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Research article

Determinants of perceived risk and liability concerns associated with prescribed burning in the United States

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ABSTRACT

While prescribed burning is a proven tool in the management of forests and grasslands, its use has been limited due, in part, to potential risks that may result in legal liability, property damage, and personal injury. The purpose of this study is to understand the factors that shape landowners' and fire professionals' perceptions of risks associated with prescribed burning activities. The data for this study were collected from active prescribed fire professionals involved in Prescribed Burn Association (PBA) activities in 14 Southern and Mid-western states. Perceived risk was higher among respondents with higher levels of concern related to safety and weather but lower among respondents with more experience in burning activities. Sociodemographic variables such as age and income were not significantly correlated with risk perception. These findings are useful for better understanding how landowners and fire professionals perceive risk and offer insight into how perceived risk affects decisions to apply prescribed burns.

1. Introduction

1.1. Background

Prescribed burning is the deliberate ignition of fire under specific environmental conditions to reduce wildfire hazards, enhance biodiversity, control invasive species, and promote new growth of desirable species (Fuhlendorf and Engle, 2001; Parr and Brockett, 1999). Prescribed burning has been applied, albeit sparingly, as a land management tool in many forest and grasslands (Fuhlendorf and Engle, 2001; Nyland, 2002). More than 4 million acres of land in the United States are burned annually (Melvin, 2012; NIFC, 2017). Despite being widely used as a land management tool, prescribed burning comes with potential risks such as property damage, personal injury, and legal liabilities (Yoder et al., 2004). Because of these concerns, landowners are often hesitant to utilize prescribed burning as a land management tool (McCaffrey, 2006). Existing research indicates that liability-related concerns are the primary reason behind landowners' low level of interest in adopting prescribed burn (Weir, 2010; Wonkka et al., 2015).

Other stakeholders such as fire professionals, land managers, and landscape service providers regularly utilize prescribed burning to complete management objectives although their perceived risks associated with the use of prescribed burning may differ from landowners (Harr et al., 2014). In particular, personal experience and intuition play more important roles in landowners' risk perceptions than in those of scientists and other professionals (Harr et al., 2014). For example, Prescribed Burn Associations (PBAs)—which collectively represent landowners, other private citizens, land managers, and agency or extension service professionals—include a diverse set of stakeholders. PBA members share ideas and equipment to effectively conduct prescribed burns (Weir et al., 2016). Originated in the Great Plains, these associations now exist in several states including over 60 organizations in the U.S. South and Midwest (Weir et al., 2016). Many PBAs work closely with and receive funding from state and federal government agencies (Weir et al., 2016). In addition, they provide a consistent voice in state legislatures promoting landowner- or manager-friendly prescribed burn policies (Weir et al., 2016). Kreuter et al. (2008) found that landowners who were members of local PBAs responded more positively to statements about the ecological role of prescribed burns.

The purpose of this study is to understand the major factors that influence risk perceptions among stakeholders involved in prescribed burning. In particular, we aim to capture how land use objectives, past experiences, insurance availability, and ownership patterns influence those perceptions. Perceived risks associated with the potential for a)

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property damage, b) liability due to damage of others' property, and c) bodily injury form the basis of this analysis. In addition to liability, issues such as structural damage, human health and safety consistently rank high among the concerns for prescribed fire (Elmore et al., 2009). These are the primary concerns documented in wild fire literature (e.g., Kreuter et al., 2008, Yoder et al., 2004, Haines et al., 2001) which are also consistent with what we have learned from our long professional engagement in prescribed fire outreach. Therefore, perceived risks associated with these attributes were considered for this analysis. Since PBAs are citizen cooperatives of knowledgeable members that aim to conserve and restore fire-dependent ecosystems (Taylor, 2005), they provide a suitable platform to investigate prescribed burn risks.

1.2. Public risk perceptions concerning wildland and prescribed burns

Substantial literature on public perception of wild fire has emerged over the past several decades. For example, Gardner et al. (1987) surveyed two urban-wildland interface communities in California to understand their awareness and perception of fire related risk and hazard planning. Two risk scenarios, one depicting fire occurrence in close proximity to a neighborhood and another depicting the potential for personal property damage due to fire, were taken into consideration. Respondents perceived the probability of fire occurring in their neighborhood to be higher than the probability of that fire damaging their property. Results also suggested that risk perceptions were more predictable in communities recently affected by fire. All else constant, respondents with higher awareness of wildland fire perceived higher risks than others (Gardner et al., 1987). They also found that respondents had low levels of awareness concerning fire severity and preferred policy strategies involving prescribed burning or green belts in fire-prone areas. Sturtevant and Jakes (2008) conducted research on ecological and social contexts of wildfire risks to demonstrate the role of collaboration (or lack thereof) in wildfire preparedness and response. They demonstrated that collaborative effort allowed communities to conduct risk assessment and set priorities for hazardous fuel reduction.

Winter and Fried (2000) conducted a focus group of 39 Michigan homeowners to study their perceptions of fire hazard and fire management strategies. Participants were also asked about the responsibilities of homeowners and fire protection organizations in the event of wildfire. Findings suggested that homeowners, although mindful about their responsibility concerning use of fire and support of prevention-oriented outreach strategies, felt that investments in fire suppression infrastructure did not pay off. This is partly because most infrastructures cannot handle uncontrolled fire, and they were skeptical about benefits from prescribed burn. A survey of community members in western Canada by McGee et al. (2009) revealed that a recent fire incidence had no effect on the residents' perception of fire related risk. These results run counter to earlier findings that local residents' perception of fire risk are shaped by fire events in the area (Gardner et al., 1987; Paton et al., 2000).

In a study of residents in the western United States, Martin et al. (2009) sought to understand how various attributes can impact risk perception and risk mitigation behavior. Attributes included 1) direct experience with or subjective knowledge about wildfire 2) perceived capacity to deal with fire hazard 3) public versus personal sense of responsibility toward wildfire mitigation and 4) permanent or seasonal residence in a wildfire impact zone. Their results showed that all attributes except personal experience with wildfire had a statistically significant impact on risk perception and risk mitigation behavior.

Twidwell et al. (2015) compared risks inherent to prescribed burn with those of other land management practices such as crop production, animal production, firefighting, logging workers, and construction equipment operators. Study results suggested that the risks associated with wildfire are substantially higher than those of prescribed burn. Risk of fatalities were inconsequential with prescribed fire and non-fatal injuries were the predominant concern. Indeed, casualty risks from prescribed burning were even less than those from ranching and farming (Twidwell et al., 2015). Results suggested that social norms, cultural beliefs, and media coverage combined to heighten risk aversion towards fire. A social perception study by Toledo et al. (2013) focused on adoption of high-intensity prescribed burns relative to ecological (brush encroachment, land condition, and proximity constraints) and social (risk orientation, fire management knowledge and skill, access too equipment, and subjective norms) attributes. Results suggested that respondents with previous experience with prescribed burns and those who are more risk averse had positive attitudes toward the use of high-intensity prescribed burns. Another study of landowners by Harr et al. (2014) concluded that emotional reactions to fire risk, uncertainty, and the possibility of hazards as the greatest obstacles to successfully implementing prescribed burning.

Some studies have specifically focused on the attitude and risk perception of PBA members. For example, a comparative study of PBA members in Texas found that PBA members had significantly more positive attitudes toward the use of prescribed burn on their properties (Toledo et al., 2012). Moreover, Toledo et al. (2014) conducted a mail survey of landowners to explore the effects of perceived risks, perceived constraints, and membership in PBAs on landowner decisions to conduct burn activity. They identified membership in a PBA and perceived constraints—such as lack of knowledge, experience, and diminished access to labor—as more important than perceived risks in a landowner's decision to conduct a prescribed burn.

Legality and liability concerns have also been studied for their impact on stakeholder perceptions of risk related to prescribed burning. For example, a study by Wonkka et al. (2015) examined prescribed burning laws and related legal challenges in the United States and found that statutory requirements significantly impact landowners' propensity to burn. Private landowners were significantly more involved in prescribed burning in counties where civil liability for uncontrolled fires were classified as gross negligence compared to counties where liability fell under simple negligence standards.

Overall, review of existing literature led us to synthesize evidence that paved ground for our work. First, we found that extensive media coverage, cultural beliefs and norms for wildfire damages have heightened the perceived risks of liability, bodily injuries, and property damages. This has contributed to a fear for use of fire as a safe management tool. Second, while meaningful efforts have been made to understand risk perceptions concerning wildland fire, only a handful of studies have focused on the risk perceptions associated with prescribed burn. Third, while some literature has acknowledged that risk perceptions can impact prescribed burning decisions, no studies have identified the factors that shape landowners' and other fire professionals' perceptions of risk associated with prescribed burning activities. Building on the previous research, this work aims to understand the factors that play significant role in determining risk perception among stakeholders of the prescribed burning community.

1.3. Theoretical framework

Several prominent theories have shaped social science research on risk perception. The contagion theory of risk perception, for example, highlights the role of social interactions in risk perceptions. According to contagion theory, individuals' perceptions of a social construct are guided by the groups or like-minded networks in which they interact (Scherer and Cho, 2003). Therefore, networks or cooperatives built on collective action principles should be targeted for better perspectives on the cognitive processes involved in risk perception (Scherer and Cho, 2003). Similarly, risk perception has been analyzed using a social amplification framework in which risk information passes through an intermediate platform that can intensify or weaken an individual's risk perception (e.g. Kasperson et al., 1988). Likewise, Rogers (1975) conceptualized protection motivation theory, which suggests that the perceived assessment of vulnerability from a risk factor, perceived