal Agency
(8) Private Landowner
(1) Local fire protection
(4) Timber Industry
(55) Total number of participants across four locations

Interview Process

A sixteen question semi-structured interview instrument (see Appendix C) was used during each interview meeting. Questions on the interview instrument addressed the following topics:

- the participant's role within the fire and smoke community
- general perspectives about smoke
- current concerns and perceptions of public acceptance levels
- recognition of risks and benefits and willingness to accept tradeoffs (e.g., between forest health and planned and unplanned smoke emissions)
- identification of local partnerships or collaborative efforts pertaining to smoke or fire management
- identification of communication strategies and public awareness tactics used in relation to smoke

Interviews were held in both singular and group formats, each averaging one hour in length. These were administered in a semi-formal fashion which encouraged participants to engage in a conversation pertaining to specific questions. Not all questions on the interview instrument were addressed in every interview. Rather, questions were selected based on their applicability and relevancy for each interview participant. When permissible, interviews were recorded and later transcribed.

Data Analysis and Reporting

Interview transcriptions and notes were analyzed using a standard interpretive coding technique (Robson 2002) which subsequently revealed key themes relative to this study. Following a similar coding technique, a second researcher from The Ohio State University completed an independent analysis of the interview transcriptions and notes. The emergent themes from both researchers were compared between coders to check for

inter-coder reliability. The results were cross-checked and validated by the rest of the research team.

Upon completion of the interview analysis, individual reports were developed for each of the four research locations. These reports include a short background section on the research site, general observations and impressions from the researchers that participated in the site visit and interview process, and a summary of research findings. The reports will be presented to the Joint Fire Science Program and will eventually be made available to research participants and interested publics in the respective communities.

RESULTS

The purpose of this study was to identify trends that appeared to impact public perceptions of smoke and smoke management, and to identify management interventions which could potentially improve tolerance and acceptance levels. The following is a synthesis of relevant findings from the four research locations taken as a whole. Location specific findings can be seen in Appendix D. Results are presented here in four categories: 1) public perceptions of smoke and forest management practices, 2) communication strategies, 3) local partnership involvement, and 4) inter-agency collaboration.

Public Perceptions

When site visits began, the research team anticipated that perceptions and tolerance of smoke would be influenced by emissions from prescribed and wildland fire sources. However, respondents indicated that emissions from wood burning stoves (as a home heating source) as well as agricultural and trash burning also played a significant

role in air quality and smoke production. Accordingly, the research team addressed these emission sources during the interview process when relevant.

From the analysis, three broad categories of factors emerged that interview participants considered as contributing to public perceptions and tolerance levels for smoke: 1) agency/industry practices and regulations, 2) concerns about fire and smoke impact and, 3) sociological, historical and ecological considerations (Table 4). Findings reported under each of these categories were factors that were most commonly identified across research locations.

Table 4: Factors Thought to Influence Public Perceptions and Acceptability of Smoke

Agency/industry practices and regulations

- Forest service plays by own rules, if smoke is involved it is always the Forest Service (public lack knowledge for agency boundaries and roles)
- Burn regulations for agency/industry vs. public seen as not fair (lack of understanding for regulations)
- Agencies do not show genuine concern for smoke impacts on communities
- Smoke seen as a sign of wastefulness, timber resource could be utilized in a different way

Concerns about fire and smoke impact

- Health repercussions from smoke
- General safety (smoke impacts on roadways, hazard from fire)
- Fire getting out of control
- Being liable for an escaped fire/property damage
- Negative impacts on recreation and commerce from smoke

Sociological, historical and ecological considerations

- "Locals" perceived as having a better understanding of the need for fire on the landscape
- Influx of newcomers into the regions (lack knowledge of the ecological and social landscape)
- Smoke impacting air quality (especially in non-attainment areas)
- Timber industry legacy – negative correlation to FS from historical timber harvesting regulation during T&E controversies

While it appeared these factors influenced perceptions of smoke, perceptions also appeared to reflect location-specific management practices and history. Regions where managers seemed to have more trust from the community generally reported less resistance to management programs. A forest manager from Montana comments on previous forest management efforts:

> *"It is the credibility and the foresight of the previous managers saying this is going to be an issue and we need to deal with this. They took the bumps so that we can be successful. They [previous managers] make our lives a lot easier now. The experience of the two FMOs that were here a long time really paid off. They didn't lose a lot of burns; they had a long successful track record that didn't have big escape fires that burnt up houses…. [the public] are used to it."*

Communication Strategies

One of the mostly commonly identified challenges from the interview analysis was participants not knowing if communication messages were reaching the intended audience. Across research locations, varying degrees of both one-way and interactive communication tactics were utilized to deliver information (Table 5). It was discovered that while one-way communication tactics were regarded as a relatively easy way to provide public notification to a large number of people, they were also viewed as not necessarily effective for providing educational information. In some cases, managers felt that providing background information on smoke and prescribed fire was as important as the actual notification. This was especially true in communities that had growing populations from an influx of new-comers to the region. Interview participants commonly stated that they felt transplanted residents lacked an understanding for forest management practices and were unfamiliar with the ecological need for fire on the landscape. Communication tactics that provided the opportunity for members of the public to ask questions and clarify uncertainties were beneficial in developing understanding of forest

management. While one-way tactics did provide relevant information pertaining to fire and smoke emission, these tactics lacked the ability to connect the public to their local forest managers. This face-to-management association was regarded as a critical component in developing and maintaining public support for management practices.

Table 5: Identified Public Communication Tactics

One-way /Unidirectional

- Newspaper and other media print
- Flyers or Brochures
- Radio announcements
- Television announcements
- Road signage
- Websites
- Hotline
- Reverse call system

Two-way /Interactive

- Tabling or presentations at public events
- School programs
- Community field trips
- Face to face discussion
- Information trap lines
- Personal phone calls
- Open houses
- Public meetings

While lack of fire and smoke experience associated with new comers was frequently discussed, there was also the sentiment that people that had lived in the region for an extended time were more familiar with management techniques and thus were more apt to tolerate smoke and prescribed burning. When discussing this community change, a Forest Service manager in Oregon made the following comment:

> *"What we are up against now is a lack of knowledge by the publics that are not associated with the forest……it used to be everyone had a relative that worked for the Forest Service or else they worked for it themselves. But I don't think that is the case anymore. There are a lot of retired people or new people that have no ties to the Forest Service"*

Lack of understanding for burn regulations and policies were also considered by interview participants to be further reasons for public unwillingness to support prescribed fire. Members of the public were often confused when restrictions were in place for

private burning yet they would still see smoke being put up into the air. Although the smoke source was not always clear, interview participants felt the public commonly associated this smoke with the Forest Service. This mentality was often described as "why is the Forest Service burning but no one else can?" Many forest managers felt that personal interaction and communication with the public was useful for creating public understanding of burn windows and regulations. Interfacing with managers was thought to improve understanding of how and why management decisions were made. Although more time was required to implement interactive communication strategies, many of the interview participants were willing to make this tradeoff. Referring to the time verses benefit of personalized communication, a private industry forester commented:

> *"I find it is more effective to meet with rural people on their ground; most of the time they are just curious. Going out spending time kicking gravels pays the dividends… It does eat up time but it also eats up my headaches later on down the road"*

Some interview participants expressed the opinion that investing in personalized communication efforts prior to burning helped the public to feel more informed. It seemed that the public was willing to accept short-term smoke impacts because they felt the agency had considered implications to the community and had taken the precautionary measures. A Forest Service manager interjected that from his experience, the public was tolerant of smoke so long as they were informed about what to expect and also knew that the duration would be minimized:

> *"People what to know that you care and they want to know what is going to impact them. By making that contact, it shows you care and then it is easier for them to say 'well we know they will be impacting us.' They accept that it will only be a day or so and then they tolerate it."*

Communication Traplines

Although the development of positive relations with the public seemed to evolve out of face-to-face interactions, the reality in many cases was that resource constraints did not always provide managers this opportunity. In response to limited time and staffing, a handful of managers disclosed that they utilized "traplines" as a technique for delivering information to their community. Key messages or notifications were strategically communicated to selected individuals (or organizations) within the community who were publicly well known or trusted. These individuals then relayed information to others whom they were acquainted with. One air resource manager found success by providing air quality advisories to acquaintances in management roles. These individuals relayed information onto their employees. She explains:

> *"I make sure I disseminate as much information as I can. I have a friend that works at the prison; every one of his employees gets air quality information. He encourages his employees to follow the advisories. The hospital is another big employer; I make sure they get information as well. I am just touching base with as many people I can. I use management [staff] to reach out to their employees."*

A forest manager in a different community used a similar technique for disseminating fire and smoke information. In the interview, this manager told the research group that he took time to train staff members on how to identify and capitalize on this method.

> *"If we have a large wildland fire, we do an excellent job of setting up communication traplines through public information officers….Who is that one person that you know if you talk to within an hour there are going to be 100 other people that are going to know? I am still training the team to be thinking about the trap lines."*

While traplines provided a strategy to reach a large number of individuals, it became apparent that the unifying factor for any type of communication strategy was timing. Many managers felt there was a fine balance between how much information to disclose and how early the public wanted to hear it. While some interview participants expressed concern for the public disregarding information because it came too early, the majority felt that providing information too late in the game carried far worse consequences. One of the largest perceived risks from not providing information in a timely manner was loss of public trust. The consensus seemed to be that early-on notification was imperative, as was the continuation of communication during fire and smoke events.

Community-Based Partnerships

Across research locations, many forms of community-based partnerships and collaborative efforts were identified. However, during the analysis process particular attention was given to partnerships with agency representation as this provided a basis for determining if or what management benefits could be derived from partnership efforts.

Partnerships that were identified in the study varied in organizational assembly and participant size. While some community partnership groups had been meeting for over a decade and were characterized by well-defined goals and objectives, others were in the preliminary stages of formation. Furthermore, the purpose behind these community-based partnerships varied widely. Some groups had formed out of a singular need or in response to a specific project, while others were formed under a contextual basis (such as forest health or air quality). The Klamath-Lake Forest Health Partnership group in Oregon provides an example of a long standing community-based group. This group operates under a mission to promote forest health across Klamath and Lake counties and is comprised of federal, state, conservation and private landowner

representatives. Regular meetings attended by participants assist the group in sharing ideas, identifying funding sources, and prioritizing local needs and projects.

Predictably, many of the groups that were observed had individual successes and challenges associated with their specific region and/or particular mission. However, a unifying similarity across these groups emerged; intentional representation of multiple interests. The most commonly noted benefit was the addition of diversity into the groups' communication and decision making processes. Members indicated that when a wide range of interests were brought to the table, the spectrum of concerns was easy to identify. Decision making became more inclusive. In discussing a meeting that brought together a group to talk about prescribed burning in South Carolina, an air quality manager made the comment:

> *"We really wanted all those varied perspectives to start this discussion….Sitting around the table we realized we needed to talk with community members and at the same time we need all of our partners and stakeholders that have an interest in prescribed burning. That includes a lot of people."*

A forest manager in Oregon described how developing a partnership with the local tribe assisted in not only improving the relationship between the agency and the tribe, but also improved support for management efforts:

> *"In the last couple of years we have worked with the tribe very closely and they are actually helping us to develop projects. We have a new tribal forester. We have biologists. They are out here on the ground helping us. It is really great to see. I have been here since 1984. Seeing the history of conflict, even to the point of lawsuits to turn around and see now where we are. They are right on board with us. They are sitting in on our id teams and are filling in with us, saying yeah let's get this going."*

Finally, some interview participants discussed the benefit of outside support derived from their partnership. Having affiliations with multiple interests provided access to communication lines, opened the opportunity to receive monetary support from sponsors, and provided a potential means for establishing positive relationships with individuals and organizations that could contribute to management goals and efforts. In specific circumstances, this outside support proved to be an invaluable asset to assist in negotiating appeals and even avoiding litigations. A community based group from Oregon found success by developing a positive reputation with distant environmental groups. When the challenge of litigation arose, these acquaintances were willing to support and back the partnership's mission.

> ***"****It really helps upfront to have folks helping you and to get that support. In some cases we've even had people calling up other environmental groups and saying 'hey we've worked with them and this is a good deal what they are doing. Don't harass them on this. We have been on the ground with them, we have helped them develop it, we've asked questions and we know what they are doing is good. Back off.' In the long run it makes it simpler and more effective to get the things that we want to get done out there."*

Inter-Agency Based Collaborative Decision Making

Several forms of inter-agency collaborative efforts were seen across research locations. Throughout the study, the most commonly observed collaborative arrangement was an inter-agency based effort that included federal, state or local government representation in response to smoke emission, air quality, and fuel and/or fire hazard reduction. While these efforts seemingly opened up communication lines within and among agencies, there appeared to be additional public benefits from this behind-the-scenes collaboration. A handful of interviewees reported that in the past, conflicting and

potentially confusing messages about prescribed burning had been unknowingly developed by different agencies and delivered to the public. To avoid this issue in the future, public communication and outreach was discussed during meetings. Messages were collectively agree upon prior to delivering at the public interface. By doing so, participants perceived that contradictory messages were more likely avoided. In respect to this same issue, a forest manager at a different research location discussed how he and the local air quality official together developed presentations regarding prescribed fire. Both individuals would attend public events and deliver presentations side-by-side. A different participant in an air quality management role also recognized the need for this effort. This individual referred to cross-agency public communication as the development of a hybrid message. She explained one of their methods:

> *"On our website for open burning we put a link to prescribed burning so it doesn't just indicate a circle with a mark across it for burning. We recognize the benefits of prescribed burning on our website and then link [the public] to other sites…[By doing this] it does not look like we are saying things that conflict each other, instead you got to tell the whole story."*

Maintaining communication lines with forest and air quality personnel provided the additional opportunity for managers to make more informed prescribed fire and smoke management decisions. By participating in collaborative efforts, they became aware of surrounding burn projects and thus could make management determinations by considering these outlying factors. Collaboratively-based burn decisions were considered a strategy for reducing the probability of inundating the public with smoke. The Northeast Air Alliance out of California provides an example of a joint-decision making model in which members actively participate in collaboration through open communication and information lines. The group connects through daily conference calls during burn season and an email-based list serve throughout the year. Members report on planned burn projects through a standardized protocol and the group then collectively

makes decisions as to who will go forward with plans. Information about weather patterns provided by air quality managers assist the group in determining whether or not to move forward with a burn project on a given day. A member of the group commented:

> *"The group, the burners, the land management – federal, state… private people, forestry companies, air quality districts, county representatives, all these different people and we all work together to provide information about what is going on and who is doing what so we can coordinate to minimize impacts to communities as much as possible"*

While time commitment was frequently mentioned when discussing participation in collaborative efforts, managers were generally willing to make this trade-off in exchange for the perceived benefits.

> "*Sometimes it is a little cumbersome to spend a half an hour listening to burns in southern California that you don't care about but it is worth it because I think it is the single most important thing we do when we are getting ready to give authorization for a burn. You get to talk to the meteorologist, the air districts, the board and the other burners. You can kind of get a good feel for how high the stakes are for burning that day. I think it is probably the best tool that we have." (North-East Air Alliance Member).*

DISCUSSION

This study identified factors that contributed to public perceptions of smoke and smoke management. In addition, management tactics were identified that were utilized to inform the public about smoke and fire. Identifying and discussing these tactics helped to reveal strategies that were considered useful for increasing public support for forest

management. The multi-regional design provided an opportunity to assess public perceptions and management strategies on a larger scale, ultimately allowing for a comparison of tactics across regions. Several important points emerged.

First, there was recognizable need for interactive communication, especially when it came to providing educational information for fire and smoke management practices. Many of these communities had an influx of newcomers, suggesting that a number of these individuals may lack an understanding of local management practices and relationships with agency employees. Prior research suggests that this lack of long-term relationship may be associated with low levels of management acceptance (Olsen & Shindler 2010). The use of interactive tactics provided the opportunity for managers in these locations to interface with the community, which ultimately has the potential to increase public understanding of and support for fuel and fire management (Toman et al. 2006).

In addition, promoting discussion about smoke and fire management has the potential to increase acceptance (Weisshaupt 2004, Loomis et al. 2001). Engaging in conversation generally makes people feel more informed; they are able to voice concerns and process information during a conversation. Findings from this study indicated that communication traplines were perceived as an effective strategy for relaying information about smoke and fire. Delivering information to a large number of people with minimal efforts may be one reason traplines were so highly regarded. Even though individuals were not receiving information straight from an agency source, the information was still delivered in an interactive fashion, providing a chance for receivers to engage in a discussion about the situation. If an information provider was well known or respected in the community and displayed acceptance themselves, it may be likely that a receiver could develop the same perspective. Information traplines could be a potential strategy for making public outreach messages travel faster and further within a community.

Second, this study showed that partnership groups brought a diverse set of people together, opened up communication lines and helped to establish outside resources and support. The most important implication of this finding was the potential for developing dialogue with stakeholders about management decisions and practices. With dialogue, concerns can be collaboratively identified and discussed, which can lead to the establishment of common ground between stakeholders (Wondolleck and Yaffee 2000). In doing so, uncertainties can be resolved and eventually, solutions can be identified that are mutually agreeable (Innes and Booher 2010).

Increasing resources from partnership efforts can, for managers, mean opportunities to access communications lines, make connections with a community, and gain information that may improve management efforts. In many situations, there may be chances to expand funding opportunities or scenarios in which limitations from property boundaries are dissolved. An increased resource base may also offer the potential for managers to accomplish projects on a larger scale or in a timelier way.

Finally, findings revealed that inter-agency collaboration provided managers the opportunity to discuss public outreach messages, to share information, and collectively resolve management decisions. In doing so, agencies may appear more uniform and organized in the public eye. Mark Brunson (1992) noted that when the public perceives mixed messages from who they think should be "experts" they are likely to disbelieve all of them. The result is loss of public trust in the legitimacy of management institutions (Innes and Booher 2010). By discussing public outreach messages prior to delivering at the public interface, there is less likelihood for contradiction between agencies.

Additionally, using a collaborative decision making process to agree on burn plans can assist managers in reducing smoke impacts on communities. Being more aware of what is occurring on surrounding forests and lands provides managers an opportunity to make decisions that are contingent on surrounding conditions. Less conflict develops

at the public interface because smoke impacts are managed in a holistic way. Overtime this can build credibility with the public because they become more confident in management decisions and actions.

Lastly, collaboration among agencies provides an information resource for managers. There are opportunities to share experiences and expertise. Using others' input may give managers a chance to positively influence their own decision-making process.

MANAGEMENT RECOMMENDATIONS

This study has shown that overcoming barriers to acceptance for management practices that include fire and smoke can be a true challenge for forest and air quality managers. Adhering to a one-size-fits all model for pubic interaction is unrealistic; no two communities are the same and often additional factors are at play which can dictate public perceptions and acceptability. Awareness of these factors is useful when deciding what tactics are practical for a specific community. With this in mind, the following considerations and recommendations are intended for individuals in management and public outreach roles. These recommendations were not only derived from findings reported in early sections of this report but also from location specific findings, literature review, personal accounts and informal conversations with professionals in the fire and fuel community and with members of the general public.

Evaluate Communication Plans

Is there currently a communication plan in place to provide public information about smoke, fire or forest management practices? Organization and upfront planning for communication is an essential component for success in communication campaigns. This study showed that without a plan in place, public communication and engagement is

often overlooked, especially when unplanned events occur. Detailed planning for all aspects of communication and outreach (who, what, when and how) puts staff members on the same page and clarifies agency-wide expectations as to how public interactions should be upheld. Managers may want to consider the following:

What resources are currently available?

Identify access to communication traplines, newsletters or other media, road signs, webpages, etc. Is there a way to combine communication efforts with other organizations? Often, resources are underutilized or not realized. Taking an inventory of existing resources may help to identify ways to improve communication lines without large monetary investments.

Who is responsible for maintaining communications with the public?

Forming genuine connections with the public is a special talent that not everyone possesses. Staff that is responsible for communication and outreach should have strong leadership personalities that resonate with the public (see Shindler & Gordon 2005). Investing in staff and providing the resources to train and support these individuals may prove invaluable for improving public understanding and acceptance of forest management. Consider public events or informal gatherings (such as community BBQ's or school-based events) as an opportunity to form relationships with the public. When distributing information to a large number of individuals, attempt to identify communication traplines. Are there key individuals in the community that are well known or trusted? Who are the individuals that are most likely to spread information? Establish relationships with these individuals and provide them with public information. Ask them to pass messages along.

Invest Time in Community-Based Partnerships

Participation in community-based partnerships may be a critical tool for managers to consider for improving public relations and developing genuine dialogue with stakeholders. Involvement with these groups allows managers to increase their awareness as to what local residents find acceptable. Consider reaching out to groups with not only similar goals but also consider groups with dis-similar interests. Investing in a partnership and taking time to listen to stakeholders may lead to common grounds that could provide an opportunity for navigating conflict.

In addition to forming new partnerships, managers may want to identify existing partnerships in the community. Is there a potential to become involved? Often partnership groups have local ties and existing communication lines that can be utilized to deliver information and build connections. Throughout the partnership, it is important to be aware of the needs of other members but also to clearly express agency management efforts and goals.

Collaborate with Other Agency Personnel

Discuss public outreach efforts with other managers

Consider targeting not only managers with similar goals but also those who may oversee policies and regulations. Agree on what messages should look like before they reach the public. By doing so, messages can be intentionally designed to not contradict one another. Public messages become more uniform and thus are generally easier for the public to understand and trust.

Identify a method for collaboration

If not already established, consider a method for connecting forest and air quality managers together on a regular basis. This can be through email based correspondence, conference calling or even annual meetings. This provides an

opportunity to discuss management plans and in some instances collaboratively agree on what plans should progress and when. This opens the opportunity for managers to gain a better understanding of surrounding conditions and management protocols. Communicating regularly was considered key to maintaining inter-agency collaboration. Whereas occasional phone calls or emails may serve purpose, providing regular updates and voicing concerns keep managers on the same page with one another.

CONCLUSION

Smoke emissions from prescribed and wildland fire will continue to be a challenge for managers. This study has shown that there are a number of factors which are considered influential on public perceptions of fire and fuel related management practices. Since public perceptions also influence acceptability and tolerance levels for smoke, understanding the basis from which these perceptions developed may be the first step in deciding what management actions and communication tactics are most appropriate for improving acceptability in a particular community.

As seen in this study, interactive communication tactics, partnership development and interagency collaboration may be strategies that could be utilized by managers to build public awareness on issues related to smoke management. These same endeavors have the potential to assist in the development of meaningful and trustworthy relationships with citizens, communities, and amongst the fire and smoke management community. Overtime, these actions may translate into improvements in support for management practices. The fundamental conclusion from this study is that in order to improve tolerance and acceptance of smoke, interactions with both the public and between managers needs to occur. Investing time in the dialogue process may be a key to productive interactions with one another. Rethinking both internal and external

communication strategies and re-assessing resource bases may offer insights on how to facilitate worthwhile interactions. While resolving to make these endeavors is important, more important is following through on this determination over the long run.

BUSINESS REPORT

The Joint Fire Sciences Program

This research project was part of a larger on-going study funded by the Joint Fire Science Program (JFSP). This section offers background information on the JFSP, provides a brief overview of marketing tactics, discusses JFSP budget strategies and concludes with specific funding, budgeting and organizational information for the larger study project as a whole. Much of the information to follow was obtained from the Joint Fire Science website located at www.firescience.gov/.

Program History and Structural Organization

The Joint Fire Science Program (JFSP) operates in an interagency framework to support the development of information and tools to assist land managers with wildland fuels issues. Initial funding for the program was appropriated by Congress in 1998. The program is now jointly funded by the Departments of Agriculture and Interior. Six federal land management and research organizations comprise the foundation for the JFSP including the USDA Forest Service and five bureaus from the Department of the Interior: Bureau of Indian Affairs, Bureau of Land Management, National Park Service, U.S. Fish and Wildlife Service, and the U.S. Geological Survey.

In addition, more than 90 colleges and universities have also collaborated on and partnered with JFSP-sponsored research projects. JFSP engages masters and doctoral candidates in projects to develop training experiences for future resource managers and scientists. This collaboration also extends into private, non-profit organizations and tribal,

state, county, and local governments as well. In all, nearly 200 organizations have become partners with the JFSP.

Board of Directors

The governing board for the JFSP is comprised of ten members. Five members are from the Forest Service and one member each from the Bureaus of Land Management, Indian Affairs, Fish and Wildlife Service, Park Service, and the U.S. Geological Survey.

JFSP Regional Consortia

The JFSP program has provided funding for fourteen Regional Consortia (Figure 9). These groups are comprised of local experts that help to connect managers, practitioners, and scientists to information and resources. They collaborate with the JFSP to provide sources of best available fire science information and demonstrate new knowledge in the field.

Figure 9: JFSP Regional Consortia

Marketing for Research: a Means for Delivering Science

To meet the needs of agency partners, the Joint Fire Science Program's primary goals are to identify and provide information and technological support needs for wildland fuel management programs across agencies. The JFSP operates under four mission statements to achieve these goals (Table 6).

Table 6: Joint Fire Science Mission Statements

- Provide credible research tailored to the needs of fire and fuel managers
- Engage and listen to clients and then develop focused, strategic lines of new research responsive to those needs
- Solicit proposals from scientists who compete for funding through a rigorous peer-review process designed to ensure the best projects are funded
- Focus on science delivery when research is completed with a suite of communication tools to ensure that managers are aware of, understand, and can use the information to make sound decisions and implement projects

Products and Services

The JFSP offers a spectrum of products and services designed to provide forest and fuel managers access to best available fire science information. Some of these products and services include:

- ✓ Virtual workshops and webinars
- ✓ Smoke management resources and tools
- ✓ Prescribed fire management resources and tools
- ✓ Access to the fire community
- ✓ Software and fire/smoke modeling information
- ✓ Discussion forums
- ✓ Scientifically and technically researched fire and fuel information

Marketing and Communication Tactics

The JFSP employs a variety of tactics for delivering scientific information and advertising research opportunities. The primary source for information is a JFSP maintained website.

JFSP Website

This web space is designed to provide information about funding announcements, on-going and completed research, links to individual regional consortia websites and access to archived newsletters. It is also updated for current events and educational opportunities (see figure 10).

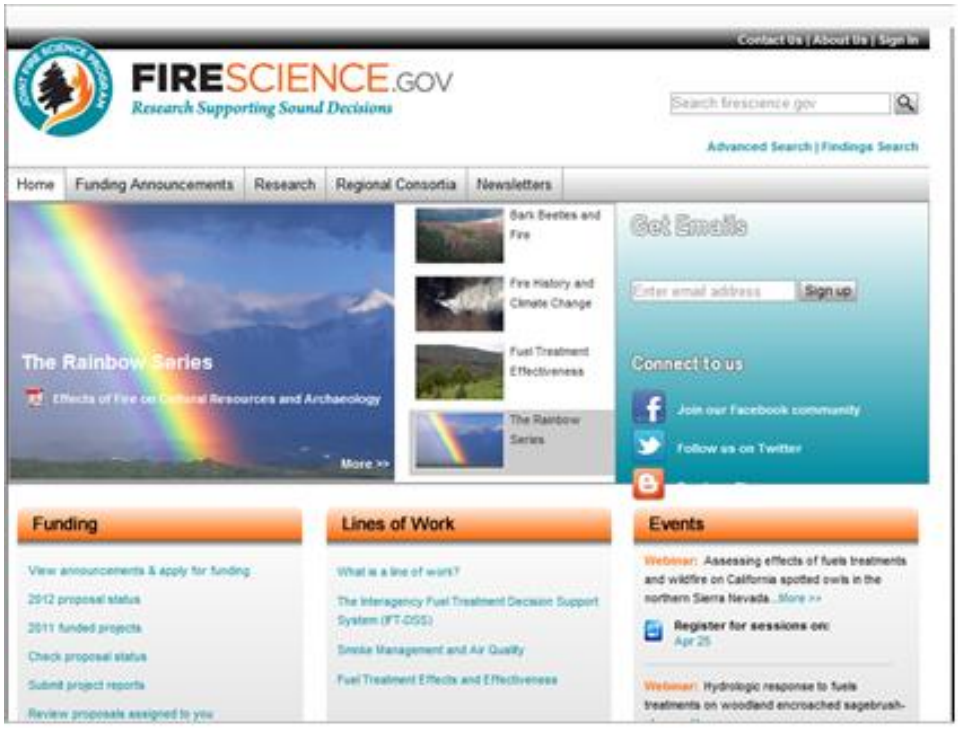

Figure 10: Joint Fire Science Webpage

Newsletters

The Fire Science Digest provides information on fire and fuel related research and JFSP updates. Newsletters are available in both print and on-line and are released several times throughout the year.

Requests for Applications (RFA)

Each year, the JFSP releases RFAs into the fire and science community. These funding opportunities are in response to the emerging needs of policy makers and fire managers. Applications undergo a rigorous review process, currently only 10-20% of applications are selected for funding.

SWOT Analysis

A SWOT (Strength, Weakness, Opportunity and Threat) is a marketing analysis tool that assists in identifying where internal strengths and weakness may exist and brings attention to external opportunities and threats. This process is particularly useful for visually understanding assets and bearers to a business or program. Once recognized, these factors can then be considered in future management decisions.

The Joint Fire Science Program SWOT analysis indicates that one of the program's greatest strengths is derived from the interagency model in which the program is founded; it combines diversity of real-life experiences with scientific expertise. By offering a competitive RFA process, the JFSP is able uphold a high standard of quality in research. Information that is obtained from this process is scientifically grounded. However, because the JFSP caters to the fire community, perspectives relating to project feasibility or research needs may be weighted in one direction. For example, scientific justification for a project may be obvious, yet the economic feasibility may be lacking. Expanding the Regional Consortia program could be an opportunity for mitigating this weakness because economic and social project feasibility could be more accurately assessed on a regional basis. In addition, the JFSP may want to consider branching efforts

to include a broader audience base. Currently the program funnels public outreach messages through the fire community. There may be an opportunity to market the JFSP information directly to the public. The largest primary threat to the program is loss of federal funding. As the program grows, it will continue to rely on federal monies for support. If this allocation is no longer available, the JFSP would not be able to support itself. The JFSP SWOT analysis can be seen in Figure 11.

Figure 11: JFSP Strength Weakness Opportunity and Threat Analysis

JFSP Budget and Funding Prioritizations

By 2007, the JFSP had funded more than 350 projects on wildland fire science research and between 1998 and 2005 had invested more than $100 million in fire-related research projects (Barbour 2007). An independent ten-year program review was conducted in 2008. Out of this review, a primary recommendation was that the JFSP invest more energy and resources on fostering a two –way communication process between scientists and those who will ultimately benefit from the knowledge gained -

practitioners involved in applying fire science on the ground (Joint Fire Digest 2011.) Prompted by this, the JFSP Governing Board developed a five-year investment strategy to guide program actions and balance investments. The budget strategy is broken down below (figure 12); the solid fill represents 65% percent of the total budget allocation. This portion is solely invested in science related research. Budget categories are described in further detail.

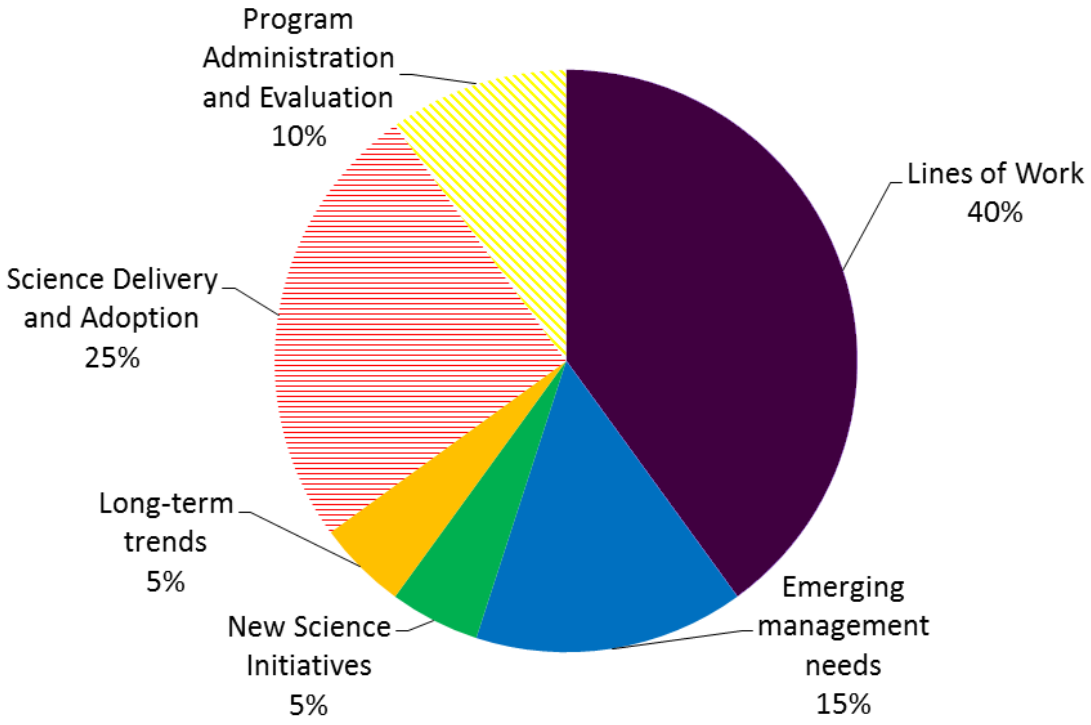

Figure 12: JFSP Budget Strategy

Science Related Investment Topics

Lines of work: This was designed as a framework for problem identification and as a means for addressing complex management problems. These are issues that require coordinated, multi-year investments to develop useful solutions. The JFSP is currently engaged in three lines of work and offers funding for research related to these topics:

1. Software system integration (for fuels treatment planning)
2. Smoke and emissions
3. Fuel treatment effectiveness and effects

Emerging management needs: The program solicits and fund proposals in response to the emerging needs of fire and fuel managers. The JPSP is currently investing in these topics:

- Arid land re-vegetation
- Compatibility of fire and fuel treatments with threatened and endangered species
- Fire prevention effectiveness
- Managing fire in deep, organic soils
- Climate change effects on fire regimes and ecosystems

New science initiative: This category funds innovative ideas and topics of current interest. The purpose is to stimulate new thinking and creative approaches that could lead to science breakthroughs needed to support future fire and fuels management.

Long-term trends: Funding is provided for the re-measurement of previously established field experiments, and re-measurement of plots and surveys in areas burned by a recent fire. The intent is to extend the usefulness of previous investments and capture unique opportunities provided by unplanned events.

Of the remaining budget, the JFSP allocates twenty-five percent to a category referred to as science delivery and adoption, and ten percent to JFSP administrative and operational costs. The science delivery and adoption money is used for the national network of regional knowledge exchange consortia and is intended to significantly increase location-based science delivery and adoption. Funds are distributed to each consortium and are utilized to develop educational training programs and resources for the fire community.

The Three Year Smoke Study: A JFSP Funded Project

Scope and Timeline

This project meets the goals as defined under the line of work framework for smoke and emissions. In 2009, JFSP put out a request for applications (RFA) specifically looking to develop research on public perceptions of smoke management. JFSP was particularly interested in understanding regional variations in people's perceptions of smoke and smoke management. Priority funding was given to projects that demonstrated how results could be used by land managers to manage fire and fuel programs.

In response to this RFA, a research proposal was developed by Dr. Christine Olsen of Oregon State University and Dr. Eric Toman of The Ohio State University entitled *Examining the influence and effectiveness of communication programs and community partnerships on public perceptions of smoke management: A multi-region analysis* (see Appendix A). The proposal was accepted and funded in 2010 for a three year period beginning in October 2010 and ending in September 2013. The project was broken down into three phases (see Table 7).

TABLE 7: Smoke Project Stages

Project Stage	**Description**	**Delivery Dates**
Phase One	Site identification and completion of on-site, qualitative data collection and analysis.	End of year 1
Phase Two	Design and implementation of quantitative survey. Analysis across multiple regions	End of year 2
Phase Three	Synthesis of preliminary findings and preparation for behavioral experiments	
	Behavioral experiments at one study location.	End of year 3

Project Budget

A project budget was developed for three fiscal years, with the total budget equating to $203,607 (see figure 13). Expenses were divided into five categories: labor, travel, equipment, materials and supplies, and science delivery. For full budget breakdown see Appendix E. Across all three funding years, labor was the most costly expense. Graduate research support was provided in part by labor expenses allocated to the first fiscal year. Travel expenses occur in the first and third project years and correspond to the delivery of phases one and three. Material and supply costs were high for the second project year because of the quantitative survey design and implementation. Additional funding was provided by the Western Wildland Environmental Threat Assessment Center for the first year only.

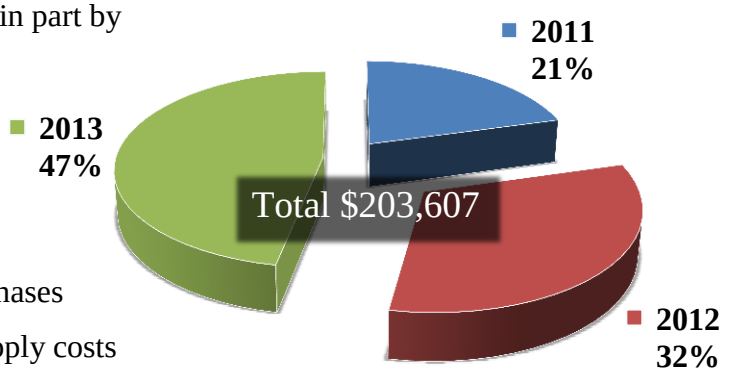

Figure 13: Smoke Project Budget

Professional Science Masters Project

The first year of this study provided the basis for the Professional Science Masters (PSM) project described in this report. Supervision and project guidance was provided by Dr. Christine Olsen, a Research Social Scientist at Oregon State University in the Department of Forest Ecosystems & Society and the co-principal investigator on the JFSP funded study. In addition, communications were upheld with the study's principal investigator, Dr. Eric Toman of Ohio State University. During the California site visit and data analysis process, collaborations were made with a second graduate student researcher from The Ohio State University who is studying under the direction of Dr. Toman. Lastly, findings have been communicated to a third graduate student researcher

who is also working under the direction of Dr. Olsen. This student will be focusing on the survey implementation phase in year 2. Figure 14 illustrates the organizational chart relating to this study.

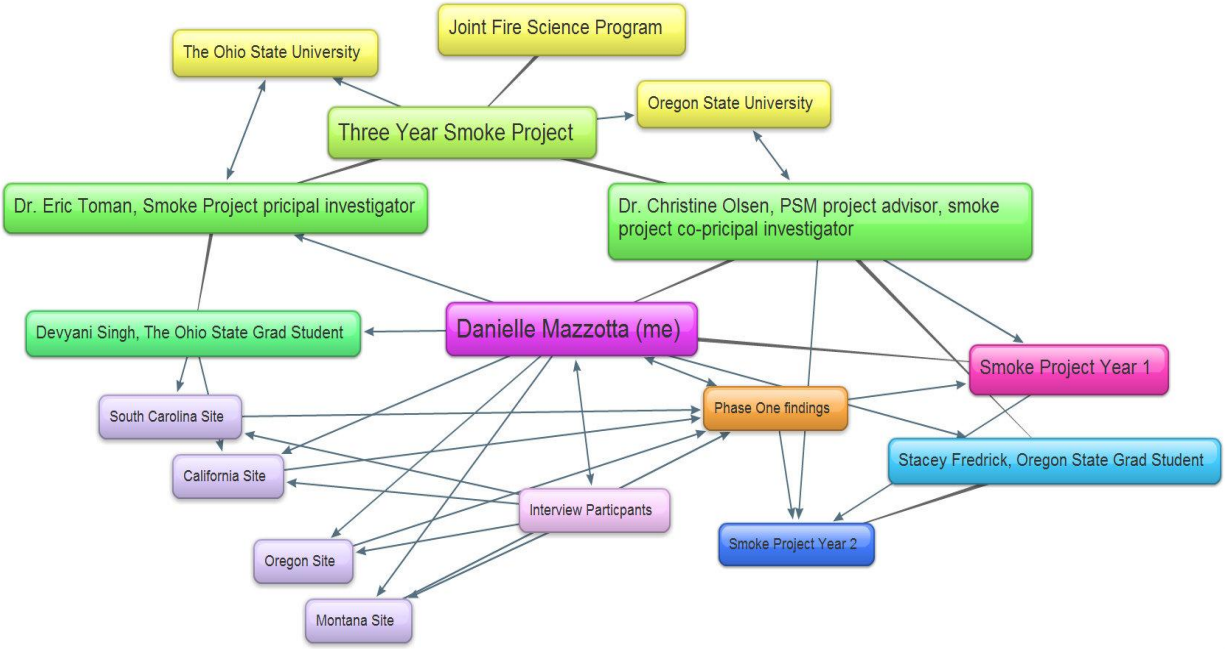

Figure 14: Smoke Project Organizational Structure

This project provided the opportunity to gain experience in social science research, specifically the methodology of interviewing, data analysis and reporting. Working under the guidance of two experienced social scientists assisted in developing the critical thinking skills required for drawing results from the data. Highlights of this project included to opportunity to travel to research locations and learn firsthand from the research participants. These visits created a deeper understanding not only of the sites themselves but also of the challenges and opportunities that existed in smoke and fire management.

Moving Forward

The findings from the first year are being used to inform research carried out in the second and third study phases. Findings will also be published in a scholarly journal and developed into site-specific reports for the Joint Fire Science Program. These reports will be distributed to managers and interested individuals at each research location.

APPENDIX

Appendix A

Examining the influence and effectiveness of communication programs and community partnerships on public perceptions of smoke management: A multi-region analysis

Eric Toman, School of Environment & Natural Resources, Ohio State University (PI)
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I. Overview

This project examines how communication programs and fire and fuels-related community partnerships influence public perceptions of smoke management across multiple regions. Using a case study design, we will compare communities where smoke (from wildfire or prescribed fire) has impacted citizens and examine the factors that influence acceptance levels. We will identify communication strategies that were used in relation to smoke, assess community preparedness for fire and presence of partnerships, and explore whether these strategies and partnerships influence citizen tolerance of smoke. Preliminary results will be synthesized and used in a series of behavioral experiments at each study site to assess the influence of different interventions on participants' attitudes and behaviors towards smoke. This project addresses RFA 2010-1, Task Statement 3, Questions 4 and 5.

1. Project Justification & Expected Benefits

Wildland fire and its relationship to forest fuel conditions is a primary challenge for land managers. Wildland fires have been larger and more frequent in the last decade, and prescribed fire is used to treat fuels on millions of acres per year (NIFC 2009). Smoke from fires, prescribed or wild, affects air quality regardless of boundaries, sometimes at great distances. Acceptability of smoke can influence the use of prescribed fire as a management tool and how agencies communicate with communities during wildland fires (Weisshaupt et al. 2005, Taylor et al. 2005, McCaffrey 2006). This project aims to understand how different types of communication programs (e.g., media announcements, on-site bulletin boards, collaborative planning projects) and the presence of fire-related citizen-agency partnerships influence citizen tolerance of smoke. This research topic has been noted as an area of particular interest by the Joint Fire Science Program Smoke Management and Air Quality Roundtables (SRA International 2007). Moreover, the approach proposed here has received support from resource professionals in multiple locations across the U.S. (see attached letters of support).

Research on the acceptability of prescribed fire has grown in recent years. While acceptance for prescribed fire use has increased across diverse geographic regions (Loomis et al. 2001, Winter et al. 2002, Shindler and Toman 2003, Brunson and Shindler 2004), a major concern that has surfaced over the use of prescribed fire is that of air quality and smoke (Winter et al. 2002, Abrams and Lowe 2005, Brunson and Evans 2005). Indeed, it was noted as a primary concern by residents in the vicinity of an escaped prescribed burn (Brunson and Evans 2005), and remains a concern surrounding wildfires as well (Weisshaupt et al. 2005). Some study participants have even suggested smoke is too significant a concern to consider prescribed fire as a management option (Shindler et al. 2009). In spite of this, few studies have examined citizen tolerance for smoke or what may influence it. One recent study noted a majority of public respondents in Utah, Oregon, and Arizona indicated moderate or great levels of concern about increased levels of smoke as a result of prescribed fires (Brunson and Shindler 2004), while two others revealed smoke may be acceptable depending on the origin of the smoke and if it results in a healthier forest (Shindler and Toman 2003, Weisshaupt et al. 2005). In a rare look at what may influence perceptions of smoke from prescribed fire, one study determined participants were more tolerant after receiving education materials (Loomis et al. 2001). However, research on factors that influence tolerance of smoke (e.g., types of communication strategies used, information conveyed) and the role citizen-agency interactions and relationships play is scarce.

The purpose of this project is to improve our understanding of the factors that influence citizen tolerance of smoke and assess the effectiveness of management interventions, including communication programs,

2. *Project Objectives*

This study will improve our understanding of the factors that influence public acceptance of smoke emissions and how communication strategies and community partnerships influence acceptance levels. Specific objectives include:

1. **Identify appropriate research sites where prescribed fires have recently occurred or are planned, or there has recently been a wildland fire.** Sites will be chosen to represent a variety of geographic, ecological, and social regions. The intention is to choose sites employing different communication strategies and with varying degrees of preparedness for wildfire and community partnerships. At least three sites will be included in this research (see description of candidate sites below).
2. **Compare perceptions about and tolerance of smoke across multiple regions.** The research team will conduct a series of interviews with agency personnel and key community members across locations. These interviews will inform the development of a general population survey that will be replicated across the study sites. Results will enable comparisons across locations to identify similarities and key differences in public understanding, attitudes, and acceptance.
3. **Evaluate factors that influence perceptions of smoke, prescribed fire, fuel reduction, and citizen-agency communication.** Grounded in the Augmented RISP social-psychological model, the research team will examine the factors that influence citizen acceptance of smoke within and across locations. The analysis will examine the role of beliefs (including risk perceptions, trust, perceived knowledge, etc.) in influencing information seeking and processing behaviors, norms, and perceived behavioral control on attitudes toward smoke. The analysis will also account for the role of site characteristics, history of citizen-agency interactions and communication strategies, and wildfire preparedness and other important contextual factors in the analysis.
4. **Develop experimental communication approaches and examine their effectiveness.** Based on findings to Objective 3, the research team will develop different communication designed to influence those variables most strongly associated with citizen acceptance of smoke. A series of experiments will be conducted with participants to examine the effectiveness of these messages.
5. **Conduct regional workshops to discuss findings and implications with JFSP cooperators and partner groups.** This research will be useful if it is relevant to those who can benefit most. We will work with agency partners to conduct workshops and provide technology transfer materials for appropriate audiences (e.g., decision-makers, fire management and outreach personnel, community leaders). Discussion will include how to best use the information resulting from this study.

II. Methods

This project will be implemented in four stages.

Stage One: Following a case study design, a triangulation of data sources will be employed (Yin 2003). Researchers will make final study site choices after seasonal fires have occurred or when prescribed burn plans are finalized (see additional information on candidate sites below). A qualitative analysis of the current conditions (e.g., demographic, ecological, social) will be conducted at each site. Semi-structured interviews will be conducted with key agency personnel and citizens at each site. Interview data will enable identification and a rich understanding of wildfire preparedness, general perspectives about smoke, recognition of risks and benefits and willingness to accept tradeoffs (e.g., between forest health, planned and unplanned smoke emissions), current concerns and acceptance levels, citizen-agency interactions, ongoing communication programs, and other relevant factors. These factors will function as independent variables for the second stage of research.

Stage Two: Mail-back questionnaires will be sent to a random public sample within each study location after prescribed fires and notification programs have concluded. Survey design will be based on information gathered from the interviews and will measure citizen perceptions of fire management, understanding of forest conditions and fuel treatments including prescribed fire, preference for treatments, tolerance for

smoke from prescribed or wildland fire, and influencing variables (including those outlined in the RISP model and discussed above). Questions will include Likert-type scales and closed-choice question sets as well as statements requiring respondents to choose between two opposing outcomes and/or tradeoffs associated with smoke management decisions. Surveys will be implemented using a modified "tailored design method" (Dillman 2007). Mailings will occur in two waves. First, a hand-signed notification postcard will be sent to all individuals in the sample, followed a few days later by a complete mail packet (hand-signed cover letter, questionnaire, and stamped return envelope). After two weeks, a reminder postcard will be sent to all participants who have not yet replied. Complete packets will again be sent to all non-respondents three weeks later.

Stage Three: We will analyze data from interviews and surveys in the context of each site. We will compare and synthesize the most important elements, looking at factors that influence perceptions of smoke, and examine regional and cultural differences. Preliminary findings will be summarized for each location as well as across all sites.

Stage Four: Drawing on the analysis in Stage 3, the research team with input from management personnel at each site will develop a series of potential management interventions targeted at the most salient variables influencing citizen attitudes and behaviors regarding smoke emissions. The research team will then conduct a series of behavioral experiments in each study site to assess the influence of these different management interventions on participant attitudes and behaviors. For example, if the quantitative study indicates concerns about smoke emissions are primarily related to the risk perceptions, then a communication approach could attempt to influence perceived levels of risk. Experiments will include pre-test/post-test measurements as well as a control group to examine the influence of the experimental manipulation on responses.

1. Study Sites

At least three locations will be included in this research. Because this research relies on wildfires that cannot be predicted and prescribed burns that are weather- and resource dependent, final decisions on research sites cannot be made until fire seasons unfold. The research team has established relationships with resource professionals at each potential location below. We will work closely with these cooperators to identify key variables and individuals for qualitative study at each site. Final site choices will include locations across multiple regions in order to allow examination of the influences of different ecological, social, cultural, and economic settings. Potential research sites include but are not limited to:

- **Arizona White Mountains.** Consisting of high-elevation forested terrain roughly encompassed by the Apache-Sitgreaves National Forests and White Mountain Apache Tribal lands, the ponderosa-pine dominant forests in this region are degraded from the area's historically frequent fire regime. The 2002 Rodeo-Chediski Fire (nearly 500,000 acs.) served as a catalyst for the communities of the White Mountains to address high fuel loads. National forest managers worked with local communities to develop a plan for restoring 150,000 acres of overstocked WUI forest, which ultimately led to the 10-year White Mountain Stewardship Contract. Understanding factors that influence tolerance of smoke is particularly important in this area, as a number of different land management entities burn every year resulting in several different sources of smoke emissions.
- **Colorado Front Range.** Rocky Mountain National Park (RMNP) and the Arapahoe-Roosevelt National Forest (ARNF) are located northeast of Denver. Both management units are key recreation destinations and are adjacent to popular resort communities (Estes Park) and major metropolitan areas (Boulder). Mixed ownership patterns and exurban migration to this region have resulted in a large area of wildland-urban interface. In recent years, a massive mountain pine beetle outbreak in the Front Range has concentrated management emphasis on addressing hazards and concerns associated with the epidemic and preparing the public for its consequences. Follow-

ing the record fire season of 2002 (including the Hayman Fire), federal, state, and local governments, as well as private landowners, conservation organizations, and other stakeholders joined together in creating the Front Range Fuels Treatment Partnership.

- **Utah Great Basin.** The Uinta-Wasatch-Cache National Forest and Bureau of Land Management West Desert District are located along the western edge of the Wasatch Front, adjacent to Salt Lake, Utah, and Tooele Counties. Together, Salt Lake County and Utah County are the most densely populated in Utah, while Tooele County to the east contains only small ranching communities. Vegetation ranges from grasslands and oak-juniper woodlands in the valleys to mixed conifer and aspen on the slopes of the Wasatch Range. A number of wildfires have occurred in the area since 2000. The 2007 Milford Flat Fire, which burned just south of this region, was Utah's largest fire and resulted in interstate closures, vehicle accidents, and evacuations. Perhaps the most significant event was the 2003 Cascade II Fire, an escaped prescribed burn which occurred in a highly visible area outside of Provo. This burn received substantial media coverage and caused significant smoke impacts across the Salt Lake region.
- **Lake States (MI, MN, WI).** Fire activity and fuels management efforts have increased in the Lake States over the last several years. In spite of the small size of wildland fires or prescribed burn units compared to those in western states, most activities are in close proximity to structures and local communities due to the less expansive nature of federal lands in the region. This spatial arrangement of forests and homes means most fire management activities will have some impacts on local residents. Moreover, there is a history of limited acceptance for the use of prescribed fire in some locations within this region. This is particularly true in the lower peninsula of Michigan where in 1980 a Forest Service prescribed burn escaped and became the Mack Lake fire that eventually burned 24,000 acres and 44 structures. While this fire occurred nearly 30 years ago, citizen memories of it are still strong (Winter et al. 2002). An understanding of the factors that influence acceptance of fuels management programs and resulting smoke emissions are particularly important in this region as citizens are largely in the early stages of developing awareness and forming attitudes toward these activities. Targeted management interventions can be particularly effective in these early stages of attitude formation.
- **North-Eastern Washington.** The Colville area stretches from the Canadian Border south nearly to Spokane, and includes Ferry, Stevens, and Pond Oreille Counties, the Kalispel Indian Community, the Confederated Tribes of the Colville Reservation, and the Spokane Tribe of the Spokane Reservation. Forests range from dry to cold and moist and have high fuel loads after decades of effective fire suppression. The Colville National Forest is of note because it is one of three "Proof of Concept" Forests in the U.S. This alternative business model allows the Forest to meet new management objectives in partnership with communities, local governments, NGOs, and contractors. Prescribed fire is a commonly used tool on this landscape. As such, smoke impacts are a concern for citizens and managers.

2. *Sampling Design*

Case study sites will be chosen purposively following a critical case format where locations are chosen based on their ability to best address research questions and provide rich information (Robson 2002). Interview participants will be chosen using the same purposive, critical-case protocol. Individuals who have been affected by smoke or who are engaged in discussions about smoke activities will be targeted in order to most effectively address the research questions. Survey administration will follow a random sample design. Random samples of households will be selected for participation within areas at each site that have been affected by smoke as a result of recent prescribed or wild fires. Samples will be purchased from a professional sampling organization. In locations that contain large metropolitan areas (e.g., Colorado or Utah), the samples will be stratified by oversampling rural households to ensure sufficient levels of participation from WUI residents. Findings will enable within-location analysis and comparisons between sites.

3. *Field Measurements*

Case study design with qualitative and quantitative methods employs collecting interview and survey data at each location. Interviews will be recorded when permissible and transcribed for later review. No other special measurements or techniques will be employed.

4. *Data Analysis*

Qualitative data will be analyzed using standard interpretive coding techniques to reveal key themes from interview responses (Robson 2002). This will result in rich description of contextual variables at each location. Qualitative analysis will be completed prior to questionnaire implementation. Quantitative analysis of survey responses will include multiple steps. The data will be summarized using descriptive statistics. Correlation analysis will be used to assess the effect of independent variables on dependent measures. Findings will be compared across study locations using chi-square and ANOVA tests. Variables and respondents will also grouped for more in-depth examination using factor and cluster analysis. Regression analysis will be employed to study the influence of individual independent variables on dependent variables with others held constant.

5. *Materials*

No field equipment is needed for this study. The second stage of data collection requires a questionnaire and mailing materials to complete the quantitative survey.

III. Project Duration and Timeline

This project will last approximately 3 years, assuming a start date in October 2010, with completion in September 2013. Details of the timeline are in Table 1 below.

Table 1. Project Timeline

Project Milestone	Description	Delivery Dates
Phase One Complete	Site identification and completion of on-site, qualitative data collection and analysis.	End of year 1
Phase Two Complete	Design and implementation of quantitative survey. Analysis across multiple regions.	End of year 2
Phase Three Complete	Synthesis of preliminary findings and preparation for behavioral experiements.	Beginning of year 3
Phase Four Complete	Behavioral experiments at each study location.	Middle of year 3
Final Analysis and Report	Synthesize and develop implications and recommendations for entire project.	Middle-end of year 3
Concluding Workshops	Interactive workshops for discussion of findings and implications.	End of year 3

IV. Project Compliance

The NEPA does not apply to this research. No new projects will be implemented by management agencies as a direct result of this project. This study does involve human subjects. The study design will be reviewed and approved by the Ohio State University and/or Oregon State University Institutional Review Board.

V. Budget

VI. Research Linkage

Three ongoing and several recently completed projects involved the PI and the context of the proposed research. Ongoing JFSP projects include 09-4-1-11, Developing a fire-science network and delivery system for the northern Lake States (preproposal funding), 09-2-01-22, Fuel treatments in mixed-pine forest

in the Great Lakes Region, and 07-1-6-12, Social Science at the Wildland-Urban Interface: Creating Fire Safe Communities. Related recently completed JFSP projects include an analysis of public attitudes and acceptance of fuel treatments in seven states over a six-year time period (Longitudinal Analysis of Public Responses to Wildland Fuel Management) and a multi-state examination of communication approaches and partnership activities to build support for fire management programs (Evaluating Communication Strategies and Local Partnerships). These projects provide the research team with a strong foundation in the available literature on social acceptability of smoke as well as different communication and management approaches to address resulting concerns. Several of these projects asked preliminary questions about smoke in mail and interview formats and will be used to inform our design for the proposed project.

The new proposed research has an independent design from the recently concluded and ongoing work. This new work is targeted at specific sites and local issues and specifically examines smoke, an issue that was only addressed tangentially in prior work. However, this prior work highlighted the importance of effective smoke management in maintaining support for fire and fuels activities. Other pending projects have the potential to lend insight into this new proposed research. For example, the NSF CNHS project examining interactions, dynamics, and adaptation in fire-prone landscapes includes analysis of social networks and partnerships and their influence on willingness to accept or conduct fuel reduction activities.

VII. Deliverables and Science Delivery

Informal updates will be made to project cooperator on a regular and continuing basis. Formal progress reports will be made at least annually. Electronic versions of appropriate documents will be provided. Deliverables are further explained in Table 4 below.

Table 4. Deliverable, Description and Delivery Dates

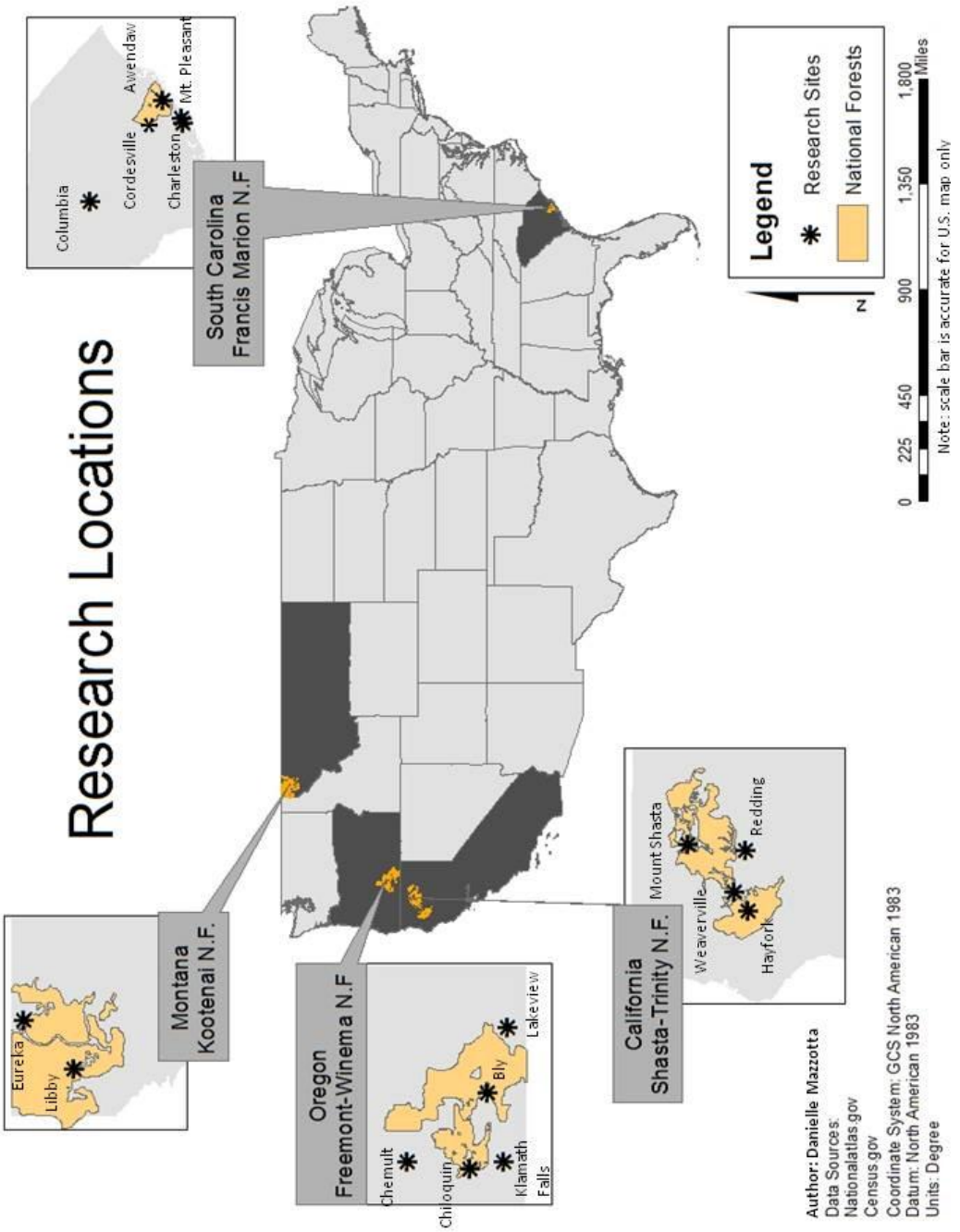
Deliverable Type	Description	Delivery Dates
Qualitative summary	Key findings from initial qualitative research assessing contextual factors	End of year 1
Study protocol	Questionnaire for expanded replication and evaluation	1.5 years
Survey results	Reports from quantitative research for each site	As completed, years 2-3
Preliminary findings	Summary of preliminary results in preparation for ground-truthing assessment exercises	End of year 2
Progress reports	Description of progress towards objectives, timeline of project, findings to date	Annually
Executive summaries	Key results in graphical format with supporting text – these will be the primary, easily disseminated, attractive product to share with managers	Periodic throughout study
Interactive workshops	With agency and community partners to examine findings, interpret results, and discuss their application	Year 3
Final report	Summary of research design, findings, and influence of factors on citizen responses	End of year 3
Refereed publications	Submitted to scientific and applied journals	As completed, year 3
Conference presentations	Findings will be presented at professional conferences	Year 3

VIII. Roles of Investigators and Associated Personnel

Table 5. Roles and Responsibilities of Associated Personnel

Personnel	Role	Responsibility
Eric Toman	PI	Dr. Toman will be responsible for managing the project and directing the research team. This will include research design, implementation of research protocols, data analysis, project reporting, product deliverables, and tech transfer including workshop presentations.
Christine Olsen	Co-PI	Dr. Olsen will work closely with Dr. Toman on research design, field implementation, data analysis, and workshop presentations.
Paige Fischer	Federal Cooperator	Dr. Fischer is the cooperating scientist with the USFS Pacific Northwest Research Station. She will administer the project contract with the JFSP, assist in research design, and contribute to theory and interpretation.
Federal management personnel at each site	Cooperator and Participant	Will cooperate through field interviews and identification of local practices and programs.

Appendix B: Locational Map of all Four Research Locations



Appendix C: Interview Instrument

1. Describe your role within your community concerned with forest health, the threat of wildfire, fuel reduction and smoke management. How long have you been here?

2. From your perspective, what is the current condition of forest lands in [name region]. What is the level of risk from fire? How have those conditions changed over time? In your opinion, what caused these changes?

3. Which are the most important public and private organizations in determining fire management practices in this region? Specific individuals (or groups) that influence these organizations? How so?

4. How is smoke from prescribed and wildland fire managed in this area? What are the key factors that influence the use of prescribed fire? What is the general public opinion about smoke from prescribed and wildland fire?

5. What forms of communication do individuals or groups use to interact with one another about wildfire issues? Prescribed fire and smoke issues? Which ones are the best, and in which situations? Most trustworthy? Where do you get good information about fire management practices and programs?

6. How open are government management agencies to citizen involvement in planning processes? How do individuals or representative groups influence decisions? What is the role of collaboratives or partnerships in the region?

<u>Personal experiences.</u>

7. Have you experience a smoke event from prescribed or wildland fire in the decade? Tell me about it. Did you know the source of the smoke? What it tolerable to you? If it was from a prescribed fire, would you accept that level of smoke again in exchange for a reduction in fire risk for the surrounding forest?

8. What types of communication do you receive from nearby land management agencies, groups, or individuals? Do you receive information about planned prescribed fires? In what format? Is it useful? Easy to understand? Trustworthy?

9. Are you involved in any partnerships related to land or forest management in the area? If so, please describe.

10. For the land you manage (or own), do you use prescribed fire? What influences your decision to use (or not use) prescribed fire? How do you handle smoke? Who do you notify about your plans to burn?

11. Do your neighbors do the same sort of things or do they have a different approach?

12. Are your management decisions/actions influenced by any local, state, or federal policies? How so? How about influences from local citizen groups?
13. Which agencies and organizations do you work with in regards to land, fire, and smoke management? Who do you trust? How do you work together? When did the relationship start?

14. What is the biggest problem facing [name of region] regarding the wildfire issue?

15. What obstacles and opportunities exist for developing and implementing prescribed fire and smoke policies? Any ideas about overcoming these obstacles?

16. What is your opinion of how well fire management is carried out in [name region]?

Appendix D: Site-Specific Findings

	Oregon	South Carolina
Background	➢ Historically a timber dominated economy, now suppressed economically ➢ Non-attainment areas ➢ Issues with wood stove smoke and air quality ➢ People that grew up in the area feel connection to others and the land ➢ Area has a predisposition topographically for air stagnation ➢ Once community recent site for a "smoke out" accident	➢ Knowledge of landscape and fire ecology present in local community ➢ Rural areas have "locals" with the mindset of "burning is not a big deal" ➢ Many private land owners utilize prescribed burning ➢ Increasing population and influx of outsiders moving in ➢ Many people mentioned fire dependent ecology ➢ Frequent Prescribed utilized fairly regularly by local agencies
	Montana	**California**
Background	➢ Superfund site ➢ Air Quality has improved (historically worse than it is today) ➢ High Unemployment (historically timber economy) ➢ Local topography plays a role in poor air quality	➢ Large portion of land that is federally owned ➢ Frequent fire return intervals (every 10 yrs) with forest conditions not considered "natural state" ➢ Anti-prescribed burning mentality in rural areas (stemming from timber industry) ➢ hindered rural economies ➢ locals have more experience and better understanding of fire where non-locals considered having less knowledge and lower tolerance for fire/smoke

	Oregon	South Carolina
Concerns (about fire and smoke emission)	➢ Smoke will have impact on air quality and thus the local economy ➢ Adversely affect tourism and recreation ➢ Fire will get out of control ➢ Health repercussions from smoke ➢ Liability ➢ Decrease air quality and effect attainment status	➢ More fire regulation will limit management abilities ➢ Liability ➢ Health effects from smoke ➢ Smoke in general (seeing it) ➢ Fire escape ➢ Inconvenience ➢ Impacts on roadways/public safety ➢ Visuals (fire), aesthetics (aftermath)
	Montana	**California**
Concerns (about fire and smoke emission)	➢ Impacts on recreation (and daily activities) ➢ Smoke ➢ Visual impacts ➢ Escape ➢ Health Impacts ➢ Losing credibility (agency/industry concern) ➢ Loss of Human life from fire suppression ➢ Monetary Liability of Escaped Fire ➢ Impacts on non-attainment area from burning outside of regulated zone (smoke drift)	➢ **Being inundated with smoke!** ➢ Negative effect on health ➢ Risk of escape ➢ Personal safety ➢ Fires could get large/out of control ➢ Negative impacts on recreation/aesthetics ➢ Fire and smoke will be a nuisance ➢ Forest is not being managed correctly ➢ Liability

	Oregon	Montana
Perceptions	❖ Smoke is being seen as a sign of wastefulness ❖ If there is smoke, the forest service is involved ❖ Agencies are playing by their own rules ❖ Public lack of understanding for regulation (burn days) and for forest management – "they burn but we can't" ❖ Not enough info from agencies to public **More on Local Perception** - Biomass will solve many of the local problems (air, economy, forest health) - Stove change out has helped with emission - Locals have better understanding of the land **Perceived importance:** developing trust, displaying genuine concern for the public and having effective and timely communication strategies	❖ Aversions to Prescribed Burning Treatments ❖ Burning seen as wasting resources ❖ Government not having support for the town ❖ Government Regulation is challenging to work with ❖ Unfair regulation ❖ Citizens grateful when notified of prescribed burning or smoke ❖ New comers not as tolerant ❖ Tolerance is a cultural attribute ❖ Agency is all the same in public eye ❖ Some individuals accept policy and appreciate it (cleaner air) ❖ Lack of Public Understanding for Policy and Regulation ❖ People have the "it's my right to burn" mentality
	South Carolina	**California**
Perceptions	❖ Idea of prescribed burning in being "marketed" to the public ❖ Lack of inclusion to agency decision making ❖ Public needs to see visual success to accept management practices ❖ Not everyone will be on board ❖ Only a portion of the public recognizes tradeoffs Disconnect between fire and self	❖ People do not associate themselves with the risk ❖ Not all managers realize scale of impact ❖ Recognizing tradeoffs- the public understands this ❖ Public does not understand "good management" ❖ Public does not understand management boundaries ❖ When public understands the outcome they are more likely to accept management

	Oregon	South Carolina
Challenges	➢ Smoke emissions from woodstoves ➢ Non-attainment status ➢ Low income economy ➢ Smoke from outside areas ➢ Predisposition of landscape ➢ Realizing smoke and fire issues expand beyond city and county lines ➢ Lack of funding ➢ Communication ○ Not knowing best way to reach public ○ Maintaining 2 way communication lines ○ Existing lack of communication ○ Extended commitment for education and communication ○ Working across management styles and objectives	➢ Historically communication messages about burning unclear/confusing ➢ Agencies unsure about implementing effective comm. ➢ Managing multiple concerns and objectives ➢ Everything takes A LOT of time! ➢ Understanding local social and ecological conditions ➢ Funding ➢ Challenges for working with the public ○ Interest levels peak then diminish ○ General lack of understanding (organizational structure and policies) ○ Public involvement
	Montana	**California**
Challenges	➢ Regulation associated with non-attainment status ➢ Policy and Regulation make accomplishments on the ground challenging ➢ Burn Days are very limited ➢ Impact on Air Quality from Woodstove smoke ➢ Working across different objectives and goals ➢ Funding Sources for Programs ➢ Burning near Urban Interface Zones ➢ Litigation (ties up money and time) ➢ Lack of Understanding for what constitutes burn regulation boundary	➢ Historical lack of coordination among agencies ➢ Historical Lack of communication to public (improving) ➢ unclear regulatory framework ➢ Hindered economy ➢ Local and National Policies ○ Seen as complex and non-uniform ○ Inconsistent vocab/terminology ○ Clean air/attainment regulation compliance ○ Let Burn policies- source of debate ➢ Communication challenges ○ Takes time and requires thought out strategy ➢ Public does not always know where to find information

	Oregon	South Carolina
Opportunity	➢ Time investment upfront and over the long run with communication ➢ Early communication ➢ Thinking ahead and addressing the concern ➢ Providing more information (5ws) ➢ Utilizing already available resources	➢ Providing staff training on public interface ➢ Delegation of public communication officer ➢ Information sharing (fosters collaboration) ➢ Do more than the bare min o Early involvement (planning) o Provide ed. Opportunities and public training o Build local ties/trust o Be part of the community ➢ Alternatives to burning are prohibitively expensive ➢ Prescribed Fire councils (tool to negotiating policy) ➢ Immerging Liability Insurance
	Montana	**California**
Opportunity	➢ Highlight "benefits of fire" when talking to public ➢ Acknowledging different perspectives/objectives ➢ Find a unifying theme to bring people together ➢ Building on successful programs to continue trust ➢ Highlighting visual successes ➢ Better Technology to work with	➢ Timing o Plan and think ahead to minimize fire and smoke impacts on citizens o Take Duration of impact and management timing (time of year) into account when planning burning activities ➢ People in this region experience fire frequently – Many already have self- initiated involvement with community fire and smoke issues

	Oregon	South Carolina
Comm. Techniques	**Public** Personal interaction, Hotlines, Mailing lists, Press Releases, Regulations as communication, TV, Websites, Seminars, Fairs and special events, through school systems, radio, field trips, Flyers or visuals posted in public areas, Public information Officers, Newspapers, Pamphlets, Public Meetings, Personal phone calls, communication webs, Maps or visual images **Internal (agency)**Data-Bases, Email, Telephone, personal interaction, Postal	**Public** Door to door, Press releases, Advertising in public places, Websites, Providing partner's information along with own, Local newspapers, Education and outreach (talks, programs) , Email lists, Campaigns or other specialty programs , Media announcements, Billboards and road signs, TV, Symbolism , Magazines, Specialty articles or written text, Providing information to other groups or affiliations, Personal phone calls, Flyers, Providing a phone number for the public to call, Town meetings, Radio, hotlines **Internal (agency)** Workshops, presentations, websites, visual diagrams
	Montana	**California**
Comm. Techniques	**Public** Agency attending conferences or meetings, classes or workshops, service foresters, face to face contact, website, hotlines or information telephone numbers, going door to door, newspaper, radio, information packets (drafted letter, outreach material), billboards or road signs, info posted in public locations, personal phone calls, public/special interest meetings, maps or other visuals, spokesperson or information officer, open house style events, informal conversations (grocery store, hunting, around town), advisories, reverse calling systems (recording call into	**Public** Public meetings, special events, media, personal interaction, notification signage, public alerts, newsletter, newspaper, fieldtrips **Internal (agency)** Email/internet, conference calls, personal comm, meetings or conferences, collaborating for public comm, participation in local fire and smoke programs, standardized reporting forms

	homes that provides information), word of mouth-gossip lines around town, email, specialty articles or other outreach materials (brochures etc.), programs in schools, fieldtrips, using hypothetical risks and showing impacts (slideshow)- scare tactics **Montana - Communication Techniques (cont)** **Internal (agency)** Personal phone calls , Have communication built into the burn plan (have already identified, individual that is responsible for communicating with other entities), Dispatch relays communication, Having a primary coordinator for projects, Invite others out to projects, Cooperative working groups	

	Oregon	South Carolina
Comm. Key Points	**Internally** ➢ Utilize info sharing networks ➢ Upfront coordination and maintaining personal communication is important ➢ Utilize current and best technology **Externally** ➢ Personal communication increases acceptance of management and fosters community knowledge ➢ Visual communication strategies effective ➢ Utilize comm trap lines where personal comm is not possible ➢ Public meetings not very effective	➢ Websites should be Interactive and easy to use ➢ Messages need to be clear and not contradictory ➢ Timing is key (not too early or too late) ➢ Identify individual or group responsible for maintain communication plans
	Montana	**California**
Comm. Key Points	➢ Citizens are grateful when notified ➢ Early communication and involvement is key ➢ Meet with one another: Bring stakeholders together to communicate ➢ Timing: otherwise people tend to forget ➢ Not knowing best ways to get information across to the public ➢ Reduce Inconsistency in terminology	➢ Establish who is responsible for contacting the public ➢ Provide early communication ➢ ID and Contact Key community individuals to disseminate information ➢ Utilize visual communication strategies ➢ Think more about pre-education ➢ Provide training for the professionals who interface with the public ➢ Information officers or community informants ➢ Be honest and transparent

	Oregon	South Carolina
Local Partnerships or Collaboration	➢ Improved overall cooperation and Collaboration for the players involved ➢ Seen as an avenue for information sharing ➢ Increased Support for forest management , especially specific projects ➢ Assisted in identifying concerns early on	➢ Provided for Community Involvement and Support ➢ Allowed for more informed decision making ➢ Built better working relationships and increased trust ➢ Achieved more on the than would have otherwise w/o collaboration
	Montana	**California**
Local Partnerships or Collaboration	<u>Idaho Montana smoke group</u> Oversees bigger picture for prescribed burning and smoke management Representative of many burners Regulating Entity for Montana and Idaho <u>Firewise Program</u> Assists community in building strategies to mitigate fire danger Offer Educational opportunities for the community Avenue to funding opportunities for fuel reduction *see key notes	➢ Improved communication ➢ Increased ability to make better management decisions ➢ Fostered better working relationships o Assisted in forming working groups with similar missions o An avenue for sharing resources and information o Helped to get everyone on the same page

	Oregon	South Carolina
Key Notes on Collaboration	n/a	➢ Requires effort but has the potential to get people on the same page ➢ Regular meetings maintain communication lines and progression ➢ Brainstorming what players should be involved provides better understand and knowledge of the community or impacted area. Players must: Acknowledge multiple perspectives and concerns
	Montana	**California**
Key Notes on Collaboration	**Collaborative projects**: Accomplished more on the ground **Collaborative groups** ➢ Reaching out further than just immediate area ➢ Prioritizing Needs for the group as a whole ➢ Representative of many Interests ➢ May take longer to reach consensus ➢ Avenue for Information Sharing	Achieved Through : ➢ Email and conference calls ➢ Organized Groups ➢ Coordination Facilitators Players must: ➢ Be open to unique or new ideas in order to arise to solutions ➢ Realize collaboration does not ➢ always come easy

	Oregon	South Carolina
Other relevant data	Emphasis placed on biomass as a "solve all" solution Recent smoke out event in Lakeview had lingering effects on the community perception of agency forest management strategies	**Regulation:** Areas with localized regulation- more applicability to regional situations Regulation currently working to address liability issue Regulation dictates what happens on the ground ❖ Many people mentioned local ecology and fire dependency- better understanding of healthy forest requirements?
	Montana	**California**
Other relevant data	**Tradeoffs** Acknowledgement of accepting management/smoke now reduces fire danger later Understanding fire risk **Tolerance (what seemed to help)** Trying to keep smoke and fire impact to a minimum Frequency of impact leading to tolerance More consistency in mgmt. Strategically choosing burn times Qualification of individual implementing burning **Other Points** Proposed Biomass Facility Stove change out Loss of Jobs in Timber Industry Completion of Projects vary by year/conditions/topography	**Regulation:** Has led to recent changes in management protocol Needs to be re-visited/re-examined as time passes May dictate what the public knows Has been a hurdle to management

Appendix E: Three Year Smoke Project Budget

Budget Item	2011		2012		2013		
	Requested	Contributed	Requested	Contributed	Requested	Contributed	TOTAL
Labor: Ohio State University	4594		4732		29274		38600
Labor: Oregon State University	23430		45786	13824	47864	14930	145834
Labor: USDA Forest Service Pacific Northwest Research Station	3590		3698		3809		11097
TOTAL LABOR	31614		54216	13824	80947	14930	195,531
Travel expenses: Ohio State University	1265				4107		5372
Travel expenses: Oregon State University	6080				4108		10188
TOTAL TRAVEL	7345				8215		15,560
Capitalized Equipment: Oregon State University	1294		544		544		2382
TOTAL EQUIPMENT	1294		544		544		2,382
Materials and Supplies: Ohio State University	50		55		60		165
Materials and Supplies: Oregon State University	50		7555		60		7665
TOTAL MATERIALS AND SUPPLIES	100		7610		120		7,830
Science Delivery and Application: Ohio State University			250		250		500
Science Delivery and Application: Oregon State University			250		1400		1650
TOTAL SCIENCE DELIVERY			500		1650		2,150
TOTAL DIRECT COSTS	40353		62870	**13824**	**91476**	14930	**223,453**
Indirect Costs: Ohio State University		3102		2644		17688	**23434**
Indirect Costs: Oregon State University		14347		31601		32041	**77989**
Indirect, Pass-thru, SBIR costs: USDA Forest Service PNW Station	1808		2874		4216		**8908**
TOTAL INDIRECT COSTS	1808	17449	2874	34245	4216	49729	**110,321**
TOTAL REQUESTED FUNDING	**42,171**		**65,744**		**95,692**		**203,607**
Total contributed funding all years		**17449**		**48069**		**64659**	**130,177**

References

Brunson, M. 1992. Professional bias, public perspectives, and communication pitfalls for natural resource managers. *Rangelands*. 14(5): 292–295.

Brunson, M. and J Evans. 2005. Badly Burned? Effects of an Escaped Prescribed Burn on Social Acceptability of Wildland Fuels Treatments. *Journal of Forestry* 103(3): 134-138.

Buckles, D., & G. Rusnak. 2005. Conflict and Collaboration in Natural Resource Management. International Development Research Centre. Available at: *commdev.org/files/1439_file_conflict_and_collaboration.pdf* [Accessed November 25th 2011].

Bureau of Land Management. 2012. Lakeview Management Unit Available At*:* http://www.blm.gov/or/districts/lakeview/about.php. [Accessed April 23rd, 2012]

CALFIRE, 2011. *WhatisCALFIRE* handout. file available at: *http://www.fire.ca.gov/communications/downloads/fact_sheets/WhatisCALFIRE.pdf* [Accessed November 13, 2011].

California Department of Transportation. 1995. SR299 Appendix, chapter-3.13. Available at: *http://www.trinitycounty.org/ShastaT%20Travel%20Management%20Plan/Volume%201/chapter-3.13.pdf* [Accessed November 13, 2011].

Charleston County. 2011. Charleston County Government Webpage. Available at: *http://www.charlestoncounty.org/* [Accessed November 14, 2011].

City Data, Cordesville, SC. 2011. Cordesville, South Carolina Profile Webpage. Available at: *http://www.city-data.com/city/Cordesville-South-Carolina.html* [Accessed November 14, 2011].

City Data, Awendaw, SC. 2009. Awendaw, South Carolina Profile Webpage. Available at: *http://www.city-data.com/city/Awendaw-South-Carolina.html#ixzz1pgHnp9fl* [Accessed November 14, 2011].

City Data, Eureka, MT. 2011. Eureka, Montana Profile Webage. Available at: *http://www.city-data.com/city/Eureka-Montana.html* [Accessed November 12, 2011].

City Data, Libby, MT. 2011. Libby, Montana Profile Webpage. Available at*: http://www.city-data.com/city/Libby-Montana.html* [Accessed November 12, 2011].

Cohen, Jack. 2008. The Wildland-Urban Interface Fire Problem: a Consequence of the fire exclusion paradigm. *Forest History Today.* Fall Issue: 20-26.

Donovan G.H and Brown T.C. Be Careful What You Wish For: The Legacy of Smokey Bear. Frontiers in Ecology and the Environment. 5 (2): 72-79

Eureka Chamber of Commerce. 2011. Eureka Montana Chamber of Commerce Webpage & Travel Information for the City of Eureka, Montana. *Available at: http://www.welcome2eureka.com/index.php* [Accessed November 12, 2011].

Fernandez-Gimenez, M. and H. Ballard. 2011."How CBCs Learn- Ecological Monitoring and Adaptive Management " in Community Based Collaboration*: Bridging Socio-Ecological Research and Practice* (Ed.) Duke, E., K. Firehock, and J. Birkhoff. University of Virginia Press. p48.

Francis Marion National Forest. 2011. Francis Marion and Sumter National Forests Webpage. Available at: *http://www.fs.usda.gov/scnfs/* [Accessed November 14, 2011].

Forestry Commission. 2011. South Carolina Forestry Commission Webpage. Available at: *http://www.state.sc.us/forest/* [Accessed November 14, 2011].

Freemont-Winema National Forest. 2011. Fremont-Winema National Forest Webpage. Available at: *http://www.fs.usda.gov/fremont-winema* [Accessed November 13, 2011].

Idaho Department of Lands. 2012. Fire Management Webpage. Available at*: http://www.idl.idaho.gov/bureau/FireMgt/airshed.htm* [Accessed February 29th, 2012]

Innes, J.E. and D.E. Booher. 2010. Planning with Complexity: an introduction to collaborative rationality for public policy. Routledge press. New York, NY. pp.118-128, 197, 201-204.

Isaacs, William. 1999. Dialogue and the Art of Thinking Together. New York: Doubleday. 19p.

Joint Fire Science Program. 2012. Webpage available at *http://www.firescience.gov/* [Accessed most recently April 23rd, 2012]

Klamath County Public Records. 2010. Oregon Historical County Records Guide: Klamath County History. Available at: *http://arcweb.sos.state.or.us/pages/records/local/county/klamath/hist.html* [Accessed November 13, 2011].

Klamath Cty Museum. 2010. Klamath County Overview. Available at: *http://www.co.klamath.or.us/museum/overview.pdf* [Accessed November 13, 2011].

Kootenai National Forest. 2011. Kootenai National Forest Webpage. Available at: *fs.usda.gov/kootenai* [Accessed November 12, 2011].

Lake County Facts, 2011. Lake County Facts Webpage. Available at: *http://www.paisley.presys.com/LakeCountyFacts1.htm* [Accessed November 13, 2011].

Leach, William D. 2011. "Building a Theory of Collaboration" in Community Based Collaboration*:* Bridging Socio-Ecological Research and Practice (Ed.) Duke, E., K. Firehock, and J. Birkhoff. University of Virginia Press. pp.146-188

Libby Area Chamber of Commerce, Montana. 2011. Libby Town Information Webpage. Available at: *http://www.libbychamber.org/* [Accessed November 12, 2011].

Libby Logging History. 2011. Libby Logging History: Students as Archivists Webkpage. Available at: *http://www.edutopia.org/logging-history-students-as-archivists* [Accessed November 12, 2011].

Loomis, J.B., L.S. Bair, and A. Gonzalez-Caban. 2001. Prescribed Fire and Public Support: Knowledge Gained, Attitudes Changed in Florida. *Journal of Forestry* 99(11): 18-22.

Manfredo, M.J., et al. 1990. Attitudes Toward Prescribed Fire Policies. *Journal of Forestry* 89(7):19–23.

McCaffrey, Sarah M. 2006. Prescribed fire: What influences public approval? In *Fire in Eastern Oak Forests: Delivery Science to Land Managers. Proceedings of a*

Conference. USDA Forest Service
General Technical Report GTR-NRS-P-1. Newtown Square, PA: Northern Research Station. Pp. 192-198.

McCaffrey, Sarah M. 2004. Fighting Fire with Education: What is the Best Way to Reach Out to Homeowners*? Journal of Forestry*. July/August edition pp. 12-19.

McDermott, M.H. etal. 2011. *Effective Collaboration.* Community Based Collaboration: Bridging Socio-Ecological Research and Practice. (Ed.) Duke, E., K. Firehock, and J.Birkhoff. University of Virginia Press. p94.

Montana-Idaho Airshed Management Group. 2011. Webpage. Available at*: http://www.smokemu.org /about.cfm* [Accessed Feb 6, 2011]

NIFC (National Interagency Fire Center). 2009. Wildland Fire Statistics Webpage. Available at: *http://www.nifc.gov/fire_stats.htm* [Accessed Oct 11, 2011]

Northeast Air Alliance Smoke Management Plan for Butte, Lassen, Modoc, Plumas, Shasta, Siskiyou, Tehama Counties. 2009. Available at*: http://www.co.siskiyou.ca.us/ag/Docs/NEAASMPOctober09_online_ver.pdf* [Accessed November 13, 2011a].

Olsen, Christine. 2011(a). *Public Outreach and Communication Strategies: Sustaining Long Actions*. lecture, FOR554 Managing at the Wildland-Urban Interface, Oregon State University. October 27th, 2011

Olsen, C. and B. Shindler. 2007. Citizen-agency interactions in planning and decision making after large wildfires. Gen. Tech. Rep. PNWGTR- 715. Portland, OR: U.S. Department of Agriculture, Forest Service, Pacific Northwest Research Station. p37

Olsen, C., and B. Shindler. 2010. Trust, Acceptance and Citizen-Agency Interactions After Large Fires: Influences on Planning Processes. *International Journal of Wildland Fire.* 19:137-147.

Ramirez, R. and M. Fernandez. 2004. Facilitation of Collaborative Management: Reflections from Practice. *Systemic Practice and Action Research*. 18:1.

Robson, C. 2002. Real World Research: A Resource for Social Scientists and Practitioner-Researchers. Madden, MA: Blackwell Publishers.

Ryan, R. and M.Wamsley. 2008. Public Perceptions of Wildfire Risk and Forest Management in the Central Pine Barrens of Long Island (USA). *The Australasian Journal of Disaster and Trauma Studies.* 2008(2).

Schwilk D.W. et al. 2009. The National Fire and Fire Surrogate Study: Effects of Fuel Reduction Methods on Forest Vegetation Structure and Fuels. *Ecological Applications* (19) 285–304

Shindler B. and L. Crammer. 1999. Shifting Public Values for Forest Management: Making Sense of Wicked Problems. *Western Journal of Applied Forestry* 14 (1) 28-34

Shindler, B. and R. Gordon. 2005. A practical Guide to Citizen-Agency Partnerships: public outreach strategies for fire and fuel management. Department of Forest Resources. Oregon State University.

Shindler, B and E. Toman. 2003. Fuel Reduction Strategies in Forest Communities: A Longitudinal Analysis of Public Support. *Journal of Forestry* 101(6): 8-15.

Shindler, B, E Toman, and S McCaffrey. 2009. Longitudinal Analysis of Public Responses to Wildland Fuel Management: Measures to Evaluate Change and Predict Citizen Behaviors in Agency Decision Processes. Final Project Report to the JFSP, Project Number 06-4-1-26.

Toman, Eric, et al. 2004. Prescribed Fire: The Influence of Site Visits on Citizen Attitudes. *Journal of Environmental Education*. 35(3): 13-17.

Toman, Eric. Et al. 2006. Fire and Fuel Management Communication Strategies: Citizen Evaluations of Agency Outreach Activities. *Society and Natural Resources.* 19:321-336

Shasta-Trinity National Forest.2011. Shasta Trinity National Forest Webpage. Available at: *http://www.fs.usda.gov/stnf* [Accessed November 13, 2011].

U.S. Census Bureau: Lake Cty. 2010. Lake County, Oregon QuickFacts from the US Census Bureau. Available at: *http://quickfacts.census.gov/qfd/states/41/41037.html* [Accessed November 13, 2011].

U.S. Census Bureau: Klamath Cty. 2010. Klamath County, Oregon QuickFacts from US Census Bureau. Available at:

*http://quickfacts.census.gov/qfd/states/41/41035.html. [*Accessed October 15th 2011].

U.S. Census Bureau: Columbia. 2010. Columbia (city), South Carolina QuickFacts from the US Census Bureau. Available at: *http://quickfacts.census.gov/qfd/states/45/4516000.html* [Accessed November 14, 2011].

U.S. Census Bureau: Charleston Cty. 2010. Charleston County, South Carolina QuickFacts from the US Census Bureau. Available at: *http://quickfacts.census.gov/qfd/states/45/45019.html* [Accessed November 14, 2011].

U.S. Census Bureau: Shasta Cty. 2010. Shasta County, California QuickFacts from the US Census Bureau. Available at: *http://quickfacts.census.gov/qfd/states/06/06089.html* [Accessed November 13, 2011].

U.S. Census Bureau: Siskiyou Cty. 2010. Siskiyou County, California QuickFacts from the US Census Bureau. Available at: *http://quickfacts.census.gov/qfd/states/06/06093.html* [Accessed November 13, 2011].

U.S. Census Bureau: Trinity Cty. 2010. Trinity County, California QuickFacts from the US Census Bureau. Available at: *http://quickfacts.census.gov/qfd/states/06/06105.html* [Accessed November 13, 2011].

U.S. Environmental Protection Agency. 2012. Green Book: Currently Designated Nonattainment Areas for All Criteria Pollutants. Available at: *http://www.epa.gov/oaqps001/greenbk/ancl.html*. [Accessed 5-1-12]

U.S. Fish and Wildlife Service. 2012. Francis-Marion National Forest Information. Available At*:* http://www.fws.gov/seweecenter/francismarion.html [Accessed April 23, 2012].

U.S. Forest Service. 2010. Fremont-Winema National Forest: Review of the Lakeview Federal Sustained Yield Unit. Available At*: http://www.fs.usda.gov/Internet/FSE_DOCUMENTS/fsbdev3_061671.pdf*

Walker, G., and S.E. Daniels. nd. *Assessing the Potential for Collaborative Learning: The Progress Triangle and discourse based decision making.* Sample chapter (prospectus for book) Systems Improvements and Sustainable Decisions: the

Collaborate Learning Field Guide for Environmental Conflict Resolution and Decision Making.

Weisshaupt, B.R. etal. 2005. Acceptability of Smoke from Prescribed Forest Burning in the Northern Inland West: A Focus Group Approach. *Journal of Forestry* **103**(4): 189-193.

Winter, G.J. etal. 2002. Fuel Treatments at the Wildland-Urban Interface: Common Concerns in Diverse Regions. *Journal of Forestry* 100(1): 15-21.

Winter, G.J. and J. Fried. 2000. Homeowner perspectives on fire hazard, responsibility, and management strategies at the wildland-urban interface. *Society and Natural Resources* 13(1):33–49.

Wondolleck, J.M., S.L. Yaffee. 2000. Making collaboration work: lessons from innovation in natural resource management. Washington, DC: Island Press. Pp 18, 27

Yankelovich, D. 1991. Coming to Public Judgment: making democracy work in a complex world. Syracuse University Press, Syracuse, NY. 290 p.