PRESCRIBED FIRE OUTREACH IN THE SOUTHERN GREAT PLAINS: CHALLENGES AND OPPORTUNITIES

A Thesis

by

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ABSTRACT

In North America, suppression of natural fire regimes has degraded grassland ecosystems. Land managers have attempted to reverse this by applying prescribed fire, but these efforts has been obfuscated by safety and liability concerns. In this thesis, this issue is addressed through the acquisition of information from stakeholder groups in Texas and Oklahoma. First, phone interviews were conducted with key informants in order to understand how prescribed fire use is promoted or inhibited in Texas and Oklahoma. Second, a mail survey of County Commissioners was conducted to understand attitudes and knowledge levels concerning prescribed fire due to the power of these officials to implement and grant exemption to burn bans.

A majority of the interviewees considered range improvement for livestock to be the primary objective for prescribed burning within their area but frequently referred to wildlife benefits as a consideration when burning. Considering the large and growing proportion of landowners in Texas and Oklahoma primarily engaged in wildlife-related recreation, this discrepancy may suggest that these are an underrepresented demographic among prescribed burners, and that prescribed fire educators should tailor programs toward them. Demonstration and personal interaction were the most effective means of education, but were constrained by personnel shortages that Prescribed Burn Associations may help to mitigate. Smoke hazards and to a slightly lesser extent property damage and injury were considered the most serious risks in regards to prescribed burning.

A majority of responding County Commissioners reported being comfortable with prescribed fire, believing it to be a safe and beneficial practice. Degree of comfort was most influenced by respondent's self-reported familiarity with prescribed fire, which was correlated

with being invited to a prescribed burn, among other factors. Most invitations that Commissioners received to participate in a burn came from private landowners rather than Natural Resource Agencies. County Commissioners' primary source of information about prescribed fire were local fire departments and emergency services, which may influence Commissioners to be more conservative with burn ban exemptions. Education and outreach efforts among these groups may help reduce any pressure Commissioners may feel to be stricter about enforcing burn bans.

DEDICATION

To my parents, for their unending support and patience.

To Lars Nielsen, for being a mentor to a young scientist and putting me on this path.

To Dr. Urs Kreuter, for his continual aid and for having faith in me.

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CHAPTER I

INTRODUCTION

Background

The Great Plains of North America are among the most distinctive and culturally iconic landscapes on the continent. A source of awe and wealth for Native American nations and European settlers alike, this vast and deceptively diverse ocean of grassland, savannah, and hills stretching from Texas to central Canada has been deeply desirable to human habitation for millennia due to its abundance of flat arable land and vast herds of bison. In its eagerness to access the wealth of the West, however, the rising American nation began to compromise the very forces which together with climate formed, shaped, and maintained the Great Plains throughout its history: periodic fire and nomadic ungulate herds (Axelrod 1985). The Red Buffalo and its mammalian twin, in a dynamic process known as pyric herbivory, maintained soil fertility through accelerated nutrient cycling, enhanced biodiversity through the formation of a fluid and heterogeneous mosaic of habitat types, and kept the ecoregion in large part maintained in a lower successional state by resisting the encroachment of most woody plants (Frank and Evans 1997). The widespread suppression of historical fire regimes together with rapid population growth and urbanization have catalyzed land fragmentation and woody encroachment across the landscape, especially within the Southern Great Plains of Texas and Oklahoma.

These long-term disruptions to the region's ecology have had consequences on a landscape-scale, both ecologically and economically. The rapid encroachment of hardy, fast-growing woody species such as honey mesquite (*Prosopis glandulosa*) and the evergreen trees of the juniper genus (*Juniperus pinchotii, Juniperus ashei, Juniperus virginiana*) colloquially known as 'cedar' across rangelands in the Southern Great Plains has compromised the habitat of

grassland species and dramatically lowered the local biodiversity across many locales (Archer 1994). Indeed, grassland birds have become the most rapidly declining avian group in North America due in large part to the habitat degradation caused by woody encroachment (Fuhlendorf et al. 2012). In terms of human impacts, this increasing density of woody plants has resulted in serious monetary losses for America's ranchers; a pasture infested with heavy concentrations of juniper may experience a loss of grazing productivity as great as 75% compared to non-degraded baseline areas (Fuhlendorf et al. 2008). Perhaps even more serious for inhabitants of the Southern Great Plains, decades of strict fire suppression in many areas have altered both the nature and quantity of fuel loads across rangelands and the urban-wildland interface (Twidwell et al. 2013). The greater accumulation of dead fuel and concentration of woody plant species within formerly sparse grasslands and savannahs have resulted in a major shift within regional fire regimes away from relatively frequent grass fires to less frequent but far more dangerous, widespread, and difficult to control wildfires resulting in grave losses of life and property (Twidwell et al. 2013).

Prescribed fire, the application of fire to a landscape in a scheduled and controlled manner, offers land managers a way to mitigate the negative effects of woody encroachment by recreating historical fire regimes, a cheaper and more environmentally friendly alternative to mechanical brush removal and herbicide application in many cases (Van Liew et al. 2012). However, the use of prescribed fire as a land management tool is hampered by the perception of potential risk by both policymakers and potential practitioners, as well as resource constraints and a shortage of qualified personnel (Kreuter et al. 2008). A number of state and federal agencies, such as the Natural Resource Conservation Service (NRCS), as well as nonprofit organizations, such as The Nature Conservancy, provide information and guidance to

landowners interested in prescribed fire. Additionally, many of these organizations, such as the Texas Parks and Wildlife Department, promote the use of prescribed fire through public outreach and education as well as performing demonstration burns within managed natural areas (Texas Parks and Wildlife Department; Texas A&M AgriLife Extension).

Problem Statement

Long-term fire suppression within the Southern Great Plains of the United States has greatly disrupted the historical regime of frequent fires that maintained the region's native grassland ecosystems. As a result, many of these grasslands have experienced invasion and dominance by woody plant species, decreasing grazing productivity and imperiling grassland biodiversity. The application of prescribed fire is the most effective means of halting and reversing this trend, but its use among landowners is limited due to its perceived risks, real or imagined. Government and select nonprofit organizations have made efforts to endorse and facilitate the use of prescribed fire. Trends in primary landownership objectives in the Southern Great Plains indicate a potential shift from ranching to recreational land use. This shift raises two important questions for the future application of prescribed fire: how can government agencies adjust their approach to promoting the use of prescribed fire in response to shifting landowner perspectives and concerns regarding prescribed fire? Additionally, are county commissioners equipped with appropriate knowledge to make informed decisions regarding the implementation of burn bans that inhibit the use of prescribed fire?

Thesis Structure

This thesis is divided into three chapters. The first chapter includes the introduction, problem statement and overall literature review. The second chapter presents the results of the telephone interviews conducted in 2017 with key informants, and the third chapter presents the results of the 2018 mail survey of County Commissioners. The citation and reference format of information sources follow the journal, Rangeland Ecology and Management.

Literature Review

Risk Recognition and Public Opinion

One major subset of perceived risks associated with prescribed fire are the possible negative effects of smoke on air quality and visibility along roadways. Smoke produced by prescribed fire carries harmful PM2.5 particulates, and the environmental circumstances considered optimal for prescribed fires (such as light winds, low temperature, and moderate humidity) can lead to poor smoke dispersal and the accumulation of airborne particulates (Haikerwal et al. 2015). Further, the PM2.5 smoke particle concentrations produced by prescribed fires are comparable to those produced by wildfires, though at much lower volumes per acre burned, and have been shown to "consistently exceed air quality guidelines". These high concentrations of fine particulates have been documented to increase the risk of pulmonary diseases (Haikerwal et al. 2015). Due to rising rural populations, smoke management is becoming an increasingly important aspect of prescribed fire because of the documented health risks. Governments must balance the long-term benefits of prescribed fire with short-term negative effects on air quality when barring prescribed fire during "bad air quality days" and in areas at risk of being designated "non-attainment" (Monroe 1999). Florida, for example, requires that burn managers receive authorization from the Florida Forest Service (FFS) in order to burn;

the FFS gives authorization based on smoke dispersal projections for that day (Monroe 1999). Burn managers are also strongly encouraged to notify neighbors and the media of upcoming burns, as well as to update them on burn results, ostensibly in order to improve public perceptions of fire (Monroe 1999). In a study conducted by Haines et al. (2001), smoke management, air quality laws and the risk of liability ranked very high as perceived barriers to future burning in both National Forests and state and private lands in the Southeastern United States. Among state and private lands, public opinion was regarded as the greatest barrier, with residential development ranking fourth. More generally, prescribed fire is viewed as an important management tool but its use is limited because of its perceived high risk (Twidwell et al. 2015). These perceived risks are not reflected by reality, however; among land management occupations logging and crop production had significantly higher death rates than wildfire control, while prescribed fire resulted in far fewer fatalities (Twidwell et al. 2015).

Misconceptions regarding the impact of fire go beyond erroneous beliefs concerning risks to human health and safety. When asked about the potential risks of prescribed fire in a survey following the 1998 wildfires, a random sample of rural and suburban Floridians believed that harm to wild animals and the spread of fire to neighboring properties were the two greatest risks (Jacobsen et al. 2001). This perception could be influenced by a lack of the public's understanding of wildlife adaptation and behavior in regards to fire as well as portrayals of fire in popular programs such as Smokey Bear (Jacobsen et al. 2001). Most respondents to a 1984 study in Tucson, Arizona also believed that rapidly moving fires killed moderate to high amounts of wildlife; education regarding native wildlife's ability to survive and escape fire could be beneficial. Four other major beliefs held by those opposed to prescribed fire were: 1) fear of fires getting out of control and becoming dangerous, 2) concern about fires damaging natural systems,

3) belief that natural systems are too complex to be fully understood and should be "left to nature", and 4) the belief that fires should not be allowed in forests for any reason (Cortner et al. 1984). Education regarding the relative low risk and good track record of prescribed fire and about the natural role of fires in native ecosystems can address the first two concerns, while the second two beliefs are more challenging for educators to overcome (Cortner et al. 1984). According to a national survey of the United States conducted in the wake of the severe fire season of 1988, in which particular attention was placed on the areas most affected by the infamous Yellowstone fires, respondents with negative attitudes believed that prescribed fire destroyed natural scenery and animal habitat and that it was a threat to human lives and property (Manfredo et al. 1990). Those who held positive attitudes toward prescribed fire also believed that it 'destroyed' natural scenery and caused many animals to lose their homes or die, though the latter was a less widely held belief among respondents local to the region surrounding Yellowstone, possibly due to greater experience and knowledge levels. Overall, the results of the surveys appear to indicate that increased knowledge of fire and prescribed fire regulations reduced controversy and improved attitudes towards prescribed fire. Education efforts can improve their efficacy among the general public by targeting misconceptions surrounding the effects of fire on animals and animal habitat, as well as by attempting to alter societal norms regarding the use of fire and its presence on the landscape, as societal pressure and concern about provoking negative reactions from others represent one of the most serious constraints to widespread use of prescribed fire (Manfredo et al. 1990; Toledo et al. 2013).

Prescribed fire use is not only constrained by societal pressure, however, but often by a lack of access to knowledge, expertise, and resources as well. In Texas, landowners who had not implemented prescribed fire listed numerous significant barriers that prevent the use

of prescribed fire, including: lack of equipment and funds to create firebreaks, insufficient knowledge and perceived lack of skill, liability concerns, and lack of assistance in developing burn plans. Small property size, perceived lack of effectiveness in using fire to meet management goals, and the lack of a local burn association were not considered meaningful barriers (Kreuter et al. 2008; Toledo et al. 2013). During a prescribed burn tour conducted at the Texas A&M Sonora Research Center in 1997, most participants supported the use of prescribed burning, but agreed that liability, lack of assistance, and lack of equipment and experience were major obstacles to prescribed fire use (Taylor 2005). Costanza and Moody (2011) found that the most important constraint for prescribed burning was human development near proposed burn sites, followed by weather, smoke regulations, high fuel loads, and resource shortages. Overall, non-ecological considerations were the dominant reasons upon which prioritization of parcels for burning was based.

Prescribed Burn Associations (PBAs) represent a potential means for facilitating the use of prescribed fire by overcoming common constraints, whether through labor and resource sharing or peer-to-peer influence and education (Twidwell et al. 2013). Beginning with a Prescribed Burn Task Force established in Nebraska in 1995, there are currently about 50 active PBAs in the Great Plains. Members of PBAs, are less concerned about the potential risks of prescribed fire than previous research would suggest; this may be to greater levels of exposure to fire or a sense of trust and solidarity between neighbors. Rather, members perceive that insufficient knowledge and skill as well as equipment and labor shortages on burn days are more important constraints to the use of prescribed fire than fear of risk (Twidwell et al. 2013). PBAs are in a good position to mitigate these constraints, however, by acting as a mechanism for sharing equipment and expertise between members as well as

providing a single point of contact through which educators may engage with large groups of landowners interested in prescribed fire (Toledo et al. 2014). Unfriendly liability legislation may limit the efficacy of PBAs, but these organizations provide a platform through which landowners can potentially lobby for friendlier legislation but, until such efforts are successful, liability will continue to be a barrier to the more widespread use of prescribed fire; one which any outreach and education efforts must be prepared to address (Twidwell et al. 2013).

Fear of liability for any damages to persons or property caused by prescribed fire is still a major concern for landowners; research in the southeastern USA indicated that more hectares were burned in counties with gross negligence liability standards, wherein burn managers are not liable for damages unless they are proven to have shown reckless disregard for potential consequences, than in adjacent counties subjected to more stringent simple liability standards (Wonkka et al. 2015). Varying liability standards, such as simple and gross negligence, shift costs and the burden of caution relating to prescribed fire between the burner and their neighbors, thereby affecting the willingness of landowners to utilize prescribed fire (Yoder et al. 2004). Stricter liability policies place most of the cost and burden of caution on the burner, making them more reluctant to burn and compelling them to be more conservative when they do; this increases the cost of preventative measures and reduces the efficacy and economic return of applying prescribed fire. Additionally, a burner's neighbors have little incentive to invest in protecting their property from fire as the burner assumes most of the burden of responsibility. By contrast, under less strict liability policies, the burden is shared more evenly between a burner and their neighbors, enabling the burner

to more confidently apply fire due to lower risk and greater net economic benefit (Yoder et al. 2004).

Current approaches to promoting prescribed fire

Beginning in the 1970s the public began leaning away from the strict suppression policies of previous decades, mirroring a similar change in natural resource management agencies' policy changes and education programs (Cortner et al. 1990). The literature suggests that exposure to education materials a) increases knowledge of the benefits of prescribed fire, b) reduces health and safety concerns related to prescribed fire, and c) improves attitudes and tolerance toward the use of prescribed fire (Cortner et al. 1984; Shindler and Reed 1996; Loomis et al. 2001). For example, suburban residents were much more amenable to prescribed burning after a demonstration burn than before (Monroe et al. 1999). Residents also showed an increased level of knowledge regarding burning near residential homes and smoke produced by prescribed fire. In relation to highly ranked education programs, homeowners mostly reported experience as the means by which they became aware of fire hazards, with news media being a distant second (Cortner et al. 1984). Demonstration burns accompanied by educational materials and publicizing results can influence public opinion and tolerance of prescribed fire. In his conceptual framework for environmental education programs Kalinowski (1990) emphasizes the importance of active participation and first-hand experiences within upper age brackets. In Texas, demonstration burns have shown landowners how the timing of a prescribed burn can influence its ability to fulfill management goals. When asked to select a preference between summer burned, winter burned, or non-burned pastures, visitors (mostly ranchers) to the Texas A&M University Research Station in Sonora almost unanimously chose the summer-burned pastures (Taylor 2005). The majority of landowners in the area had implemented winter-burns

and were unsatisfied with the resulting brush control. Overcoming the reluctance to burn during the summer due to being intimidated by higher intensity fires was stated to be a major challenge for the local PBA; this concern could be mitigated through the establishment of demonstration that showcase superior results.

Texas landowners agreed most strongly with the positive impacts of fire on wildlife habitat, nutrient cycling, and the abundance and quality of forage, as well as the lower cost of fire compared to other woody plant control treatments (Kreuter et al. 2008). Landowners who had implemented prescribed fire, on average, claimed the following as the most significant reasons for doing so: controlling problem plants, improving forage quality, reduced cost, increasing plant diversity, and improving wildlife habitat. Burners and non-burners both considered the most important measure for encouraging prescribed fire to be reduced liability. Kreuter et al. (2008) drew the conclusion that membership in PBAs may improve attitudes toward and encourage the use of prescribed fire through first-hand experience and peer influence. PBAs act as vectors for prescribed fire education and training, as well as provide shared pools of essential burn equipment, such as drip torches and machinery for creating fire breaks. PBAs also provide a setting for neighbors to build a sense of community together with a foundation of trust and a feeling of solidarity in shared management goals while helping to allow fires to take place on a landscape-scale across multiple adjacent properties. Prescribed fire becomes a matter of neighbors helping neighbors, providing an opportunity for gaining experience and tempering perceptions of risk by familiarizing landowners with common precautions (Toledo et al. 2014). In addition, peer influence between PBA members may help to alter social norms regarding prescribed burns and promote a culture in which fire and smoke are not only tolerated but even become a welcome part of the landscape (Toledo et al. 2013). Finally, these organizations can

serve as platforms for landowners to collectively represent their interests to policy-makers; it has been suggested that greater state-level representation of PBAs and a short-term contract cost-share program may be among the most effective initiatives for encouraging prescribed fire use (Kreuter et al. 2008).

Residents of Tuscon, Arizona found that prescribed fires enhanced the scenic quality and recreational attraction of ponderosa pine forests, while severe wildfires detracted from it (Taylor and Daniel 1984). Interestingly, while recipients were generally more tolerant of fire and more confident in its use after exposure to educational materials, the effect was less pronounced with full informational brochures (including both graphs and line drawings) than with more abridged versions. The authors attribute this difference to 'information overload', and recipients stated that they were less likely to read the full version if they received it in the mail unsolicited compared to the abridged versions (Taylor and Daniel 1984). In 1986, residents of Tucson were more supportive of allowing a fire to burn when provided with specific information regarding the circumstances of fire, such as fuel types and whether it was set deliberately or not (Carpenter et al. 1986). The great majority of the public in Tucson recognized both the positive and negative effects of forest fires, and public understanding and acceptance of prescribed fire were high (Cortner et al 1984). This indicates that the general public is capable of a more nuanced understanding of fire in different contexts than the entirely negative impression commonly believed to be pervasive. Cortner et al. (1984) attributed these positive attitudes largely toward public education and information programs, as well as considerable television and newspaper coverage of prescribed fire, claiming that even "brief spot announcement on radio or TV" are likely to be effective. Quick messages may be more effective than longer more detailed programs due to being able to reach a wider audience and requiring fewer resources. While the public often

holds emotionally charged negative impressions of fire scale and animal mortality, these negative impressions can be ameliorated by a sense of trust in natural resource managers. Information programs should emphasize the skill and professionalism of managers, while being careful not to oversell their ability to handle all circumstances as failure to meet high expectations can undermine public trust (Cortner et al. 1984).

Changing Landownership Trends

Amenity migration, "the movement of people based on the draw of natural and/or cultural amenities", as it is represented in American West, is fairly representative of trends in much of the world (Gosnell and Abrams 2011). The gentrification of rural areas takes place as natural and semi-natural landscapes gain value as a commodity, driving up land values and contributing to the diminishing cost-effectiveness of traditional agricultural activities. These "new" landowners are also seen to have a weaker sense of community and more strict interpretation and adherence to property rights and exclusivity than the "old-timers", meaning that cooperation and cross-boundary management on a landscape level could be more difficult to organize (Gosnell and Abrams 2011).

During the 1990s, investment and amenity together accounted for the motivation for over half of the land purchases in the Greater Yellowstone Area (Gosnell et al. 2006). Interestingly, most of the land parcels sold tended to remain whole, counter to the common fear of ownership fragmentation associated with amenity migration. While the increase in amenity landowners could be a boon to conservation in the region (less conflict with/increased tolerance of predators, decrease in degradation from intense grazing operations), it could also prove a hindrance (resistance to wildlife population management) as these landowners, while well-meaning, may not manage their land in a manner that is based on sound ecological knowledge (Gosnell et al.

2006). Additionally, Gosnell et al. (2006) expressed concern that an amenity-focused landscape is potentially unstable in the long-term, as there is no guarantee that these lands will not be broken up or converted to other uses in coming years when they change hands or owners lose interest; amenity landowners may lack economically derived motivations to keep the land parcel whole and to manage it well. Some have suggested that conservation easements may be necessary to help encourage longer-term stability.

Semi-urban Lampasas County in Central Texas has undergone a period of increasing population and gradual urbanization over the past century, correlated with decreased farm size and increased woody plant cover (Berg et al. 2015). Amenity migration from an increased population in Lampasas County led to landscape fragmentation from property subdivision, bringing in more recreation-oriented landowners. These recreational landowners usually do not manage vegetation due to the perceived aesthetic and wildlife value of woody plants, and because they do not perceive the cost of unfamiliar vegetation management techniques to be justified in fulfilling their land ownership objectives. Land fragmentation caused by amenity migration has been strongly linked to wildlife habitat fragmentation and degradation and the displacement of wildlife populations (Sorice et al. 2012). Conversely, the persistently rural Mills County has undergone a decrease in population over the same period, correlated with decreased woody plant cover and increased farm size. This correlation is attributed to the aggregation of abandoned land under a smaller number of landowners who are actively engaged in vegetation management over broad areas as part of their ranching operations and has coincided with the recent founding of a Prescribed Burn Association in the county. Agriculture can provide a financial motivation to minimize fragmentation and maintain land in an earlier successional state, preserving a higher level of biodiversity (Sorice et al. 2012; Firbank 2005).

The “Rural Rebound” driven by amenity migration is changing the character of rural communities in developed countries, with serious implications for the future of land management and private lands conservation. A number of studies conducted in Australia reveal patterns among amenity landowners which are relevant to the culturally similar United States. Among Australian landowners, the most outspoken and passionate restorers of native vegetation are those who sought out rural land for “space”, lack of interference, and control over their surroundings; in other words, “amenity” landowners (Gill et al. 2010). A majority of these do not actively manage their land, at best attempting to maintain it in the state in which they found it. Most vegetation management is characterized as “sympathetic or benign neglect”, in which landowners are amenable to environmental stewardship values but were constrained from implementing management techniques by time, resources or ignorance. Many begin as optimistic about restoration efforts on their land, but balk at the investment need in time and resources. Others manage in accordance with their holistic land stewardship values, but employ practices, such as selective plant removal and planting, which are more informed by aesthetics or the perceived desirability of species, native and non-native, than legitimate ecological knowledge (Gill et al. 2010).

According to an Australian mail survey, roughly half of respondent properties were expected to change ownership within a decade, an acceleration of the increasing turnover rates of the previous two decades. Many properties would not remain within the family of the previous owner and would either be consolidated by a decreasing number of producers or sub-divided into smaller plots bought my “amenity” landowners (Mendham et al. 2012). These high rates of turnover in rural communities are likely leading to the rapid loss of local knowledge and engagement, with newer landowners often being nonlocal and “absentee”, and that land

management practices benefitting conservation are often suspended due to time and knowledge constraints despite their professed environmental values. Compared to longer-term landowners, newer landowners spent a majority of their time working off the property as "absentee" landowners. New landowners were more likely to own smaller properties, less likely to engage in either agriculture or stewardship programs, reported lower knowledge levels on management practices, and were more environmentally conscious and conservation oriented, but were less likely to actually adopt recommended sustainability practices (Mendham and Curtis 2010). Natural resource managers in Australia identified engaging with absentee landowners as the greatest challenge that they faced. Proposed changes in practice included meeting with new landowners to discuss goals and options, organizing small group meetings of adjacent landowners on weekends to promote coordination and a sense of community, and establishing a mentorship program between new and long-term landowners (Mendham and Curtis 2010).

In 2014, 'lifestyle-oriented landowners' Texas and Oklahoma were on average much less likely to implement mechanical and chemical brush treatment or prescribed fire than either 'agriculture-oriented' landowners or 'mixed use' landowners (Sorice et al 2014). Within the past several decades in Texas, there has been a trend toward a greater total number of smaller farms with an increasing number of part-time amenity-based homes. The total area of native rangeland had decreased, and the market value of land and wildlife management as a land use had both grown by over 300% (Sorice et al. 2014). On average, rural landowners in the Edwards Plateau and Rolling Plains in Texas who applied prescribed fire on their lands had more years of ranching experience and much larger properties compared to non-burners (Kreuter et al. 2008). Burners were also significantly more likely to live on their land and earn at least a quarter of their income from land-related revenues when compared to nonmembers. Burners also earned a

notably larger proportion of their land-related income from wildlife than non-burners, although both groups earned a similar percentage of land-related income from livestock.

In Central Texas, over 60% of landowners surveyed still participated in some form of agricultural production, while only 24% of landowners engaged in agriculture exclusively. The largest landowner motivation category was lifestyle reasons or "amenity" ownership at 39% (Sorice et al. 2012). These landowner demographics are characteristic of a wider trend away from resource or extraction based land ownership towards non-consumptive amenity-based land use. The changes in landowner demographics associated with this trend necessitate targeted outreach and education efforts to convince amenity-based landowners of the value of fire on the landscape as well as the ecological importance of rangelands. Educational efforts may need to move away from an agricultural bias and towards a model that can address smaller, more homogenous subgroups of landowners in a way tailored to their particular objectives (Sorice et al. 2012; Cocklin et al. 2007). Lifestyle or amenity-oriented landowners tend to have strong pro-environmental values, and engaging landowners in ways that align with these rather than through the lens of agricultural productivity could prove to be more productive, in addition to increasing the availability of information through newer media platforms and proactive extension work (Mendham et al. 2012; Jones et al. 2003; Gosnell et al. 2007). In areas where non-agricultural and absentee landowners are a growing demographic, a "business as usual" approach to landowner engagement is proving inadequate. Mendham et al. (2012) suggest a return to a one-on-one extension model, wherein new landowners are identified within the local community and proactively approached by educators.

Objectives and Hypotheses

This study seeks to enhance knowledge about the promotion of prescribed fire in the Southern Great Plains by government agencies, and to examine the effectiveness of current outreach and education efforts among key stakeholders, including county commissioners.

Hypothesis 1: Ongoing changes in landowner demographics in the Southern Great Plains favor an increased emphasis on ecological benefits versus agricultural production in prescribed fire outreach.

Hypothesis 2: Live demonstration and personal experience are perceived as the most effective means of improving attitudes regarding prescribed fire among individuals.

Hypothesis 3: Smoke hazards and legal liability are perceived as the greatest concern in regards to the use of prescribed fire.

Hypothesis 4: A majority of county commissioners are self-reported as uncomfortable with prescribed fire due to lack of knowledge or experience and, therefore, decisions regarding burn bans may not be based on sound science.

CHAPTER II

BEST PRACTICES AND IMPLICATIONS FOR THE FUTURE

Introduction

The deleterious effects of long-term fire suppression in the Southern Great Plains have not gone unnoticed by natural resource agencies. Federal agencies that oversee or influence the management of public lands, such as the Bureau of Land Management (BLM) and the Fish and Wildlife Service (FWS), have incorporated the routine application of prescribed fire into the land management plans of many areas under their jurisdiction, such as National Monuments and Wildlife Refuges, to help restore historical fire regimes for the purposes of ecological restoration and grazing enhancement (Bureau of Land Management 2007; U.S. Fish and Wildlife Service 2012). State agencies within Texas and Oklahoma, such as the Texas Parks and Wildlife Department (TPWD), have also incorporated prescribed fire into land management plans for natural areas they manage (Texas Parks and Wildlife Department n.d.). However, while restoration of historical fire regimes within government-managed natural areas is necessary, this is insufficient to attain the goal of restoring the ecological integrity and productivity of rangeland systems on a landscape scale because much of the landscape is privately owned and not under the jurisdiction of federal and state agencies.

Texas and Oklahoma offer a particular challenge to natural resource management in that, compared to many other states west of the Mississippi River, relatively little land lies under the direct purview of government agencies. Texas in particular is almost entirely private property, with less than 5% of land being publicly owned and managed by the state or local government (Texas Land Trends 2014). Therefore, any effort to maintain or restore the ecological functionality at the landscape or watershed scale must involve partnership with private

landowners, as well as non-government land management organizations, such as the Audubon Society, The Nature Conservancy, and other Land Trusts.

Historically, however, the general public and landowners have been wary of prescribed fire due to the sensationalized portrayal of severe wildfires impacts in the media and popular anti-fire programs, such as Smokey Bear, which may have encouraged a negative perception of fire on the landscape, whether it is prescribed fire or out of control wildfire (Toledo et al. 2013; Twidwell et al. 2015). A legacy of fear towards fire has resulted in a number of entrenched misconceptions regarding risks posed by prescribed fire, including the high likelihood of escaped fire, risk of injury or death, wildlife mortality, and destruction of wildlife habitat. In particular, misconceptions about prescribed fire impacts on wildlife represent a disconnect from the reality of the positive role of periodic fire in North American ecosystems. These misconceptions, in part, stem from decades of fire suppression, highly sensationalized media coverage of wildfires especially the "loss" of Yellowstone National Park after the severe wildfire season of 1988, and emotionally charged portrayals of wildfire in popular culture such as the Disney film "Bambi" (Cortner et al. 1984; Jacobsen et al 2001; Manfredo et al. 1990). Smoke caused by prescribed fire is also a concern of landowners, who are wary about opening themselves to litigation in the event that they fail to properly control smoke emissions from a burn and become liable for public health impacts caused by air pollution or traffic accidents caused by reduced visibility on nearby roadways (Haikerwal et al. 2015; Haines et al. 2001).

Recognizing the need to address common concerns and to encourage and facilitate the use of prescribed fire on private lands, the Natural Resource Conservation Service (NRCS) provides information and other resources to private landowners interested in managing their land with prescribed fire (Natural Resource Conservation Service 2012). Many organizations also

seek to improve public perception and the use of prescribed fire through demonstration burns and by explaining the benefits of periodic fire through promotional materials; these efforts have proven to be successful in improving attitudes toward prescribed fire (Cortner et al. 1984; Shindler and Reed 1996; Loomis et al. 2001). Prescribed burn demonstrations and especially "before-and-after" comparisons have been effective in improving public perception and convincing landowners about the benefits of prescribed fire use (Monroe et al. 1999, Taylor 2005).

A majority of educational efforts among landowners have focused on emphasizing the economic benefits of prescribed fire in improving rangelands used for livestock grazing. (Sorice et al. 2012). However, in recent decades landownership patterns in developed countries have shifted away from large agriculturally-motivated landowners towards a greater number of smaller landowners who primarily own land for recreation purposes, particularly activities related to wildlife such as hunting and enjoying a "rural lifestyle" (Mendham et al. 2012, Menham and Curtis 2010, Gill et al. 2010, Sorice et al., 2012). As such, organizations seeking to promote the application of prescribed fire by landowners may benefit from more directly engaging this rising non-traditional landowner demographic, although doing so is challenging because many are "absentee" landowners, meaning that their land parcel is neither their primary residence nor their primary source of income. Although this demographic tends to hold environmental and conservation values that are amenable to the ecological benefits generated by prescribed fire, many of these landowners may feel that they lack the time, resources, or motivation to personally implement prescribed fire on their property, and thus may require a different form of outreach from more traditional agricultural landowners (Mendham and Curtis 2010; Gill et al. 2010, Sorice et al. 2014). Therefore, the personnel of government agencies and

nonprofit organizations seeking to promote and facilitate the use of prescribed fire must tailor their outreach and education programs to address the concerns and objectives of contemporary landowners.

To help provide guidance in developing these programs, the study presented in this chapter seeks to gather information among key informants about which concerns held by landowners in Texas and Oklahoma regarding prescribed fire are in most urgent need of addressing, what methods of promoting prescribed fire use are most effective in influencing landowner attitudes, and whether recreation-oriented landowners are an underrepresented demographic among prescribed burners in Texas and Oklahoma that educators should seek to tailor programs to.

Study Area and Methodology

In order to identify key issues surrounding the promotion and practice of prescribed fire within this study area, a series of three focus groups were initially conducted during the winter of 2016-2017 in College Station (TX), San Angelo (TX), and Stillwater (OK). Key stakeholders, including private burn managers, personnel from landowner representative organizations and natural resource agencies, government officials, and private landowners were invited to attend these focus groups in order to obtain input from key informants. Recurring themes that emerged from the discussions during these meets were subsequently synthesized by reviewing transcripts and individual notes of the meetings; these themes were then used to develop a pair of questionnaires targeting two stakeholder groups; prescribed fire educators and landowner representation groups (See Appendix A). The questionnaires were submitted for approval by the Texas A&M Institutional Review Board and were approved for distribution.

An initial set of potential interviewees comprised of both target groups within the study

area of Texas and Oklahoma were obtained from extension range specialists in both states. The identified individuals were contacted by email and requested to participate in the study. Those who accepted the invitation were interviewed by phone by one of three interviewers. The questionnaire used for each interview depended on which of the two groups the individual most closely represented; educators or landowner stakeholders. All phone interviews were recorded and later transcribed using the Rev audio transcription service (www.rev.com/transcription).

Additional potential interviewees were identified via snowball sampling by asking each interviewee to identify two other people in their organization within Texas or Oklahoma who might be willing to participate in the study. In order to control bias and better account for any diversity of perspective that may be present within an organization, interviewees were asked to identify one person who was generally supportive of prescribed fire and one person who may feel more skeptical. In order to capture a broad spectrum of perspectives, the target interviewee group size for each of the two groups was 30, for a combined total of 60 interviewees. A total of 64 interviews were ultimately completed, including 33 educators and 31 landowners, landowner representatives, and private burn contractors. (Table 1 and Table 2).

Table 1. Affiliation of participants interviewed using the educator interview protocol. Numbers in parentheses represent preliminary projections for the distribution of interviewees.

	NRCS (10)	FWS (N)	TFS (N)	ALES (N)	TPWD (5)	ODWC (5)	OCC (N)	ODAFF (N)	OCES (2)	ESD (N)	TNC (N)	Total
Texas (15)	1	1	7	4	3	-	-	-	-	1	2	19
Oklahoma (15)	3	0	-	-	-	5	1	2	2	0	1	14
Total	4	1	7	4	3	5	1	2	2	1	3	33
Abbreviations												
(N)	New entity we did not plan for											
NRCS	Natural Resource Conservation Service											
FWS	Fish and Wildlife Service											
TFS	Texas Forest Service											
ALES	AgriLife Extension Service											
TPWD	Texas Parks and Wildlife Department											
ODWC	Oklahoma Department of Wildlife Conservation											
OCC	Oklahoma Conservation Commission											
ODAFF	Oklahoma Department of Agriculture, Food, and Forestry											
OCES	Oklahoma Cooperative Extension Service											
ESD	Emergency Services District											
TNC	The Nature Conservancy											

Table 2. Affiliation of participants interviewed using the landowner representative interview protocol. Numbers in parentheses represent preliminary projections for the distribution of interviewees.

	KPC (N)	OCA (8)	OPJV (N)	TNF (N)	PBA/FMA (10)	PL/RM/PC (N)	Total
Texas (16)	1	-	-	-	10	6	17
Oklahoma (16)	-	3	2	4	2	3	14
Total	1	3	2	4	12	9	31
Abbreviations							
(N)	New entity we did not plan for						
KPC	Katy Prairie Conservancy						
OCA	Oklahoma Cattlemen's Association						
OPJV	Oaks and Prairie Joint Venture						
TNF	The Noble Foundation						
PBA	Prescribed Burn Association						
FMA	Fire Management Association (Oklahoma term for Prescribed Burn Association)						
PL/RM/PC	Private Landowner/Ranch Manager/Private Contractor						

After all of the interviews were transcribed to text using the Rev transcription service (Rev.com), the transcripts were anonymized with the only retained identifier being the name of the interviewee's organization and the order in which they were interviewed. The anonymized interview transcripts were then coded using NVivo, a qualitative analysis software program, to identify the occurrence of prominent and recurring themes. These recurring themes, referred to as 'nodes' within the program, were coded independently by each of the three interviewers using a common set of definitions. In order to maximize intercoder reliability, the entirety of an interviewee's response to a question was coded to a particular node whenever the respective theme occurred within the answer. After all interview transcripts were independently coded by all three interviewers to the set of theme nodes, two measures of intercoder reliability were calculated using functions provided by NVivo. These measures are percent agreement, which is the ratio of coding instances upon which coders agreed compared to those coding instances upon which they did not, and Cohen's Kappa coefficient, which is a more robust metric for intercoder reliability because it accounts for the likelihood of coders agreeing by chance. The rate of occurrence of certain themes within the data as well as the commonality of diction within coded themes and emergent response archetypes were then interpreted, with intercoder reliability being used as a metric for legitimacy of the analysis.

Results

Intercoder reliability scores for the qualitative analysis of themes within the 64 interviews between the three coders were favorable: average Cohen's Kappa of 0.73 and average percent agreement of 95.6%, indicating a high degree of reliability between the coders for the recognition of distinct themes within the interview transcripts. Of the 64 interviewees, 100% considered themselves to be supportive of prescribed fire use, on average 92% had personally

applied prescribed fire in the past (97% of educators and 87% of landowner representatives), and 97% of educators had provided information to landowners about prescribed fire.

Objectives for using Prescribed Fire

According to the largest percentage of educator interviewees (44%), the most dominant objective for prescribed fire use by landowners in Texas and Oklahoma is range improvement for cattle production, rather than wildlife habitat improvement. As one interviewee in Oklahoma explained: "In the grand scheme of things ranchers, and most of them are ranchers more than farmers, wildlife is not their concern, it's cattle." Texas educators made similar comments, such as how "statewide, obviously, there's much more acreage that's in active production. That would be the beneficial impacts would be more attuned to that [sic] because there's more land that's being used for cattle raising." Whether due to a legacy of community knowledge and peer influence, recommendation by natural resource agency personnel, or active research, landowners who are primarily engaged in ranching were considered by educators to be more informed about the benefits and potential risks of prescribed burning compared to recreational landowners. According to one Texas A&M AgriLife Extension agent, "if you're out on the land and you're working with traditional livestock managers, most of them understand fire and use fire to some degree". Ranchers were also considered to have more motivation to burn and to seek out knowledge about prescribed fire than recreation-oriented landowners due to being more economically dependent on the productivity of their land. "Really it's going to be that economic driver" of reducing woody plants and improving rangeland health for the sake of greater cattle production that leads landowners to prescribed fire, said one interviewee.

Educators in both Texas and Oklahoma considered wildlife-related benefits to be a less frequent primary objective (28%) than range improvement for prescribed fire use among

landowners, although such benefits were frequently cited as being a welcome side effect for landowners. In addition, many members of natural resource agencies were quick to point out that the grazing and wildlife benefits of prescribed fire use "go hand in hand" or that they "do not see those areas as exclusive". Some educators emphasized potential for integrated land use in the future, discussing how "wildlife leases continue to increase in value, [which is] something that ranchers and landowners can take advantage of", a notion corroborated by landowners who believed that the use of prescribed fire "for wildlife it's [sic] beneficial and yet, still very useful for our grazing business."

A notable exception to this disparity exists within regions where forestry surpasses livestock production in economic importance, specifically in the Piney Woods of East Texas and in central and eastern Oklahoma. Several educators from these regions (18%) attest that "from a […] timber-based landowner [perspective], I think they're most interested in the benefits of prescribed burning as its results relate to wildlife habitat and enhancement, as opposed to purely range condition or timber condition", and that "wildlife habitat seems to matrix out as one of the higher top objectives, maybe even more so than range management purely from a grazing standpoint".

Information Dissemination

Both educator and landowner representative interviewees were almost unanimous (98%) in their perception that person-to-person interaction in workshops or personal consultations was far more effective than published materials and other "remote" media in influencing perceptions regarding prescribed fire use, with practical "boots on the ground" demonstration being even more effective. In the words of one interviewee in Oklahoma: "You can read all you want to, but to be there at a presentation or demonstration and you [sic] feel it, touch it, kick it. I thinks that's really the effective way to do introductions into prescribed fire." Another interviewee spoke for

the success of staging tours on demonstration plots, explaining that “It's a lot more effective than just the printed with all the charts and graphs and for them to try to grasp all the information there.”

A number of interviewees also expounded the merits of peer-to-peer fire education such as that seen among Prescribed Burn Associations (PBAs), stating that “a rancher talking to a rancher is doing a whole lot more than a video, than a publication, than an indoor meeting for two hours”. Indeed, while only 23% of interviewees considered PBAs to be effective substitutes for government agencies for disseminating information about prescribed fire to landowners, they were commonly considered to be valuable supplements and partners for agencies. “I think I would rather get my information from a government agency but learn how to [use prescribed fire] from a PBA”, stated a landowner representative in Texas. “The [PBAs] count on the government agencies to supply them and help them learn and give the information to them,” agreed an educator in Oklahoma. However, PBAs were still widely regarded as a conduit through which agencies with limited personnel could extend their reach while also providing a practical means of increasing the amount of prescribed fire being used on private land through. PBAs were perceived to do this by encouraging resource sharing between members, offering opportunities to observe demonstrations, and creating a support network among landowners. “Most of the land that we're dealing with in Texas is private owned, so they are an excellent conduit, and, because it's neighbor helping neighbor, a trusted source of information”, claimed one educator in Texas, underlining that PBAs provide a locally tailored platform for engaging landowners who may be reluctant to approach government agencies for advice. This idea was corroborated by landowner representatives, who claimed that “from a landowner’s perspective, [they] would want to hear and receive [their] information from somebody that [they] know does

it for a living or does it on a daily basis", rather than government agencies who can provide information but may or may not be able to provide technical assistance due to liability avoidance policies. Interviewees did note, however, that the composition of PBAs is both highly variable and prone to change over time, citing high turnover rates among knowledgeable members as they age and the inconsistency of quality and direction between chapters. While a chapter in one county may be highly involved in sharing information and skills among members, others "aren't necessarily focused on education, as much as they are on trying to get fire on the ground for their members", claimed an agent of the NRCS.

Issues of Concern

Interviewees most frequently considered *smoke hazards* to be their most serious concern when applying prescribed fire (38%), closely followed by *personal injury or fatality* (36%), and more distantly property damage from escaped fire (24%), while *wildlife mortality* and *aesthetic effects* were almost universally considered to be trivial concerns (Table 3).

Factors which interviewees referenced as contributing factors to the high degree of concern over smoke hazards included negative effects on respiratory health among nearby populations in an increasingly fragmented landscape (13%), safety issues in instances where smoke crossed roadways and obscured the vision of drivers (22%), and the relative difficulty in mitigating smoke hazards compared to other perceived risks (19%). As one interviewee put it: "We have protocols in place that mitigate [those risks]. … So having an injury or a fatality out there on the line is pretty low risk for us. I would say that … if something's going to [cause problems] , [it's] gonna be [smoke management]." In addition, a number of interviewees concerned primarily with smoke generation (21%) expressed the opinion that many landowners overestimated the risk of personal injury and property damage due fears of liability and a lack of

experience with the effectiveness of common safety procedures, stating that "[a] lot of people don't think about smoke…When you light that fire you don't just have what's on the ground, but also wherever that smoke ends up. If it goes several miles down and settles in a community, and you smoke out a city, you're gonna have some angry people, also the reduced visibility and the respiratory issues." Several educators also expressed the idea that those who were inexperienced with prescribed fire tended to underestimate the problems caused by smoke, claiming that "[landowners] are just worried about keeping everybody safe, keeping the fire inside where it's supposed to be. But a lot of times, from what I've seen when I talk about smoke management to landowners, it can be a new concept to them." This idea was echoed by landowner representatives, one of whom stated that "[many] people are very worried about property damage, [but] many people don't realize the risk that smoke poses off site."

A key factor contributing to landowners' seemingly disproportionate concern for personal injury and property damage resulting from prescribed fire may be an underlying anxiety for opening themselves to liability. Of the interviewees, 44% mentioned liability for fire-related accidents as a major concern. One NRCS agent explained that "liability is set up so that people are responsible if fire were to escape and burn something up, so … [landowners] can sometimes have a sense of risk that is overly exaggerated". Landowner representatives agreed with this assessment, stating that "a lot of ranchers are scared off by the potential of a fire getting out and having liability issues." This anxiety may diminish over time however, as landowners become more familiar with prescribed fire and become more confident in their ability to implement it safely. "I think landowners probably would see property damage as a pretty high issue, and they might see injury as a high issue as well," explained an educator in Texas, "and that's namely because their experience isn't there yet and they lack a knowledge and the experience right now."

Wildlife mortality was considered to be a trivial concern overall, as all interviewees were aware to some degree that native wildlife species evolved in the presence of periodic fire and are equipped to evade it. “As a rule, I've never seen anything to suggest [wildlife] are really hurt much by a fire”, commented one landowner representative. This knowledge base may not be universal among landowners, however, particularly those who do not come from rural backgrounds. One landowner representative commented that “much of who's owning land in this county now are people that live in Houston and Dallas, and I think their concerns would be very different”, implying that absentee landowners may interpret perceived prescribed fire risks differently due to their different experiences and knowledge bases than more traditional landowners. Some interviewees observed that wildlife mortality was a concern among the general public and among those landowners who may be less familiar with fire: one AgriLife Extension agent claimed that “the majority of the population of Texas does not understand what fire once did and what we're trying to do with prescribed fire as a tool today.” Another Extension agent also commented that many landowners without rural backgrounds did not understand “how fire has played a role in shaping this continent and other continents for eons as part of the natural process, [but] once you sort of explain those things to people a lot of those things they’re worried about [go] away.”

Like wildlife mortality, negative aesthetic effects following fire was almost universally considered to be a trivial or nonexistent concern among those who were even slightly familiar with prescribed fire, but a concern that may still need to be addressed when conducting outreach among landowners with limited exposure to the practice.

“[Aesthetics are] definitely a roadblock that somebody needs to get through with some of the smaller landowners, is that [sic] burning is necessary and beneficial and won’t make it look

like bad forever", explained a private burn contractor. "They don't have the experience and they have a little bit more tied up in … that smaller acreage, and [are] a little bit more emotionally invested [in their land]."

Table 3. Percentage of interviewee responses for ranking concern about perceived risks related to prescribed fire use. Percentages were rounded to the nearest percentage point. Green highlights represent the most common choice for each rank.

Perceived Risk	Highest Risk	2nd Risk	3rd Risk	4th Risk	Lowest Risk
Personal Injury or Fatality	36%	17%	30%	5%	11%
Property Damage from Escaped Fire	24%	52%	17%	3%	2%
Smoke Hazards	38%	24%	29%	5%	2%
Wildlife Mortality	0%	5%	6%	65%	17%
Aesthetic Effects	0%	0%	14%	17%	61%

Discussion

Objectives for using Prescribed Fire

While the widespread awareness and tolerance of fire use may be due in large part to word-of-mouth and personal experience with practicing neighbors and peers, many educational materials and programs promoting the use of prescribed fire exhibit to varying degrees a bias toward agricultural producers (Sorice et al. 2012; Cocklin et al. 2007). This bias has historically been justified and to an extent remains due to land in the Southern Great Plains allocated to livestock grazing vastly exceeding land allocated for wildlife management (105,036,897 versus 3,306,557 acres were allocated to livestock and wildlife in Texas in 2012) (Texas Land Trends 2018). This high volume of land dedicated to active livestock production reflects the tremendous economic importance of cattle as a commodity, representing a market value of over $13 billion in Texas during 2012, greater than all other agricultural products in the state combined, providing ranchers with a clear economic motivation to learn about and accept prescribed fire use for the sake of improving and maintaining livestock forage (USDA Census of Agriculture, 2012).

However, wildlife management as a primary land use has inarguably increased in importance over the past two decades, with a 3600% increase in acres managed in Texas since 1997 (Texas Land Trends 2018). Further, while wildlife-oriented landowners also have reason use prescribed fire to maintain and improve wildlife habitat on their land, they are perceived to be less aware of the benefits it lends to their objectives than livestock producers. As one Texas interviewee stated, “The people that are coming into the business and trying to manage wildlife habitat, … typically have little or no understanding of not just prescribed fire but habitat management”. Many of these newer landowners do not come from agricultural backgrounds and

are often absentee landowners who visit their properties occasionally for recreational purposes, primarily hunting. Outreach efforts that focus on the natural role of fire in North American ecosystems and the importance of regular burns for maintaining optimal wildlife habitat may be beneficial in regions where wildlife is a particularly important land management objective, such as East Texas.

Not included in this demographic is a significant and growing group of absentee landowners who live in urban areas and own small plots of land to enjoy nature and engage in the popular conception of a "rural lifestyle" rather than for hunting or agriculture. These amenity-focused landowners often possess values highly amenable to ecological conservation and habitat restoration, but seldom actively manage their land because of time and resource constraints or lack of knowledge (Sorice et al 2014) (Mendham and Curtis 2010; Firbank 2005). As one interviewee in Oklahoma articulated: "We still have a lot of people who live out in the country but they think urban. They live out [there] because they want to be in touch with nature, but they don't want to touch nature." Amenity based "lifestyle-oriented" landowners represent a particular challenge to outreach and education efforts, in part due to their comparative lack of time and incentive for land management, and also due to their lack of homogeneity as a group, being drawn from an extremely diverse range of cultural and socio-economic backgrounds, professions, and knowledge levels. Directly engaging such an eclectic and disparate group in the same manner as ranchers or even wildlife managers, with a strong unified message founded in economics is extremely difficult. One possibility is to divide "lifestyle" landowners into more homogenous subgroups or archetypes based on shared environmental values, land ownership objectives, or proximity (Sorice et al. 2012; Cocklin et al. 2007). This may be particularly useful in areas where lifestyle-oriented landowners represent a sizable percentage of the landscape,

such as the picturesque Edwards Plateau in Texas (Sorice et al. 2012). However, this approach of reclassifying landowners into smaller, more specific categories could be very resource-intensive and may yield mixed results due to remaining significant differences between individuals within an archetype despite generalization.

Information Dissemination

The adage "seeing is believing" is well founded in educational theory, with first-hand experience and participation being convincing demonstrations of fact and as well as aiding in knowledge retention (Kalinowski 1990). This principle applies to prescribed fire education, as public demonstrations and tours of "test sites" have proven to be very effective in improving local public opinion about fire and in dispelling popular misconceptions (Monroe et al. 1999; Taylor 2005). Such demonstrations provide opportunities for landowners and the general public to observe the benefits prescribed fire provides for grassland productivity, wildlife habitat, and aesthetic value compared to unburnt control plots while also demonstrating the relative safety and prudence of burn protocols. Unfortunately, a number of logistical issues impede these demonstrations from becoming more frequent and widespread, including a shortage of natural resources agency personnel able to stage such demonstration burns.

While not quite as effective at influencing public opinion as demonstrations, the peer-to-peer education provided by Prescribed Burn Associations (PBAs) can be a very effective tool for encouraging landowners to support and practice prescribed fire (Kreuter et al. 2008). PBAs can be very useful networks of landowners for natural resource agencies, because these organizations can extend the reach of these agencies by disseminating knowledge through personal interactions among PBA members as well as providing a medium through which members can share resources such as equipment and qualified personnel, helping to mitigate constraints caused by

the scarcity of agency personnel relative to demand (Toledo et al. 2014). Inviting neighbors to observe or participate in prescribed fires provides an ideal opportunity to influence perceptions of fire through positive personal experience if the burn manager is adequately qualified and prepared to prevent or quickly address any complications. PBAs can thereby help to build a sense of community and cooperation among prescribed burners and a foundation of trust between neighbors, promoting a local culture that accepts or even welcomes fire on the landscape and helps alleviate perceived societal pressures against prescribed fire use (Toledo et al. 2013). Additionally, while few private landowners are likely to invite strangers to observe burns, media outlets may facilitate information transfer to the local population if representatives agree to attend and report events without sensationalist bias.

Indeed, implementing outreach and education efforts through the use of public media, whether print, radio, television, or internet advertisement, presents another option in cases where practical demonstration is not viable or the reach of educators is limited is to increase. Though amenity landowners are diverse in their attitude and receptiveness towards prescribed fire, studies in Arizona have proven that uninformed individuals can be educated, at least in broad strokes, about the benefits and necessity of prescribed fire even in wildfire-prone areas where reactionary sentiment would chafe against fire of all kinds (Taylor and Daniel 1984; Carpenter et al. 1986; Cortner et al. 1984). A strong presence across media platforms with a particular emphasis on reducing wildfire frequency and severity has been attributed to increasing acceptance of prescribed fire, though a preference for sensationalism among some platforms presents an obstacle to the dissemination of accurate information. Emphasizing that periodic fire is not only natural but a fundamentally critical part of most ecosystems in the Southern Great Plains may also help to normalize prescribed fire in among amenity landowners by drawing on

values of environmental stewardship and maintaining "the natural order". Creating and maintaining trust in tried and true burn methodology is essential in allaying safety concerns but also engenders inconvenient or even counter-productive levels of caution and red tape, as any mistake or carelessness in prescribed fire application could risk entrenching anti-fire paranoia and unduly exacerbate perceptions of risk to statistically unrealistic but difficult to refute levels (Cortner et al 1984).

Issues of Concern

Smoke management is a critical subject within any attempt to educate people about prescribed fire. The concentrations of fine particulates that occur in smoke produced by prescribed fire are comparable to the concentrations found in wildfire smoke, and are correlated with numerous pulmonary health issues, such as emphysema (Haikerwal et al. 2015). Such health concerns are becoming more prevalent as urban areas expand further into rural land, bringing with them increased population densities and vulnerable individuals, such as asthmatics and the elderly (Monroe 1999). Obstruction of visibility along roadways is another major risk associated with smoke; efforts to educate landowners should ensure that they understand the extent of their liability for accidents caused by smoke, what measures they can take to minimize this risk, and actions they can take in the event of smoke affecting nearby roadways, such as placing flagbearers to alert drivers and forewarning the correct authorities. Despite the seriousness of smoke-associated risks, many landowners underestimate the need to consider them when planning a prescribed burn; as such, special care should be taken when educating potential burn bosses about the conditions required for proper smoke dispersal and to ensure that local authorities are aware that a prescribe burn is taking place when calls about smoke begin to come in.

Though personal injury was nearly as great a concern among interviewees as smoke hazards, it was far less vindicated by facts. Research by Twidwell et al. (2015) has demonstrated that the risk for injury or fatality as a direct result of prescribed fire is extremely minimal, especially in comparison to other agricultural activities such as logging and crop or animal production. Furthermore, there exists a well-tested suite of safety protocols ranging from protective clothing and firebreak standards to weather analysis which can be used to greatly mitigate any potential risks to either personnel or property. Education about prescribed fire procedures, especially classes with practical components, can help to alleviate landowner's fears about injury and escapes by ensuring that they feel prepared to prevent these events through reliable methods.

Though liability-related concerns over injury or property damage from escaped fires may diminish for individual landowners as they gain more confidence in their own skills and in established safety protocols, educators should ensure that landowners interested in prescribed burning develop a firm grasp on local liability standards in order to both encourage prudent caution and to form a basis for realistic expectations of liability risk. Further, membership in Prescribed Burn Associations should be encouraged not only to better facilitate the sharing of resources and dissemination of information among landowners, but also in order to provide a platform from which landowners can collectively lobby for more favorable liability legislation within their locale and establish themselves with their state and local governments as key stakeholders in matters related to prescribed fire (Kreuter et al. 2008).

Concerns over wildlife mortality was minimal among interviewees; this may be attributed to the fact that the most interviewees were sufficiently familiar with fire to understand that periodic fire has been a component of North American ecosystems for millennia. Most

understood that wildlife in the Southern Great Plains evolved in an environment with periodic fires and, therefore, are able to escape or avoid fires to an extent that the incidental take of mobile wildlife from most prescribed burns is minimal. Even slower animals, such as tortoises, are often able to avoid harm by sheltering in burrows where temperatures remain relatively unaffected (Innes 2009). Similarly, it was apparent to every interviewee that the blackened landscape following a burn is temporary, with recovery typically occurring in a matter of weeks.

In contrast to landowners who have experience with fire, the general public and by extension inexperienced landowners are often unaware of the importance of periodic fire for functional and resilient ecosystems, specifically grasslands, considering fire to be an inherently destructive force that cannot be easily controlled and devastates wildlife habitat and natural beauty. According to a nationwide survey in the wake of the Yellowstone fires of 1988, it was widely believed that prescribed fire "destroys natural settings, allows fires to get out of control, affects private property, destroys scenery, results in many animals losing their homes, [and] causes a threat to human lives" (Manfredo et al. 1990). Interestingly, the belief that fire killed large numbers of animals was less common among those who lived closer to the fires, pointing to the role of personal experience in dispelling misinformation (Manfredo et al. 1990). Misconceptions about prescribed fire were also evident in Florida following the 1998 wildfires, where residents perceived wildlife mortality to be one of the greatest risks of prescribed fire, together with spreading to other properties (Jacobson et al. 2001). Residents of Tucson in 1984 expressed similar concerns, with a majority believing that fast-moving fires killed moderate to high numbers of wildlife (Cortner et al. 1984). It has been suggested that these erroneous beliefs about wildlife mortality have been reinforced through popular culture and media, including the popular Disney film "Bambi" and "Smokey Bear", which some accuse of exaggerating the

negative effects of fire on ecosystems and, in earlier iterations, not properly distinguishing between prescribed fire and wildfires (Jacobson et al. 2001). Any program or publication seeking to encourage or facilitate prescribed fire use by landowners, particularly those from non-agricultural backgrounds who may have limited knowledge or experience regarding the ecological realities of fire, should include elements to dispel the myths about wildlife mortality and characterize fire as a natural phenomenon upon which many species rely to maintain their habitats, as well as materials or demonstration areas which emphasize the temporary nature of any perceived negative aesthetic effects immediately following a burn.

Conclusion

Range management for cattle production is still perceived by educators to be the primary motivation for burning with the majority of prescribed burn users among private landowners in Texas and Oklahoma compared to wildlife management, despite the large and growing demographic of recreationally inclined non-agricultural landowners in both states. These landowners represent an underrepresented and potentially underserved target demographic for prescribed fire outreach and education programs whom educators should increasingly seek to tailor programs toward in the future.

Practical demonstration is perceived as the most effective means of educating landowners about prescribed fire and improving attitudes regarding the practice, and personal consultation is perceived as being more effective for doing so than publications or remote consultation through phone calls or emails. Prescribed Burn Associations can be a valuable supplement to government agencies in spreading information about prescribed fire among landowners, helping to extend the reach of agencies and to compensate for perceived scarcities of agency personnel qualified to educate landowners about prescribed fire and perform demonstrations.

Smoke hazards and the associated liability are considered the most serious potential risk posed by prescribed fire, partly due to the difficulty of controlling them and a tendency for inexperienced landowners to underestimate them. Inexperienced landowners may also be disproportionally concerned about personal injury and property damage caused by escaped fires due to a fear of liability, a fear that may decrease with experience and increased confidence in personal ability and established burn protocols. Prescribed fire education programs should emphasize the mitigation of smoke hazards while also demonstrating the effectiveness of safety precautions. Educators should also emphasize the natural history and role of fire in local ecosystems and provide before and after imagery or tours of burned sites in order to dispel any misconceptions about wildlife mortality and aesthetic damage held by landowners with less exposure to fire.

CHAPTER III

COUNTY COMMISSIONER KNOWLEDGE AND ATTITUDES

Introduction

Among the challenges which face land managers seeking to perform prescribed burns in the Southern Great Plains of Texas and Oklahoma, one of the most widespread and persistent is the implementation of county-wide burn bans. Commonly put in place during droughts and dry and hot periods of the year when wildfire risk is deemed highest, burn bans typically consist of a blanket ban on all outdoor fires and strict regulations surrounding potential sources of accidental ignition, such as welding (Brooks 2018). These bans severely limiting the ability of managers to burn at times during the year when conditions are conducive for high-intensity reclamation burns needed to substantially reduce the density of mature brush. However, there are precedents for insured and certified burn managers or Prescribed Burn Associations to use prescribed fire during burn bans, but specific exceptions vary from county to county and are at the discretion of the local County Commissioners Court (Wonkka et al. 2015).

County Commissioners are elected public officials who, as part of their county's Commissioner Court, are responsible for a wide array of duties within their precincts, including the implementation and repeal of countywide bans on outdoor burning (Brooks 2018). While burn bans are a prudent measure for preventing the reckless or accidental ignition of volatile fuels in dry conditions that may lead to destructive wildfires, they can be a source of frustration for landowners without burn certification or proper insurance, who may not be able to obtain permission from their local County Commissioner to burn during a ban. County Commissioners come from diverse educational and cultural backgrounds and are responsible for numerous duties throughout their jurisdiction and, therefore, many of them may not be sufficiently familiar with

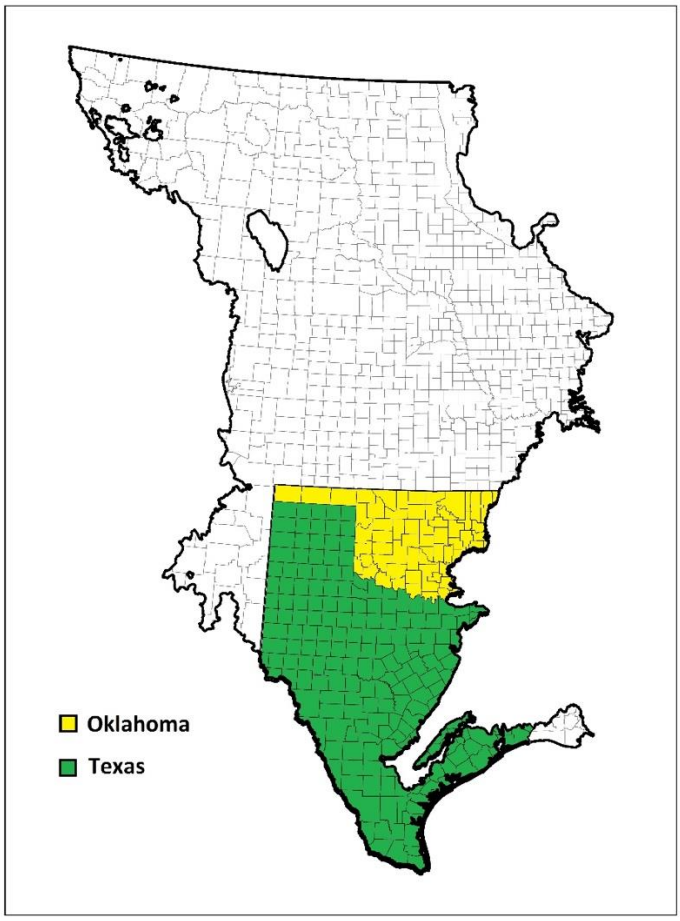
principles and practices of prescribed fire to make sufficiently informed decisions about appropriate times to enact a burn ban or circumstances for allowing an exception to apply prescribed fire during a ban. Many of them may also be influenced by popular stigma against fire caused by sensationalist portrayals of wildfire in the media and in programs such as Smokey Bear, making them uncomfortable with the use of fire in land management (Jacobsen et al. 2001). Further, as elected officials of local government, some may also feel pressured by their constituents to be stricter in enforcing burn bans, whether due to recent sensationalized wildfires or a general anxiety among the public regarding the safety of prescribed fire use (Cortner et al 1984; Toledo et al. 2013; Twidwell et al. 2015).

In order to understand how more County Commissioners may be convinced to be less eager to implement burn bans and to allow land managers to conduct prescribed burns during burn bans, it is necessary to determine if a link exists between their knowledge or familiarity with prescribed fire and their perception of the practice. If such a link exists, proactive outreach and education efforts may be able to influence County Commissioners' decisions regarding the enactment of burn bans or their willingness to allow burn managers to operate during burn bans. The success of such efforts would also depend on understanding other factors that influence these officials' perception of prescribed fire and how these factors may be leveraged in outreach. This study seeks to investigate factors affecting the perceptions of County Commissioners in Texas and Oklahoma about the use of prescribed fire. The purpose of obtaining such information is to understand the extent to which they feel comfortable with the use of prescribed fire and what actionable factors may influence their level of comfort with the practice.

Study Area and Methodology

The study area comprised the Texas and Oklahoma segments of the Southern Great Plains, incorporating 202 and 69 counties in each state respectively (Figure 1).

Figure 1. Map of the study area within the Great Plains of the United States. Adapted from Carissa Wonkka, 2018 (personal communication).



The climate of this region is influenced by two primary meteorological gradients: mean annual temperature increases in a northwest-southeast gradient ranging from 10-13°C in the Oklahoma Panhandle to over 21°C in southern Texas, and average annual precipitation increases in a west-east gradient ranging from less than 17 centimeters in western Texas to over 150 centimeters near the mouth of the Sabine River at the Louisiana border (Kunkel et al. 2013). The dominant land cover type was historically semi-arid grassland, with shortgrass prairies in the

west transitioning along the precipitation gradient to mixed prairies and tallgrass prairies in the east. However, with fire suppression, large areas have become dominated by woody plants, particularly juniper species. Together with urbanization and conversion to cropland, woody plant encroachment has contributed to the decline of native grassland across the Great Plains. Less than 30% of the original grasslands remain, with the highly arable tallgrass prairies covering only 4% of their former range (Samson and Kopf 1994) , while shortgrass (52%) and mixed grass (29%) prairies have fared somewhat better, though many of them exist as scattered patches imperiled by brush encroachment (Samson et al. 2004).

Using the transcripts from three stakeholder focus groups held in College Station and San Angelo, Texas in late 2017 and Stillwater, Oklahoma in early 2018 to obtain key informant input about prescribed fire issues of greatest concern issues, a questionnaire was designed to investigate how well informed current County Commissioners are about the application of prescribed fire within their jurisdiction (Appendix II). This included determining level of first-hand experience, knowledge regarding the benefits of fire, the legal aspects of burning, sources of information, and general attitude regarding prescribed fire. The questionnaire approved by the Texas A&M Institutional Review Board in January 2018.

Each county in Texas has four elected Commissioners and each county in Oklahoma has three elected Commissioners. The survey sample was derived from all County Commissioners in the 202 Texas counties and 69 Oklahoma counties falling within the Southern Great Plains. A total of 300 Commissioners from Texas and 100 Commissioners were selected for the study; one Commissioner per Texas county and two Commissioners per Oklahoma county were randomly selected. Additional Commissioners were randomly selected from the total pool of Commissioners until the target numbers were reached for each state, with the stipulation that no

more than two Commissioners from each county might be selected. The survey sample distribution (75% in Texas and 25% in Oklahoma) approximated the proportion of Commissioners in the counties selected for the study (80% in Texas and 20% in Oklahoma). Mailing addresses for the selected Commissioners were obtained from county website directory information. The mail survey was conducted during June and July 2018 using a four-phase mail survey protocol (Dillman et al. 2014) including a pre-survey notification mailed on day 1 of the survey period; the survey questionnaire with a cover letter mailed on day 7; a reminder card on day 21; and a replacement survey questionnaire with a reminder letter sent on day 42.

During August 2018, data from the returned questionnaires were coded to numerical values and digitized to an Excel spreadsheet. Incomplete or blank answers were interpolated using medina or mean values for each variable. Descriptive statistics (including mean, median, and standard deviation) were derived for all response variables, and frequency distribution was calculated for the results of categorical variables. Two contrasting items were used as the dependent variables to reflect each respondent's "level of comfort" or "level of discomfort" with prescribed fire. These items were the following statements: (1) "The use of prescribed fire is considered a safe and beneficial method of land management and should be practiced more frequently" (comfort); and (2) "The use of prescribed fire is an unsafe practice that should be more heavily regulated and only sparingly allowed to be conducted" (discomfort). The survey participants were asked to respond to these statements using a 5-point scale ranging from strongly agree to strongly disagree, with a neutral mid-point. A correlation matrix was generated for the explanatory variables in order to determine the strength and statistical significance of potential relationships between them and the dependent variables. Correlation was tested further using an Ordinary Least Squares regression model and stepwise regression analysis. An

exploratory Chi-Square analysis was also used to determine if being based in a county with a Prescribed Burn Association affected Commissioners' level of comfort or discomfort with prescribed fire.

Results

A total of 123 questionnaires were returned, representing a response rate of 30.8%. On average, the responding County Commissioners were 61.2 years of age, had received about 3.2 years of post-high school education, and had held their office for 9.1 years (Table 4). Of the respondents, 75% owned rural land, and of those who owned land 89% actively engaged in brush management. Additionally, slightly more than half (53%) have been invited to participate or had participated in a prescribed burn (Table 4).

Table 4. County Commissioner respondents' demographic characteristics.

	N	Male	Female	N/A
Gender	123	111 (90%)	9 (6.5%)	3 (2.5%)
	N	White	Minority	N/A
Ethnicity	123	88 (72%)	13 (10.5%)	22 (18.5%)
	N	Median	Mean	Std. Dev.
Age in years	107	61	61.2	9.6
Years of higher education	116	4	3.2	2.93
Years as County Commissioner	122	8	9.1	6.88
	N	Yes	No	
Do you own any rural land?	122	91 (75%)	31 (25%)	
If yes, have you removed brush?	91	72 (79%)	19 (21%)	
Have you ever participated in a prescribed fire?	122	65 (53%)	57 (47%)	

Of the 65 respondents who had been invited to participate or had participated in a prescribed burn, nearly half (47%) did so as a volunteer (Table 5), and 70% did so with independent private landowners rather than a government agency or a Prescribed Burn

Association (Table 6). The most common prescribed fire information sources used by the respondents were the local fire department, fire chief, or emergency services (67%) followed by State Forest Service (40%) (Table 7). The most common brush control method used by respondents on their land was mechanical treatment (89%) followed by chemical treatment (72%), and nearly half (49%) used prescribed fire (Table 8).

Table 5. Capacity in which respondents were invited to participate/participated in a prescribed fire (N=64; Total count > 64 because respondents could pick more than one response option).

	Bystander	Volunteer	Assistant	Burn Manager	Other
Count	12	30	14	10	13
% of N	19	47	22	16	20

Table 6. Entities that have invited respondents to participate in prescribe burns (N=64; Total count > 64 because respondents could pick more than one response option).

	NRCS	TFS	TPWD	OFS	PBA	Landowners	Other
Count	16	10	3	3	10	45	13
% of N	25	16	5	5	16	70	20

Table 7. Sources that respondents used to obtain information about prescribed fire (N=118; Total count > 118 because respondents could pick more than one response option).

	USDA Forest Service	State Forest Service	Fire Chief/EMS	Colleagues	Other
Count	17	47	79	27	31
% of N	14.4	39.8	66.9	22.9	26.3

Table 8. Brush removal techniques respondents used on their rural land. (N= 72; Total count > 72 because respondents could pick more than one response option.)

	Mechanical	Chemical	Goat browsing	Prescribed fire
Count	64	52	13	35
% of N	89	72	18	49

Very few respondents reported being uncomfortable with prescribed fire, with 84% selecting a positive score for “level of comfort” and 83% selecting a negative score for “level of discomfort”. A similar proportion of respondents reported a neutral score for both metrics (Table

9). Responses to the two statements were negatively correlated (Pearson's coefficient r = -0.52, P< 0.001).

Table 9. Distribution of Commissioner responses to the "comfort" and "discomfort" Likert scales. Positive scores indicate agreement while negative scores indicate disagreement.

	-2	-1	0	1	2
Comfort					
Count	1	2	15	59	40
% of N = 117	1	2	13	50	34
Discomfort					
Count	30	53	17	8	0
% of N = 108	28	49	16	7	0

The correlation matrix generated for the two statements and the independent variables is presented in Table 10. The matrix indicates that the "discomfort with prescribed fire" dependent variable was positively correlated with awareness of local fires rules, being female, being part of an ethnic minority, and age, and negatively correlated with self-reported familiarity with prescribed fire and using brush control on one's land. The "comfort with prescribed fire" dependent variable was positively correlated with self-reported familiarity with prescribed fire, owning land, and being part of an ethnic minority, and negatively correlated with age of the respondent. The exploratory Chi-square analysis indicated there was no statistically significant relationship between degree of comfort or discomfort with the respondent being based in a county with or without a Prescribed Burn Association (p = 0.128 and p = 0.244, respectively).

Table 10. Correlation matrix between explanatory variables and dependent variables showing correlation coefficients and p-values. Statistically significant correlations are highlighted. Familiarity is included as an additional dependent variable for exploratory analysis.

	Discomfort	Comfort	Familiarity
Comfort	-0.5217*		
P-value=	<0.0001		
Familiarity	-0.1719*	0.2151*	
P-value=	0.0573	0.0169	
Time Spent on Fire	0.0054	0.0738	0.2257*
P-value=	0.953	0.4175	0.0121
Participation	-0.0672	0.0966	0.4264*
P-value=	0.4604	0.2880	<0.0001
Awareness of Fire Presence	-0.1242	0.0702	0.2668*
P-value=	0.1711	0.4407	0.0029
Liability Awareness	-0.0243	0.0611	0.2520*
P-value=	0.7896	0.5018	0.0049
Fire Law Awareness	0.0615	0.1241	0.2416*
P-value=	0.4992	0.1716	0.0071
Local Rule Awareness	0.1885*	-0.0518	0.0804
P-value=	0.0368	0.5691	0.3765
Get Updates	0.1481	0.0056	0.1127
P-value=	0.102	0.9511	0.2144
Years as Commissioner	-0.0226	0.0032	0.0516
P-value=	0.8042	0.9719	0.5709
Own Land	-0.06	0.1813*	0.2330*
P-value=	0.5101	0.0447	0.0095
Brush Control	-0.2296*	0.1214	0.2015*
P-value=	0.0106	0.1809	0.0254
Gender	0.1794*	-0.1034	-0.2699*
P-value=	0.0471	0.2552	0.0025
Ethnicity	0.1499*	-0.1483	-0.0647
P-value=	0.0980	0.1016	0.4774
Age	0.1644*	-0.2042*	-0.1579*
P-value=	0.0691	0.0235	0.0812
Years of Higher Edu.	-0.0253	0.0573	0.0395
P-value=	0.781	0.5291	0.6642

Ordinary Least Squares regression found no statistically significant correlations between the explanatory variables and either respondents' level of comfort or discomfort with prescribed fire (Tables 11, 12); however, according to Stepwise regression, self-reported familiarity showed

a statistically significant positive correlation with respondents' comfort level with prescribed fire, while being part of an ethnic minority and age showed a weak negative correlations ($P<0.10$) (Table 13). Stepwise regression also revealed a positive correlation between discomfort with prescribed fire and awareness of local fire rules as well as being part of an ethnic minority while also showing a negative correlation with self-reported familiarity and using brush control on one's land (Table 14).

Table 11. Ordinary Least Squares regression for respondent's "comfort level" with prescribed fire. Statistically significant p-values are highlighted.

Source	SS	Df	MS	# observations	123
Model	9.8918	15	0.6594	F (15, 107)	1.18
Residual	59.9280	107	0.5601	Prob > F	0.3004
Total	69.8199	122	0.5723	R-squared	0.1417
Comfort				Adj R-sqd.	0.0214
				Root MSE	0.7484

	Coeff.	Std. Err.	t	P>|t|	[95% Con.	Interval]
Familiarity	0.1322	0.0990	1.34	0.184	-0.0640	0.3284
Time Spent on Fire	0.0615	0.1351	0.45	0.650	-0.2065	0.3295
Participation	-0.0589	0.1725	-0.34	0.733	-0.4008	0.2830
Awareness of Fire Presence	0.0077	0.1631	0.05	0.962	-0.3156	0.3310
Liability Awareness	-0.0781	0.2274	-0.34	0.732	-0.5289	0.3727
Fire Law Awareness	0.1917	0.1739	1.10	0.273	-0.1530	0.5363
Local Rule Awareness	-0.2173	0.1869	-1.16	0.247	-0.5878	0.1531
Get Rule Updates	0.0007	0.1518	0.00	0.996	-0.3002	0.3016
Years as Commissioner	-0.0020	0.0110	-0.18	0.854	-0.0239	0.0199
Own Land	0.2343	0.1668	1.40	0.163	-0.0963	0.5650
Brush Control	0.0490	0.1990	0.25	0.806	-0.3454	0.4434
Gender	-0.0924	0.2960	-0.31	0.756	-0.6793	0.4944
Ethnicity	-0.3093	0.1999	-1.55	0.124	-0.7053	.08665
Age	-0.0134	0.0082	-1.62	0.108	-0.0297	0.0030
Years Higher Edu.	0.0110	0.02500	0.44	0.662	-0.0386	0.0605

Table 12. Ordinary Least Squares regression for respondent's "discomfort level" with prescribed fire. Statistically significant p-values are highlighted.

Source	SS	Df	MS	# observations	123
Model	18.3420	15	1.2228	F (15, 107)	1.91
Residual	68.4307	107	0.6395	Prob > F	0.0295
Total	86.7728	122	0.7112	R-squared	0.2114
Discomfort				Adj R-sqd.	0.1008
				Root MSE	0.7997

	Coeff.	Std. Err.	t	P>|t|	[95% Con.	Interval]
Familiarity	-0.1405	0.1058	-1.33	0.187	-0.3502	0.0692
Time Spent on Fire	0.0759	0.1445	0.53	0.600	-0.2105	0.3623
Participation	0.0136	0.1842	0.07	0.941	-0.3517	0.3789
Awareness of Fire Presence	-0.2046	0.1743	-1.17	0.243	-0.5501	0.1409
Liability Awareness	0.0302	0.2430	0.12	0.901	-0.4515	0.5119
Fire Law Awareness	0.1203	0.1858	0.65	0.519	-0.2480	0.4886
Local Rule Awareness	0.3255	0.1997	1.63	0.106	-0.0704	0.7213
Get Rule Updates	0.1733	0.1622	1.07	0.288	-0.1483	0.4948
Years as Commissioner	-0.0086	0.0118	-0.73	0.469	-0.0320	0.0148
Own Land	-0.0015	0.1782	-0.01	0.993	-0.3548	0.3518
Brush Control	-0.3163	0.2126	-1.49	0.140	-0.7377	0.1052
Gender	0.2225	0.3163	0.70	0.483	-0.4046	0.8410
Ethnicity	0.3395	0.2171	1.56	0.121	-0.0908	0.7698
Age	0.0110	0.0088	1.25	0.215	-0.0065	0.0284
Years Higher Edu.	-0.0091	0.0267	-0.34	0.734	-0.0620	0.0438

Table 13. Stepwise regression for respondent's "comfort level" with prescribed fire.

Source	SS	Df	MS	# observations	123
Model	7.1832	3	2.3944	F (15, 107)	4.55
Residual	62.6366	119	0.5264	Prob > F	0.0047
Total	69.8198	122	0.5723	R-squared	0.1029
Comfort				Adj R-sqd.	0.0803
				Root MSE	0.72551

	Coeff.	Std. Err.	t	P>|t|	[95% Con.	Interval]
Familiarity	0.1791	0.0793	2.26	0.026	0.0221	0.3360
Ethnicity	-0.3187	0.1843	-1.73	0.086	-0.6836	0.0462
Age	-0.0138	0.0075	-1.85	0.067	-0.0286	0.0010

Table 14. Stepwise regression for respondent's "discomfort level" with prescribed fire.

Source	SS	Df	MS	# observations	123
Model	14.2859	4	3.5715	F (15, 107)	5.81
Residual	72.4868	118	0.6143	Prob > F	0.0003
Total	86.7728	122	0.7113	R-squared	0.1646
Discomfort				Adj R-sqd.	0.1363
				Root MSE	0.78377

	Coeff.	Std. Err.	t	P>|t|	[95% Con.	Interval]
Familiarity	-0.1706	0.0868	-1.97	0.052	-0.3425	0.0013
Local Rule Awareness	0.3935	0.1687	2.33	0.021	0.0593	0.7276
Brush Control	-0.3356	0.1980	-1.69	0.093	-0.7277	0.0565
Ethnicity	0.3436	0.2043	1.68	0.095	-0.0609	0.7481

An exploratory analysis found that, according to the correlation matrix, self-reported familiarity with prescribed fire was positively correlated with the amount of time a Commissioner spent dealing with fire, participation in prescribed fires, being aware of the amount of prescribed fire used in their jurisdiction, awareness of fire liability standards, awareness of laws related to prescribed fire, owning rural land, and using brush control on one's land, while being negatively correlated with age and being female (Table 10). Ordinary Least Squares regression analysis (Table 15) and Stepwise regression analysis (Table 16) both confirmed the positive correlation with participation, awareness of the amount of prescribed fire used in the jurisdiction, awareness of laws related to prescribed fire, and using brush control on one's land, and the negative correlation with self-reported familiarity and being female. Additionally, both regressions also detected a positive correlation with being part of an ethnic minority and the stepwise regression also detected a positive correlation with owning rural land (Table 15).

Table 15. Ordinary Least Squares regression for respondent's self-reported familiarity with prescribed fire. Statistically significant p-values are highlighted.

Source	SS	Df	MS	# observations	123
Model	29.1684	14	2.0835	F (15, 107)	3.94
Residual	57.1624	108	0.5293	Prob > F	<0.0001
Total	86.3308	122	0.7076	R-squared	0.3379
Familiarity				Adj R-sqd.	0.2520
				Root MSE	0.7275

	Coeff.	Std. Err.	t	P>|t|	[95% Con.	Interval]
Time Spent on Fire	0.12101	0.1309	0.92	0.357	-0.1384	0.3805
Participation	0.5083	0.16036	3.17	0.002	0.1904	0.8262
Awareness of Fire Presence	0.2685	0.1564	1.72	0.089	-0.0416	0.5786
Liability Awareness	-0.0856	0.2209	-0.39	0.699	-0.5235	0.3523
Fire Law Awareness	0.3161	0.1662	1.9	0.060	-0.0135	0.6456
Local Rule Awareness	-0.1102	0.1813	-0.61	0.545	-0.4697	0.2492
Get Rule Updates	0.1215	0.1471	0.83	0.411	-0.1701	0.4130
Years as Commissioner	0.0016	0.0107	0.15	0.881	-0.0197	0.0229
Own Land	0.2275	0.1607	1.42	0.160	-0.0909	0.5456
Brush Control	0.3305	0.1908	1.73	0.086	-0.0477	0.7086
Gender	-0.5082	0.2836	-1.79	0.076	-1.0704	0.0539
Ethnicity	0.3384	0.1898	1.78	0.077	-0.0378	0.7146
Age	-0.0039	0.0080	-0.48	0.631	-0.0197	0.0120
Years Higher Edu.	0.0083	0.0243	0.34	0.734	-0.0399	0.0564

Table 16. Stepwise regression for respondent's self-reported familiarity with prescribed fire.

Source	SS	Df	MS	# observations	123
Model	25.8095	5	5.1619	F (15, 107)	9.98
Residual	57.5567	115	0.5005	Prob > F	<0.0001
Total	86.3308	122	0.7076	R-squared	0.3333
Familiarity				Adj R-sqd.	0.2927
				Root MSE	0.7075

	Coeff.	Std. Err.	t	P>|t|	[95% Con.	Interval]
Participation	0.5798	0.1337	4.34	0.000	0.3151	0.8446
Awareness of Fire Presence	0.2668	0.1402	1.9	0.059	-0.0108	0.5444
Fire Law Awareness	0.2685	0.1376	1.95	0.053	-0.0040	0.5410
Brush Control	0.3272	0.1818	1.8	0.075	-0.0330	0.6874
Own Land	0.2578	0.1536	1.68	0.096	-0.0464	0.5619
Gender	-0.4572	0.2572	-1.78	0.078	-0.9667	0.0523
Ethnicity	0.3532	0.1821	1.94	0.055	-0.0074	0.7140

Discussion

The high proportion of instances where County Commissioner's participation with fire was facilitated by independent private landowners may partially be related to the tendency for County Commissioners to own rural land (Table 4). A Commissioner may have any number of neighbors who use prescribed fire on their property and, considering the relatively high average age of Commissioners (Table 4), respondents may have lived in the area long enough to know their neighbors well and develop a sense of community with nearby landowners. Under such circumstances, it is possible that many of the private landowners inviting Commissioners to observe or participate in prescribed burns may have personal connections with them and, therefore, be more likely to convince Commissioners to attend than strangers or members of government agencies who may only know them in an official capacity. Prescribed Burn Associations and members of natural resource agencies may benefit from establishing personal relationships with their local County Commissioners and taking the initiative to invite them to attend prescribed burns under good conditions as a social event, thereby establishing a foundation of trust in the ability of the burn managers to apply fire safely. Further, it is notable that only 49% of Commissioners who manage brush on their land use prescribed fire (Table 8); if a greater number of Commissioners could be convinced or helped to apply prescribed fire on their own property, then they may be better able to internalize the benefits and relative safety of prescribed fire use and understand its considerable value to landowners. Together these factors may make them more amenable to allow qualified individuals, such as prescribed burn managers, to apply prescribed fire during burn bans (Cortner et al. 1984; Monroe et al. 1999; Taylor 2005).

The most common source which responding County Commissioners consulted for information or answers to questions regarding prescribed fire (answers that may influence their decision to impose or continue a burn ban) was their local fire department, fire chief, or emergency management coordinator (Table 7). This carries implications for how County Commissioners may think about prescribed fire: these entities are responsible for preventing and mitigating damage caused by fire, and thus inevitably approach it with a "suppression" mindset that may bias the information and advice that they provide to Commissioners. Even if a Commissioner is comfortable or familiar enough with prescribed fire to believe it to be a beneficial and relatively safe practice, the influence of these groups may cause them to lean towards a "better safe than sorry" approach to allowing prescribed burns during burn bans. Given the likely ability of local fire departments and emergency services to influence County Commissioner's decision-making process with regards to burn bans and prescribed fire, these organizations may represent another important target group for outreach and education efforts seeking to promote prescribed fire. Inviting the local fire chief or emergency services coordinator to a prescribed burn may help them, through demonstration and personal experience, to internalize the safety with which burns can be conducted; these individuals may then be more supportive of County Commissioners' decision to grant burn ban exemptions (Cortner et al. 1984; Monroe et al. 1999; Taylor 2005). Inviting members of the media to observe and report on the safety and benefits of prescribed fire may also help allay public anxieties regarding the practice and reduce any pressure Commissioners receive from their constituents to be "tough" on fire (Cortner et al. 1984; Toledo et al. 2013; Twidwell et al. 2015).

Contrary to expectations, very few responding County Commissioners reported themselves as being uncomfortable with prescribed fire. Therefore, the collected data may

indicate that only a small number of County Commissioners are actively opposed to the use of prescribed fire and that a majority are supportive or at least amenable to its use. Indeed, over a quarter of respondents used prescribed fire on their own land, though mechanical and chemical treatments were more commonly used to control brush. It is possible, however, that the pro-fire nature of the questionnaire, entitled "Social and Regulatory Barriers to the Use of Prescribed Fire by Private Land Managers in the Southern Great Plains" may have created bias by influencing some respondents to answer in a way more favorable to prescribed fire.

Age and being part of an ethnic minority were both negatively correlated with comfort and positively correlated with discomfort, though the former correlation was very weak and the proportion of responding Commissioners who were part of an ethnic minority was small (10.5%) (Table 4). Nevertheless, with the continued growth of non-Caucasian populations in the United States, the number of County Commissioners who are part of ethnic "minorities" will likely also increase, underscoring the need for educators to improve knowledge and attitudes regarding prescribed fire within this demographic. Owning rural land was positively correlated with comfort with prescribed fire according to the correlation matrix, but this correlation was not robust enough to be confirmed by Ordinary Least Squares regression or stepwise regression, nor was the positive correlation between discomfort with prescribed fire and being female or the very weak positive correlation with age. Despite this and the very small percentage of respondents who were female (6.5%) (Table 4), educators may consider female County Commissioners a target demographic of significance for prescribed fire outreach and education due to this positive correlation with fire discomfort.

The explanatory variable most conclusively correlated with respondents' level of comfort or discomfort with prescribed fire was their self-reported familiarity with the practice;

those who claimed to be more familiar with prescribed fire use were more likely to have a higher level of comfort with it and a lower level of discomfort than those who reported themselves to be less familiar with fire. However, compared to other potential explanatory variables, such as awareness of fire liability standards, self-reported familiarity was subject to a higher degree of interpretation by respondents and was reported on a continuous scale rather than as a binary or discrete categorical variable, meaning that self-reported familiarity was itself a highly individualized score formed by a number of contributing factors. By understanding which variables might have contributed to respondents' level of familiarity with prescribed fire, it is possible to gain insight toward what factors, albeit with a degree of separation, might contribute to County Commissioners' perception of prescribed fire as a safe and helpful tool for land management.

The explanatory variable most strongly correlated with self-reported familiarity with prescribed fire was a County Commissioner participating or being invited to participate in a prescribed burn, with the majority of these burns (70%) being conducted by independent private landowners, rather than by government agencies or Prescribed Burn Associations (Table 6). These results are consistent with the conclusions drawn by Monroe et al. (1999) and Cortner et al. (1984) which state that personal observation of and experience with prescribed fire are highly effective in influencing attitudes and perceptions regarding the practice, as well as Kalinowski's (1990) framework which emphasized the importance of hands-on involvement and personal contact in environmental education programs targeting higher age brackets. Positive correlations were also evident between self-reported familiarity and whether or not a Commissioner was aware of laws regarding prescribed fire use and the amount of prescribed fire being used in their county; these correlations may be interpreted either as a tendency for County Commissioners to

consider their awareness of these fire laws and local fire presence to be contributing factors to their familiarity with prescribed fire in general, or as a tendency for those with a personal or professional interest in prescribed fire to keep informed about such things. Although ethnic minorities and women represented only a small fraction of respondents, the presence of a negative correlation between these populations and prescribed fire comfort level and self-reported familiarity, respectively, may indicate them as potential target demographics for outreach. Additionally, as there is some indication that County Commissioners who do not own rural land may not be as familiar with prescribed fire as those who do possess properties, Commissioners who live in urban and suburban areas may also be a group of special interest for prescribed fire outreach.

Conclusion

While most County Commissioners surveyed were not opposed to or uncomfortable with prescribed fire, most of their information about the practice came from their local fire departments or emergency services, who may or may not be particularly informed about prescribed fire themselves and are typically more interested in preventing and suppressing fires than starting them. Further, the most potentially influential contributing factor for County Commissioner's perceptions of prescribed fire was their degree of self-reported familiarity with the practice. As such, it is important that those who wish to promote and implement prescribed fire, be they agency personnel, members of Non-Government Organizations, or prescribed fire associations, reach out to members of their local Commissioners' Court and actively attempt to involve them in the use of prescribed fire. Relationships based on trust in burn managers' abilities to apply fire safely even during burn ban conditions may be the key to convincing Commissioners to grant burn ban exemptions based on their knowledge of safety standards. In

addition, County Commissioners who are women or members of ethnic minorities may be more uncomfortable with prescribed fire than men or Caucasians, respectively, and therefore may represent a target demographic for educators, especially as minorities and women begin to make up a larger proportion of the County Commissioner population.

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APPENDIX I

Phone Interview Protocol – Educators

1. In general, does your agency promote prescribed fire use?
    a. If so, please explain how it does this?
2. What is your opinion of prescribed fire as a brush control/land management tool?
    a. What information sources or experiences informed this opinion?
3. Have you personally experienced or been involved with prescribed fire?
    a. If so, please explain how?
4. In general, do you support the use of prescribed fire?
    a. Please explain?
5. In general, would you describe your land management decisions as risk-averse, risk-neutral, or risk-prone?
    a. Please explain your response in the context of land for which you provide management advice.
6. How do Prescribed Burn Associations compare to government agencies in regards the provision of information on prescribed fire?
    a. Are they an effective substitute to government agencies as disseminators of information about prescribed fire?
7. On average, how do you rank concern about the following risks of using prescribed fire -- greatest risk to lowest risk: personal injury or fatality, property damage from escaped fire, smoke hazards, wildlife mortality, aesthetic effects on the landscape?
    a. Have you had any personal experience with any of these concerns?
    b. Do you think this ranking is different for landowners, and if so how?
8. How do you think the demand for prescribed fire as a wildlife management tool compare to its demand as a range management tool (brush control, forage improvement, etc.) on lands your agency manages?
    a. How about among private landowners?
9. Which is the most likely challenge that someone who wishes to apply prescribed fire will face: limited knowledge and expertise, shortage of resources (personnel, equipment,

money), lack of assistance with development of prescribed burn plans, or inability to apply fire when it is most effective due to weather conditions or burn bans, etc?

10. In general, do you think the Smokey the Bear Campaign has encouraged or discouraged the use of prescribed fire?
    a. Has the Smokey the Bear campaign affected your perceptions about fire in general and about the use of prescribed fire in particular?
    b. How do you think the Smokey the Bear campaign has affected landowner perceptions about fire in general and about the use of prescribed fire in particular?
11. Do you provide information to landowners about prescribed fire?
    a. If yes, how do you typically communicate with landowners about this issue?
    b. Do you find any particular kind of messaging more effective than others?
12. Has the expansion of social media made it easier to quickly and effectively disseminate information or give advice about the use of prescribed fire?
13. Please recommend two other people in your organization who we could approach for additional interviews? We would like to contact one person who actively supports the use of prescribed fire and one person who may have greater concerns about the use of this management tool.
14. If we have any further questions or need to clarify any of your answers, may we contact you again?

Phone Interview Protocol – Landowner Representatives

1. What is your current role in the organization _____(fill in blank of organization we're talking to)?
2. Are you a landowner?
    a. If so, how much land do you own?
3. In general, would you describe your land management decisions as risk-averse, risk-neutral, or risk-prone?
    a. Please explain your response in the context of land for which you are legally and fiscally responsible.
4. What is your opinion of prescribed fire as a brush control/land management tool?
    a. What information sources or experiences informed this opinion?
5. Are you a member of your local PBA?
    a. If yes, which one _____
6. In general, do you personally use or support the use of prescribed fire?
    a. Please explain?
7. Have you personally participated in the application of prescribed fire use?
    a. If yes, on your own land -- Y/N
    b. If yes, on another person's land -- Y/N
8. If you have not used or do not support the use of prescribed fire, to what extent have state and local liability concerns affected your perspectives about this land management tool?
9. In your opinion, how readily available to you is information and expertise about the use of prescribed fire?
10. Have you ever received information on social media about prescribed fire issues?
    a. If yes, from what social media platforms did you get such information?
    b. If no, would receiving information about prescribed fire be useful to you?
    c. If no, would you be more inclined to use prescribed fire if you saw lots of social media posting positive information about this land management tool?
11. How do Prescribed Burn Associations compare to government agencies in regards the provision of information on prescribed fire?

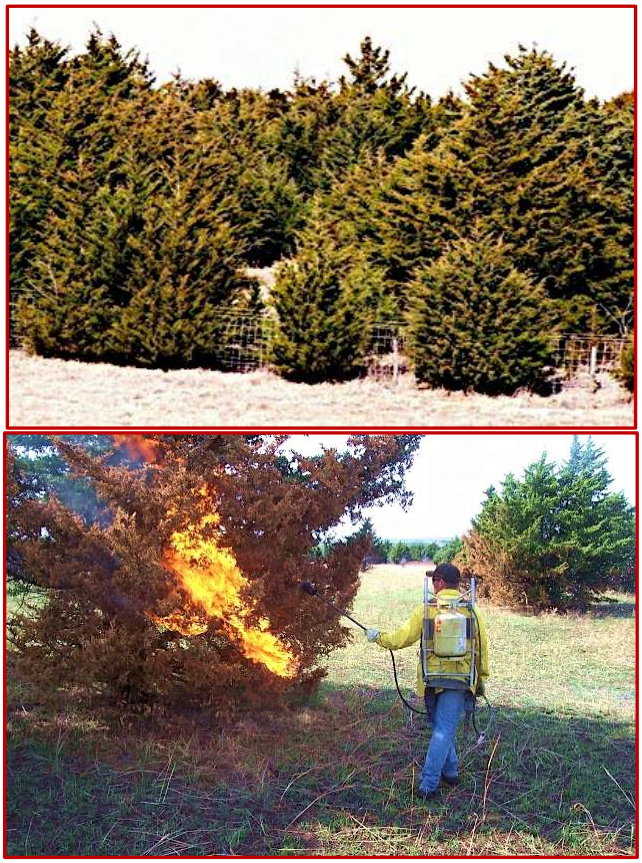
a. Are they an effective substitute to government agencies as disseminators of information about prescribed fire?

13. On average, how do you rank concern about the following risks of using prescribed fire -- greatest risk to lowest risk: personal injury or fatality, property damage from escaped fire, smoke hazards, wildlife mortality, aesthetic effects on the landscape?
    a. Have you had any personal experience with any of these concerns?
    b. Do you think this ranking is different for landowners, and if so how?
12. Which is the most likely challenge that someone who wishes to apply prescribed fire will face: shortage of knowledge and expertise, shortage of resources (personnel, equipment, money), lack of assistance with development of prescribed burn plans, or inability to apply fire when it is most effective due to, for example, burn bans, others?
13. In general, do you think the Smokey the Bear Campaign has encouraged or discouraged the use of prescribed fire?
    a. Has Smokey the Bear affected your perceptions about fire in general and about the use of prescribed fire in particular?
    b. Has this message confused you in any way?
14. Do you provide information to landowners about prescribed fire?
    a. If yes, how do you typically communicate with landowners about this issue?
15. What are the primary sources of information that landowners are likely to use when considering the use of prescribed fire on their land?
16. Has the expansion of social media made it easier to quickly and effectively disseminate information or give advice about the use of prescribed fire?
    a. Do you take the social media posts about prescribed fire seriously?
    b. Are social media an effective tool for this?
    c. Do you prefer the face to face interaction when obtaining information about land management issues, such as the use of prescribed fire?
17. Could you recommend two colleagues for our interview process? One of whom does use prescribed fire and one who doesn't?
18. If we have any further questions or need to clarify any of your answers, may we contact you again?

APPENDIX II

SOCIAL AND REGULATORY BARRIERS TO THE USE OF PRESCRIBED FIRE BY PRIVATE LAND MANAGERS IN THE SOUTHERN GREAT PLAINS

A Survey of County Commissioners in Texas and Oklahoma



Study Conducted by

Department of Ecosystem Science & Management

Texas A&M University, College Station, TX 77843-212

In Collaboration with

Department of Natural Resources Ecology & Management

Section 1: Involvement with prescribed fire

1. How familiar would you say you are with prescribed fire?

   - Very familiar
   - Moderately familiar
   - Slightly familiar
   - Not at all familiar

2. During your career as a commissioner, what portion of your time have you spent on issues relating to prescribed fire, burn bans, or wildfires? Please check only one box.

   - 0%
   - 1-25%
   - 26-50%
   - more than 50%

3. Have you ever been asked to participate or have you ever participated in a prescribed burn?

   - Yes
   - No

   If No, please go to question 6 on the next page, otherwise continue to question 4.

4. In what capacity were you invited to participate or did you actually participate? Please check all that apply.

   - Bystander
   - Volunteer
   - Assistant
   - Burn Manager
   - Other

   If other, please specify how: _____

5. Which of the following agencies or organizations have asked you to participate or have had you participate in a prescribed burn? Please check all that apply.

   - Natural Resources Conservation Service
   - Texas Parks & Wildlife
   - Texas Forest Service
   - Oklahoma Forestry Services
   - Prescribed Burn Association
   - Private landowners
   - Other. Please specify which one(s): _____

Section 2: Perspectives and awareness of issues pertaining to prescribed fire

6. In the table below, please check the opinion that best fits your opinion about each statement. Please check only one box per statement.

		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
A.	The use of prescribed fire is considered a safe and beneficial method of land management and should be practiced more frequently.	•	•	•	•	•
B.	The use of prescribed fire is an unsafe practice that should be more heavily regulated and only sparingly allowed to be conducted.	•	•	•	•	•

Please briefly explain your choice of response option for each statement.

A.

B.

7. Are you aware of the amount of prescribed burning that is applied in your county?

• Yes • No

If yes, about how many acres of prescribed fire were applied in your county during the last 12 months? _____(acres)

8. Are you aware of the liability standard your state currently enforces for the use of prescribed fire? • Yes • No

If yes, please provide a brief description of the liability standard.

9. Are you aware of the State and County laws and regulations related to outdoor burning and prescribed fire in your County? • Yes • No

   If yes, please list them.

   _____

   _____

10. Are you aware of the State and County rules as they apply to outdoor burning or prescribed burning while a burn ban is in effect in your County? • Yes • No

    If yes, please explain.

    _____

    _____

11. From where do you obtain information regarding prescribed fire or, if you are not familiar with this information, where would you most likely go to obtain answers?
    - USDA Forest Service
    - State Forest Service
    - Local fire chief/fire department/emergency management coordinators
    - Colleagues/fellow County Commissioners
    - Other, please specify: _____

12. Do you get regular updates on changes made to fire regulations and laws?
    • Yes • No

    If Yes, from where do you get the updates?

    _____

Section 3: Prescribed fire and the law

In the statement below we provide some of the language included in State statutes regarding the use of prescribed or controlled fire. Please read the statements pertaining to the State in which you are located before answering the subsequent questions.

TEXAS Commission on Environmental Quality – §111.219. General Requirements for Allowable Outdoor Burning

Outdoor burning which is otherwise authorized shall also be subject to the following requirements:

Burning shall be commenced and conducted only when wind direction and other meteorological conditions are such that smoke and other pollutants will not cause adverse effects to any public road, landing strip, navigable water, or off-site structure containing sensitive receptor(s).

Burning shall be conducted in compliance with the following meteorological and timing considerations:

(A) The initiation of burning shall commence no earlier than one hour after sunrise. Burning shall be completed on the same day not later than one hour before sunset, and shall be attended by a responsible party at all times during the active burn phase when the fire is progressing. In cases where residual fires and/or smoldering objects continue to emit smoke after this time, such areas shall be extinguished if the smoke from these areas has the potential to create a nuisance or traffic hazard condition. In no case shall the extent of the burn area be allowed to increase after this time.

(B) Burning shall not be commenced when surface wind speed is predicted to be less than six miles per hour (mph) (five knots) or greater than 23 mph (20 knots) during the burn period.

(C) Burning shall not be conducted during periods of actual or predicted persistent low-level atmospheric temperature inversions.

TEXAS Natural Resources Code – NAT RES § 153.081. Limitation of Owner Liability

Subject to Section 153.082, an owner, lessee, or occupant of agricultural or conservation land is not liable for property damage or for injury or death to persons caused by or resulting from prescribed burning conducted on the land owned by, leased by, or occupied by the person if the prescribed burning is conducted: (1) under the supervision of a certified and insured prescribed burn manager*; or (2) by the members of a prescribed burning organization*.

This section does not apply to an owner, lessee, or occupant of agricultural or conservation land who is a certified and insured prescribed burn manager and conducts a burn on that land.

OKLAHOMA Forestry Code 1 & 2-16-28

Outside protection areas, in order for prescribed or controlled burning to be lawful, an owner shall take reasonable precaution against the spreading of fire to other lands by providing adequate fire lines, manpower, and firefighting equipment for the control of the fire, shall watch over the fire until it is extinguished and shall not permit fire to escape to adjoining land.

Nothing in this section shall relieve the person from the obligation to confine the fire to the owner's, agent's, or tenant's land.

Any owner conducting a prescribed burn who is found by a court of law to have caused damages or injury as a result of accident or by ordinary negligence shall only be civilly liable for actual damages resulting from the prescribed burn.

Any owner conducting a prescribed burn who is found by a court of law to have committed gross negligence in conducting the prescribed burn may be found to be both civilly liable for the amount of damage done by the fire, and criminally liable pursuant to paragraph 3 of this subsection.

13. Having read the excerpt above, do you think the statute provides a clear understanding of the law governing prescribed fire to people practicing such fire on their own land?
    - Yes
    - No

    Please explain your response briefly.

14. Do you feel the statute provides you with a clear understanding of the law governing prescribed fire in your state?
    - Yes
    - No

    Please explain your response briefly.

15. Have constituents, state agencies, or other organizations ever attempted to meet and discuss fire law, regulation, or to lift a burn ban?
    - Yes
    - No

    If yes, please explain briefly.

16. Have you ever placed a burn ban in your county?
    - Yes
    - No

    If yes, please provide a brief description of the conditions under which the burn ban(s) was (were) placed and the length of the ban.

17. To the best of your knowledge, what are the criteria that must be met for placing a burn ban? Please check all that apply.
    - Persistent high wind conditions (greater than 20 mph)
    - Persistent dry conditions (relative humidity below 20%)
    - Persistent hot conditions (air temperatures are greater than 95 deg Fahrenheit)
    - Abnormally high fuel loads
    - The Keetch-Byram Drought Index exceeds 400
    - Red Flag designation from the USDA Forest Service
    - State of emergency being declared for the county or state
    - No criteria must be met. A burn ban can be placed at discretion of County Commissioners.
    - Other. Please specify:

    _____

    _____

18. What information sources do you use to determine the basis for implementing a burn ban in your County? Please check all that apply.
    - Local weather reports
    - Burn bans of neighboring counties
    - Local fire chiefs recommendations
    - State agency drought index
    - Red Flag designations from the USDA Forest Service
    - Fire danger ratings from state agencies
    - USDA Forest Service
    - State Forest Service
    - Local fire chief/fire department
    - Colleagues/fellow county commissioners
    - Other. Please specify:

    _____

    _____

19. Are you aware of any exceptions for burning during a burn ban and what those exceptions entail?
    - Yes
    - No

    If yes, please explain briefly:

    _____

Please read the following definitions regarding liability standards for applying prescribed fire before answering the next question.

The liability standard for prescribed fire can be either Simple or Gross negligence. Simple negligence standards require the burner to practice reasonable care in applying a prescribed burn; they require the plaintiff to show negligence by the defendant in order for the burner to be liable for damage caused by escaped wildfire. Gross negligence liability standards provide that, if a burner follows a set of codified regulations regarding burning, a plaintiff must show reckless disregard of the duty of care owed others by the burner.

20. Considering the previous definitions, do you think a shift in the legislation from simple negligence (failure to use ordinary care) to gross negligence (conscious and voluntary disregard of the need to use reasonable care) would change the frequency with which you enact burn bans? • Yes • No

    If yes, would you enact more or fewer burn bans? • More • Fewer

    Please briefly explain your response:

    _____

    _____

    _____

    _____

21. Considering the previous definitions, do you think that a shift in the legislation from simple negligence to gross negligence would result in a change in pressure from the public to enact more burn bans? • Yes • No

    If yes, do you think the public would demand more or fewer burn bans?

    • More • Fewer

    Please briefly explain your response:

    _____

    _____

Section 3: Demographic information

22. How many years have you served as a County Commissioner?
    _____(Years)

23. Please briefly tell us about your line of work before you became a County Commissioner?

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24. Do you own any rural land?
    - Yes
    - No

25. If yes, have you removed any brush control on your property
    - Yes
    - No

26. If yes, which of the following treatments have you used to control brush in your land?
    - Mechanical
    - Chemical
    - Goat browsing
    - Prescribed fire

27. Please describe the primary reason for either applying or not applying prescribed fire on your land.

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28. In what year were you born?_____

29. What is your gender?
    - Male
    - Female

30. What is your ethnicity?

    _____

31. How many years of formal education did you receive (including school, technical training and college?

    _____(Years)