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

Jason Gordon, Adam S. Willcox, A.E. Luloff, James C. Finley and Donald G. Hodges

Abstract

The wildland-urban interface (WUI) continues to transform rural landscapes as previously undeveloped areas are populated with residential and commercial structures which, in turn, impact ecosystems and create landscapes of risk. Within this context, the science of wildfire risk mitigation 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. We report findings from qualitative interviews conducted across the United States to identify and define various values at risk from wildfire. Values influencing risk mitigation emerged from the biophysical, sociodemographic, and sociocultural contexts of wildfire. Findings demonstrate how wildfire is intertwined with diverse sets of risks experienced in daily life. We provide a discussion of how this research impacts the transformation of landscapes and risk management strategies. Identifying and better understanding the effects of values associated with wildfire—and landscape change in the WUI—will allow natural resource managers and decision makers to develop more effective fuel treatment programs and land use policies.

Keywords: wildfire, wildland-urban interface, public perception

1. Introduction

For generations, the public was told that fire destroys forests and many of its associated values (e.g., timber, wildlife, recreation, esthetics, ecosystem services). Recently, 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, wildfire prevention measures for enhancing ecosystem services have not found purchase in either the public's acceptance or involvement in this new role of and for fire.

This is especially true of wildland-urban interface (WUI), a landscape of transition whereby increasing numbers of people and built structures invade wildlands. In the WUI of the United States, fire protection is directed not only at forests but also at homes and structures that are much more prevalent there. Resistance to recommended fuel treatments arises from two primary factors: (1) many of the prescribed fuel treatments do not reflect residents' understanding of forest management and (2) treatments are developed with little recognition of the multiple values owners and the public place on forests [1–3].

A limited number of studies have examined the relationship between wildfire mitigation activities and amenity values, recreation, or sense of place (e.g., [4–8]). More research is needed to consider the full set of multiple and competing values, particularly because wildland fire policy has evolved from agency-focused risk mitigation to empowerment and action at the household and community levels [9, 10]. Risk managers must acknowledge that successful implementation of risk reduction strategies necessitates resident participation which, in turn, demands an understanding of values associated with wildfire protection.

This chapter synthesizes findings from research exploring wildfire risk perceptions as they reflect variation in social values of the forest surrounding the study communities. To do this, we present findings from key informant interviews, which comprised the first phase of a multi-phase, mixed methods project that also included 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 rural-urban transition zones. The definition of “public” is as dynamic as the forest, and it is land managers' responsibility to recognize public concerns and tailor their messages and activities to them.

2. Literature

2.1 Risk perceptions of wildfire

Risk perceptions of wildfire have reflected the variability of findings found in the broader risk perception literature. Despite the importance of risk perceptions to wildfire mitigation actions [11–16], there is little consistency in the literature regarding the relationship between risk perceptions and mitigation behavior. For example, previous experience has been a factor in creating defensible space around homes; as well, it has been associated with apathy regarding the perceived likelihood of repeated wildfire events [17]. Similarly, proximity to wildfire has been shown to increase concern [18] or have little significance [19]. Inconsistencies suggest intervening social, economic, and ecological elements influence the ways homeowners view and address a wildfire hazard [20, 21]. As noted by several authors, risk perception is important to mitigation actions, but other factors within the biophysical, sociodemographic, and sociocultural contexts of wildfire may play equal or more important roles [22, 23].

2.2 The biophysical context

Figure 1 depicts a matrix of biophysical, sociodemographic, and sociocultural contexts affecting landscape change and risk perceptions. The matrix reflects the idea of ecological roots, or the connection between ecological, social, economic,

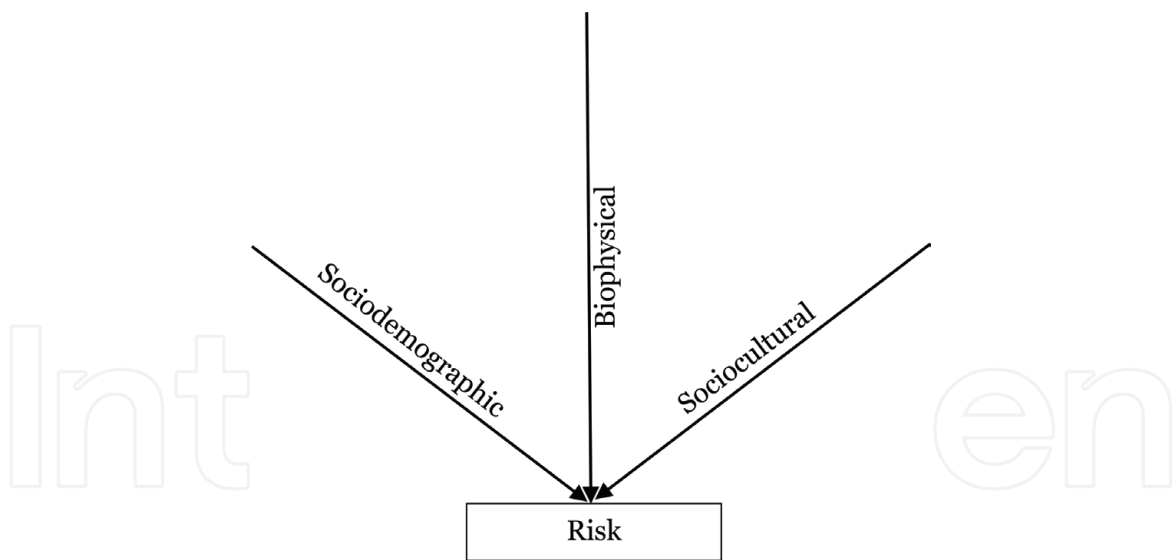


Figure 1.
Biophysical, sociodemographic, and sociocultural contexts (modified from [24]).

and cultural resources [25]. Ecological roots encourage landscape recovery by finding solutions linking these four elements.

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 wildfire risk can increase due to forest harvesting and fragmentation, inappropriate landscaping decisions, and flammable home building materials [26–29]. Landscape type, that is, shrub land versus pine forest or upland hardwood forests, also responds differently to fire susceptibility [30]. Emergency responders and natural resource managers are obligated to protect life and property even when low-density housing is difficult to defend from wildfire due to long emergency response times, lack of water sources, and underdeveloped road systems [31].

Recent studies have found WUI residents were aware that the lack of fire led to unhealthy forest conditions [21, 32, 33]. As well, public education and outreach has had a positive influence on knowledge about fuel reduction treatment methods [34, 35]. Some studies have found respondents accepted the use of prescribed burning as an ecological practice on public land, although they preferred mechanical treatments when the forest is located close to a populated area [32, 36, 37]. Despite these findings, high knowledge levels have also been associated with decreased concerns [20, 38]. Ample evidence that the public recognizes the ecological role of fire suggests that additional factors intervene in attitudes toward fuel treatment methods, decisions to live in high-risk places, and other factors related to wildfire risk perceptions and mitigation activities.

2.3 The sociodemographic context

Transitional landscapes are defined not only by biological characteristics, but also by social changes, which should be considered in understanding risk perceptions and mitigation. For example, Moreira et al. [39] literature review noted socioeconomic drivers favoring land cover changes, which, in turn, contributed to increasing wildfire risk. Still, although some differences have been observed for race and gender, sociodemographic variables by themselves have rarely explained important differences in attitudes and behaviors toward wildfire [3, 7, 15, 17, 40, 41]. This includes urban or rural residency status, which has been linked to divergent views in

resource management (i.e., prescribed fire, thinning, grazing), but not significant differences in wildfire risk perceptions per se [41]. Still, sociodemographics are important in the WUI where social and landscape change can lead to conflict in the sociocultural context of wildfire [42]. Surveys used to quantify perceptions of wildfire risk often have a limited ability to draw connections between sociodemographic variables and more difficult to measure sociocultural variables, including social conflict and collective agency [43]. Improving social assessment related to land use change is critical given that land use policies and land cover management affect fire patterns and intensity [39].

2.4 The sociocultural context

Traditions, attitudes, beliefs, and value systems of WUI populations are part of the sociocultural context of wildfire. As Beck [44] noted, risk is intertwined with society's economic and political structures, and the complexity of modern risk means no one fully understands the dangers they face. Wildfire risk is a fusion of ecological and technological drivers complicated further by enormous budgets, political lobbying, and media amplification. Nevertheless, risks are bound up in instrumental rational control—through decisions people make about their lives and future courses of action [44]. The sociocultural context of risk underscores both agency and the social construction of wildfire and preparedness (also [45]).

Within the sociocultural context, in-migration is an important characteristic of many interface zones even though the WUI is not defined by population change. In such cases, 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 [42, 46]. These differences can manifest in competing notions about esthetics, land use and community growth, natural resources management, and strategies for addressing wildfire risk. Additional community processes (e.g., race and class conflict, environmental concerns, historical grudges, social movements, cultural celebrations) emerge from change. Sharing direct and indirect wildfire experiences and local landscape knowledge can become increasingly challenging as a result of conflicting worldviews and competing group memberships [22, 47, 48].

Social institutions (i.e., insurance, government, and corporations) are a critical aspect of the sociocultural context because they are key players in the management of risk [44]. To maintain this role, effective messaging must be continuously reevaluated because trust is dynamic and highly dependent on the relationship between the institution and the public. Residents who have less confidence in an institution's ability to fulfill its role have demonstrated increased levels of concern about wildfire and are less likely than others to accept initiatives designed to address it [21, 29]. Risk communication through direct contact, citizen involvement in decision-making, and an understanding of local context has been most effective in sustained wildfire mitigation at the individual and community levels [16, 27, 34].

To examine values associated with wildfire perceptions and risk management, we consider the three dimensions of wildfire risk outlined above: biophysical, sociodemographic, and sociocultural. We then describe how community mitigation actions materialized from the contexts and merged into effective risk reduction strategies. Findings can serve as a springboard for wildfire and fuel treatment message development and contribute to evaluation processes capable of use in areas where public education campaigns are ongoing, are required, or are appropriate.

3. Study area

Research sites for this study were selected based on their classification in the WUI [31] 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., in-migration and seasonal housing) and bio-physical factors (e.g., forest type) and corresponded to US Forest Service Regions (Eastern, Pacific Northwest, Southern; [49]). 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 [9]. Human-driven changes have had an important influence on land cover dynamics, including landscape diversity [50].

Study counties included 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 under 6798 in Clinch County to over 200,000 in St. Louis County. All counties except Clinch, St. Louis, and Rio Arriba experienced an increase in population between decennial censuses. Deschutes County experienced the greatest population increase (37% to 157,733); Clinch County the greatest decline (−1% to 6798). Jefferson County experienced the largest amount of in-migration to rural areas (17% to 13,710), while Rio Arriba County lost the most rural population (−2% to 40,246).

4. Methods

Key informant interviews were conducted in each of these four states during 2012 (**Table 1**). Interviews were administered to individuals knowledgeable about WUI issues and local affairs; moreover, these people were broadly representative of private forest landowners (PFLs), forest industry, government, local political and social factions, and social status [51]. We conducted 33 interviews in Georgia, 35 in New Mexico, 35 in Minnesota, and 45 in Oregon for a total of 148. Initial key informants were identified using local directories and Internet sources. To ensure

Type	Number of key informants			
	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

Table 1.
Key informant types (n = 148).

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 diverse perspectives, including an underrepresented or marginalized segment of local society [52].

Each interview covered (1) awareness of past and proposed fuel treatments in the area; (2) 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. Open-ended questions encouraged informants to volunteer information, rather than simply responded to queries. Their rich and spontaneous replies provided a reality view of a place, including broad relationship patterns among actions and actors with the local environment [53].

Interviewers' notes were analyzed for emergent themes using a two-step coding process involving reading the notes and then coding into thematic categories [54]. 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.

5. Findings

5.1 Risk perceptions

Risk perception themes were related to both wildfire and wildfire prevention with a focus on (1) wildfire concern and (2) smoke. Aside from Jefferson County, where communities along a main highway were surrounded by irrigated crops, residents from rural communities in the study area demonstrated awareness about wildfire. In highly wildfire-prone areas, long-term residents mentioned wildfire as a routine aspect of life, especially during "wildfire" season. For example, a Minnesota respondent remarked, "We were raised with that awareness. We know to be careful as individuals" (St. Louis County). As discussed further below, this attitude may be waning in communities characterized by in-migration of residents seeking recreation and retirement opportunities. In such cases, perceptions tended to be mixed, ranging from heightened concern to indifference.

Of the four study areas, wildfire was mentioned as a prominent risk worthy of immediate concern only in Deschutes County (although CWPPs existed in each site¹). In the other sites, wildfire became a priority when residents perceived a near and eminent danger. A respondent in Lowndes County 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." By contrast, previous experience with wildfire was mentioned as a source for influencing risk perceptions only when the disaster event was recent (within the last 10 years) and catastrophic.

As the Georgia participant noted, smoke increased concerns about a wildfire even if personal safety and property were not under immediate threat. In particular, rural

¹ Although CWPP requires resident input (HFRA 2003), most of our informants were unaware of local CWPPs. Because CWPP is a necessary condition for receiving financial aid for mitigation under the Healthy Forests Restoration Act (2003), the critical elements of participation may have been neglected during the CWPP process in order to receive funding.

residents were likely to mention the negative health effects from smoke linked to prescribed fuel reduction fires or controlled fires employed in agriculture field preparation. Some informants said official and unofficial communication about smoke effects had wider socioeconomic impacts, especially in areas reliant on outdoor recreation. For example, a rural 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” (St. Louis County). In urban areas and communities frequented by seasonal residents and vacationers, smoke was perceived as a risk if it disrupted community events, personal recreation activities, and travel. Although natural resource and emergency managers acknowledged wildfire risk specifically, the broader population was often more concerned about smoke.

5.2 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 overwhelmingly mentioned as an issue in the Western states. For example, several New Mexico informants connected noticeable decreases in water availability with climate change and mountain pine beetle (MPB; *Dendroctonus ponderosae*). Wildfire was seen as a corollary to these hazards. In the quote below, an informant noted a decrease in precipitation with less snow hitting the forest floor due to a thick canopy.

The snow pack is no good - it does not hit the ground because the trees are too thick. We are 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. (Rio Arriba County)

This description suggests that high tree density increases wildfire risk because snow caught in the canopy sublimates.

Findings related to the biophysical context overlapped with the other dimensions of wildfire. For instance, Western residents connected water issues with sociodemographic themes such as population growth. Water problems were perceived as worsening with the growing WUI, but policy had not kept pace with water use. In some cases, study participants made a connection between management of local watersheds and wildfire. More importantly, WUI growth was a common denominator for both water use and wildfire.

By comparison, proximity to wildfire fuels emerged most prominently in Oregon and Minnesota. These places also exhibited the greatest degree of knowledge about fire's role in forest ecosystems. Minnesota informants noted that wildfire hazard increased proximal to a designated wilderness area. There, a catastrophic storm toppled extensive timber volume in the late 1990s. Through the media, word of mouth, and recreation activities, residents were frequently reminded of the well-known blow-down: “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, Jefferson County informants noted forests were not near their agricultural communities. However, Deschutes County residents were in closer contact with the forest and concerns increased with knowledge of forest conditions. Informant responses highlighted how wildfire risk perceptions varied across minor geographic areas in relation to biophysical characteristics.

Perceptions of fire as part of an ecological system differed within and across study sites. Although such attitudes can reflect biophysical conditions, they were often intertwined with sociocultural values. Some, as in rural Georgia, considered idle land the antithesis of nature. Plantation forests were as natural as nonplantation 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” (Clinch County). By contrast, rural Minnesota informants often thought that because their forests were “overmanaged,” they were not natural and prescribed burning was an artificial event (although not necessarily an unwanted practice). Rural Oregon informants said contemporary forests were not natural, but prescribed fire simulated a natural event to improve forest health.

5.3 Sociodemographic context

There were two predominant themes in the sociodemographic context: (1) population change and (2) economic shifts. In all states, residents discussed population change. Depending on the site, change was linked to WUI encroachment into fuel zones, increased diversity, and loss of community identity. In Georgia, New Mexico, and Oregon (Jefferson County), racial conflict emerged as an aspect of population change. Oregon and New Mexico were experiencing increasing immigrant populations, while the Georgia sites were characterized by race-based residence patterns. 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 wildfire hazard impacts, 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 comparison rural agricultural counties. Economic strength was linked with perceived high levels of human capital, which in turn translated to successful wildfire 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 the NGO mentioned above, engaged residents in defensible space, collaborated with the U.S. Forest Service, organized homeowner fuel removal and disposal events, and constructed a FireFree demonstration home, among other activities.

In all sites, informants expressed concerns about rural poverty and the decline of traditional agricultural economies and population. This quote from St. Louis County illustrates emergent conflict as communities struggled to reconcile extraction-oriented 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.” Notably, rural residents were more accepting of timber management; however, they were just as unlikely as their urban counterparts to discuss involvement in wildfire mitigation activities.

The sociodemographic context helped frame sociocultural values associated with wildfire preparedness and fuel reduction.

5.4 Sociocultural context

The main themes from the sociocultural context revolved around (1) natural resource values; (2) trust in government; and (3) community participation. Urban informants often discussed how residents valued forests for recreational pursuits (the main exception was rural St. Louis County where both urban and rural residents discussed recreation). In all sites, rural residents focused on cultural values associated with agriculture. Major conflicts over natural resource values often converged on motorized versus nonmotorized recreation (e.g., Minnesota), resource utilization versus ecocentrism (e.g., New Mexico), and progrowth versus restrained growth into wildlands (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 from urban areas were seen as opposed to management actions that included thinning, prescribed fire, and postwildfire salvage logging. This quote illustrates nuances in disagreements over management philosophies:

There are some environmentalists that say just leave it alone [and not to allow fuel reduction treatments]. But no one here wants to just clearcut the forest, they want responsible management. (Santa Fe County)

Trusting the government to fight wildfires, conducting prevention treatments, and working with communities differed among and within study sites and related to past interactions and experiences with government agencies. Although interviewees indicated a degree of trust in the ability of state and municipal governments to fight wildfires, they expressed less confidence in the federal government to implement wildfire prevention treatments and programs. All of our study sites, except Georgia, had reportedly 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. (Deschutes County)

All study sites reported positive community response and increased volunteerism when faced with natural disasters, including 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, a New Mexico informant described wildfire 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?" Informants from Minnesota, New Mexico, and Oregon described contradictory values and resources among social groups, which exponentially impacted conflict regarding other local life issues as well as disparate effectiveness of wildfire preparedness messaging between groups.

6. Discussion

This chapter presented a synthesis of key informant findings from four states regarding public perceptions of values associated with wildfire protection. Findings provide a foundation for future research and application by placing public wildfire risk perceptions into the biophysical, sociodemographic, and sociocultural contexts of communities, which frame the full range of values, attitudes, and behaviors associated with wildfire and forests (**Figure 2**). The model is fluid, with each dimension influencing and influenced by the other dimensions. Findings underscore the need to better measure and understand how sociocultural factors are associated with wildfire response.

Most key informants described fairly low community level concerns about wildfire despite their counties being recognized as high risk and having Community Wildfire Protection Plans in place [9]. Deschutes County was an exception, with community-wide risk mitigation actions reflecting relatively high levels of concern. Interviews from the two Western states illustrated residents' understanding of additional risks associated with fuel regimes. In some cases, informants were concerned about increased potential for wildfire as a result of tree mortality caused by the mountain pine beetle. In other cases, wildfire was linked to drought, which, in turn, was linked to climate change. Key informants noted population pressures can increase this web of concerns in the American West. These findings underscore the public's capacity for perceiving associations between environmental vulnerabilities; however, social and cultural dimensions of the community may cloud interpretations, and residents may have difficulty articulating such relationships.

Related to the sociodemographic dimension, risk perceptions, concerns, and behaviors varied across geographic areas in relation to biophysical characteristics of the landscape and cultural values of the population. This finding contrasts with previous research failing to demonstrate sociodemographic differences, including urban or rural residency [3, 17, 55]. Our study found increased concerns in the West compared to the two other study areas primarily due to the regions' recent history of catastrophic wildfires and drought conditions. As well, prescribed burning was generally accepted, but perspectives varied regionally as to whether it mimicked natural processes or was a component of "unnatural forests." In addition, findings generally supported previous research demonstrating public understanding of

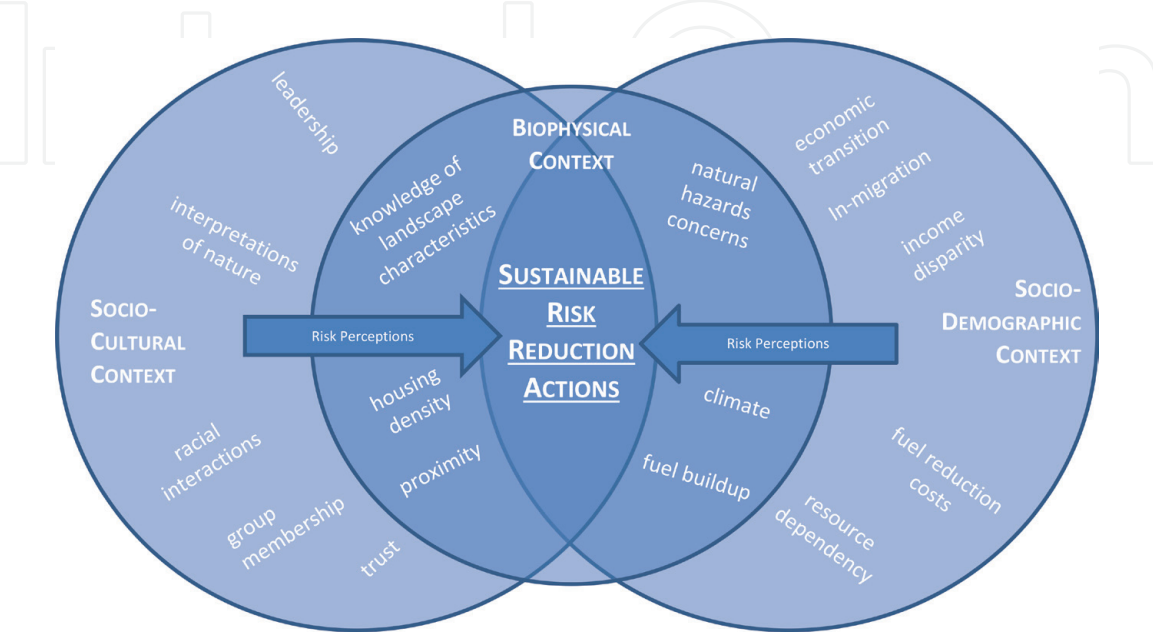


Figure 2.
Framework for understanding sustainable risk reduction.

wildfire in forest ecosystems (e.g., [33, 45, 56–58]). However, rural residents, who informants described as having more knowledge of biophysical processes than urban residents, were typically less concerned than their counterparts.

This study acknowledges that differences in wildfire perceptions are entwined in society's sociocultural structures, which evolve along with the changing ecology of transitional landscapes. As McCaffrey and Olsen [43] 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.” Key informant interviews demonstrated that growing communities have substantial challenges related to the social milieu, which influenced collective perceptions and the ways communities could address wildfire [22, 42, 47, 48]. The importance of sociocultural factors suggests a considerable need for work that improves the ability to identify and describe how the sociocultural context fits into risk perceptions and mitigation, key components of managing transitional landscapes, along with ecological restoration and environmental activities.

As well, our findings underscore the importance of local social and political institutions as key players in leading risk management [44]. Of our eight county sites, Santa Fe and Deschutes Counties demonstrated the strongest actions to reduce wildfire hazard. These actions were driven by robust collaboration between public and private groups (also [59]). Organizations, such as the NGO in Deschutes County, were important for transcending sociocultural divisions within communities and initiating dialog about the threat of wildfire to *all* residents. Although New Mexico exhibited mitigation activities, key informants acknowledged the activities excluded specific segments of the population; therefore, the actions were impeded at the community level.

Several implications emerge from this discussion. Because residents cope with a range of risks and hazards in their daily lives, many of which emerge from the changing social and biophysical landscape of the WUI, risk managers and community leaders should acknowledge competing risks when developing wildfire mitigation programs and messages. Risk managers have long understood that individuals have a finite capacity to effectively address many risks they face, and wildfire may take a backseat to other more salient concerns. This study suggests one way of initially identifying and characterizing competing risks and concerns is to employ the framework used here for understanding sustainable risk reduction (**Figure 2**). With residents' direct input, this approach can help promote dialog, understanding, and prioritization of community level concerns. As evidenced by Deschutes County leadership, resident contribution to the classification of risks is critical to the success of a comprehensive framework.

In addition, findings from this study suggest the potential for increasing awareness about wildfire and reducing risk by incorporating intersecting concerns from the biophysical context and acknowledging geographic differences [7]. For example, because water concerns and mountain pine beetle were salient and linked to wildfire, such hazards could be used as a vehicle to develop messaging that specifically addresses wildfire mitigation activities at the individual and community levels. For many places in the arid West, fuel reduction within the immediate goal of water quantity (and watershed management) may be valued more than fuel reduction for its own sake.

Similarly, programs in Georgia might focus more on the local health effects of smoke produced by wildfires; forest management activities such as prescribed fire have the potential to reduce airborne contaminants. One goal of this communication would be to allay the remnants of the total suppression message. Because residents are familiar with smoke, but not familiar with wildfire per se, communication strategies addressing smoke may have the desired impact. This implication may have ancillary effects on the scale of fuel reduction since all prescriptions must be implemented on a larger scale than currently performed in order to have any real difference in mitigating wildfire risk [60].

Finally, strong leadership can drive the process of characterizing community members' diverse values and concerns. Ideally, leadership in wildfire risk mitigation would originate from a community organization with no political affiliation. It is critical that, as one Oregonian put it, the program grow "in an organic way" and be part of the broader community development process [38, 61]. Although leadership has been a factor in the human dimensions of wildfire literature [7, 41, 62, 63], further research is needed to characterize the qualities and processes (e.g., dispute resolution, social learning, and collaborative planning, which require an understanding of the ecological and social dynamics of the locality) of leadership emerging in success stories [43, 59, 64, 65].

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