Public Perceptions and Tolerance of Smoke from Prescribed and Wildland Fire

Citation: Blades, J., & Hall, T. (2011). Public perceptions and tolerance of smoke from prescribed and wildland fire. Working Literature Synthesis. Conservation Social Sciences. University of Idaho. Moscow, Idaho.

Contents

Introduction

There is a crucial need to understand the diverse public opinions toward smoke from wildland fires; however, a very limited amount of research has been conducted specific to this topic. Land and fire managers are largely uncertain about the societal willingness to tolerate smoke in the short-term for long-term benefits, and there is a need for more effective ways to describe the smoke realities of alternative fire management programs (e.g., prescribed burning treatments vs. suppression) to justify why these programs serve the public interest (Potter, Rorig, Strand, Goodrick, & Olson, 2007). Smoke management programs require assessing public attitudes, beliefs, and values to gain an understanding of public perceptions and tolerance for smoke. Such information can be used to inform land management decisions and tailor public communication strategies that better align with local and regional perspectives. There has been a recent call from the fire management community to improve

the scientific understanding of "how people value their personal health and the health of their surrounding ecosystems, especially in circumstances where fire, climate change and increasing populations are interconnecting" (Riebau & Fox, 2010, p.20). This chapter provides an overview of the limited research that has been conducted to date on public perceptions of smoke, and conclude with future research recommendations.

It is difficult to disentangle public perceptions and tolerance of smoke from perceptions and tolerance of fire – the source of the smoke. A large amount of research has focused on public perceptions of wildland fire; therefore, many of the variables that affect perceptions of wildland fire have provided insights about the variables that influence public perceptions and tolerance of smoke. This chapter focuses on perceptions of smoke that are influenced by (1) values focused on personal health, property, and recreation/tourism; (2) environmental values and beliefs about ecosystem health; (3) agency trust; and (4) individual characteristics (e.g., knowledge, past experience with smoke, preparedness, and demographics).

Personal Values and Beliefs about Smoke

How does a person's values and specific beliefs about consequences of smoke influence tolerance? Value structures are established early in life through socialization and are considered to be stable guides for behavior and judgments that can be applied generally, rather than only to specific situations. Values can often be in conflict, and it is logical that people value both their personal health and the health of the landscape. The practical utility is that a better understanding of the hierarchy of public values, beliefs, and tolerance of smoke from wildland fires can inform land management decisions and tailor public communication strategies that better align with local and regional perspectives (e.g., messages with greater focus on improving ecosystem health or protecting human health).

Values Focused on Personal Health, Property, and Recreation/Tourism

Smoke from wildland fires can impact community residents in a variety of ways, such as public health, ash deposition (soiling of materials), public nuisance, visibility loss, and economic considerations (see Chapter 3). Though these impacts are known, there is a paucity of research related to public perceptions of health impacts from wildland fire smoke, and how such perceptions influence tolerance/acceptability.

For most people, smoke from wildland fires does not have a noticeable impact on health; however, certain segments of the population that are seriously affected by smoke, and people at

greater risk of exposure to smoke from wildland fires, for example residents of the wildland-urban interface, outdoor enthusiasts, and firefighters, are also more vulnerable to health risks (Fowler, 2003). In regions of Arizona, Colorado, Oregon, and Utah, Brunson and Shindler (2004) found that fears about human safety and apprehensions about increased levels of smoke (both reduced scenic quality and health) were the primary concerns with regard to forest fuel treatments. A study by of three western U.S. national forests (Arapaho–Roosevelt, Mt. Baker–Snoqualmie, and San Bernardino) found that respondents rated air quality concerns as a consistent factor for supporting full suppression of fires (Kneeshaw, Vaske, Bright, & Absher, 2004). McCaffrey, Moghaddas, & Stephens (2008) found that although only a small percentage of the California survey respondents considered smoke an important consideration, it was likely a highly salient one for individuals with an existing health issue, and those individuals may be more vocal about concerns. Given that many U.S. households have some type of health problem, and the post-World War II baby boomer generation is getting older (generally age 50-65 years), the issue of smoke-related impacts and management is clearly an important smoke management consideration. Individuals, households, and communities that have existing health problems are more likely to have an increased awareness of the consequences of smoke for public health, and a lower tolerance for smoke from wildland fires.

There is not clear evidence that smoke from wildland fires is considered a serious threat to recreation, tourism, economy, and lifestyles. Several studies in the U.S. and Australia have found concerns about prescribed fire and smoke impacts to be less than historically speculated and to vary by region (e.g., Bell & Oliveras, 2006; Blanchard & Ryan, 2007; Bowker et al., 2008; Brunson & Shindler, 2004; Carroll, Cohn, & Blatner, 2004; Shindler & Toman, 2003). The nationwide survey by Bowker et al. (2008) found that 42 percent of respondents were concerned about prescribed fire impacts to recreation and aesthetics, but overall the research indicated less concern for smoke and loss of scenic quality than other studies (e.g., Shindler & Toman, 2003; Brunson & Shindler, 2004). Blanchard and Ryan (2007) found little concern in the northeastern U.S. about the impacts of smoke from prescribed fire, or potential car accidents that could be caused by smoke blowing across roads, as these concerns respectively ranked 6th and 8th of a possible 8 indicators of risk. In the Blue Mountains of Oregon, two-thirds of residents agreed that prescribed fire was acceptable if it helped forest health – even though 24 percent of the residents identified smoke as a health problem for their family (Shindler & Reed, 1996). Similarly, some focus group members from the Inland Northwest who had health issues that could be aggravated by smoke (e.g., asthma) were nonetheless willing to accept smoke as a reality of where they live (Weisshaupt et al., 2005). Support for agricultural burning has been related to benefits for the

economic base (i.e., income and jobs) and benefits to the health of the aricultural fields (Weisshaupt et al., 2005), but it is unclear whether this support also occurs for prescribed burning and tolerance of smoke.

Though there is some evidence that smoke may not be a major concern related to wildland fires and fuels treatments, people do travel to National Forests and protected areas (e.g., Wilderness Areas, National Parks) to enjoy solitude and scenery – both of which can be impacted by smoke. The wildfire season often occurs at the same time as the peak tourism and recreation season, increasing the likelihood of smoke impacts to outdoor-related economies. Prescribed fire and smoke are often perceived as "bad" if they impact local interests, such as aesthetics (Brunson & Shindler, 2004; Winter et al., 2002). An example of the economic cost of smoke was made clear by Sandberg, Ottmar, Peterson, and Core (2002): the cost of preventing a visible smoke plume on most days at the Grand Canyon was estimated at approximately $5.7 billion each year when applied to the total U.S. population. Ross (1988) found that park visitors responded that they would spend more time and money on clear days and less time and money on days with lower visibility. In a Florida recreation study (Thapa et al., 2004), half of the survey respondents said they would cancel their vacation or change destinations if smoke and ash were reported as causing health problems at the destination, and 40 percent would cancel or change destination if there were high levels of smoke or car accidents due to smoke. Decreased recreation and tourism means adverse impacts to the local economy.

It is easy to comprehend how nuisance smoke is often a greater concern to fire managers and community officials than meeting federal air quality standards, because only a few complaints due to nuisance smoke can inhibit fire management and prescribed burning activities (NWCG, 2010). Clearly, when smoke from a fire impacts an individuals lifestyle (e.g., recreation or work revenue) it is anticipated to decrease that person's tolerance for smoke. Other potential impacts to a person's lifestyle could include staying indoors, changing outdoor activity patters, and changing travel or work patterns. Given that many rural communities, notably in the West, are shifting from commodity to amenity based-economies (Winkler, Field, Luloff, Krannich, & Williams, 2007), impacts to recreation-tourism, or other amenity-based lifestyles are an increasing concern.

Environmental Values and Beliefs about Ecosystem Health

Concerns about the environment have been shown to substantially influence attitudes about natural resource policy and management (De Groot & Steg 2007; Dietz, Dan, and Schwom, 2007). Although many people value natural landscapes and agree that ecosystem health is important, there are

divergent opinions about what defines a healthy ecosystem, the role of fire and impacts of smoke, and how each should be managed.

A study of diverse regions in the U.S. (Winter, Vogt, & McCaffrey, 2004; 2006) found that respondents in northern California, northern Florida, and Michigan's Lower Peninsula all reported strong biospheric values and believed that prescribed fire practices could improve conditions for wildlife and help to restore forests to a more natural condition by reducing dense fuels. The public understanding of the origins of smoke (e.g., prescribed fire, wildfire, agricultural burning) and beliefs about smoke being an unavoidable consequence of improving forest health have also been related to varying levels of tolerance of smoke (Jacobson, Monroe, & Marynowski, 2001; Shindler & Toman, 2003). Focus groups conducted in the Inland Northwest found agreement between participants that smoke is a part of life in the region, and that prescribed fire results in forest renewal and benefits both ecologic and human interests (Weisshaupt et al., 2005). Alternatively, other research has found that people with strong environmental values ranked their concerns about prescribed fire impacts on fish and wildlife above their concerns about the potential health effects of smoke and the cost of conducting the treatment (Bowker et al., 2008; Jacobson et al., 2001).   These studies suggest that there is a relationship between environmental values, beliefs about ecosystem health and the role of fire, and tolerance of wildland fire smoke. It seems logical that individuals who have strong environmental values will be more aware of the ecological consequences of a wildland fire, and would be more tolerant of wildland fire smoke than people who are more concerned with personal health and property.

Beliefs about the Controllability of Fire and Smoke and Agency Trust

As stated at the beginning of this chapter, it is often difficult to separate perceptions of smoke from perceptions of fire – where beliefs about wildland fire supersede the beliefs about the resulting smoke. Fire is not a tool that can always be controlled; it is a self-sustaining chemical reaction that continues until the fuel supply is exhausted or it is suppressed (Gorte, 2006). Therefore, public support for using prescribed fire and wildfire as a land management tools is often dependent on whether people believe that the fire and smoke can be effectively controlled, and whether fuels management tools will reduce the risks and consequences to their values (e.g., health, property, the ecosystem). Does the public believe that prescribed burning or using prescribed-natural fires (light to moderate amount of smoke) will reduce the likelihood of an extreme wildfire (unhealthy dense smoke) and reduce future risks to ecosystems and/or human health and property? Focus groups conducted in the Inland Northwest found that many participants were willing to trade off the negative aspects of smoke from

prescribed fires conducted now for the benefits of less smoke and reduced threat of large wildfires in the future (Weisshaupt et al., 2005). Large proportions of WUI residents from studies in California, Florida, Michigan, and Missouri believed that prescribed burning would result in less smoke over the long-term (Winter et al., 2006; Weisshaupt et al., 2005). It seems logical that people will be more tolerant of smoke from prescribed fires if they believe that it ensures greater control over present or future fires and reduces the risks to personal health and property.

On the other hand, for the public and sometimes managers, the threat associated with escaped fire and widespread smoke from prescribed and prescribed-natural fires are often perceived as being greater than the potential benefits of the actual action (Hunter et al., 2007). Stated another way, the cure is perceived to be worse than the disease. The possibility of a prescribed fire escaping and becoming uncontrolled often represents the greatest public concern (Absher, Vaske, & Shelby, 2009; Blanchard & Ryan, 2007; Brunson & Evans, 2005; Weisshaupt et al., 2005; Winter et al., 2002), even more than concerns about personal health problems from smoke and ash (Jacobson et al., 2001). The belief that prescribed burning can result in uncontrolled fires, and can reduce tolerance for using it as a management tool, has been fairly well established (e.g., Fried et al., 2006). Therefore, people holding beliefs about being vulnerable to escaped fires will be less tolerant of smoke than those who are less concerned about escaped fires. Additionally, beliefs related to the effectiveness of prescribed fire and prescribed natural fire in reducing future extreme smoke events will influence perceptions about smoke impacts and overall tolerance of smoke. For example, if a person believes that a successful prescribed fire will reduce fuel vegetation density and the potential for escaped fires or extreme smoke events in the future, and understands that staying indoors and reducing outdoor activity during prescribed burning will reduce health effects from smoke, they will likely perceive themselves as being less vulnerable to smoke impacts and be more tolerant of prescribed fire smoke.

Agency Trust

Trust has long been established as an important component of public land management. In any aspect of life, trust is a concept that is difficult to establish, easy to lose, and very hard to regain. Carroll and Daniel (2003) have suggested that public perceptions attached to fire and smoke events are directly related to beliefs about who should take responsibility for mitigating current impacts and preventing future impacts. Expectations for land managers are higher now than in the past because fire and smoke management have more direct impacts on citizens living in rural WUI communities, largely due to population growth and greater opportunities for fire-human interaction (Shindler, 2004).

Public acceptance of fuel treatment approaches that involve smoke is often related to the degree to which people trust the implementing agencies (Fried et al., 2006; Vogt, Winter, & Fried, 2003; Vogt, Winter, & Fried, 2005). The national survey conducted by Bowker et al. (2008) found that 68 percent of the respondents indicated that public land managers and forest professionals can be trusted to select the best methods for dealing with wildfire, and 91 percent favored the use of prescribed fire as a forest treatment. Trust in land managers is clearly related to increased support for management objectives and actions.

Several dimensions of trust related to land management hazards have emerged as being most salient, notably: competence, credibility, care, and shared values (Johnson, 1999; Winter et al., 2004; Winter et al., 2004). Care and credibility are represented as agency efforts to communicate with the public about future planned agency actions (e.g., prescribed burning) and the risks associated with wildfire and prescribed fire (Winter et al., 2004; 2006). Credibility and competency increase public trust and acceptance of forest treatment activities, resulting in a belief in the agency to safely manage the burn (Winter et al., 2002). Social trust has been shown to be based on "perceived shared values" rather than direct knowledge of the managing agency (Absher et al., 2009; Winter et al. 2004). Trust judgments are based on whether people perceived that they share similar goals, thoughts, values, and opinions with the agency (Absher et al., 2009).

Trust has long been known as an important factor of management effectiveness, and the same holds true for smoke management. Blanchard and Ryan (2007) found very strong support in the northeastern U.S. for educating and involving the public in fire activities, as the public respondents felt that state and federal agencies should not be solely responsible for fire mitigation planning – where involvement and shared responsibility were components of trust. Agency trust and the perceived benefits of prescribed burning have been shown to be closely (e.g., saves money, restores natural conditions, reduces fire risk, and improves wildlife habitat) (Winter et al., 2004). Negative associations with trust have been found for some previously discussed variables, such as the risk of escaped fire from prescribed burning and its impacts on aesthetic qualities. Daniel (2003) stresses the importance of clearly communicating all trade-offs that fuel treatments entail, warning that vague, incomplete or glossed over-representations of treatment effects and exaggerated expectations of safety benefits could jeopardize public trust and support needed for success over the long-term. Face-to-face personal contacts have been found to increase trust and support for more controversial aspects of prescribed burning practices (e.g., McCaffrey, 2002). Shindler (2004) recommended that communications should

clearly reflect land managers' understanding of public concerns and a commitment to a long-term relationship managing public lands. As stated previously, building and maintaining trust between land managers and public stakeholders is not a new concept; however, a deeper understanding of variables related to trust, competence, credibility, care, and shared values needs to be developed and implemented with regard to smoke management and potential impacts.

Other Individual Characteristics Related to Perceptions and Tolerance of Smoke

Knowledge and Attitude

Different levels of knowledge and understanding of current fire and smoke issues can influence tolerance of smoke and support for fire management. Individuals and communities can become more accepting of smoke and supportive of management if they fully understand its necessity and if agencies take steps to minimize smoke impacts on communities (e.g., Ryan & Wamsley, 2008). McCaffrey (2002) found that the greater the respondent's accurate understanding about risk of fire, the less their concerns about smoke. In fact, 88 percent of respondents were aware of prescribed burning in their region; of those, 94 percent felt that it was an appropriate management tool (McCaffrey, 2002). In the Blue Mountains of eastern Oregon and Washington, Shindler and Toman (2003) found that that the more people knew about mechanical thinning or prescribed burning the greater the level of support for these practices. Researchers have argued that knowledge of a management practice leads to a positive attitude towards the practice (Absher et al. 2009; Ryan & Wamsley, 2008; Shindler & Toman 2003), although this is not always the case (Johnson, 2005). However, Fried et al. (2006) also found that the extent of actual approval is often less than that of attitude: as much as 40 percent of people who reported they did not support a treatment type nonetheless reported having a positive attitude towards it in principle. This finding suggests that other factors (e.g., agency trust, past experience, smoke source, or where the treatment would take place) influenced the acceptability of a management action. For example, Weissenhaupt et al. (2005) found that smoke from prescribed burns was more acceptable than that from agricultural field burning, largely because forest treatments were perceived to provide benefits for everyone who values and uses the forest, whereas field burning mostly benefits an individual farmer but impacts many others. These findings suggest that many of the other factors discussed in this chapter, such as trust, values, norms, and the source of the smoke (e.g., agricultural, chimneys, wildland fires) can influence acceptance of fire and fuels management activities.

Clearly there is a well-established relationship between knowledge, attitude towards fire, and support of different landscape treatments. However, with the majority of research devoted to acceptance and tolerance of fire and fuels management practices, and limited focus specifically on smoke, it still begs the question: Are perceptions and tolerance of fire and fuels management the same as perceptions about smoke from these sources? A longitudinal study by Shindler et al. (2009) across four western states and three Great Lake states somewhat supports this notion, with the finding that most participants specifically indicated a willingness to accept the potential inconveniences associated with smoke from prescribed fire. In a related question, only 5 percent of all participants in 2008 felt that because of smoke, "prescribed fire is not worth using" (p. 8).

Past Experience with Fire and Smoke

The frequency and magnitude of seasonal fire activity by region has been sugjensted as a driving influence in regional differences in support for prescribed fire practices (Loomis, Bair, & González-Cabán, 2001), and the same is likely true for tolerance of smoke. Residents or communities with more wildland fire experience, permanent (as opposed to seasonal) residents, and those individuals who have worked in natural resource-related fields have been documented to be more accepting of forest treatments (Blanchard & Ryan, 2007; McCaffrey, 2002; Vogt et al., 2003; Vogt et al., 2005; Winter et al., 2006). Florida and Missouri residents, for example, are used to prescribed fire practices due to extensive experience, and subsequently support their use. This was also reflected in Missoula focus groups that claimed to be more tolerant of prescribed fire smoke because they had experienced severe wildfire smoke the previous summer and viewed prescribed burning as an effective technique for reducing catastrophic wildfire risk and smoke (Weissenhaupt et al., 2005). For four regions of the west that had recently experienced fire, Brunson & Shindler (2004) found that the number of people expressing "moderate" to "great" concern about smoke from prescribed fires ranged from 37 to 58 percent, while the number with "no concern" ranged from 13 to 23 percent. On the other hand, less personal experience with prescribed fire has been linked to beliefs about negative outcomes of prescribed fire, such as escaped fires (McCaffrey, 2002; Winter et al., 2006). It appears that recent experience with fire reinforces acceptance of prescribed fire activity, and therefore moderate smoke levels, but this has not always been found to be the case.

A study of north and central Florida residents assessed the relationship of previous fire experience to knowledge, attitude, and intention related to wildland fire and reducing fire risks on their property (Jacobson et al., 2001). Interestingly, respondents' knowledge, attitudes, and intentions were

not affected by previous experience with wildfire or prescribed fire, which contrasts with other research findings. Fried et al. (2006) similarly found that experience with a treatment type was not related to acceptance of that treatment type. In fact, Jacobsen et al. (2001) found that respondents who reported more experience with fire were less likely to say they would take action to decrease fire risk to their home. This finding suggests that residents' previous experience resulted in a decreased perception of risk, and that the risk was at an acceptable level not requiring action; this finding may reflect the "gambler's fallacy," or the belief that an event that has just happened is unlikely to occur again in the immediate future (Burton et al., 1993; McCaffrey, 2004). Conversely, Bright and Newman (2006) found greater support for fuels reduction after a recent wildfire occurrence. These authors found that people's support for treatment was lower when forests had little or no wildfire history, which is an important consideration because the lack of fire could indicate a higher risk of severe wildfire and smoke, and the need for treatment. These results suggest that *type* of past experience (e.g., severity of adverse consequences, no impact, or perceived benefits from fire) influences beliefs about how severe the next fire will be, and are important in determining future attitudes of fire management and smoke. It is logical to assume that people who have had positive experiences with prescribed fire are likely to have a higher tolerance for smoke than people who have had negative experiences with fire or smoke.

Proximity to Wildlands and Potential Smoke Impacts

How does the location of a person's home (e.g., urban, suburban, exurban, or rural) and proximity to wildlands influence perception and tolerance of smoke? A public preference for lower risk treatments (i.e., mechanical thinning) near developed areas and perceived higher-risk treatments (i.e., prescribed fire) in remote rural areas has been documented in some instances (e.g., Bright & Newman, 2006; Weisshaupt et al., 2005). Bright and Newman (2006) found that both urban and rural residents of the Colorado Front Range, southern Illinois, and metropolitan Chicago preferred the use of prescribed fire in remote areas (rural forests) and mechanical thinning in more developed or urban areas, which the authors suggested was due to the belief that prescribed fire could be more dangerous near urban areas. Focus groups of the Inland Northwest (Weisshaupt et al., 2005) also reflected this preference. Carroll, Cohn, and Blatner (2004) suspected that smoke from prescribed burning could likely be an issue for urban areas where residents are typically more vocal in their opposition to smoke. Given the absence of data, one can only speculate that the documented preference for prescribed fire use in remote areas is accompanied by the assumption that smoke is undesirable near developed and urban areas, and that residents living in remote rural areas will be more tolerant of smoke. A study in north and central Florida (Jacobson et al., 2001) partially supported this assumption with the finding that most

respondents (79 %) believed that residents who live near natural areas should also tolerate more smoke. However, it is unknown whether this preference is consistent with regions outside Florida and the South.

Community Preparedness for Fire and Smoke

Several studies have discussed the important relationships among space, community, and culture that define a WUI community and the level of preparedness for fire (e.g., Bowker et al., 2008; Jakes et al., 1998, 2007; Paveglio et al., 2009). A national survey of attitudes, knowledge, and preferences pertaining to fire, fire risk, and fire recovery found support for personal responsibility related to fire risk and the guiding role of government (Bowker et al., 2008). The majority (70%) of survey respondents said that people who live in and around forests and rangelands should be prepared to accept the inherent fire and smoke risks, and 66 percent felt they should follow government guidelines to mitigate risk (Bowker et al., 2008).

Recent research by Jakes et al. (2007) illustrated that landscape, government involvement, human capacity, and social capacity were important to the success of wildland fire preparedness initiatives in 15 U.S. communities. Lee (1991) and Paveglio et al. (2009) illustrated that WUI communities are not a single monolithic cohesive unit with residents who know each other, work together, and effectively communicate – but rather a mosaic of varying interests and lifestyles that are intermixed without clearly delineated boundaries. Smoke management today must be prepared for diverse community approaches and to understand that competing levels of personal relevance will drive conflict (Lee, 1991; Paveglio et al., 2009). However, it is logical that community preparedness will increase overall resident knowledge of land management objectives and smoke issues, leading to a greater tolerance for smoke from prescribed and prescribed-natural fire than among residents in communities that are less prepared for fire.

Demographics

Many studies have shown few or weak relationships between forest treatments or policy support and sociodemographic characteristics (e.g., Absher & Vaske, 2007; Absher et al., 2009; Fried et al., 2006; Shindler & Toman, 2003). Fried et al. (2006), who examined support for prescribed burning in California, Michigan, and Florida, found that none of the contextual or sociodemographic attributes assessed was substantially related to people's acceptance of a treatment type (e.g., length of residence, age, educational attainment, income, property value, proportion of the vicinity in high-hazard fuels, number of large historical fires in the vicinity, distance to the perimeter of the closest large fire, and

distance to the nearest area of high-hazard fuels). These findings are not altogether surprising in suggesting that the issue is often more complex than demographic, geographic, and other contextual details. However, some of the studies indicated that variables of race/ethnicity and gender may illustrate regional or national differences and are worth exploring further.

Two particularly interesting demographic factors that have been related to fire or smoke issues are ethnicity and gender (e.g., Bowker et al., 2008; Lim et al., 2009; Ryan & Wamsley, 2008). The nationwide survey conducted by Bowker et al. (2008) found that 60 percent of African-Americans were concerned about prescribed fire smoke, versus 51 percent of Hispanic and 30 percent of Caucasian respondents. Similarly, Lim et al. (2009) found that the probability of disagreeing with the use of prescribed fire was 6 percent higher for African-Americans and 5 percent higher among Hispanics than Caucasians. Further, women, African-Americans, and Hispanics tended to be more concerned about the potential effects of prescribed fire and smoke.

Ryan and Wamsley (2008) and Lim et al. (2009) found that male respondents were much more likely to support the use of prescribed fire than women; male respondents were also less concerned about the risks of fire near their homes. In fact, female respondents felt more strongly than males that that prescribed fire is too dangerous and should not be used at all (Ryan & Wamsley, 2008). Based on these findings it appears that women (notably African-American and Hispanic) are more concerned than men about the environment in general, and certainly more concerned about the potential adverse effects of prescribed fire and smoke.

Conclusions and Future Research

This chapter has focused on the complex factors that can influence public perceptions and tolerance of smoke from wildland fires. The studies discussed in this chapter suggest that public perceptions and tolerance of smoke can vary significantly for different groups. Often public communication materials developed for a homogenous audience, yet these studies are a useful reminder of the variability that exists within communities and regions, and that locally tailored messages are required to achieve stronger public tolerance or acceptance of smoke from wildland fire management. In summary, wildland fire outreach and management plans should take into account values, beliefs, and indiviudal characteristics, such as:

1. **Understand values and beliefs about smoke** — The strength of different personal values and beliefs about the consequences of fire and smoke can influence tolerance of smoke and

management strategies that produce smoke. Individuals, households, and communities that have health concerns that are exacerbated by smoke are likely to be more aware of the consequences of wildland fire smoke for public health, and a lower tolerance for smoke from wildland fires. People who have stronger environmental values are likely more aware of the ecological benefits of a wildland fire, and more tolerant of smoke from management actions that strive to improve ecosystem health. A better understanding of the hierarchy of public values, beliefs, and tolerance of smoke from wildland fires can inform land management decisions and help tailor effective public communication strategies.

2. **Build and maintain trust, and validate concerns about controlling fire and smoke** — The possibility of a fire escaping and becoming uncontrolled, irregardless of smoke impacts, often represents the greatest public concern. People or communities that hold beliefs about being vulnerable to escaped fires will likely be less tolerant of smoke than those who are less concerned about escaped fires. People are more tolerant of smoke from prescribed fires if they believe that it ensures greater control over future fires and reduces the risks to personal health and property. Managers should clearly communicate all trade-offs surrounding wildland fire smoke; because vague, untimely, incomplete or glossed over-representations of smoke effects and exaggerated expectations of safety benefits could jeopardize public trust and support needed for success over the long-term. A deeper understanding of variables related to agency trust, competence, credibility, care, and shared values needs to be developed and implemented with regard to smoke management and potential impacts.

3. **The Devil's in the details, so know your audience** — Of course, this is not a new suggestion, but there are individual and community charateristics that influence perceptions and tolerance of smoke (e.g., knowledge and attitude about smoke and landscape treatments, past experience with fire and/or smoke, preparedness for fire and smoke, and demographics). Because there is a mosaic of varying interests and lifestyles that are intermixed, often without clearly delineated boundaries, it is important to dive into the details of each community in an attempt to understand contextual and spatial difference that could influence perceptions and tolerance of smoke.

The literature related to public perceptions of wildland fire smoke has illustrated how individual and community tolerance for smoke can vary greatly across cognitive, contextual, and spatial gradients – and the underlying reasons for such variations are not always clear. Although insights have been gained from research on perceptions wildland fire and management, there remains a crucial need for

studies that focus specifically on the cognitive and behavioral factors that influence public perceptions and tolerance of smoke. Land managers need better information on smoke tolerance levels, factors that affect tolerance, and trade-offs among competing desired objectives (e.g., control over the fire, type and degree of habitat alteration, and smoke timing and levels). Additionally, managers need better direction about how to communicate with the public regarding the short- and long-term costs and benefits of different smoke-emitting management scenarios that better align with diverse local and regional values and perspectives.

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