

Public Perceptions of Values Associated with Wildfire Protection at the Wildland Urban Interface: A Synthesis of National Findings

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With an increasing understanding of ecosystem functions and processes, the science of fire prevention and fuel treatments has experienced renewed and enhanced support among scientists and managers. However, risk mitigation measures have not found purchase in either the public's acceptance or involvement in this new role of and for fire. This may partially result from little regard for the effects of wildfire prevention efforts on values other than protecting homes and other structures. Addressing this gap, we report findings from semi-structured qualitative interviews conducted across the United States to identify and define the various values at risk from wildfire events. Findings demonstrate that public resistance to wildfire prevention efforts arises from two primary factors: (1) many of the prescribed fuel treatments do not reflect forest owners' understanding of vegetation management; and (2) treatments are developed with little recognition of the multiple values landowners and the general public place on the forests - particularly regarding the intertwined nature of diverse sets of risks experienced in daily life. We provide a discussion of how findings impact educational outreach programs and strategies for increasing acceptance of forest management activities in reducing risk while improving the health of the nation's forests. Identifying and better understanding the effects of values associated with public perceptions of wildfire prevention will allow outreach professionals and natural resource managers to develop more effective fuel treatment programs.

Introduction

The American psyche struggles with fire. For generations, the public has been taught that fire destroys forests and many of its associated values (e.g., timber, wildlife, recreation, and aesthetics). Recently, however, the science of fire prevention and fuel treatments has experienced renewed and enhanced support particularly as resource managers have learned more about ecosystems, their functions, and feedback loops. Still, the use of fire prevention measures for enhancing ecosystem services has not found purchase in either the public's acceptance or involvement in this new role of and for fire. This is especially true of the forests within the Wildland Urban Interface (WUI), where fire protection is directed not only at the forests but also the homes and structures that are becoming much more prevalent in the WUI.

The USDA Forest Service, for example, has estimated that of the more than 17 million hectares of private forests in the U.S., 11 percent of the total area, is at risk of conversion to development within the next two decades which will exacerbate the wildland fire problem (Stein et al. 2005; USDA-USDI 2009). Coupled with public uncertainty of fire's role in the ecosystem, resistance to many recommended fuel treatments within and in close proximity to the WUI further complicates fire managers' roles. This resistance arises from two primary factors: (1)

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many of the prescribed fuel treatments do not reflect forest owners' understanding of vegetation management; and (2) treatments are developed with little recognition of the multiple values owners and the general public place on the forests and the WUI.

A wide range of diverse values have been attributed to the WUI. This includes a variety of ecosystem services such as climate regulation, enhanced air quality, habitat for a variety of species, noise abatement, enhanced property values, and numerous human and community health benefits. To date, however, much of the fire prevention/fuel treatment efforts have concentrated on protecting homes and other structures with little regard for the effects on other values. This is surprising given that over the last decade wildland fire policy has evolved from agency-focused risk mitigation to empowerment and actions at the household and community levels (USDA-USDI 2000; USDA-USDI 2009). Risk managers acknowledge that successful implementation of risk reduction strategies necessitates resident participation which, in turn, necessitates an understanding of values associated with wildfire protection.

This paper's objective is to provide a synthesis of findings from a national, comparative, cross-sectional analysis of fire prevention/fuel treatment and their effects on the values associated with the WUI. Specifically, we explore values associated with WUI and fuel treatments reflecting biophysical, sociodemographic, and sociocultural variation as well as perceived differences in risks across regions of the nation. To do this, we present findings from key informant (KIs) interviews, the first phase of a multi-phase, mixed methods research project that also includes facilitated community discussions and a national mail survey. Findings will help fire managers, community leaders, and other end users better understand public perceptions of issues surrounding the full range of values associated with WUIs. Such an understanding is critical to developing educational outreach programs and strategies for increasing acceptance of fire as an important management tool in reducing risk to these values while improving the health of the nation's forests. The definition of "public" is as dynamic as the forest, and it is land managers' responsibility to recognize public concerns and tailor their message to them. Moreover, findings could serve as a springboard for fire and fuel treatment message development and contribute to evaluation processes capable of use in areas where public education campaigns are being used, are required, or are appropriate.

The Biophysical Context of Wildfire

Biophysical factors include land use and cover, topography, climate, fuel load, fire regimes, wildlife, and numerous other ecological characteristics of the study site. An important consideration in the WUI is that risk increases as a result of forest fragmentation, landscaping decisions, and home building materials (Daniel et al. 2003; Jakes et al. 2007). Emergency responders and natural resource managers are obligated to protect life and property even when low-density housing is difficult to defend from fire due to long emergency response times, lack of water sources, and underdeveloped road systems (Radeloff et al. 2005). WUI residents have often indicated a sophisticated understanding of wildfire's role in forest ecosystems and environmental conditions influencing risk (Brenkert-Smith 2011; Flint 2006; Gordon et al. 2010; McCaffrey 2008; Monroe et al. 2006; Paveglio et al. 2011; Vining and Merrick 2008). As well, they often understand the tradeoffs of different fuel reduction strategies in order to enhance ecological benefits (Absher and Vaske 2006; Vining and Merrick 2008). Private forest landowners (PFLs) are more likely to engage in fuel treatments when they live on their land and take a proactive role in forest management (Carroll et al. 2004, Jarrett et al. 2009).

Several studies have focused on public acceptance of fuel reduction treatments on public land. A number of studies have found that the majority of respondents accept some utilization of

prescribed burning or thinning to reduce hazard (McCaffrey 2013; Absher and Vaske 2006; Brunson and Shindler 2004; Kaval 2007). The public tends to prefer thinning over prescribed burning (and similarly, let-burn strategies) when the site to be treated is close to a highly populated area (Brunson and Shindler 2004, Knotek et al. 2008, McFarlane et al. 2007, Paveglio et al. 2011, Ryan et al. 2006; Winter and Cvetkovich 2010). The two major factors that seem to influence acceptance of fuel reduction on public land are familiarity with a treatment technique and trust in those implementing the treatment (Shindler and Toman 2003; Weible et al. 2005; Winter et al. 2006; Walker et al. 2007). Additional factors include ecological effects, aesthetics, and citizen involvement in decision-making (Lim et al. 2009; McCaffrey et al. 2008; Shindler et al. 2011; Toman and Shindler 2006; Vogt et al. 2007; Walker et al. 2007).

The Sociodemographic Context of Wildfire

Sociodemographic characteristics consist of population distribution, spatial distribution of land use, political jurisdictions, and economic structure, among other factors. This is important in the WUI where many communities formerly dependent on resource extraction experience in-migration of new and seasonal residents. The ensuing dynamic can result in parcelization and fragmentation of the forests as well as a shift from extraction to recreational uses of forestland. As new social groups move into a community, services may become strained and decision-makers may be forced to raise taxes in order to finance the need for improved roads, emergency protection, education, and other public services (Cortese 1979; Freudenberg 1986).

A common assumption is that people living in different regions of the country, or with different sociodemographic characteristics, exhibit different fire management knowledge, attitudes, or actions. However, research findings indicate that geographic and socio-demographic differences were rarely key explanatory factors, particularly regarding support for treatment regimens (Fischer 2011; Jarrett et al. 2009; Lim et al. 2009; Mendez et al. 2011; Toman et al. 2011; Vogt et al. 2003; Wyman et al. 2012). Further, there is little consistency among the studies that report significant relationships between fire-related attitudes and behavior, and education, income, age, length of residence, or rural-urban differences (Absher and Vaske 2006; Bright and Newman 2006; Brunson and Evans 2005; Shindler et al. 2011; Ostergren et al. 2006; Weible et al. 2005).

A study by Absher and Vaske (2006) found demographic measures explained a limited percent of response variance. However, a psychological composite (familiarity, effectiveness, aesthetics) explained four to eight times more variance for each activity, indicating that these latter factors are much more important in determining approval. Inconsistencies in sociodemographic characteristics suggest they may be overshadowed by harder-to-measure differences such as culture, identity, and worldview, which are correlated with sociodemographics variables (Brenkert-Smith 2006; Gordon et al. 2010; Paveglio et al. 2009).

The Sociocultural Context of Wildfire

Social and cultural factors include traditions, attitudes, beliefs, and value systems of the study population. In the cultural context, risk is reflective of what is important to people in relation to the social institutions they create (Douglas and Wildavsky 1982). Residents often have to renegotiate local identity and symbols of collective life as the penetration of new and different value systems and threats to traditional norms and membership groups occurs with the emergence of heterogeneity in the WUI (Greider et al. 1991; Smith and Krannich 2000). These differences can manifest in competing notions about aesthetics, land use, and natural resources

management. Conflicting worldviews makes sharing indirect fire experiences that influence greater mitigation behaviors than direct wildfire experience difficult (McCaffrey 2002). Further, the large body of natural hazards research has found that communities with many new residents, tourists, or other transients were highly vulnerable to hazards if social networks were not developed enough to result in assistance from neighbors and institutions (Drabek et al. 1975; Tierney et al. 2001). Communication of wildfire risk to various segments of the public depends on attending to effective messaging for majority and minority groups as well as within minority groups (Lindell and Perry 2004; Martin et al. 2008).

For all WUI groups, sources of information about fire must be credible and trustworthy (Sturtevant and Jakes 2008; Winter and Cvetkovish 2008). Shindler et al. (2004) identify trust as one of the core components in determining social acceptability of forest management. Public trust in natural resource agencies is particularly important because resource managers mediate risks within and adjacent to the community. WUI residents tend to prefer wildfire information from local government sources that account for local context; however, information from neighbors and friends is also an important avenue of trusted communication, particularly among minority groups (Lindell and Perry 2004; McCaffrey 2002).

Residents who have less confidence in the institution's ability to fulfill its role tend to have increased perceptions of fire risk and were less likely than others to accept initiatives designed to address it (Fowlkes and Miller 1987; Paveglio et al. 2009; Shindler et al. 2011; Winter et al. 2004). Public trust has been influenced by the success of collaboration between local, state, and federal organizations as well the role of agencies, businesses, non-governmental organizations, and other institutions in facilitating wildfire hazard preparedness (Jakes and Nelson 2007; Halvorson 2002; Liljeblad and Borrie 2006). Because trust is dynamic and highly dependent on social relationships, effective messaging must be continuously reevaluated. It is important that fire managers know their affected groups (including local opinion leaders) and make efforts to increase their credibility through direct contact. This type of communication also allows for assessment of homeowner readiness.

Risk Perceptions

In their review, McCaffrey and Olsen (2012) note few studies have specifically discussed possible relationships between level of risk perceptions and fuels treatments (also Daniel 2007). The authors suggest this is a byproduct of selecting research sites in areas with high fire risk and the assumption of high fire risk in most fuels treatments discussions. Wildfire studies that have focused on risk perceptions indicate findings are consistent with those in the wider field of risk perception research. Risk varies based on individual probability calculations; timeframe and spatial area; vulnerability to potential negative outcomes; control, dread, and unknown effects; type of negative consequences; risk tolerance; and personal trade-offs with respect to exposure (Carroll et al. 2004; Daniel 2007; McCaffrey 2008; Martin et al. 2007; Cohn et al. 2008; Steelman 2008; Winter and Fried 2000). Finally, previous experience with fire has had mixed results. In some cases, prior experience led to greater perceptions of risk, in others it had a dampening effect (Winter and Fried 2000; McCaffrey 2004a; Blanchard and Ryan 2007; Flint 2007; Cohn et al. 2008).

Despite the subjectivity of risk, a few studies have noted it as an important factor in public support for fuel treatment. For instance, Bright and Newman (2006) found current hazard conditions leading to acceptance of prescribed burning and mechanical thinning. An Oregon study by Fischer (2011) found private forest owners were more likely to use fuel treatments when they perceived a high probability of damage to their property. Finally, acceptance of

defensible space activities and fuel zones around forests emerged where homeowners perceived high proximity to harm and probability of ignition (Ryan and Wamsley 2008; Winter et al. 2009). Rather than directly influencing mitigation and acceptance of fuel treatments, risk perceptions are more often an indirect factor, vis-à-vis, concerns about ecological conditions (i.e., biophysical knowledge) and experience with wildfire.

Study Area

Research sites (Figure 1) were selected based on their classification in the Wildland-Urban Interface (Radeloff et al. 2005) and whether or not they had a Community Wildfire Protection Plan (CWPP; <http://www.forestsandrangelands.gov/success/index.cfm>). Sites varied by sociodemographic indicators (e.g., migration and seasonal housing) and biophysical factors (e.g., forest type) and corresponded to US Forest Service Regions (Eastern, Pacific Northwest, Southern; Brennan et al. 2005). For comparison, a metropolitan county was selected with an adjacent nonmetropolitan county in each region. All sites had been designated as wildfire-prone and wildland fire issues were prominent (USDA-USDI 2001).

Table 1 provides population and housing characteristics for study counties: Clinch (nonmetropolitan) and Lowndes Counties (metropolitan) in Georgia; Carlton (nonmetropolitan) and St. Louis (metropolitan) Counties in Minnesota; Rio Arriba (nonmetropolitan) and Santa Fe (metropolitan) Counties in New Mexico; and Jefferson (nonmetropolitan) and Deschutes (metropolitan) Counties in Oregon.

In 2010, populations ranged from nearly 7 thousand in Clinch County to over 200 thousand in St. Louis County. All counties experienced an increase in population between decennial censuses except Clinch, St. Louis, and Rio Arriba Counties. Deschutes County had the greatest population increase. Urban populations ranged from the largest in St. Louis County to the smallest in Clinch County. The greatest increase occurred in Deschutes County while Clinch County experienced the greatest decrease. Corresponding rural populations ranged from the largest in Jefferson County to the smallest in Santa Fe County. Jefferson County received the largest amount of in-migration to rural areas, while Rio Arriba County lost the most rural population. Housing units indicate growth, a common characteristic of WUI communities. Santa Fe County had the fewest number of housing units while Jefferson County had the most with the greatest amount of change in Deschutes County.

Methods

Key informant interviews were conducted in four states during 2012 (Table 2). Interviews were administered to individuals knowledgeable about WUI issues and local affairs; moreover, these people were broadly representative of PFLs, forest industry, government, local political and social factions, and social status (Krannich and Humphrey 1986). We conducted 33 interviews in Georgia, 35 in New Mexico, 35 in Minnesota, and 45 in Oregon for a total of 148 interviews. Initial key informants were identified by local directories and internet sources. To ensure comparability across urban and rural counties of each state, informants representing each of the following perspectives were interviewed in each community: (1) federal and state land manager; (2) extension agent; (3) local planner and/or natural resource manager; (4) emergency services professional; (5) elected official; (6) business leader; (7) landowner; (8) religious leader; (9) journalist; (10) consultant or industrial forester; (11) environmental activist; and (12) citizen activist. Additional informants were identified using snowball sampling with purposive selection to encourage a diversity of perspectives, including underrepresented or marginalized segment of local society (Heckathorn 2002).

The interview covered: (1) awareness of past and proposed fuel treatments in the area; (2) the range of values associated with the WUI; (3) perceptions of wildfire risk; (4) public response to wildfire risk and occurrence; and (5) constraints on implementing wildfire reduction treatments. As well, we explored the perspectives informants had with respect to the public's perceptions and attitudes towards WUI values and fuel treatments. The use of open-ended questions encouraged informants to volunteer information, rather than simply respond to queries. Their rich and spontaneous replies provided a view of the reality of a place, including broad patterns of relationships among actions and actors with the local environment (Elmendorf and Luloff 2001).

Interviewers' notes were analyzed for emergent themes using a two-step coding process involving reading through the transcripts and then coding into thematic categories (Creswell 1998). Themes were compared within and across cases in each state and then over the four states. Each author reviewed the data and added additional interpretation to improve reliability.

Findings

Biophysical Context

The predominant themes from the biophysical context were (1) water availability; (2) proximity to fuels; and (3) fire as part of a natural system. Water was an issue in primarily in the Western states. For example, in New Mexico, several informants connected a noticeable decrease in water availability with climate change and mountain pine beetle (MPB). Fire was seen as a corollary to these hazards. In the quote below, an informant noted a decrease in precipitation with less snow hitting forest floor due to a thick forest canopy. His description indicates the high density of trees increases fire risk because water evaporates before it can contact the ground.

The snow pack is no good - it doesn't hit the ground because the trees are too thick. We're not getting runoff like before, so it's too dry. MPB is threatening stands in NM... There is too much fuel loading and fire suppression.

In turn, water issues were connected with several sociodemographic issues. It was perceived as worsening with the growing WUI as more people needed water, but policy had not kept pace with water use. Water was also connected to income – those who could economically afford to not be concerned about water.

Proximity to fuels was a strong theme in Oregon and Minnesota. Minnesota informants noted that the fire hazard increased with proximity to a designated wilderness area in northern St. Louis County. There, a catastrophic storm left a high volume of fallen timber in the late 1990s. “Fire is simply not thought about very often [in Carlton County]. However, the Boundary Waters incident makes people think about what could happen.” Similarly, in Oregon, informants noted forests were not near the agricultural communities in Jefferson County. By contrast, Deschutes County residents were in closer contact with the forest and fire perceptions differed due to proximity and fuel type. Informants highlighted perceptions of fire risk vary across minor geographic areas in relation to biophysical characteristics.

Perceptions of fire as part of natural systems varied within and across study sites. Although such attitudes indicate biophysical conditions, they were often intertwined with sociocultural values. Some, as in Georgia, considered idle land as the antithesis of natural. Plantation forests were as natural as non-plantation forests and human intervention, including prescribed burning, in the forest was natural. “(The) difference between a planted forest and natural is not much...Controlled burning is insurance against wildfire – fire is our best friend.” By contrast, Minnesota informants often thought that because their forests were “over-managed,” they were not natural and prescribed burning was an artificial event. Oregon informants said contemporary forests were not natural, but prescribed fire simulated a natural event to improve forest health.

Sociodemographic Context

The predominant themes from the sociodemographic context were (1) population change; and (2) economic shifts. In all states, population change was frequently mentioned. Depending on the site, change was linked to encroachment of the WUI into fuel zones, increased diversity, and loss of community identity. In Georgia, New Mexico, and Oregon, racial conflict emerged as an aspect of population change. As a result, the sociodemographic context tested local social relationships and capacities to agree on values associated with fire and fuels management. For example, new and seasonal residents were said to be less concerned with community impacts of fire hazard, but very concerned with smoke. Permanent residents, by contrast, either expressed concern or were not concerned about both aspects of fire.

Overall, Oregon communities sharply contrasted with the other sites in terms of dealing with different population groups. Despite responses such as “The term local ... is a misnomer because of the vast growth that this area has experienced” and “It is hard to do things when people are not the same,” the communities were described as proactive regarding wildfire preparedness. A local NGO specifically dealing with coordinating wildfire efforts was largely credited with leading community-wide efforts.

We were on the forefront of developing fuel management programs...Even the large landowners have gone on to do mitigation work without any assistance because it is the right thing to do. The program has grown in an organic way – it has not been forced

In New Mexico and Oregon, diversified and progressive economies of the metropolitan areas contrasted with the agricultural economies of rural counties. Economic strength was linked with high levels of human capital, which in turn translated to successful fire preparedness strategies, among other collective concerns. Santa Fe County leaders (private and public) engaged in fuel reduction to protect its watershed. Deschutes County leadership led by an NGO engaged residents in defensible space, collaborated with the Forest Service, organized

homeowner fuel removal and disposal events, and constructed a FireFree demonstration home, among other activities.

In other sites, economic concern was a major theme as communities shifted from extraction- to amenity-based economies. In all sites, informants expressed concerns about rural poverty and the decline of agricultural economies and population. This quote from St. Louis County illustrates emergent conflict as communities struggle to reconcile extraction-oriented values and recreation-oriented values. Long-time, permanent residents saw the recent influx of seasonal residents and tourists as “ideologues ... [newcomers] like the appearance of the town, and then they are shocked there is support for mining. It is not that [permanent residents] support [mining], but that they want to see it be done to support the economy and their livelihoods.” The sociodemographic context helped frame sociocultural values associated with wildfire preparedness and fuel reduction.

Sociocultural Context

The main themes from the sociocultural context were (1) natural resources values; (2) trust in government; and (3) community participation. Urban informants often discussed how residents valued forests in terms of recreational pursuits (the exception was rural St. Louis County, in which both urban and rural residents discussed recreation). Rural residents in all sites focused on cultural values towards agriculture. Major conflicts over natural resource values often focused on motorized versus non-motorized recreation (e.g., Minnesota), resource utilization versus ecocentrism (e.g., New Mexico), and pro-growth versus anti-development (e.g., Georgia). Such conflicts often overshadowed collective definitions of risk and acceptable mitigation strategies. For example, in New Mexico and Oregon, environmental activist groups were noted to oppose management actions that included thinning, prescribed fire, and post-fire salvage logging. This quote illustrates nuances in disagreements over management philosophies:

There are some environmentalists that say just leave it alone for the spotted owl and salamanders [and not to allow fuel reduction treatments], but no one here wants to clearcut the forest, they want responsible management.

Trust in the government to fight wildfires, conduct prevention treatments, and work with communities differed among and within study sites and had much to do with past interactions and experiences with government agencies. Many of the interviewees indicated a degree of trust in the government’s ability to fight wildfires. In contrast, interviewees expressed less confidence with federal government to implement wildfire prevention treatments and programs. All of our study sites except Georgia had experienced escaped prescribed fires, leading to skepticism regarding treatment needs and agencies’ ability to implement prescriptions. This quote from Oregon exemplifies the difficulty of balancing public acceptance of fuel reduction treatments.

If we do a prescribed fire and unexpected weather conditions crop up do we [local government] and forest service know what we are doing? This is a concern and is problematic. The pendulum that swings back and forth all the time – too aggressive logging the forests and now too aggressive burning them down – still sorting out how to balance this out.

All study sites reported positive community response and increased volunteerism when faced with natural disasters, including previous wildfires. A high degree of participation in daily activities was described; informants said residents were proud of their communities and enjoyed contributing to improved local well-being in various ways. Like many communities, they also experienced major divisions along racial, ethnic, and socioeconomic lines. Participation was

often linked to group membership. For example, racial conflict was a major issue in all sites. In New Mexico, an informant described a number of fire preparedness activities, including fuel reduction demonstrations. However, the Hispanic population was not involved and there was little expectation they would participate. One informant noted a constant question among residents was “Whose town is it anyway?” In another example, informants from Minnesota, New Mexico, and Oregon, described contradictory values and resources among income categories. This conflict led to exponentially impacting conflict regarding other issues of local life as well as disparate effectiveness of fire preparedness messaging between the groups.

Risk Perceptions

Risk perception themes were related to both wildfire and wildfire prevention treatments and centered around (1) wildfire concern; and (2) smoke. Aside from Jefferson County in communities along a main highway that were surrounded by irrigated crops, rural communities universally expressed wildfire concern. In highly fire-prone areas, long-term residents mentioned wildfire as a routine aspect life, especially during “fire” season. For example, a Minnesota respondent remarked, “We were raised with that awareness. We know to be careful as individuals.” However, this sense of concern may be eroding in some communities with high immigration of residents seeking recreation and retirement opportunities, such as Oregon, Minnesota, and New Mexico.

Wildfire was mentioned as a prominent risk only in Deschutes County, although CWPPs existed in each site. Informants said fire was prioritized when residents perceive a near and eminent danger. For example, a respondent in Georgia noted, “Fires in Colorado: we see and hear about (them) but that’s just another news story until you smell and see the smoke in your neighborhood and communities.” Informants failed to suggest that public experience with fire was an indicator of risk perceptions.

If personal safety and property were not under immediate threat from fire, smoke effects on health were mentioned often as a risk. Smoke management risks were stated in cases of wildfire and prescribed fires for wildfire prevention and cropland preparation. In urban areas and communities with seasonal residents and vacationers, smoke was perceived to be a risk if it disrupted community events, recreational activities, or travel. In several cases, natural resource and emergency managers were concerned about fire; however, the broader population was more concerned about smoke. According to informants, the mere mention of smoke could have wider socioeconomic impacts, especially in areas reliant on outdoor recreation. One Minnesota resident stated, “The Pagami Creek Fire did not put smoke into Ely. The headlines outside of the community were that the town was on fire. These headlines killed business for the season.”

Conclusion

This paper presented a synthesis of key informant findings from four states about public perceptions of values associated with wildfire protection in the WUI. Findings provide a foundation for future research and application by placing public wildfire risk perceptions into the biophysical, sociodemographic, and sociocultural contexts of the communities where WUI residents live. As well, findings point to concerns that need to be addressed and future research needed for human dimensions of wildfire to move forward.

Findings from this study support previous research (e.g., Flint 2006; McCaffrey 2008; Monroe et al. 2006) demonstrating the public’s sophisticated understanding of fire’s role in forest ecosystems. Key informant interviews in all sites illustrated spatial variance in fire risk perceptions. Regardless of whether the county was metropolitan or nonmetropolitan, spatial

variance existed based partly on proximity to fuel buildup and fuel type. For example, rural Georgia and Minnesota informants were aware of, but expressed little concern over fire from forest fuels, while urban residents in New Mexico and Oregon were more likely to express concern. In addition, interviews from the two Western states in our study illustrated residents' understanding of the connection between fire and other forest hazards. Informants expressed concerns over the relationship between fuel buildup and bark beetle and as well as water availability and climate change. Implications of these findings suggest that fire managers and community leaders should incorporate other salient concerns from the biophysical context (e.g., water or bark beetles) into fuel reduction and wildfire hazard planning.

Two study sites, Santa Fe and Deschutes Counties, demonstrated strong community-wide actions to reduce fire hazard. These actions were driven by robust collaboration between public and private groups. Of all our study sites, Deschutes County had the most well-developed fire mitigation efforts which were led by a local non-governmental organization (also Sturtevant and Jakes 2003). Findings suggest that such organizations were important to transcending sociocultural divisions with the communities and initiating dialogues about the threat of fire to all residents. In previous research, leadership has been described as critical to successfully mobilizing resources and facilitating on-going education (Fleeger 2008; Jakes et al. 2007; Krueger et al. 2002; Nelson et al. 2002; Shindler et al. 2011).

The obvious risk of an NGO's leadership is that such an organization can become as politicized as government actions. As such, collaboration between public and private entities is critical to the long-term success of fire mitigation. Although leadership has emerged in the human dimensions of wildfire literature, research would further benefit from investigation into the qualities and processes of leadership that have emerged in success stories. Such research could help identify processes and strategies for on-going leadership training in resident-led fire management. In places where strong leadership exists, it must be continuously enriched and developed to maintain the organization's efficacy, vigor, and sustained collaboration with government and stakeholders (Garkovich 2009).

Leadership is an aspect of the sociocultural context of community wildfire preparation which dominated many of the key informant's conversations in this study. In every site, group membership, cultural norms and values, and worldviews played important roles in risk perceptions of wildfire. In Georgia, rural residents involved in agriculture were more concerned about fire than urban residents. Risk perceptions in Minnesota were overshadowed by conflict over recreation or extraction uses of the forest. New Mexico and Oregon informants described racial conflict and culture clash between new/seasonal and long-time residents. As McCaffrey and Olsen (2012:25) noted, sociocultural factors are "the more complex, often identity-based, and harder-to-measure factors ... [that] appear more likely to explain variation in how individuals respond to fire management issues." The importance of these factors suggests a considerable need for work that improves researchers' ability to identify and describe the sociocultural context.

Continued development of regional or state-wide case studies that assess individual probability calculations; timeframe and spatial area; vulnerability to potential negative outcomes; control, dread, and unknown effects; type of negative consequences; risk tolerance; and personal trade-offs of mitigation may only nominally add to current research because such factors are well understood (McCaffrey et al. 2013). There is an increasing need to better understand the degree of influence of contextual variables, which are often more difficult to measure (Daniel et al. 2007). More emphasis should be placed on evaluation of dispute resolution, social learning, and

collaborative planning, all of which require an understanding of the ecological and social dynamics of the locality (Blatner et al. 2001; Sturtevant and Jakes 2007). A participatory approach (e.g., citizen science) that emphasizes diverse and balanced stakeholder representation, early and frequent collaboration, and transparency of decision-making will enhance community wildfire preparedness and acceptance of fuel reduction strategies (HFRA 2003; Mumford 1938; Pretty 1995; WGA 2001). In particular, the dynamic complexity of the sociocultural context calls for participatory methods that mix research and citizen involvement to unveil obscure elements of culture, values, and worldviews in addition to identifying local organizational networks and capacities (Selin and Chavez 1995). Such an approach will provide a complete characterization of fire-prone communities and other factors influencing the scope of sociocultural effects on the human dimensions of wildfire.

It is important to note that, in terms of outreach, the CWPP requires resident collaboration (HFRA 2003); however, most of our informants were unaware of local CWPPs. Because CWPP is a necessary condition of receiving financial aid for mitigation under the Healthy Forests Restoration Act (2003), the critical elements of participation may have been glossed over during the CWPP process in order to receive funding. CWPPs, like all well-intentioned participatory efforts, are ineffective without meaningful and long-term resident participation.

Figure 1. Map of study sites

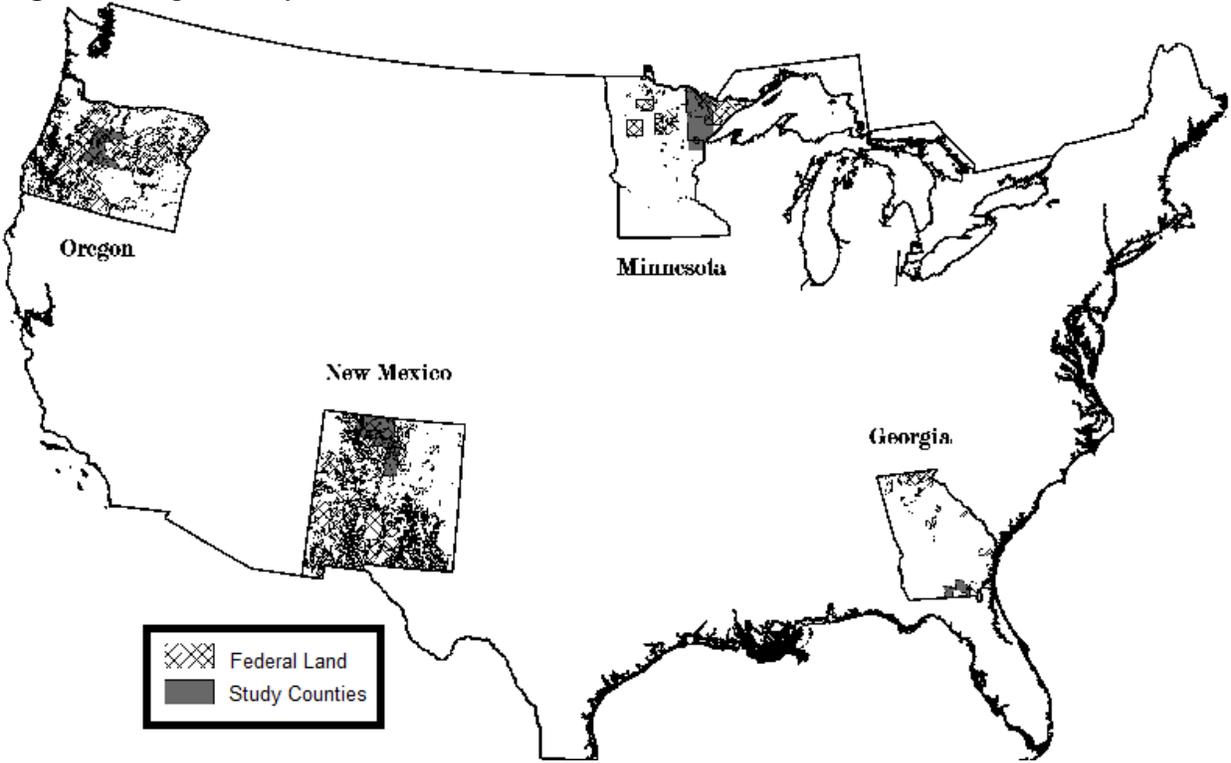


Table 1. Selected demographic characteristics of research sites and percent change between 2000 and 2010

	Total Population (2010)	Urban Population (2010)	Rural Population (2010)	Housing Units (2010)
Clinch County, GA	6,798	2,690	4,108	3,007
% Change	-1.16	-6.50	2.67	5.99
Lowndes County, GA	109,233	79,517	29,716	43,921
% Change	18.58	26.76	1.13	20.16
Carlton County, MN	35,386	15,865	19,521	15,656
% Change	11.73	36.98	-2.83	14.10
St. Louis County, MN	200,226	125,913	74,313	103,058
% Change	-0.15	-1.16	1.60	7.58
Rio Arriba County, NM	40,246	20,218	20,028	19,638
% Change	-2.29	13.81	-14.50	9.00
Santa Fe County, NM	144,170	107,896	36,274	71,267
% Change	11.51	10.72	13.93	23.51
Deschutes County, OR	157,733	114,130	43,603	80,139
% Change	36.72	57.30	1.85	46.82
Jefferson County, OR	21,720	8,010	13,710	9815
% Change	14.26	10.45	16.61	17.98

US Census Bureau, SF1 and SF2 100% data 2000, 2010

Table 1. Key informant types (n=148)

Type	Number of KIs			
	New Mexico	Georgia	Minnesota	Oregon
Government (Federal, State, Local)	13	23	16	28
Business	5	4	6	4
Minority group	2		2	3
Environmentalist	4		3	4
Media	2	2	3	2
Landowners	4			
Forest Industry	1	3	3	2
Citizen Activists	2		1	
Religious Leaders	2	1	1	2
TOTAL	35	33	35	45