# LANDOWNERS' PERCEPTIONS ON THE USE OF PRESCRIBED FIRE AS A MANAGEMENT TOOL

A Thesis

by

JUSTIN BRADLEY WOODARD

Submitted to the Office of Graduate Studies of
Texas A&M University
in partial fulfillment of the requirements for the degree of

MASTER OF SCIENCE

December 2005

Major Subject: Rangeland Ecology and Management

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Approved by:

Chair of Committee, Urs P. Kreuter
Committee Members, Wayne T. Hamilton
Roel R. Lopez
Head of Department, Steve G. Whisenant

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# ABSTRACT

Landowners' Perceptions on the Use of Prescribed Fire as a Management Tool.

(December 2005)

Justin Bradley Woodard, B.S., Texas A&M University

Chair of Advisory Committee: Dr. Urs P. Kreuter

The purpose of this project is to determine landowners' perceptions on the use of prescribed fire as a management tool. The majority of Texas rangelands are privately owned, and the sustainable management of almost all of the state's rangelands is contingent upon private land management decisions. Therefore, it is imperative for policy makers and extension agencies to understand landowners' perceptions, interests and concerns about alternative land management techniques. This is especially important for the use of prescribed fire, which has been identified as a critical management tool for maintaining the productivity of most Texas rangelands yet many landowners do not include it as an integral practice in managing their land. A better understanding of landowners' perspective of the use of fire could facilitate the increased use of this management tool through the development of effective educational, cost-share and fire planning programs.

The study reported here consisted of a mail survey of all 185 members of the Edwards Plateau Prescribed Burn Association (EPPBA) and 600 landowners in six counties in Texas. Four of those counties were located in the Edwards Plateau (Sutton,

Schleicher, Mason, Llano) and two counties were located in the Rolling Plains (Throckmorton, Shackleford). In each county, 100 landowners possessing at least 50 acres of land were randomly selected for inclusion in the survey. The mail survey approach followed Dilman's five-step mailing procedure.

Fire is an important rangeland management tool, but in a state where the majority of the land is privately owned fire suppression is still a dominant perspective. Our study suggests that important efforts to increase the use of prescribed fire include, educational programs about use of fire by landowners, increased assistance with prescribed fire plans, cost-sharing programs for fire implementation, and reduction in the legal liability associated with fire that burns out of control. Encouraging agencies to back educational programs and help teach landowners about the effects and uses of fire (burn plan assistance), and developing a resource pool to underwrite fire policies could increase the interest in and risk associated with the use of prescribed fires to more effectively manage rangelands in Texas, and elsewhere.

# DEDICATION

To the Lord for the strength, perseverance, and wisdom he provided
and my wife…for believing in me

## ACKNOWLEDGEMENTS

I would like to thank my committee chair, Dr. Urs P. Kreuter, for all his wisdom, support and guidance throughout my research. I would like to thank my committee members for their knowledge and involvement in this project.

Thank you to the faculty and staff for making my time at Texas A&M a wonderful and "educational" experience. I have made many relationships that will last forever.

Thank you to my family and friends for all your support and encouragement throughout my time here at Texas A&M University. Your love, support, and prayers have been greatly appreciated.

Finally, thanks to my mother and father for your years of love, support and encouragement and my wife for her strength, wisdom, and unbelievable heart….you're amazing.

# NOMENCLATURE

| | |
|---|---|
| EPPBA | Edwards Plateau Prescribed Burning Association |
| PBA | Prescribed Burn Association |

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# CHAPTER I

# INTRODUCTION

Fire has played an important role in the development of many of the world's rangeland ecosystems (Collins 1990). Peking man was burning vegetation to his advantage at least a quarter of a million years ago, and as Stewart (1956) noted "The discovery of a method of ignite vegetable matter looms as one of humanity's greatest acts". Since then discoveries and experiments, has led to a wide range of uses of fire, including prescribed burning of rangeland vegetation.

Prescribed burning is "the systematically planned application of burning to meet specific vegetation management applications" (Scifres and Hamilton 1993). This important rangeland management tool can create an increase in biodiversity and is a relatively inexpensive method of controlling woody plants (brush) for landowners who can not afford to use mechanical or chemical treatments.

Fire suppression in the past has caused an increase in the number of woody plants and other invasive species on rangelands today. Along with overgrazing this has caused a decrease in grass species and allowed the widespread proliferation of woody plants on rangelands in Texas.

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This thesis follows the style of Journal of Rangeland Ecology & Management.

This study will focus on landowners' knowledge of fire and their perceptions regarding the use of fire as a land management tool; and landowner interests and concerns about the use of rangeland management practices, dealing primarily with fire. Also, perspectives from prescribed burning associations will be addressed to show if burning associations enhance knowledge concerning the use of prescribed fire as a management tool.

**Problem Statement**

The suppression of fire, in conjunction with overgrazing has led to an increase in woody plant cover, especially Ashe juniper (*Juniperus asheii*) on the Edwards Plateau. This has led to a decline in perennial grass cover, quality of wildlife habitat, and possibly stream flows. Landowners spend large sums of money every year on woody plant (brush) management, but are often reluctant to incorporate fire as part of the land management. A primary concern associated with the use of prescribed fire today is the lack of knowledge about the ecological importance of fire and the degree to which fire can be controlled. Other causes for concern to landowners may include legal liabilities (i.e., wildfire and smoke hazards), loss of forage, removal of cattle from pastures, and lack of organized landowner associations that facilitate information dissemination. To encourage landowners to incorporate prescribed fire as an integral part of their land management practices, greater knowledge among landowners about the ecological role of fire is extremely important along with a better understanding of their interests in and concerns about fire safety training, reduced liability risks, and local prescribed fire associations.

**Objectives and Hypothesis**

The overall objective of this study is to determine landowners' perceptions regarding the ecological role and use of fire as a management tool and to determine reasons why landowners may be disinclined to use fire. Key hypothesis that will be tested are:

1. Property size, level of knowledge about fire, and economic status of landowners are positively correlated with the use of prescribed fire as a management tool.
2. Landowners who reside on their land are more incline to use prescribed fires than absentee landowners.
3. Landowners' lack of knowledge about fire and a lack of resources (time, labor, money and equipment) deter them from using prescribed fire as a management tool.
4. Landowners' willingness to incorporate fire as a rangeland management tool is contingent upon their perceived liability of using fire.
5. Membership in a prescribed burning association enhances landowners' knowledge about the ecological role of fire and fire as a management tool and their willingness to apply prescribed burns.

# CHAPTER II

# LITERATURE REVIEW

Fire is a key driver in the evolution of many of the world's rangeland ecosystems (Collins 1990). In addition, mankind has used fire as a tool for a very long time. For example, Peking man was burning vegetation to advantage at least a quarter of a million years ago (Stewart 1956). "Whatever may have been its start, fire must have been controlled by him [man] before he learned to manufacture it. The discovery of a method to ignite vegetable matter looms as one of humanity's greatest acts" (Stewart 1956). Since then, through these discoveries and experiments, many specific uses for fire have been established.

One profitable use of fire is that of prescribed burns to manage rangeland vegetation. Prescribed burning has been defined as "the systematically planned application of burning to meet specific management applications" (Scifres and Hamilton 1993). This is an important issue to landowners because it does not only create an increase in the biodiversity of an ecosystem it is also a relatively inexpensive method of woody plant (brush) control compared to alternative mechanical or chemical treatments.

## Dominant Woody Plant Species in the Edwards Plateau

In the Edwards Plateau and Rolling Plains Regions of Texas prescribed fire is often used to control redberry juniper (*Juniperus pinchottii*) and/or ashe juniper (*Juniperus asheii*) (Hamilton et al. 2004). These two species provide highly volatile fuels and a four-stage life cycle: seeds, seedlings, non-reproductive juveniles, and adults

(Ueckert 2001). The timing of fire application plays a vital role in controlling these species. A study, conducted by Texas Tech University and Texas Parks and Wildlife, concluded that for winter burns and fine fuel loads less than 2,000lbs/acre, a juniper leaf moisture of 75% is necessary to obtain adequate control of 4-8 foot redberry juniper trees (Hamilton et al. 2004). They also stated, as leaf moisture increases it is still possible to get a good burn as long as the fuel load increases in proportion. Because it is difficult to achieve fuel loads of 2000lbs or more in the Edwards Plateau, more intense fires are needed for control, but for junipers less than four feet tall, only moderately intense fires are necessary (Hamilton et al. 2004). As a result of the increase in mature woody plants there has been an increase in interest in the use of summer fires for reducing their number. Summer fires are more effective on cactus and for achieving high juniper mortality (Smeins 2004).

Redberry juniper is a serious problem on 12 million acres of the Edwards Plateau and Rolling Plains (Taylor 2001). Redberry juniper is a basal-sprouting, evergreen conifer that occurs in West and North Central Texas, Southwestern Oklahoma, Southeastern New Mexico, and Northeastern Mexico (Adams and Zanoni 1979). The following describes the fire effects on different types of juniper species. On the Edwards Plateau, where juniper species are mixed, Adams and Zanoni (1979) and the 1982 Soil Conservation Service indicated that junipers in Northwest Texas (extending from Amarillo to San Angelo) are predominantly redberry junipers. Many areas in Northwest Texas are currently dominated by young redberry juniper plants. Originally, redberry juniper populations were found on rocky outcrops, dry hills, arroyos and canyons,

caprocks and shallow limestone, or gypsum soils where they were protected from grass fires (Ansley et al. 1995). Fire, on the other hand, does have its limitations. Fire will not kill many sprouting species, such as redberry juniper, even after numerous repeated fires or summer fires (Ansley and Jacoby 1998). When managing immature plants such as seedlings or young redberry junipers, fire is an effective means of management, but mature plants usually sprout following fire (Steuter and Wright 1983), which requires repeated follow-up treatments.

The factor that affects redberry susceptibility to fire is determined by the basal budzone (caudex) location. Redberry juniper resprouts profusely when the aboveground portions of the plants above the bud zone are removed. While the plant is susceptible to fire when the caudex is not covered by soil, with maturity the caudex becomes covered by the soil, and the plant becomes fire resistant. Dense, mature, redberry juniper stands often require mechanical treatment before prescribed fire is possible. This is because their dense canopy suppresses the understory and herbaceous production (fine fuels) necessary to carry an effective fire (Smith et al. 1975). The optimal burning cycle for maintenance burns was found to be approximately 7-years under most conditions (Smith et al. 1975). Correct stocking and deferment methods will allow grass to compete with juniper and to build up sufficient fuel load for future prescription burns.

Ashe Juniper (*Juniperus asheii*) is also a serious problem on approximately 10 million acres of the Edwards Plateau, most significantly on the eastern part (Taylor 2001). Data from the Sonora Research Station shows that Ashe juniper makes up 30% of the total woody plant canopy cover (Smeins et al. 1994, Fuhlendorf unpublished

data). Ashe junipers are non-sprouting plants, which can succumb to fire because removal of the aboveground portion of the plant kills it since it cannot resprout. The implications for fire intensity and season of burn for this species of juniper are that it's easier to manage with fire due to the fact that removal of the aboveground portion of the plant will kill it. Prescribed fires are one of the least costly brush management methods, and are very effective in controlling Ashe juniper. Determining the frequencies of maintenance fires depend on the rate of juniper intrusion, which is affected by factors such as precipitation, grazing pressure, and prevailing climate.

Another problem species in Texas is honey mesquite (*Prosophis glandulosa*). Prescribed fire has long been used to treat mesquite (Stinson and Wright 1969). While fire is considered to be "one of the most economically sustainable and least environmentally challenged mesquite management options," the full potential of fire as a management tool for this species has not been explored (Ansley et al. 1997). Mesquite is a vigorous resprouter even after being subject to a fire event that top kills the plant. Plants may initiate new growth from either buds within the crown or from buds underground on the taproot or lateral roots (Graham 1941). The response of honey mesquite following a fire event depends on the magnitude of the fire and the damage that the fire inflicts on the plant. Repeated low-intensity winter fires seem to be better suited than intense summer fires for converting mesquite thickets to savannas because they modify the vertical distribution of mesquite foliage by reducing foliage per tree, yet maintaining apical dominance (Ansley and Jacoby 1998). For example, in a low fuel load (1160 lbs/ac) fire near Encinal, Texas honey mesquite had recovered to 106% of

preburn canopy cover in 2 years, but still had 14% less canopy cover than honey mesquite in the unburned plots (Hamilton 1980a). Conversely, the more intense the fire, the greater is the probability of increasing percent mortality and the amount of suppression. Thus, summer burns with large fuel loads may offer the best chance of mesquite mortality and suppression. Small seedling and sapling mesquite plants are more susceptible to fire than larger mature mesquite plants, which have an extremely high fire tolerance. Consequently, prescribed burning seems to be of limited effectiveness for controlling honey mesquite (Hamilton et al. 2004).

Fire also plays an important role in distribution and development of oak woodlands. The ecological effects of fire will vary based on the rate of recurrence, the size of patches that result from fire induced mortality, and also the adjacent vegetation types (Rouse 1986). Many factors such as season of year, bark characteristics, and size determine the effect of fire in oak woodlands (Rouse 1986). Oaks are generally less susceptible to injury from fire during the dormant season due to their non-critical physiological state (Rouse 1986). Bark thickness plays an important role in determining how resistant an oak is to fire. The older and more mature a tree is the higher the fire resistance (Stickel 1934, Little 1946, Somes and Moorhead 1950) because older trees have thicker bark, and a larger cambium area that reduces the impact of fire destruction of part of the cambium (Rouse 1986).

Vigor is also an important factor, because trees having low vigor do not sprout well and may not be able to heal as fast as a more vigorous tree. Summer burns of high intensity can reduce the vigor of oak trees (Chaiken 1982). However, oak trees can

resprout when top-killed by fire (Rouse 1986). Oak seedlings have dormant buds at the soil surface, which allows them to be protected from the intense heat of a fire, and when the aerial portion of a plant is removed these new sprouts grow vigorously from existing root stock (Rouse 1986). Fire often increases the number of sprouts present (Sanders 1977).

**Fire as a Management Tool**

Prescribed fire is a very effective management tool, but there are more aspects to consider than just lighting the fire. Planning for a prescribed burn should take place at least six to twelve months before the burn, and deferment of grazing must be considered along with location of alternate food sources (Hamilton 1980b). Arrangements for the use of equipment such as, a grader, bulldozer, pumper truck, and water trailer need to be made three to six months in advance of the burn. In addition, decisions need to be made regarding the fire boss, ranch personnel, and training necessary for each individual participating in the burn. The preburn preparations consist of developing fire lines according to the proposed plan, removing leftover livestock and protecting facilities, such as telephone lines, fences, buildings, and areas not designated for burning. It is also necessary to notify the proper authorities including the Texas Forest Service, Fire Department, Sheriffs Office, neighbors and other persons requiring advanced notice.

There are many factors to consider when determining what conditions are optimal for the burn. One critical factor is season in which the burn is to be applied, because this affects various environmental variables that influence fire intensity. Weather conditions affect air temperature, wind speed and direction, and moisture, while

other important variable determinants include fuel load type and amount, topography, soils, grazing pressure, and fire frequency (Ohmann and Grigal 1981, Sousa 1984, Wade 1986, Masters et al.1993, Masters and Engle 1994). When burning Texas rangelands, the 40:60 rule generally provides safe and effective burning conditions (Wright and Bailey 1982): Temperature = 40-60°F, relative humidity = 40-60% and wind speed = 0-8 mph. When these specific conditions do not prevail when burning black lines, other variables must be considered to reduce the risk of a fire burning out of control. These variables may include herbaceous fuel moisture, juniper leaf moisture, and fine fuel load (Blair et al. 2000). Another consideration is the time of day that the burn is executed. For example, if an area is burned in the early morning when air temperatures are cool, fire temperature will be less than if a fire is started in the afternoon. Fire temperature generally regarded as lethal for plant tissue is 140°F (Hare 1961), and the ambient temperature at the time of burning impacts the temperature rise needed to reach the lethal point (Scifres and Hamilton 1993). For example, a plant already at 95°F due to high ambient air temperatures requires only about half the temperature rise as a plant of 50°F to reach the fatal temperature (Scifres and Hamilton 1993).

When performing a prescribed fire, conditions are selected to ensure the desired outcome of the burn. Maintenance burns which are relatively "cool" fires, are used to increase vegetation production, suppress undesirable species, remove debris from previous treatments (roller chopping, chaining), and improve the quality of forage. They are applied under environmental conditions that minimize the fire risk of damage to desired species. Reclamation burns, on the other hand, are severe fires with extremely

high temperatures that change vegetation composition by increasing kill of undesirable species which dominate a particular pasture (Scifres and Hamilton 1993). They are more difficult to control than a maintenance burn, because they are applied under extreme conditions and the risk of damage to desirable species is elevated. Reclamation burns are applied in the summer when the conditions allow for hot and intense fires. Due to the higher risk of wildfire and unintended plant damage reclamation burns should be used when no other alternatives are available for restoring desirable plant species composition (Hamilton 2004).

The types of fires used when performing a burn are determined by their direction of movement relative to prevailing wind. Backfires, are slow burning fires that move against the direction of the wind. While, headfires move more rapidly with the wind. The purpose of using backfires is to enlarge fire breaks prior to the application of a prescribed burn in order to increased safety. These fires reduce the risk of losing control of fire in areas with heavy fuel loads. Headfires maximize fire temperatures and can traverse breaks in fuel continuity to move the fire across the selected burn area quickly. Another type of fire is a strip headfire, which is the lighting of a back and head fire simultaneously. This reduces the requirements for a fire crew and increases safety margin during a burn.

**Comparison of Woody Plant Treatments**

When deciding which brush management treatment to use, the plant species, area of invasion and topography must be considered, as well as cost of applying the treatment. Mechanical brush treatments that use simple top removal techniques are

generally less costly and cause less soil disturbance than those designed for complete plant removal, but may have a short treatment life due to the potential regrowth of woody plants (Hamilton et al. 1981). Conversely, "Energy intensive methods such as dozing or root plowing cause maximum soil disturbance and are relatively expensive, but are highly effective for brush removal" (Scifres 1986). Mechanical treatments are normally only practical on scattered or small patches of brush where the use of equipment is not restricted by terrain. In addition, while non-sprouting species are highly affected by mechanical treatments, resprouting species need to be cut when root reserves are low for this approach to be effective.

Herbicide treatments are another effective management tool, if applied at the correct rate and time with the right chemical for the target species. Such treatments can vary from individual plant treatment to broadcast aerial application, depending on the size and distribution of targeted woody species. They can be relatively expensive, but there are several advantages to their use including speed and effectiveness, no soil disturbance, and wildlife cover from remaining woody debris. Thus it may be possible to reduce undesirable plants while leaving desired cover for wildlife species. A disadvantage of using herbicides is that desirable forbs are usually also reduced. In addition, herbicides must be applied when target plants are most susceptible, which is usually restricted to a window of a few weeks, and herbicide resistant species may increase into unmanageable stands.

Prescribed fire is generally the most economical woody plant management alternative, and is often appealing to those who cannot afford prolonged chemical and

mechanical brush treatments. Although suppression of fire contributed to the increasing dominance of woody plants, trees, shrubs, and vines on rangelands are only temporarily reduced with the use of a single prescribed fire (Hamilton and Scifres 1993). Prescribed fire may kill juvenile plants and seedlings of some species, and speeds up removal of weakened mature individuals (Hamilton and Scifres 1993). Thus "A major role of prescribed fire is to lend a competitive edge to herbaceous plants rather than to rid the landscape of brush" (Hamilton and Scifres 1993).

If properly applied, prescribed fire is useful for maintaining herbaceous plants in shrublands following the initial application of more costly chemical or mechanical treatments for brush control (Hamilton and Scifres 1993; Scifres 1986; Garoian et al. 1984; Whitson and Scifres 1980). The rate of top growth replacement by woody species after a burn will determine the optimal time intervals for maintenance burns to maintain growth suppression (Hamilton and Scifres 1993). Successful use of prescribed fire requires development of skills, mainly gained by experience (Scifres 1980; Wright and Bailey 1982).

While proving to be a highly effective management technique, fire does have some drawbacks. These drawbacks are caused by fine fuel loads and continuity under heavy brush that is often insufficient for effective prescribed burns (Scifres 1986). If ample vegetative fuel for an effective burn is not available, other methods of weed and brush control should be considered (Bovey 2001). Burning under marginal moisture conditions followed by a prolonged dry period may necessitate prolonged grazing deferment because of slow recovery of desirable species (Scifres 1986). The greatest

benefit of prescribed fire is that it is moderately inexpensive, but some costs will vary with the objectives of the burn and variations in terrain and fine fuel (Scifres 1986). The main cost for the initial burn is generally higher than subsequent burns, given that the initial costs incurred deal mainly with the installation of structures or land modification (e.g., fire lines) (Hamilton and Scifres 1993).

Holechek and Hess (1994) estimated that burning cost $1-5/ acre, compared to $12-20/acre for herbicide treatments and $25-50/acre for mechanical control treatments. Therefore, it has been stated that "Fire will continue to be important, especially in combination with other practices. Future research will emphasize combinations of treatments for economical and effective weed control" (Bovey 2001).

**Landowners and the Use of Fire**

Landowners spend thousands of dollars every year on brush control on their lands. Many prefer to use management techniques that they have previously found to be successful in combating woody plants (i.e., chemical and mechanical). The increase in the use of mechanical and chemical treatments is due in part to the suppression of fire, which has often been thought of as a destructive event rather than a helpful tool. However, "Today we burn to accomplish many important ecological functions and landowner objectives" (Hamilton 2004). Primary reasons landowners use fire is to reduce hazardous fuels, improve livestock and wildlife habitat, alter vegetation communities, control pest problems, and to improve access and visibility in areas previously consisting of heavy vegetation (Hamilton 2004). While use of fire for land management has increased tremendously over the years, there are still some concerns

which can be attributed mainly to the lack of knowledge about the ecological role. Other factors that cause concern among landowners are the legal liabilities associated with the use of fire, smoke hazards, loss of forage, loss of forage resources, and lack of organized associations. However, landowners differ in their views of the use of fire as a management tool. To encourage them to incorporate prescribed fire as an integral part of their land management practices, increasing knowledge about the ecological role of fire is critical along with fire safety training, reducing liability risks, and developing and promoting of local prescribed fire associations. The main reason the landowners use fire is that it is an effective and economical management tool.

A study conducted on Texas landowners' adoptions of brush busters and other brush management methods found that landowners satisfaction with Brush Busters' would likely result in an increase in IPT treatments recommended by the program (Amestoy 2002). This study also indicated that for rangeland management practices to be widely adopted it would be important to develop user friendly information about the low cost methods that generate quick results (Amestoy 2002). Another study dealing with relationships among landowner and land ownership characteristics and participation in conservation programs (Sanders 2005). This study classified landowners into three categories consisting of individuals who were Born to the Land, Ag. Business, and Re-born to the land (Sanders 2005). Individuals Born to the Land were found to be more "connected" to the land and disapproved of government involvement in their land decisions (Sanders 2005). Agriculture Business individuals were found to be not as strongly "connected" to the land and felt that farm and ranch management could be

handled better on the state or county level (Sanders 2005). Individuals Re-born to the land were found to be strongly "connected" to the land and had more of an emphasis on the land for recreational (Sanders 2005). This group of individuals was not aware of the management programs available and was open to knowledge in these areas (Sanders 2005). This particular study will allow natural resource agencies the ability to better profile landowners as to their likelihood of participation in governmental programs (Sanders 2005).

# CHAPTER III

# METHODS

A mail survey was conducted in four counties in the Edwards Plateau and two counties in the Rolling Plains, Texas. Of the four Edwards Plateau counties, Sutton and Schleicher are the original locations of the Edwards Plateau Prescribed Burning Association (EPPBA), while Mason and Llano are the counties with the Associations most recent members. The two counties in the Rolling Plains are Throckmorton and Shackleford both of which are included in the formation a new prescribed burning association. Counties were grouped according to the time of involvement in a prescribed burn association.

Individuals that were involved in the survey consisted of both members and non-members of the EPPBA. Addresses of members were obtained from the EPPBA mailing list. This included 185 landowners, some of which were located in counties outside of the six counties listed above. In the six counties listed above, non-member addresses were obtained from the County Appraiser's office. In each county, 100 landowners possessing at least 50 acres were randomly selected for the study, giving a total of 600 non-member landowners. Landowner stratification by property size prior to sample selection was not used because the range of property sizes varied significantly across counties which made selection of universal strata inappropriate. The total survey sample size was 785 landowners.

A survey questionnaire was sent to each survey participant. The mail survey was administered using Dilman's (2000) five-step mailing procedure (Dilman 2000). This included a notification letter sent on June 14, 2004 first mailing of the questionnaire on June 21, mailing of reminder/thank you card on June 30, mailing of replacement questionnaire to non-respondents on July 8, and mailing of final reminder card to non-respondents on July 30.

The survey questionnaire sought information about the landowner's perception on the use of prescribed fire as a management tool. The key areas of inquiry dealt with characteristics of property and land management, landowner perceptions regarding fire ecology, use of prescribed burns, cost share programs for managing woody plants, and personal information. In addition, members of the EPPBA were sent an insert to obtain information about their interest and concerns regarding the EPPBA.

Statistical techniques used to analyze data consisted of descriptive statistics, such as frequency distributions, bivariate analyses including cross tab analysis and analysis of variance with post hoc tests. Because of the debate over whether Leikert scale response values constitute categorical or continuous variables, non-parametric tests, specifically the Kruskal-Wallis test, were also conducted for analyzing scaled response data. Finally, multiple regression analyses were conducted to determine the predictive power of various independent variables in explaining landowner perspectives. Cross tab analysis are presented using Goodman and Kruskal's gamma ($\gamma$), with ANOVA results presented with the F-statistic and associated probability value. Kruskal-Wallis results are presented with the chi-square statistic and associated probability value. Regression

analyses were performed to develop simple linear regression models to identify factors to explain respondent variability with respect to knowledge about effects of fire, knowledge about use of fire as a management tool, concerns about insufficient resources, legal liability, interest in cost-share, reduced liability, and assistance with fire plans as a reason for not using fire. In each model we used the following factors as explanatory variables: year born, acreage, residency on property, annual income, proportion of income from property, livestock income, wildlife income, importance of forage supply, importance of wildlife habitat improvement, importance of control invasives, and burn association membership. The regression results are represented by the R statistic, adjusted $R^2$ statistic, the F statistic, and the associated probability value.

# CHAPTER IV

## RESPONDENT CHARACTERISTICS

Tabulated data that support the results reported in this section are included in Appendix B. Of the 785 survey participants, 366 (46.6%) completed and retuned the questionnaire. Non-members of the EPPBA made up 60.4 % of the respondents while EPPBA members made up the remaining 39.6%. Of the 185 members of the EPPBA, 141 responded, and of the 600 non-members surveyed, 220 responded. The response rates for member and non-member county groups are presented seen in Table 1.

Table 1. Response rates of county groups that were surveyed.

| County group | N | Frequency | Percent |
|---|---|---|---|
| Original EPPBA | 200 | 110 | 30.05 |
| Recent EPPBA | 200 | 104 | 28.42 |
| Other Edwards Plateau | | 73 | 19.95 |
| Rolling Plains | 200 | 75 | 20.49 |
| No Response | | 4 | 1.09 |
| Total | | 366 | 100.00 |

Ages of respondents ranged from 23-93 years with a mean of 61 years of age. There was no significant difference in the age of EPPBA members (mean = 60.5) and non-members (mean=61) (F=0.144; P=0.736). An analysis of ranching experience showed that the respondents had an average of 28.2 years of ranching experience and ranging from 0-76 years. EPPBA members had significantly more ranching experience than non-members (F=4.76; P= 0.030), average experience for EPPBA members was 30.7

years compared to an average of 26.5 years for non-members. Analysis of years of ownership showed that 54.6% of respondents have owned their property for more than one generation (see Figure 1). Crosstab analysis indicated there was no significant difference in period of ownership across counties ($\gamma = 1.66$, P=0.096).

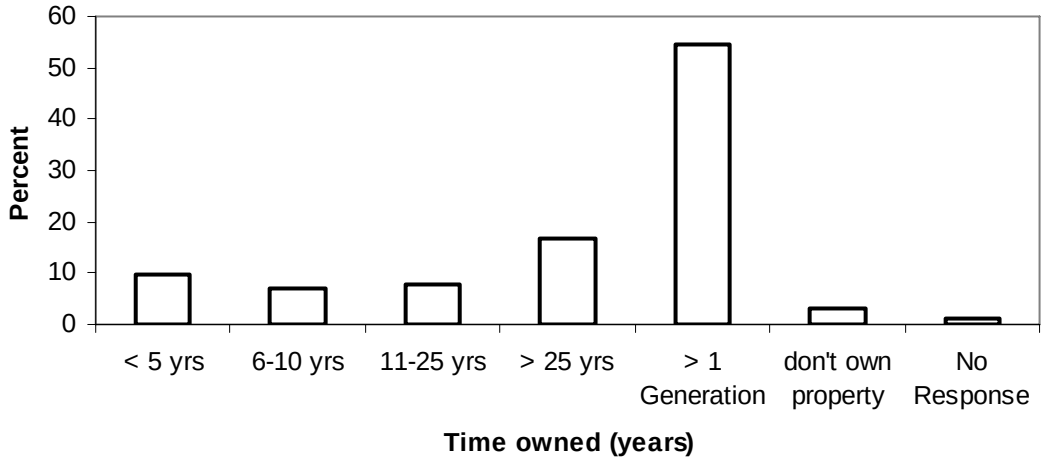


Figure 1. Years of land ownership of survey respondents.

Of the respondents only 45.6% lived on their property (see Table 2).

Table 2. Percent of respondents who live on their property.

| Live on property | Frequency | Percent |
|---|---|---|
| No | 197 | 53.8 |
| Yes | 167 | 45.6 |
| No Response | 2 | 0.5 |
| Total | 366 | 100 |

However, significantly more EPPBA members live on their land (56%) than non-members (40%) ($\gamma$= 2.913, P=0.004). The implication is people who reside on their land are more inclined to be a member of a burn association.

Respondents' property sizes ranged from 21-39,660 hectares with an average of 1,598 hectares (SEM = 485, 95% CI = 953). However, EPPBA members have significantly larger properties (mean = 3,067 ha) (SEM = 230, 95% CI = 2,239) than non-members (mean = 644 ha) (SEM = 1,132, 95% CI = 454) (F = 39.48, P≤0.000) (see Table 3). In addition, there were significant differences between county groups (F = 9.19, P≤0.000). Respondents' properties in counties in the original EPPBA (Sutton and Schleicher) (mean = 2,036 ha) (SEM = 827, 95% CI = 1,639) and other Edwards Plateau counties with EPPBA members (mean = 2,673 ha) (SEM = 1,296, 95% CI = 2,584) were on average significantly larger than those in the counties with more recent EPPBA members (Llano and Mason) (mean = 481) (SEM = 163, 95% CI = 323) and Rolling Plains counties (Throckmorton and Shackleford) (mean = 973) (SEM = 781, 95% CI = 1,557) (F = 9.19, P≤0.000).

Table 3. Comparison of acreage of EPPBA members/non-members and county groups

| Member/Non-member/County | N | Mean hectares | 95% CI |
|---|---|---|---|
| EPPBA member | 140 | 3,067 | 2,239 |
| Non-member | 217 | 644 | 454 |
| Original EPPBA counties | 109 | 2,036 | 1,639 |
| Recent EPPBA counties | 103 | 481 | 323 |
| Other Edwards Plateau counties | 72 | 2,673 | 2,584 |
| Rolling Plains counties | 74 | 973 | 1,557 |
| Total | | 1,598 | 953 |

Total income was analyzed and 59% of respondents stated that they earned $100,000 or less per year while 26.2% made less than $50,000 annually. There was no significant difference ($\gamma$= -0.119, P=0.905) in income earned across counties, but EPPBA members earned significantly more than non-members ($\gamma$= 2.351, P=0.019) 61.0% of EPPBA members earned more than $75,000, while 50.0% of non-members had an annual income of $75,000 or less (Table 4).

Table 4. Total income among survey participants and total income of EPPBA members and non-members.

| | All Respondents | | EPPBA members | | Non-members | |
|---|---|---|---|---|---|---|
| Total income | Frequency | Percent | Frequency | Percent | Frequency | Percent |
| Less than $25,000 | 20 | 5.46 | 6 | 4.26 | 13 | 5.91 |
| $25,001-$50,000 | 76 | 20.77 | 22 | 15.60 | 53 | 24.09 |
| $50,001-75,000 | 65 | 17.76 | 21 | 14.89 | 44 | 20.00 |
| $75,001-$100,000 | 55 | 15.03 | 25 | 17.73 | 30 | 13.64 |
| $100,001-$500,000 | 115 | 31.42 | 55 | 39.01 | 59 | 26.82 |
| Greater than $500,000 | 11 | 3.01 | 6 | 4.26 | 5 | 2.27 |
| Don't Know | 2 | 0.55 | 1 | 0.71 | 1 | 0.45 |
| No Response | 22 | 6.01 | 5 | 3.55 | 15 | 6.82 |
| Total | 366 | 100 | 141 | 100 | 220 | 100 |

Analysis of proportion of income derived from property found that 54.4% of respondents acquired 25% or less of their income from their property (Table 5).

Table 5. Overall proportion of income from property and EPPBA member and non-member proportions of income from property.

| | All Respondents | | EPPBA members | | Non-members | |
|---|---|---|---|---|---|---|
| Proportion | Frequency | Percent | Frequency | Percent | Frequency | Percent |
| Less than 10% | 144 | 39.34 | 38 | 26.95 | 104 | 47.27 |
| 11-25% | 55 | 15.02 | 16 | 11.35 | 38 | 17.27 |
| 26-50% | 51 | 13.93 | 22 | 15.6 | 29 | 13.18 |
| 51-75% | 47 | 12.84 | 27 | 19.15 | 19 | 8.64 |
| More than 75% | 59 | 16.12 | 35 | 24.83 | 24 | 10.91 |
| Don't Know | 2 | 0.54 | 1 | 0.71 | 1 | 0.45 |
| No Response | 8 | 2.18 | 2 | 1.42 | 5 | 2.27 |
| Total | 366 | 100 | 141 | 100 | 220 | 100 |

There was no significant difference in proportion of income among counties included in the survey ($\gamma$= -1.81, P=0.071). However, there was a significant difference ($\gamma$= 4.947, P<0.001) in the proportion of income derived from their land between EPPBA members and non-members; 59.6% of EPPBA members acquired 26% or more of their income from their land , while 64.5% of non-members acquired 25% or less of their income from their property.

When investments in land management improvements were analyzed, it was found that 53.3% of respondents spent under $10,000 per year (Table 6). There was no significant difference ($\gamma$= -1.91, P=0.066) in land investments across county groups but EPPBA members invested significantly more than non-members ($\gamma$= 5.905, P<0.001); 63.1% of EPPBA members spent more than $10,000 while 65.9% of non-members spent less than $10,000 per year.

Table 6. Overall landowner investment in land improvement and annual investments made by EPPBA members and non-members.

| | All Respondents | | EPPBA member | | Non- member | |
|---|---|---|---|---|---|---|
| Investments | Frequency | Percent | Frequency | Percent | Frequency | Percent |
| Under $1,000 | 34 | 9.28 | 6 | 4.26 | 28 | 12.73 |
| $1,000-$9,999 | 161 | 43.98 | 42 | 29.79 | 117 | 53.18 |
| $10,000-$24,999 | 82 | 22.40 | 45 | 31.91 | 35 | 15.91 |
| $25,000-$49,999 | 27 | 7.38 | 12 | 8.51 | 15 | 6.82 |
| $50,000-$99,999 | 26 | 7.10 | 17 | 12.06 | 9 | 4.09 |
| Over $100,000 | 20 | 5.46 | 15 | 10.64 | 5 | 2.27 |
| Don't Know | 4 | 1.09 | 1 | 0.71 | 3 | 1.36 |
| No Response | 12 | 3.27 | 3 | 2.13 | 8 | 3.64 |
| Total | 366 | 100 | 220 | 100 | 141 | 100 |

Income from ranch activities was analyzed using ANOVA. Overall, most of on-ranch income came from livestock (50%) and hunting fees (25%). We also found that there were significant differences between EPPBA members and non-members with respect to income derived from fee hunting of native or exotic wildlife ($F= 11.06$, $P =0.001$), sale of wildlife for breeding stock, meat or other products ($F= 3.91$, $P = 0.049$), sale of crops ($F= 5.03$, $P = 0.026$), and other non-specified activities ($F= 4.27$, $P = 0.040$) (Figure 2, Figure 3, Table 7). Often, livestock are not bringing the prices that they used to for landowners. In turn, landowners are increasingly supplementing their income through hunting fees to make up for lower livestock prices. Also by leasing out their land for hunting, this produces a more stable source of income for the landowner who controls the price.


Figure 2. Overall proportion of total income derived from ranch activities (error bars show 95% CI).

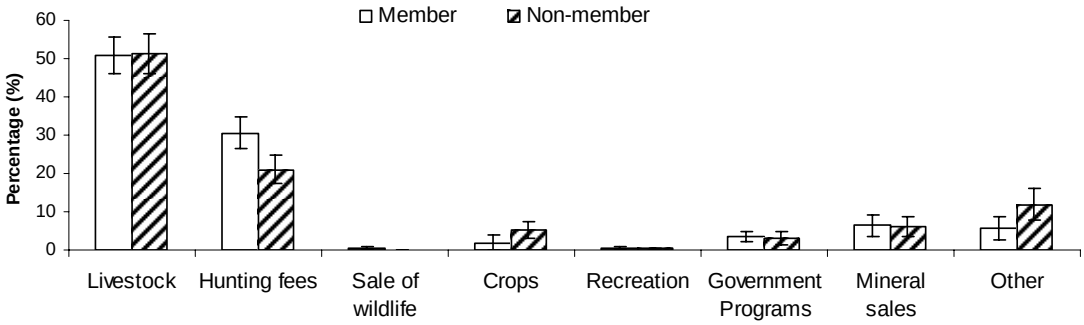


Figure 3. Percent of income from ranch activities in Texas (comparing members and non-members) (error bars are showing 95% CI).

Table 7. Income from ranch activities.

| **Activities** | Mean | 95%CI | Member | Non-member |
|---|---|---|---|---|
| Livestock | 51.31 | 3.62 | 50.91 | 51.24 |
| Hunting fees | 24.53 | 2.81 | 30.60 | 21.00 |
| Sale of wildlife | 0.26 | 0.22 | 0.54 | 0.08 |
| Crops | 3.94 | 1.44 | 1.95 | 5.29 |
| Recreation | 0.34 | 0.28 | 0.42 | 0.27 |
| Government Programs | 3.21 | 1.08 | 3.37 | 3.10 |
| Mineral sales | 6.42 | 1.88 | 6.38 | 6.10 |
| Other | 9.29 | 2.77 | 5.83 | 11.77 |

The estimated average percentage of vegetation cover present on the respondents' properties was as follows: open grassland 33%, prickly pear and other cacti 13%, live oak cover 7%, juniper cover 6%, mesquite 15%, mixed brush 22%, water bodies 1% and other land cover 3% (Figure 4).

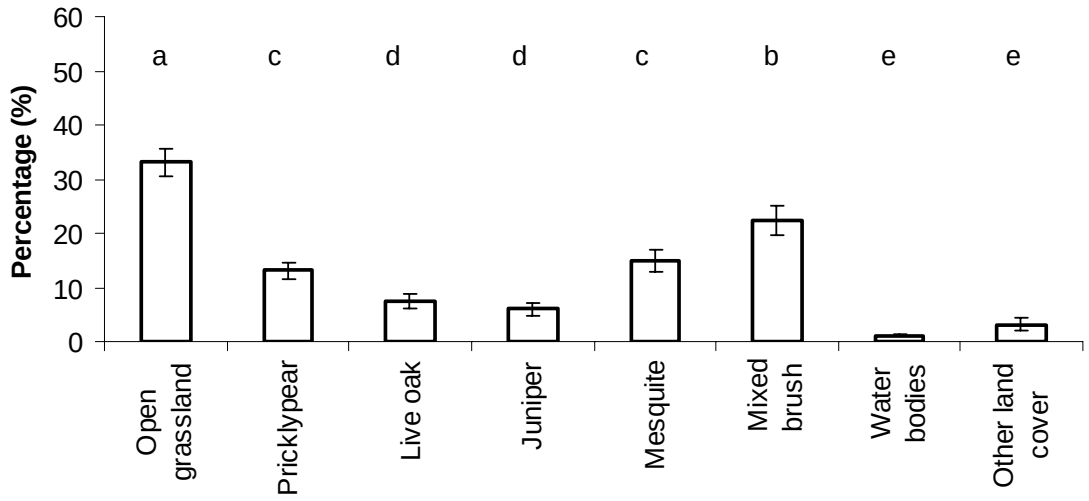


Figure 4. Cover of vegetation types present on land, by percent (error bars show 95% CI).

However, the amount of vegetation cover differed significantly between county groups in every vegetation type except grassland. Respondents in the two Rolling Plains counties reported having higher proportions of mesquite and prickly pear than respondents in the Edwards Plateau (mesquite: $F= 24.59$, $P\leq0.000$; prickly pear $F=6.75$, $P=0.001$).

Conversely, the Edwards Plateau respondents reported more live oak and mixed brush than the Rolling Plains respondents (live oak $F= 7.15$, $P\leq0.000$; mixed brush

F=7.77, P<0.001 ). In addition, the amount of cedar present in the Original EPPBA was significantly higher (F=7.99, P = 0.032) than juniper in the Recent EPPBA counties, while the Rolling Plains had significantly less cedar than the original EPPBA and other Edwards Plateau county groups (F= 7.99, P≤0.000; F= 7.99, P=0.002).

Landowners' rangeland management objectives were surveyed. With the most important objectives being improve perennial grass, improve browse and forbs, improve habitat and control woody plants. Every aspect surveyed except increased soil fertility was significantly different when analyzed between EPPBA members and non-members, with the PBA members stating that these management objectives were more important to them (see Figure 5).

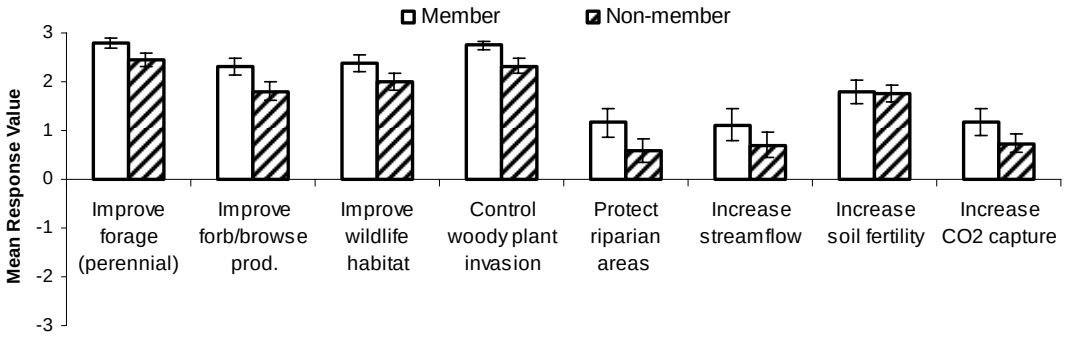


Figure 5. Overall importance of landowner rangeland management objectives (Total) (+3= very important…..-3= not important at all; error bars showing 95% CI).

Rangeland management objectives were analyzed over county groups and found that there were significant differences across county groups in certain objectives. Respondents in original EPPBA counties indicated that improving browse and forb

production was more important to them compared to the respondents in the recent EPPBA counties (F= 9.21, P= 0.015) and Rolling Plains (F= 9.21, P≤ 0.000). Furthermore the other Edwards Plateau counties also showed that improving browse and forb production was more important to them than the Rolling Plains (F= 9.21, P= 0.020). The respondents in the original EPPBA counties and the other Edwards Plateau counties also indicated that improving wildlife habitat was more important to them than respondents in the Rolling Plains (Original F=4.49, P=0.003; Other EP F=4.49, P=0.027). Other Edwards Plateau county respondents stated that it was also more important to them to increase stream flow than the original EPPBA county respondents (F= 3.44, P=0.045) (Figure 6).

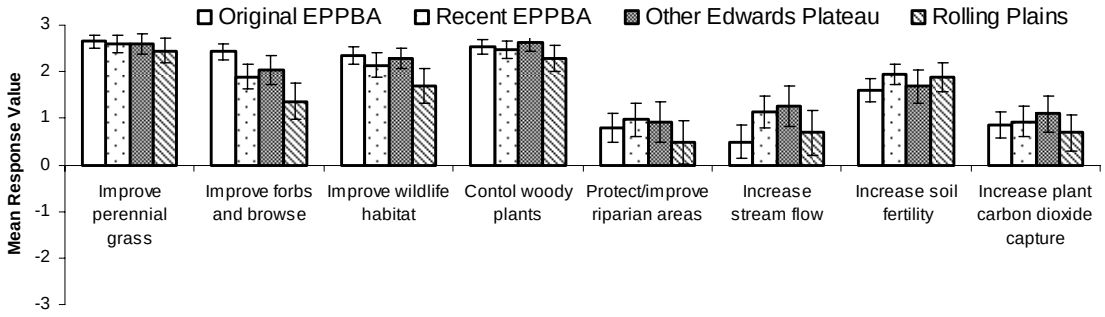


Figure 6. County group comparison of importance of rangeland management objectives (+3= very important…-3= not important at all; error bars show 95% CI).

# CHAPTER V

# RESPONDENT PERCEPTIONS AND KNOWLEDGE

## Management Objectives

Supplemental information for the results reported in this section using a scale of -3 to +3 (-3= very unimportant, +3= very important) can be found in Appendix C.

Survey participants were asked to indicate how important certain rangeland management objectives were to them. The listed objectives included improve forage supply, improve forbs and browse, improve wildlife habitat, control woody plants, protect riparian areas, increase stream flow, increase soil fertility, and increase carbon dioxide capture. When comparing average responses there were significant differences between responses to various categories of questions (ANOVA: $F= 100.81$, $P< 0.001$; Kruskal-Wallis: $\chi^2= 592.03$, $P< 0.001$). Overall mean response values for these objectives are presented in Figure 7. In general the most important objectives were improving grass supply, improving forb and browse production, improving wildlife habitat, and controlling woody plants.

However, there were significant differences ($P< 0.05$) among EPPBA members and non-members with respect to the importance of most of these objectives. The mean responses to categories of the same question compared to members and non-members of prescribed burn associations are presented in Figure 8. In each case the importance of these objectives (except for increased soil fertility) was greater to EPPBA members than

non-members. This is likely explained by the greater dependence by EPPBA member on their land for income generation than non-member.

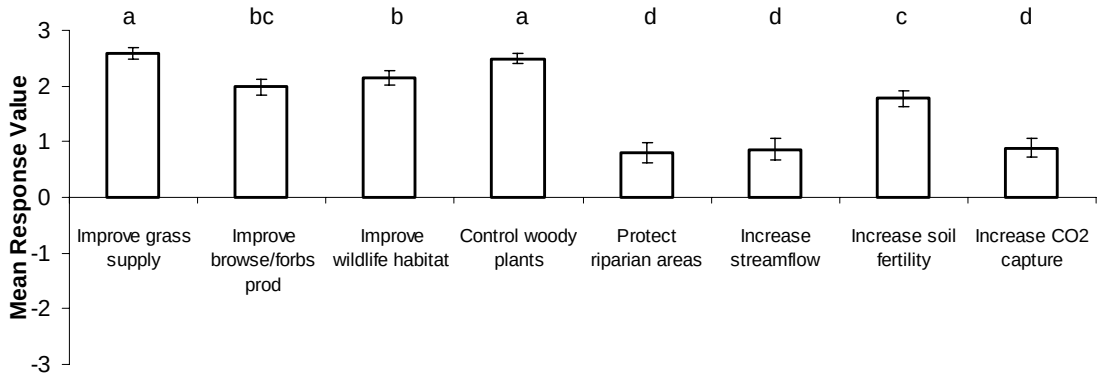


Figure 7. Total response of participants when asked "How important is each of the following rangeland management objectives to you?" (+3= very important…-3= not important at all; error bars show 95% CI)

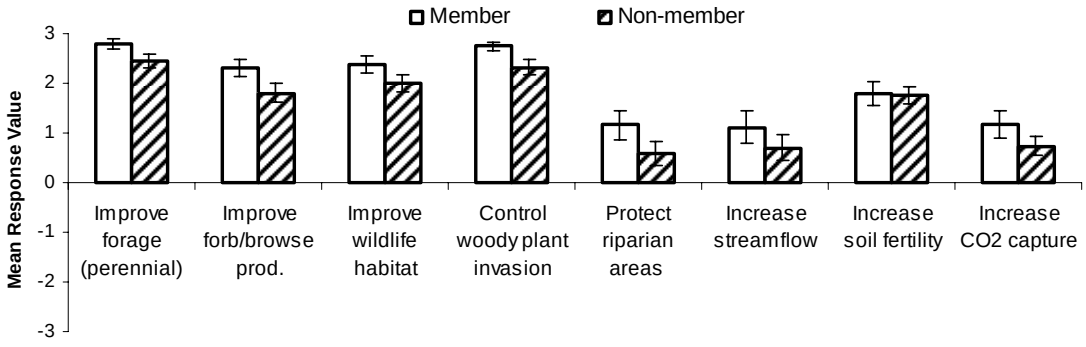


Figure 8. Comparison of PBA members and non-members response to "How important is each of the following rangeland management objectives to you?"

Landowners involved in the survey were also asked to use a scale of -3 to +3 (-3= very dissatisfied, +3 very satisfied) to indicate how satisfied they are with the

amount of grassland, prickly pear and other cacti, live oak, juniper, mesquite, and mixed brush on their land. Overall, there were significant differences between levels of satisfaction with each cover type (ANOVA: F= 43.98, P≤ 0.000; Kruskal-Wallis: $\chi^2$= 235.36, P< 0.001) (Figure 9).

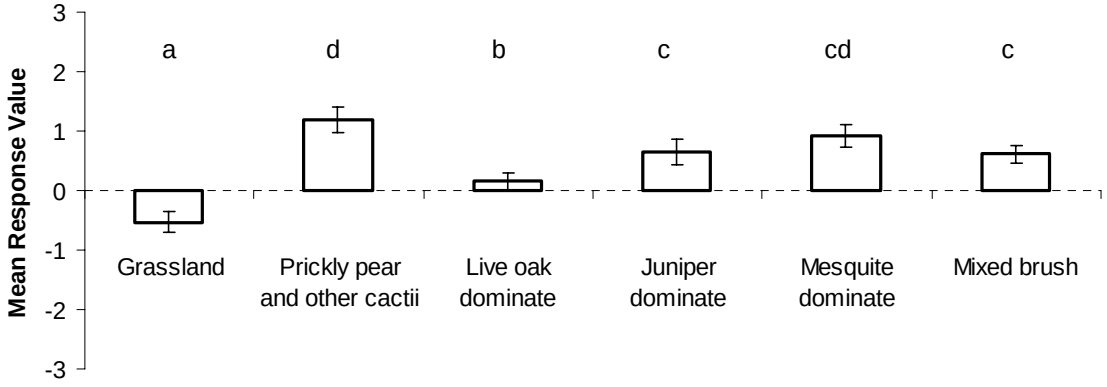


Figure 9. Overall level of satisfaction with "How satisfied are you with the amount of each vegetation type on your land?" (+3= much too much…-3= Much too little; error bars show 95% CI)

In no case were average levels of satisfaction extreme. In general, respondents felt that there was too much prickly pear and other cacti, juniper, mesquite, and mixed brush, too little grass cover and about the right amount of live oak. The amount of grassland and live oak present was significantly less than the other vegetation types surveyed with grasslands being below zero, which indicated there was not enough grassland present to satisfy landowners. The mean responses of EPPBA members and non-members to categories included in the question were compared (Figure 10).

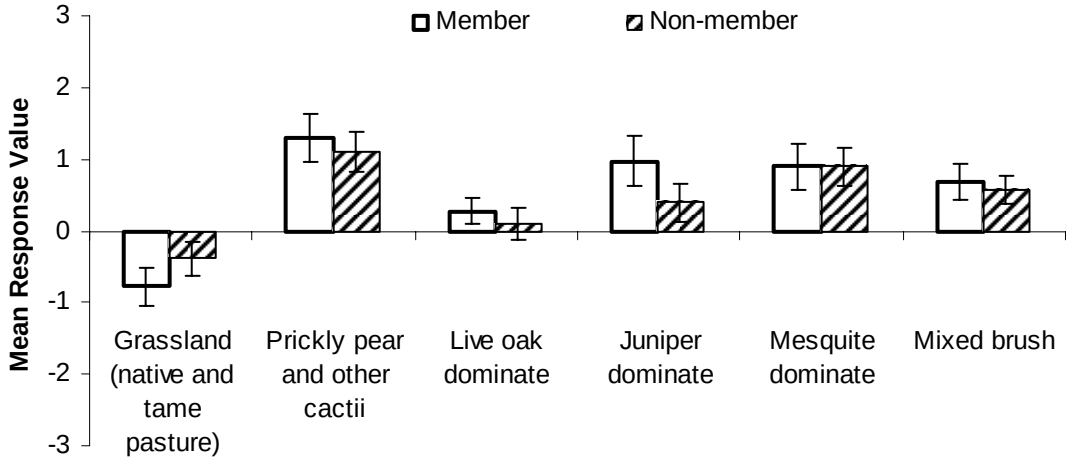


Figure 10. Comparison of members and non-members when asked "How satisfied are you with the amount of each vegetation types on your land?"

There were significant differences between members and non-members in the grassland and juniper categories. EPPBA members stated that there was too little grassland and much more juniper, than non-members stated.

**Perceptions Regarding Fire**

Survey participants were asked to answer questions about their perceptions regarding the ecology and use of prescribed fire as a management tool. Questions about the effects of fire were categorized into nutrient cycling, woody plants, forage supply, and wildlife habitat. The specific statements that survey respondents were asked to respond to were: Fire generally accelerates the cycling of nutrients in ecosystems; In the absence of fire, grassland often convert to woodlands; Woody plants are generally more susceptible to fire than rangeland grasses; Woody plants that sprout from the base often survive a single fire event; Occasional fire has a long-term positive impact on the supply

of quality forage for grazing animals; Habitats of browsing wildlife, such as white-tailed deer, can be positively affected by occasional fire; Habitats of grassland birds can be positively affected by occasional fire. Questions relating to the use of fire as a management tool are categorized according to season of burn, cost, selectivity, and effectiveness of fire compared to chemical and mechanical treatment methods and planning for prescribe burns.

Using a -3 to +3 response scale (-3= strongly disagree and +3= strongly agree) for these categories of nutrient cycling knowledge, woody plant knowledge, habitat knowledge, fire effect, treatment comparisons and fire planning knowledge the questions were asked in such a way that a positive response was anticipated. When comparing overall response to questions regarding the effect and use of fire all response rates were, on average, greater than zero. However, there were significant differences between responses to various categories of questions (ANOVA: $F= 18.26$, $P< 0.001$; Kruskal-Wallis: $\chi^2= 140.63$, $P< 0.001$) (Figure 11). Respondents agreed most strongly with statements suggesting that fire affects nutrient cycling and wildlife habitat, that season of fire (especially warm season burns) effects plant growth and composition, and that the use of prescribed fire requires specification of burn conditions, liability insurance and formal notification of various officials. They also agreed, but less strongly, with statements about the effects of fire on woody plants, the greater species diversity resulting from cool season burns, and the relative cost, selectivity and effectiveness of fire compared to chemical and mechanical treatments for controlling brush.

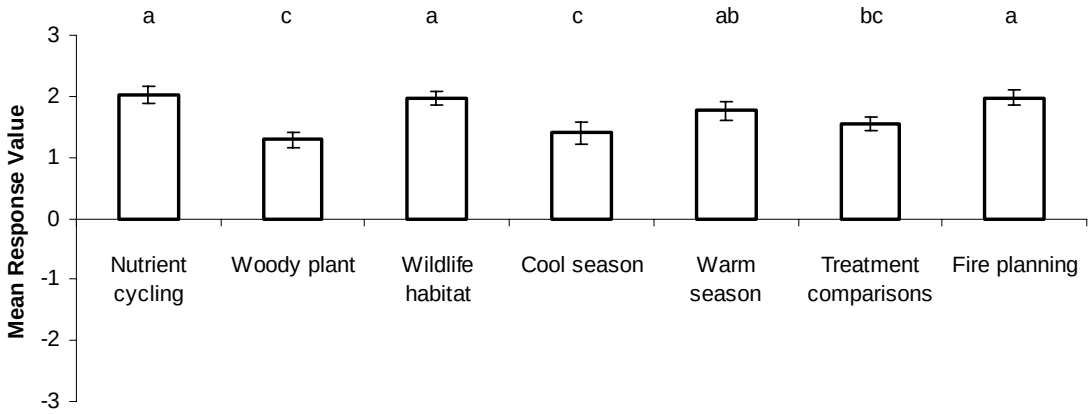


Figure 11. Total response when asked "To what extent do you agree or disagree with each statement about the effect of fire on ecosystems and about the use of fire as a management tool?" (+3= strongly agree….-3= strongly disagree)

The mean responses to categories of the question by members and non-members of the EPPBA are presented in Figure 12. In all cases, members of the EPPBA agreed more strongly than non-members with the statements, suggesting they had greater knowledge about the effects of fire and its use as a management tool.

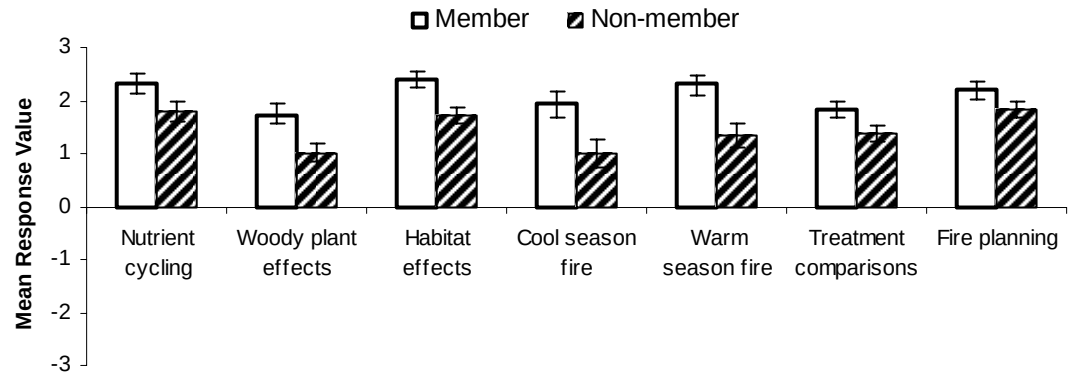


Figure 12. Comparison of members and non-members when asked "To what extent do you agree or disagree with each statement about the effect of fire on ecosystems and about the use of fire as a management tool?" (+3= strongly agree…-3= strongly disagree)

Survey participants were also asked to answer questions concerning reasons for not using fire. Reasons included small property size, forage loss, limited fire effect on woody plants, insufficient knowledge, insufficient resources (time, labor, money, equipment), lack of prescribed burn associations, legal concerns (wildfire and smoke hazard), and lack of assistance with burn plan development. There were significant differences in overall responses to questions regarding reasons for not using fire (ANOVA: $F= 29.09$, $P< 0.001$; Kruskal-Wallis: $\chi^2= 185.92$, $P< 0.001$) (Figure 13).

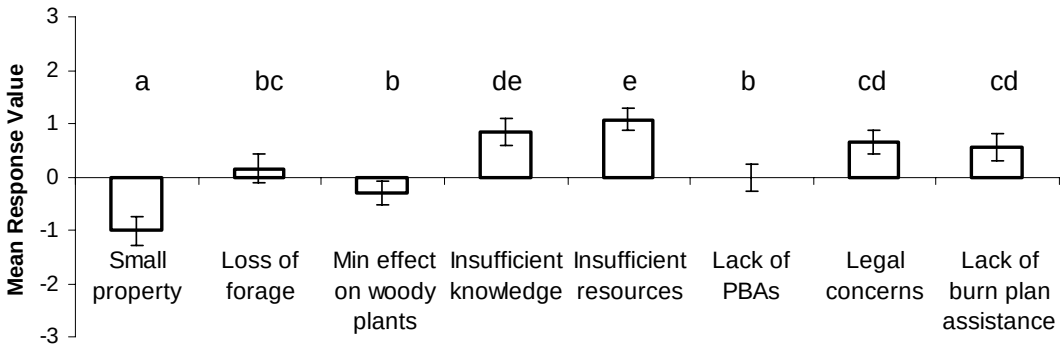


Figure 13. Total response of landowners when asked "How important is each of the following reasons for you not using prescribed fire?" (+3= very important…-3= not at all important)

Small property size was not considered to be an important reason for not incorporating fire, while insufficient knowledge and resources as well as legal concerns and lack of assistance with the development of burn plans were all considered to be important inhibitory factors.

Survey participants were asked questions to determine what criteria would encourage them to incorporate fire as a management tool. These were categorized

according to cost-share forage loss, cost-share fire-breaks, reduce legal liability, fire management training opportunity, assistance with burn plan development, assistance of local fire department, and provision of fire equipment. There were significant differences between responses to questions regarding the importance of these criteria (ANOVA: $F= 5.93$, $P< 0.001$, Kruskal-Wallis: $\chi^2= 39.14$, $P< 0.001$) (Figure 14).

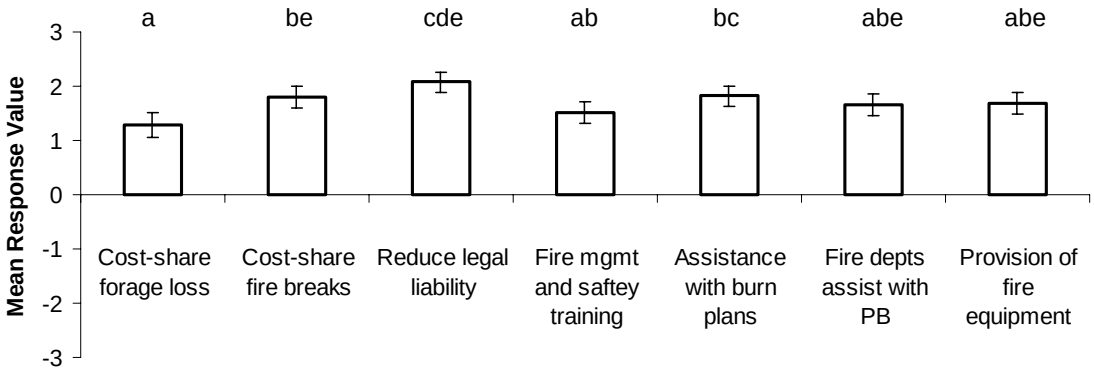


Figure 14. Total response of participants when asked "How important would each of the following be in encouraging you to incorporate prescribe fire as a management tool?" (+3= very likely….-3= very unlikely)

While respondents considered all criteria to be important for encouraging the use of fire as a management tool, reduction of legal liabilities seemed to be particularly important, followed by assistance with burn plans, and cost share with fire breaks.

Survey participants that responded "yes" to using fire on their property were asked how frequently they have applied prescribed fire on at least part of their land (Figure 15).

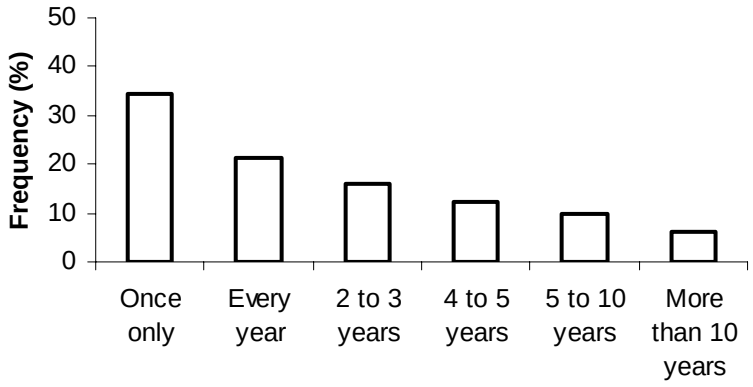


Figure 15. Frequency that fire is applied to property.

Percentages are based on 113 responses to this question to which 35% have used fire only once, 21% use fire every year, 16% every two to three years, 12% every four to five years, 10% every five to ten years, and 6% over ten years.

Those survey participants who have used prescribed fire were asked to answer questions relating to the importance of various reasons for using fire. These reasons were categorized as follows: problem plant reduction, increase diversity of vegetation, improve forage quality, improve wildlife habitat, reduce fuelloads, lower cost than other brush control methods, less hazardous than chemical treatment, easier implementation, presence of PBA in area, and assistance with burn plan development. When comparing overall responses there were significant differences with respect to the importance of reasons for using fire (ANOVA: $F= 17.74$, $P< 0.001$; Kruskal-Wallis $\chi^2= 136.82$, $P< 0.001$) (Figure 16).

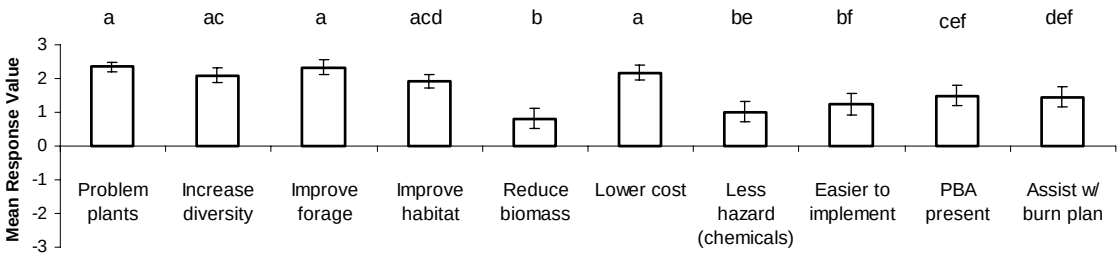


Figure 16. Total response of participants when asked "How important is each of the following reasons for you using prescribed fire?" (+3= very important….-3= not important at all)

The importance of these reasons fell into two broad groups of importance. Controlling problem plants, increasing species diversity, improving forage quality, improving wildlife habitat and lower cost than other brush control methods were considered to be most important. Differences between EPPBA members and non-members with respect to the importance of reasons for using fire as a management tool are presented in Figure 17.

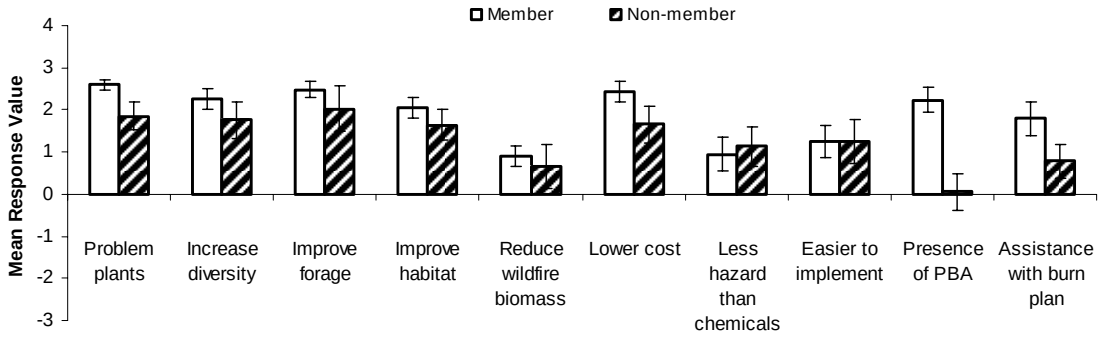


Figure 17. Prescribed burn association members and non-members response to questions when asked "How important is each of the following reasons for you using prescribed fire?"

Significant differences of opinion occurred for the following criteria: problem plants, increased diversity, lower costs, presence of PBA, and assistance with burn plan. In each case EPPBA members felt that the importance of these reasons for using fire was greater than did non-members.

Survey participants were asked what would encourage them to use prescribed fire more frequently as a management tool. Listed reasons for using fire more frequently included cost-share programs, reduced liability, opportunities for fire/safety training, assistance with burn plan development, assistance of fire departments, provision of fire equipment, and greater landowner representation at the state level by prescribed burning association representatives. There were significant differences in the likelihood that respondents would include prescribed fire under different scenarios (ANOVA: $F= 7.83$, $P<0.001$; Kruskal-Wallis: $\chi^2= 42.95$, $P<0.001$) (Figure 18).

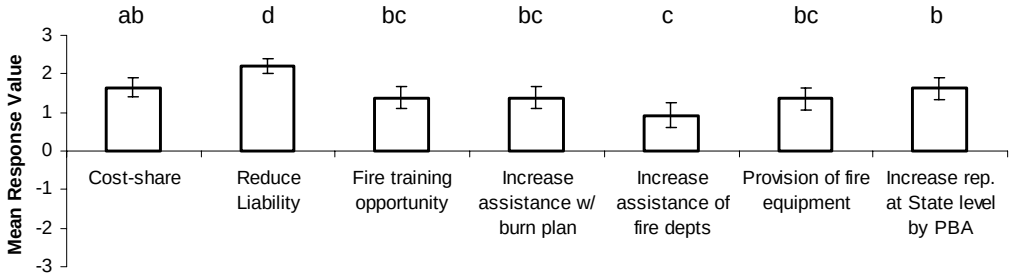


Figure 18. Total response of participants when asked "How likely would each of the following be in encouraging you to use prescribed fire more frequently as a land management tool?" (+3= very likely….-3=very unlikely)

Reduced liability was still the single most important factor that would increase the likelihood of prescribed fire being used more frequently followed by cost-share and increased representation at the state level. The only significant difference found from this analysis between members and non-members of the EPPBA is that members indicated they would likely use prescribed fire more frequently if there was more landowner representation at the state level (Figure 19). All other areas were not significantly different.

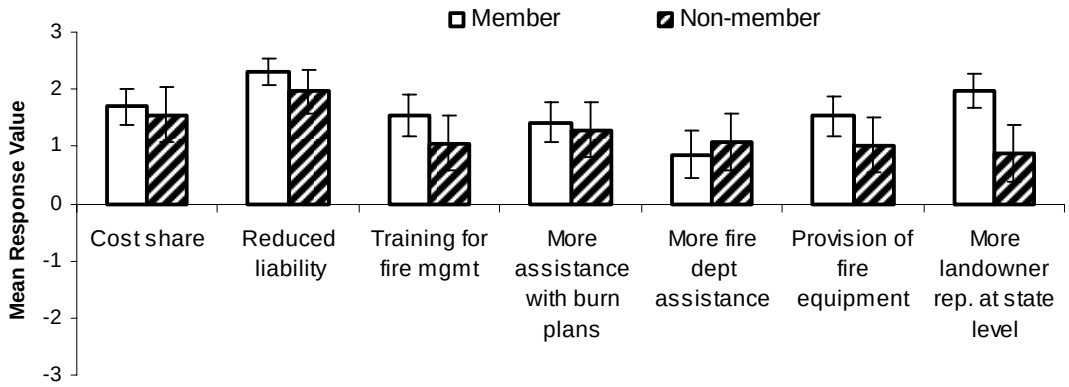


Figure 19. Prescribed burn association members and non-members response to questions when asked "How likely would each of the following be in encouraging you to use prescribed fire more frequently as a land management tool?"

**Contractual Agreements**

Survey participants were asked to respond to the following question: "If you were to participate in a cost-share brush control program, how interested would you be in each of the following types of contractual arrangements?" These agreements included cost-share 5-year performance contract, 10-year performance contract, 5-year lease

agreement, 10-yr lease agreement, long-term conservation easement, transferable contracts, and group contracts that involve several landowners. There were significant differences between responses regarding the level of interest in each type of agreement (ANOVA: $F= 79.40$, $P<0.001$; Kruskal-Wallis: $\chi^2= 378.67$, $P<0.001$) (Figure 20).

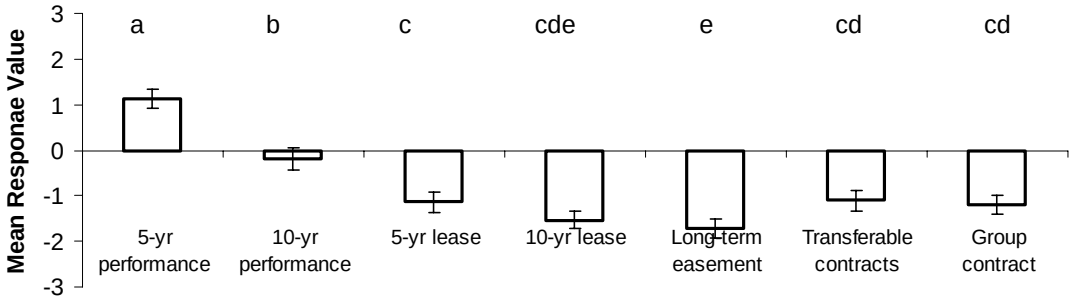


Figure 20. Total response of participants when asked "If you were to participate in a cost-share brush control program, how interested would you be in each of the following types of contractual agreements?" (+3= very interested….-3= not interested at all)

Respondents expressed positive interest in 5-year performance contracts only. They expressed neutrality regarding 10-year performance contracts and were disinterested in the other types of contractual agreements. This result is consistent with past data. The mean responses to categories in this question compared to members and non-members of prescribed burn associations are presented in Figure 21.

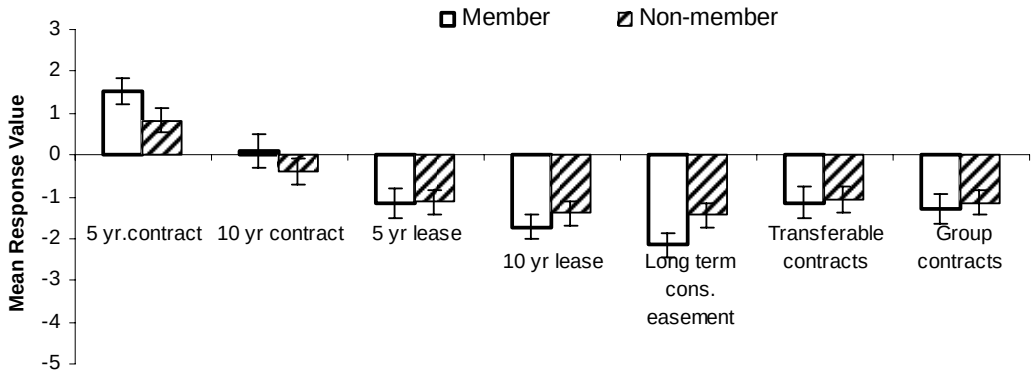


Figure 21. Prescribed burn association members and non-members response to questions when asked "If you were to participate in a cost-share brush control program, how interested would you be in each of the following types of contractual agreements?"

When comparing EPPBA members' and non-members interests, the only significant differences found were significantly greater interest in 5-year contracts and significantly less interest in long term conservation easements by EPPBA members.

Survey participants were asked to respond to the following question "Because funding for cost-share programs would be limited, what is likely to be the minimum percentage of cost share you would require to participate in such a program?" (Figure 22).

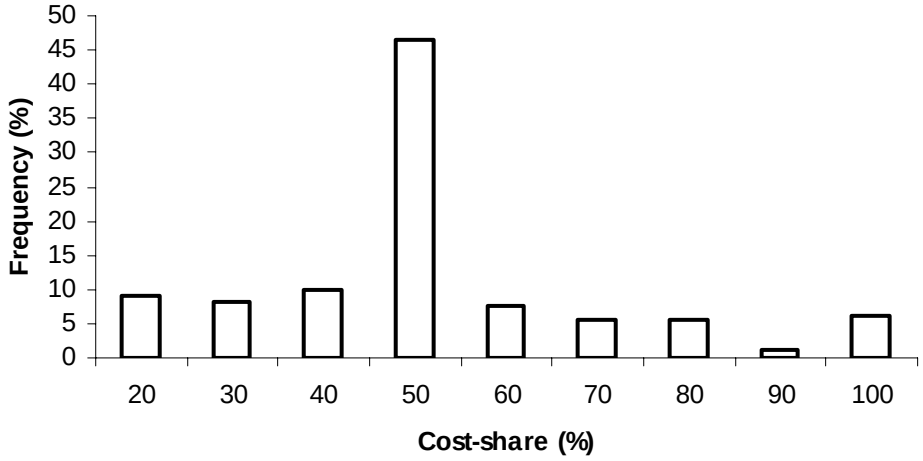


Figure 22. Overall results for minimum amount of cost-share required for landowner participation.

Overall, the majority of respondents showed that in order for them to participate in cost-share programs they would require a minimum cost-share of 50%. Preferences for other cost-share percentages were about the same for 10% increments between 20% and 100% cost-sharing. The responses to categories in this question compared to members and non-members of prescribed burn associations are presented in Figure 23.

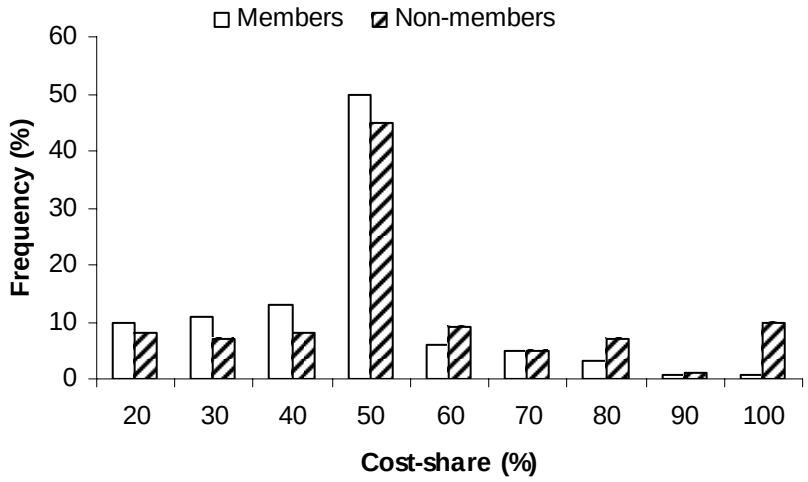


Figure 23. EPPBA members and non-members results for minimum amount of cost-share required for landowner participation.

Results concerning EPPBA members and non-members showed that there was a higher percent of members that preferred 20-50% cost-share and that non-members preferred 60-100% cost-share preference.

Survey participants were asked "Which of the following organizations do you think plays an important role in helping landowners use prescribed fire on their land?" (Figure 24).

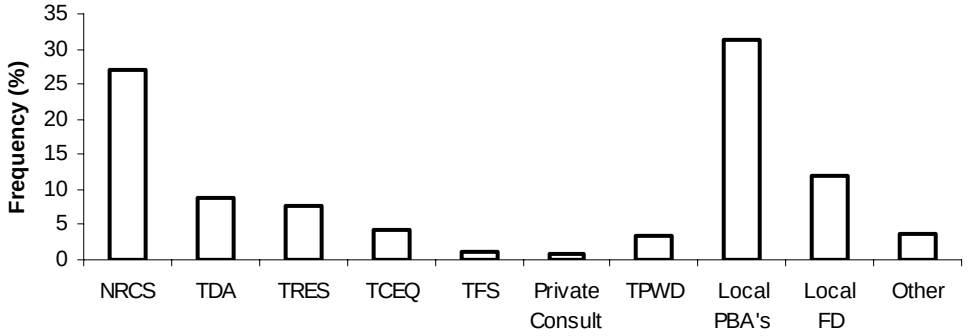


Figure 24. Overall results of organizations that respondents felt played the most important role in helping landowners use prescribed fire.

The majority of respondents showed that the natural resource conservation service (NRCS), local prescribed burning associations, and local fire departments there were three organizations that they felt were most important in helping landowners implement prescribed fire. The responses to this question were also compared to members and non-members of prescribed burn associations and are presented in Figure 25.

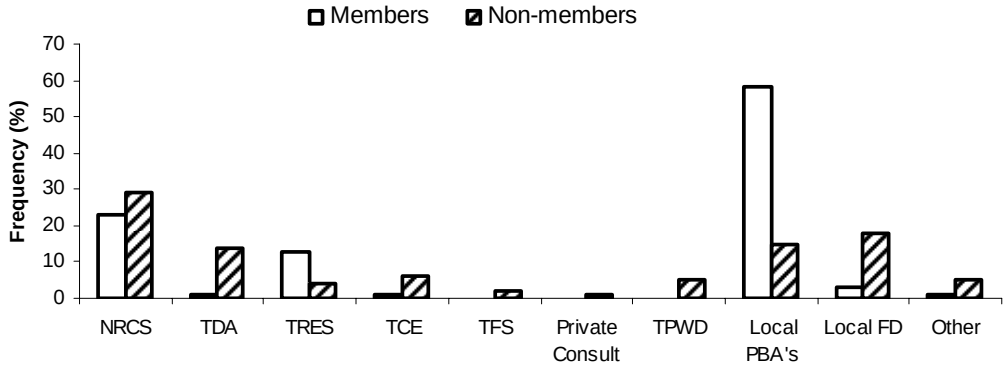


Figure 25. Member and non-member responses to "Which organizations they felt were most important in helping landowners implement fire on their land?"

There were significant differences between members and non-members opinions regarding the importance of local PBA's or local fire departments in providing assistance with prescribed fire. This difference can be explained because PBA members realize the benefits that come with being a member of the association (i.e. personnel, equipment). Non-members see the fire departments as more important reason because of the equipment and personnel they have to help in burns also the fire department gives a sense of reduced liability when they are present at a burn.

**Edwards Plateau Prescribed Burning Association Characteristics**

A supplemental one-page questionnaire was given to all EPPBA members, in which they were asked "to what extent do you agree that the following are valuable membership benefits of the EPPBA?" Potential benefits were listed as: 1) greater availability of expertise regarding fire, 2) assistance with burn plans, 3) increased opportunity for fire/safety management training, 4) availability of fire equipment, 5) available labor on burn days, 6) reduced liability, 7) improved landowner relationships, 8) improved relationship with fire department, 9) improve state and federal relationships, and 10) increased landowner representation at the state level. Overall, there were significant differences between responses to various categories of benefits (ANOVA: $F= 10.22$, $P<0.001$; Kruskal-Wallis: $\chi^2= 88.39$, $P<0.001$) (Figure 26).

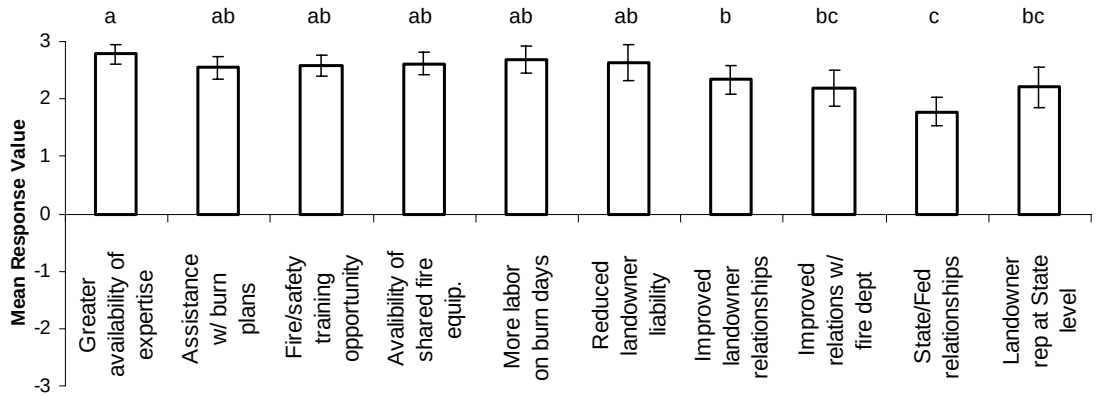


Figure 26. EPPBA member responses when asked "To what extent do you agree that the following are valuable membership benefits of the EPPBA?" (+3= very valuable….-3= not valuable at all)

All of the listed benefits were considered to be valuable or very valuable with improved relationships with State/Federal agencies, fire departments and landowners as well as landowner representation at the state level being perceived to be significantly less valuable to the members than the other benefits. Member of the EPPBA were asked what would be the most suitable model for prescribed burning associations across Texas (Figure 27).

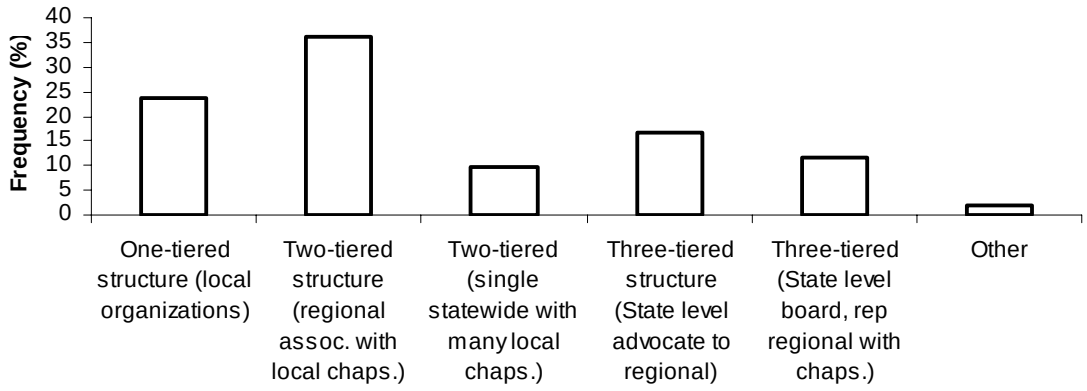


Figure 27. Structure preference of burn association members who responded to the survey.

EPPBA members seemed to prefer the two-tiered structure that consisted of a regional association with local chapters (this is the current model for the EPPBA) with the next preferred model being a one-tiered structure. Overall, the two-tiered structures and the three tiered structures combined received the most preference among members which show that these different structures may be more appealing when foming burn associations in the future.

**Regression Analysis for Indicators**

Finally, two sets of regression of analyses were conducted. The factors found to have a beta coefficient (β) significantly greater than zero at the 10% level of significance are identified in the following tables and text.

The first set of regression analyses were conducted to identify the factors that significantly affected respondents' (1) knowledge about the ecological role of fire, (2) knowledge about fire as a management tool, (3) resource scarcity for implementing

prescribed burns, and (4) liability concerns as reasons for not using fire. Although none of the regression analyses produced an overall high degree of explanation of variation among respondents (adjusted $R^2$ values were all less than 10%), some of the explanatory variables were found to be statistically significant at the 10% level.

The regression for respondent knowledge of ecological fire effects (R= 0.274, adj. $R^2$= 0.072, F= 23.871, P<0.001) identified the importance of knowledge about the ability of fire to control invasive brush species as a significant explanatory variable (P<0.001) (Table 8). This same explanatory variable similarly significantly influenced (P= 0.004) landowner knowledge concerning fire as a management tool (R=0.166, adj. $R^2$= 0.024, F= 8.377, P= 0.004) (Table 8). This suggests that landowners with greater interest in knowledge about the suppressive effect of fire on many invasive plants have an overall greater understanding about the beneficial ecological role of fire as well as the use of fire as a management tool in Texas Ecosystems. In addition, interest in knowledge about the potentially beneficial influence of fire on habitat for many wildlife species was also a significant explanatory variable for the level of general knowledge about the ecological role of fire (P = 0.053).

Table 8. Regression analysis showing knowledge of fire effects and knowledge of fire as a management tool.

| | Fire knowledge | | | Fire as management tool | | |
|---|---|---|---|---|---|---|
| R | 0.274 | | | 0.166 | | |
| Adj. $R^2$ | 0.072 | | | 0.024 | | |
| F | 23.871 | | | 8.377 | | |
| P | 0.000 | | | 0.004 | | |
| | Beta | t | P | Beta | T | P |
| Control invasive species | **0.274** | **4.886** | **0.000** | **0.166** | **2.894** | **0.004** |
| Wildlife habitat improvement | **0.109** | **1.944** | **0.053** | | | |

Regression analyses to identify factors influencing resource scarcity for implementing rangeland management (R= 0.218, adj. $R^2$= 0.042, F= 9.353, P= 0.003) and level of concern about legal liability associated with using prescribed burns (R= 0.380, adj. $R^2$= 0.091, F= 2.684, P= 0.003) both identified property size as a significant explanatory variable (in both cases P = 0.003) (Table 9.). In both instances the dependent variable was negatively related to property size suggesting that the smaller the property the greater the resource constraint for implementing fire and the greater the concern about legal liability.

Table 9. Regression analysis showing perceptions toward insufficient resources and legal concerns.

| | Resource scarcity | | | Legal concerns | | |
|---|---|---|---|---|---|---|
| R | 0.218 | | | 0.215 | | |
| Adj. $R^2$ | 0.042 | | | 0.041 | | |
| F | 9.353 | | | 9.187 | | |
| P | 0.003 | | | 0.003 | | |
| | Beta | t | P | Beta | T | P |
| Acres | **-0.218** | **-3.058** | **0.003** | **-0.215** | **-3.031** | **0.003** |
| Wildlife income | | | | **-0.121** | **-1.711** | **0.089** |

The second set of regression analyses were conducted to identify explanatory variable for survey respondents interest in increasing the frequency of use of prescribed fire if cost-share programs were introduced, liability associated with the use of prescribed fire was reduced and assistance with fire plans was increased (Table 10). In the case of cost share programs as a method for encouraging increased use of prescribed fire (R= 0.204, adj. $R^2$= 0.032, F= 4.239, P= 0.042), the level of interest in controlling invasive plants was found to be a significant determinant (P= 0.042). In contrast, neither

of the regressions for reduced liability (R= 0.362, adj. $R^2$= 0.0323 F= 1.341, P= 0.222) or increased assistance with fire plans (R= 0.321, adj. $R^2$= 0.002, F= 1.024, P= 0.430) as methods for increasing the use of prescribed fire were found to be statistically significant.

Table 10. Regression analysis showing landowner perceptions of cost-share programs, reduced liability and fire plan assistance for increasing fire use.

| | Cost-share | | | Reduced Liability | | | Fire plan assistance | | |
|---|---|---|---|---|---|---|---|---|---|
| R | 0.204 | | | 0.362 | | | 0.321 | | |
| Adj. $R^2$ | 0.032 | | | 0.033 | | | 0.002 | | |
| F | 4.239 | | | 1.341 | | | 1.024 | | |
| P | 0.042 | | | 0.222 | | | 0.430 | | |
| | Beta | t | P | Beta | t | P | Beta | t | P |
| Control invasive species | **0.204** | **2.059** | **0.042** | | | | | | |
| Livestock income | | | | **-0.261** | **-1.860** | **0.066** | | | |
| Forage supply | | | | | | | **0.205** | **1.714** | **0.090** |

# CHAPTER VI

# DISCUSSION AND CONCLUSION

Five main hypotheses were postulated for the study on landowners' perceptions concerning prescribed fire as a management tool. Each of these will be addressed in turn:

1. The first hypothesis was to determine if property size, level of knowledge about fire and economic status of landowners were positively correlated with the use of prescribed fire as a management tool. We found no statistically significant correlation between property size and the use of prescribed fire. Similarly there was no significant difference in the apparent level of knowledge about fire and the use of prescribed fire as a management tool. However, there was a significant difference (P=0.001) in the use of prescribed fire as a management tool with respect to level of income, suggesting that landowners with larger incomes can more readily afford burn preparations. From this information one can conclude that to increase the use of prescribed fire by landowners, a cost-sharing program that would provide financial incentives for landowners to use fire might increase the application of prescribed burns especially among lower income landowners.

2. Resident landowners are more incline to use fire than absentee landowners. The survey also indicate that respondents who reside on their land are significantly more inclined (P=0.050) to use fire than absentee landowners. This could be due to the fact that it is easier for landowners that live on their land to perform time sensitive burns,

while absentee landowners may be less able to plan ahead for specific burn dates. Since landowners don't normally know that you are going to burn until about 24 hours before it is time, it is easier for those who live on their property to capitalize on optimal burn condition. To try to increase the use of prescribed fire by landowners, it would be important to target resident landowners and provide more educational opportunities for absentee landowners.

3. Landowners' lack of knowledge about fire and lack of resources deters them from using prescribed fire as a management tool. Landowners felt that a lack of knowledge and insufficient resources were "important" reasons for not incorporating fire as a management tool. Policies aimed at increasing landowners' use of prescribed fire should focus on implementing educational programs to help increase knowledge about prescribed burning and implement cost-share programs to help in areas where there is a lack of resources.

4. The extent to which landowners are willing to incorporate fire as a rangeland management tool is contingent upon their perceived liability of implementing prescribed burns. Specifically, respondents who don't use fire indicated that the legal liability of losing control of fire is an "important" reason for not using this management tool. Moreover, respondents who do use fire expressed the opinion that the reduction in legal liability associated with using prescribed burns would likely increase the frequency of using this management tool. A policy put in to action to increase the use of prescribed fire could allow for increased options for obtaining liability insurance. One option would be to create a pool of state dollars for underwriting such insurance.

5. The final hypothesis dealt with the influence of prescribed burning associations memberships on the use of fire as a management tool. Burn association members were significantly more knowledgeable than non-members about the role and impact of fire on ecosystems and the use of fire as a management tool. In addition, more than half of the prescribed burn association members incorporated fire as a management tool compared to less than 18% of non-members. These results suggest that membership of a burn association tends to increase knowledge about the ecological importance of fire and its use as a management tool. The policy implication of this finding is that the development and promotion of burn management associations in a state where most of the land is privately owned will improve landowner knowledge about the benefits of prescribed burning. In turn, this will lead to better decision making to improve plant community composition and to avoid catastrophic wild fires resulting from excessive fuel loads. This could be a key component of acquiring affordable insurance by landowners wishing to use fire as a management tool. Prescribed burn associations are possible thru landowner involvement and presently members prefer a two-tiered structure consisting of regional associations with local chapters. They also show interest in three-tiered structures that would incorporate a state level advocate for the burn association. With this type structure it is possible to develop regional burn associations in east, south, central, and north Texas, which would increase education and increasing association members' representation at the state level. With more members in the association the more power that association can have on government involvement in implementing burn programs.

From regression analyses there was a correlation between fire knowledge and interest in controlling invasive species, which suggests that educational programs should be focused on controlling invasive plants. There was also a correlation between fire knowledge and wildlife habitat improvement. Landowners that have an interest in controlling invasives and improving wildlife habitat could be a potential target group for presenting these programs to, as well as, livestock owners. A correlation was also found between acres and resource scarcity which suggested that smaller landowners might be targeted for educational and cost-share programs. A correlation between legal concerns and acreage showed that smaller landowners have greater concerns about the use of fire. Education can also be focused on these smaller landowners to improve their knowledge on the use of fire. Finally, there was a correlation between controlling invasive species and cost-share programs which showed that it's important to educate landowners about controlling invasives and the cost-share assistance that can be provided through agencies such as Natural Resource Conservation Service (NRCS) for this practice.

In a state where the majority of the land is privately owned and you want to show fire to be an effective management option then we must educate those who are not aware of the benefits of this management tool. During analysis of data, several respondents commented that they want to use fire, but feel that they do not know enough about the practice to implement it. Finding ways to increase education about prescribed fire and acquiring insurance have been found to be extremely important areas when talking about prescribed burning. Several agencies such as the Texas Extension Service and the NRCS have an interest in the use of prescribed burning and due to this interest they may

be inclined to allocate resources to help fund and implement such programs. Possible option may be to provide levies to local fire departments and even to burn associations to increase their interest in participating in prescribed burns and make these burns more feasible, economically. Future studies in dealing with landowners should incorporate a larger sample size as well as greater geographic distribution to obtain results with wider relevance. Also, reformat questions so that they might better reflect landowner opinions.

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# APPENDIX A

# Landowner Perceptions about Prescribed Burning

## Edwards Plateau and Rolling Plains, Texas


***Department of Rangeland Ecology and Management***
***Texas A&M University***
***TAMU 2126***
***College Station, TX 77843-2126***

**June 2004**

**INTRODUCTION**

We are asking that this questionnaire be completed by the addressee or by the individual most knowledgeable about your rural property.

If you encounter a question that does not apply to your property, please indicate this by writing "NA" in the margin next to the question. If you encounter a question for which you do not know the answer, please indicate this by writing "DK" in the margin next to the question.

If you have any questions, please contact Dr. Urs Kreuter (telephone: 979-845-5583 or email: urs@tamu.edu).

**INITIAL QUESTION**: First, we want to make sure you should complete the entire questionnaire.

Are you the owner, operator, or manager of at least 50 acres of private land?

☐ No ? Please stop here and return the survey in the envelope provided. It is important we hear back from everyone who receives a questionnaire. We thank you for taking the time to place the entire questionnaire in the enclosed addressed envelope, and returning it to us. No postage is necessary.

☐ Yes ? Please go to SECTION A on the next page and complete the questionnaire.

In answering the questionnaire, please provide answers for the land for which you pay property taxes in a county in the Edwards Plateau or Rolling Plains regions. Please **DO NOT** include responses for land you own outside of these regions. **IF YOU OWN SEVERAL TRACTS OF LAND IN ONE OR MORE COUNTY IN EITHER REGION, PLEASE ANSWER THE QUESTIONS BASED ON ALL OF YOUR LANDHOLDINGS IN THE REGION.**

**SECTION A – CHARACTERISTICS OF YOUR PROPERTY AND LAND MANAGEMENT**

Please supply the requested information about various aspects of your rural land property.

A1. ***How many ACRES do you own in each of the following regions?***

Edwards Plateau _____ acres
Rolling Plains _____ acres

A2. ***In which COUNTY is your land predominantly located?***_____

A3. ***How would you describe YOUR ROLE at this property?***

☐ I make most of the management decisions and have an ownership interest in this property.
☐ I am one of two or more key decision makers with an ownership interest in this property
☐ I am a hired manager with no ownership interest in this property
☐ Other (Please describe: _____)

A4. ***What is the PRIMARY NATURE of your property?*** (Check only the MOST applicable box)

☐ Mainly a livestock ranch
☐ Mainly a wildlife operation
☐ Mainly a crop production farm
☐ Mixed livestock and wildlife ranch
☐ Mixed crop and livestock operation
☐ Tourist operation (e.g., dude ranch, bed and breakfast, etc.)
☐ Primarily a residence, weekend retreat, or holiday home
☐ Long term investment
☐ Other (Please describe: _____)

A5. ***Approximately what percent of your PROPERTY INCOME is derived from each of the following activities?*** (Please ensure that your answers TOTAL 100%)

- Income from the sale of domestic livestock _____%
- Fees for hunting of native or exotic wildlife _____%
- Income from the sale of wildlife for breeding stock, meat or other products _____%
- Income from the sale of crops _____%
- Income from recreation related activities (other than hunting) _____%
- Government program payments _____%
- Mineral sales and leases _____%
- Other (Please specify _____) _____%

**Total = 100 %**

A6. ***How important is each of the following RANGELAND MANAGEMENT OBJECTIVES to you?*** (In each row, circle the ONE value that best reflects your opinion).

| *+3 = very important … 0 = neutral … -3 = very unimportant* | | | | | | | |
|---|---|---|---|---|---|---|---|
| Improve perennial grass supply (forage) | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Improve forbs and browse production | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Improve wildlife habitat | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Control the invasion and spread of brush (woody plant) | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Protect/improve riparian areas (drainage areas, wetlands) | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Increase stream flow | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Increase soil fertility | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Increase carbon dioxide capture by plants | +3 | +2 | +1 | 0 | -1 | -2 | -3 |

A7. ***Which of the following RANGELAND MANAGEMENT PRACTICES do you use on your property?*** (Check ALL THAT APPLY).

- ☐ Rotation grazing systems (deferred rotation, short duration grazing,. etc.)
- ☐ Mechanical brush control (shears, root plow, roller chopping, dozing, grubbing, etc.)
- ☐ Chemical brush control (broadcast or individual plant treatment)
- ☐ Prescribed fire
- ☐ Reseeding and/or replanting in drainage areas or bare areas
- ☐ Artificial water points (ponds, tanks, etc.)
- ☐ Supplemental feed (mineral and salt licks, grain, cubes, etc.)
- ☐ Other (Please describe: _____)

A8. ***Approximately what percentage of your property is currently covered by each of the following VEGETATION TYPES?*** (Please ensure that your answers TOTAL 100%)

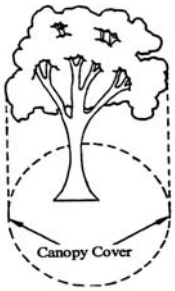
- Open grassland (native and tame pasture) _____%
- Pricklypear and other cacti _____%
- Predominantly live oak _____%
- Predominantly juniper (Cedar) _____%
- Predominantly mesquite _____%
- Mixed brush or woodland (live oak, juniper, mesquite, other) _____%
- Water bodies (ponds, tanks, lakes, etc.) _____%
- Other land cover (Please specify _____) _____%

**Total = 100 %**

A9. ***How SATISFIED are you with the amount of each vegetation types on your land?*** (In each row, please circle the ONE value that best reflects your opinion).

| *+3 = much too much … 0 = just right … -3 = much too little* | | | | | | | |
|---|---|---|---|---|---|---|---|
| Grassland (native and tame pasture) | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Prickly pear and other cacti | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Predominantly live oak | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Predominantly juniper (Cedar) | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Predominantly mesquite | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Mixed brush or woodland | +3 | +2 | +1 | 0 | -1 | -2 | -3 |

Please answer the next question about brush canopy cover by referring to the DIAGRAMS BELOW, which define **CANOPY COVER** and show two distribution patterns for **5%, 25% and 50% cover**. In the following question we ask for information about four categories of canopy cover that are intermediate between those shown in the diagrams.

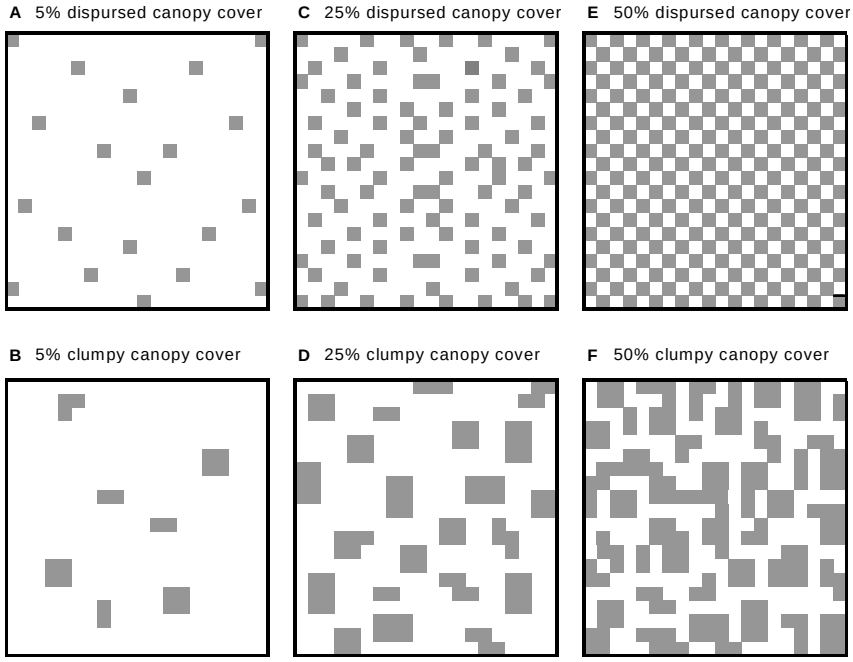



**CANOPY COVER** is defined as the total ground area covered by the aboveground aerial parts (branches, leaves) of woody plants, as shown on the diagram below.

**SCATTER DIAGRAMS** show two distribution patterns for three canopy covers. Diagrams A and B show a dispersed and a clumpy pattern for 5% canopy cover, C and D show a dispersed and a clumpy pattern for 25% canopy cover, and E and F show a dispersed and a clumpy pattern for 50% canopy cover.

N COVER (less than 5%) = densities less than that shown in the first column

- LIGHT COVER (5% to 25%) = densities between first and second column
- MODERATE COVER (25% to 50%) = densities between second and third column
- HEAVY COVER (greater than 50%) = densities greater than that shown in the third column




A10. ***Approximately what percentage of your property is best described by each of the following CANOPY COVER classes?*** (Please ensure that your answers TOTAL 100%)

Open cover **(less than 5% cover**)…… _____%
Light cover (**5-25% cover)**…… _____%
Moderate cover (**26%-50% cover)**…… _____%
Heavy cover (**greater than 50% cover)**…… _____%
**Total = 100 %**

## SECTION B – FIRE ECOLOGY AND USE OF PRESCRIBED BURNS

B1. ***To what extent do you agree or disagree with each statement about the EFFECT OF FIRE on ecosystems?*** (In each row, please circle the ONE value that best reflects your opinion).

| *+3 = strongly agree… 0 = neutral … -3 = strongly disagree; U = Unsure* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Fire generally accelerates the cycling of nutrient cycling in ecosystems | +3 | +2 | +1 | 0 | -1 | -2 | -3 | U |
| In the absence of fire, grasslands often convert to woodlands | +3 | +2 | +1 | 0 | -1 | -2 | -3 | U |
| Woody plants are generally more susceptible to fire than rangeland grasses | +3 | +2 | +1 | 0 | -1 | -2 | -3 | U |
| Woody plants that sprout from the base often survive a single fire event | +3 | +2 | +1 | 0 | -1 | -2 | -3 | U |
| Woody plants that do not sprout from the base can be killed by a single fire event | +3 | +2 | +1 | 0 | -1 | -2 | -3 | U |
| Occasional fire has a long-term positive impact on the supply of quality forage for grazing animals | +3 | +2 | +1 | 0 | -1 | -2 | -3 | U |
| Habitats of browsing wildlife, such as white-tailed deer, can be positively affected by occasional fire | +3 | +2 | +1 | 0 | -1 | -2 | -3 | U |
| Habitats of grassland birds can be positively affected by occasional fire | +3 | +2 | +1 | 0 | -1 | -2 | -3 | U |

B2. ***To what extent do you agree or disagree with each statement about the use of FIRE AS A MANAGEMENT TOOL?*** (In each row, circle the ONE value that best reflects your opinion).

| *+3 = strongly agree… 0 = neutral … -3 = strongly disagree; U = Unsure* | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Forage quality of rangeland grasses is generally greater following fire | +3 | +2 | +1 | 0 | -1 | -2 | -3 | U |
| Late winter or early spring burns can accelerate the onset of spring forage supply | +3 | +2 | +1 | 0 | -1 | -2 | -3 | U |
| Cool season burns can result in increased species diversity in an ecosystem | +3 | +2 | +1 | 0 | -1 | -2 | -3 | U |
| A hot summer burn can be used to restore rangelands dominated by woody plants to open grasslands | +3 | +2 | +1 | 0 | -1 | -2 | -3 | U |
| Prescribed fire is a less expensive way of controlling woody plants than mechanical or chemical methods | +3 | +2 | +1 | 0 | -1 | -2 | -3 | U |
| Prescribed fire is generally a less selective method for controlling brush than mechanical or chemical methods | +3 | +2 | +1 | 0 | -1 | -2 | -3 | U |
| Prescribed fire is generally a more effective method for controlling brush than mechanical or chemical methods | +3 | +2 | +1 | 0 | -1 | -2 | -3 | U |
| The use of prescribed fire requires specification of where, when and what to burn and who is to be present | +3 | +2 | +1 | 0 | -1 | -2 | -3 | U |
| The use of prescribed fire requires liability insurance for the landowner whose land is being burned | +3 | +2 | +1 | 0 | -1 | -2 | -3 | U |
| A Certified Prescribed Burn Manager must be present at prescribed fires | +3 | +2 | +1 | 0 | -1 | -2 | -3 | U |
| Entities that must be notified about a prescribed fire include the sheriff's office, fire department, and Texas Forest Service | +3 | +2 | +1 | 0 | -1 | -2 | -3 | U |

B3. ***Which of the following ORGANIZATIONS do you think plays the most important role in helping landowners use prescribed fire on their land?*** (Check only ONE).

- ☐ Natural Resource Conservation Service
- ☐ Texas Department of Agriculture
- ☐ Texas Research Experiment Station
- ☐ Texas Cooperative Extension
- ☐ Texas Forest Service
- ☐ Private consultants
- ☐ Texas Parks and Wildlife Department
- ☐ Local prescribed burning association
- ☐ Local Fire Department
- ☐ Other (Specify: _____)

B4. ***Is there a PRESCRIBED BURNING ASSOCIATION that covers your county?***

☐ No ☐ Yes

B5. ***Are you a MEMBER of a prescribed burning association?***

☐ No ☐ Yes

B6. ***Have you USED prescribed fire on your property?***

☐ No ? Answer questions B7 and B8 on this page and then skip to section C.
☐ Yes ? Skip to question B9 on the next page.

B7. ***How important is each of the following reasons for you NOT USING prescribed fire?*** (In each row, circle the ONE value that best reflects your opinion).

| *+3 = very important… 0 = neutral … -3 = not at all important* | | | | | | | |
|---|---|---|---|---|---|---|---|
| Property is too small | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Loss of forage resources | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Limited impact of fire on woody plants | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Insufficient knowledge about the use of prescribed fire | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Insufficient time to apply a prescribed fire | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Insufficient labor for managing a prescribed fire | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Insufficient equipment for managing a prescribed fire | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Insufficient money for putting in fire breaks, etc. | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Lack of local prescribed fire associations | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Concern about the legal liability of losing control of fire | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Concern about smoke hazards | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Lack of assistance with the development of burning plans | +3 | +2 | +1 | 0 | -1 | -2 | -3 |

B8. ***How important would each of the following be in encouraging you to INCORPORATE prescribed fire as a land management tool?*** (In each row, circle the ONE value that best reflects your opinion. Then skip to question C1).

| *+3 = very important… 0 = neutral … -3 = not at all important* | | | | | | | |
|---|---|---|---|---|---|---|---|
| Cost-share program to offset costs of lost forage | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Cost-share program to offset costs of putting in fire breaks | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Reduction in legal liability associated with using of fire | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Fire management and safety training opportunities | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Assistance with development of a prescribed burning plan | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Assistance of fire department with prescribed fires | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Provision of fire fighting equipment | +3 | +2 | +1 | 0 | -1 | -2 | -3 |

B9. ***How FREQUENTLY have you applied prescribed fire on at least part of your land?*** (Check only ONE).

☐ Once only ☐ Every 2 to 3 years ☐ Every 5 to 10 years
☐ Every year ☐ Every 4 to 5 years ☐ More than 10 years

B10. ***Which SPECIES are you trying to control with prescribed fire?*** (Check ALL THAT APPLY).

☐ Mesquite ☐ Juniper ☐ Oak
☐ Huisache ☐ Lotebush ☐ Texas persimmon
☐ Yaupon ☐ Salt cedar ☐ Pricklypear/other cactii
☐ Other (Please describe: _____)

B11. ***How important is each of the following REASONS for you using prescribed fire?*** (In each row, circle the ONE value that best reflects your opinion).

| *+3 = very important… 0 = neutral … -3 = not at all important* | | | | | | | |
|---|---|---|---|---|---|---|---|
| Reduce woody plant density | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Reduce pricklypear and other cacti | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Increase diversity of vegetation | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Improve forage quality for livestock | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Improve habitat for white-tailed deer | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Improve habitat for grassland birds | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Minimize risk of wild fires by reducing flammable biomass | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Lower cost than other brush control methods | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Less hazardous than using chemical control methods | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Easier to implement than other brush control methods | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Presence of a prescribed burning association in your area | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Assistance with development of a prescribed burning plan | +3 | +2 | +1 | 0 | -1 | -2 | -3 |

B12. ***How likely would each of the following be in ENCOURAGING you to use prescribed fire more frequently as a land management tool?*** (In each row, circle the ONE value that best reflects your opinion).

| *+3 = very likely… 0 = neutral … -3 = not at all likely* | | | | | | | |
|---|---|---|---|---|---|---|---|
| Cost-share program to offset costs of lost forage | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Cost-share program to offset costs of putting in fire breaks | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Reduction in legal liability associated with use of fire | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Increased availability of affordable fire liability insurance | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Opportunities for fire management/safety training | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Greater assistance with prescribed burning plans | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Greater assistance of fire department with prescribed fires | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Provision of fire fighting equipment | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Greater landowner representation at the State level by burning association representative | +3 | +2 | +1 | 0 | -1 | -2 | -3 |

B13. ***If liability insurance was readily available and affordable, how likely would you become a CERTIFIED PRESCRIBED BURN MANAGER?*** (Check only ONE).

☐ Definitely ☐ Maybe ☐ Uncertain ☐ Unlikely ☐ Definitely not

**SECTION C – COST SHARE PROGRAMS FOR MANAGING WOODY PLANTS**

One of the main reasons for using prescribed fire is to manage the proliferation of woody plants. Because increasing amounts and distribution of woody plants can negatively affect forage supply, wildlife habitat, and water yields, there is increasing public interest in funding cost-share programs aimed at woody plant management. Participation in publicly funded programs usually requires landowners to enter a contractual agreement with the funding agency. In this section we seek information about landowner opinions regarding various types of cost-share contracts. Please refer to the following definitions about three types of contracts, which may incur some constraints in use rights during the contract period.

- **Performance Contract**: The landowner is partially/fully compensated for his/her costs of participating in a land improvement program after meeting predetermined performance criteria (e.g., Environmental Quality Improvement Program – EQIP).
- **Lease Agreement**: In participating in a program aimed at restoring land, landowner gives up all/part of his/her land use right in exchange for an annual payment (e.g., Conservation Reserve Program – CRP).
- **Conservation Easement**: Landowner receives a lump sum payment or property tax reductions in exchange for the transfer of part of his/her use rights to all or part of their land. Conservation easement contracts usually cover longer time periods than performance contracts or lease agreements.

C1. ***Have you or are you currently participating in any other Federal or State funded program (***e.g., Environmental Quality Initiative Program (EQIP), Conservation Reserve Program (CRP), Wildlife Habitat Incentive Program (WHIP), etc.)

☐ No ☐ Yes (Please identify: _____)

C2. ***If you were to participate in a cost-share brush control program, how interested would you be in each of the following types of contractual arrangements?*** (In each row, circle the ONE value that best reflects your opinion).

| *+3 = very interested … 0 = neutral … -3 = not at all interested* | | | | | | | |
|---|---|---|---|---|---|---|---|
| 5-year Performance Contract | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| 10-year Performance Contract | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| 5-year Lease Agreement | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| 10-year Lease Agreement | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Long-term Conservation Easement | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Contracts that transfer to new owners if land is sold | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Group contract that includes several landowners | +3 | +2 | +1 | 0 | -1 | -2 | -3 |

☐ I am not interested in participating in any cost-share program (Please skip to Section D)

C3. ***Because funding for cost-share programs would be limited, what is likely to be the minimum percentage of cost share you would require to participate in such a program?*** (Check only ONE box).

| | | |
|---|---|---|
| ☐ 20% | ☐ 30% | ☐ 40% |
| ☐ 50% | ☐ 60% | ☐ 70% |
| ☐ 80% | ☐ 90% | ☐ 100% |

**SECTION D – PERSONAL INFORMATION**

To understand differences among landowners regarding their interest and concerns about prescribed fire and cost-share programs, we ask you to provide some information about yourself. We want to assure you that **YOUR RESPONSES WILL BE KEPT STRICTLY CONFIDENTIAL**, and will not be shared with any individual, business, or government agency. Results of this study will be reported only in the form of statistical summaries of many operations. At no time will the identity of your operation be disclosed. We thank you in advance for your willingness to provide this information.

D1. ***In which year were you born?*** _____

D2. ***Since age 18, how many years of ranching or farming experience do you have?*** _____

D3. ***For how long have you or your family owned this property?*** *(Check only ONE box)*

☐ Less than 5 years ☐ 6 -10 years ☐ 11-25 years
☐ More than 25 years ☐ More than one generation ☐ I don't own the property

D4. ***How many years do you estimate you will continue to own the property?*** *(Check the ONE box for the answer that best applies to your situation.)*

☐ 1 to 5 years ☐ 5 to 10 years ☐ Indefinitely

D5. ***Do you currently live on your property?***

☐ Yes ? Please skip to question D6 below.
☐ No ? Please answer the following questions.

(a) ***How far from your rural property do you live?***
- ☐ Less than 50 miles
- ☐ 50 to 100 miles
- ☐ More than 100 miles

(b) ***In what type of community do you live?***
- ☐ In the country or a small rural community (under 2,500 population)
- ☐ Small urban area (2,500-25,000 population)
- ☐ City (25,000-250,000 population)
- ☐ Large city or metropolitan area (over 250,000 population)

D6. ***Please check the category that most accurately reflects your average annual investment in improvements on your property over the last five years.*** (By improvements we mean roads, fencing, stock tanks and other water facilities, brush clearing, etc.)

☐ Under $1,000 ☐ $1,000-$9,999 ☐ $10,000-$24,999
☐ $25,000-$49,999 ☐ $50,000-$99,999 ☐ Over $100,000

D7. ***What proportion of your household's total income usually comes from activities related to your property?***

☐ Less than 10% ☐ 11-25% ☐ 26-50% ☐ 51-75% ☐ More than 75%

D8. ***Please check the category that best represents your household's total income before taxes in 2003.*** (Include net property income, income from wages, salaries, non-farm businesses, rental property, investments, retirement accounts, and other income sources).

☐ Less than $25,000 ☐ $25,001 - $50,000 ☐ $50,001 - $75,000
☐ $75,001 - $100,000 ☐ $100,001 - $500,000 ☐ Greater than $500,000

**SECTION E –EDWARDS PLATEAU PRESCRIBED BURNING ASSOCIATION MEMBERS**

This supplemental section asks for some information about your experiences with the Edwards Plateau Prescribed Burning Association (EPPBA). If you are not an EPPBA member, please say so here and return the form without filling it in.

E1. ***How long have you been a member of the EPPBA?*** _____ years

E2. ***To what extent to you agree that the following are valuable MEMBERSHIP BENEFITS of the EPPBA?*** (In each row, circle the ONE value that best reflects your opinion).

| *+3 = very valuable … 0 = neutral … -3 = not at all valuable* | | | | | | | |
|---|---|---|---|---|---|---|---|
| Greater availability of expertise regarding the use of fire as a management tool | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Assistance with development of prescribed burn plans | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Increased opportunity for fire management/safety training | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Availability of shared fire management equipment | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Increased availability of labor on burn days | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Reduced landowner liability for initiating a fire | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Improved landowner relationships | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Improved relationships with fire department | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Improved relationships with State agencies | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Improved relationships with Federal agencies | +3 | +2 | +1 | 0 | -1 | -2 | -3 |
| Increased landowner representation at the State level | +3 | +2 | +1 | 0 | -1 | -2 | -3 |

E3. ***Based on your experience, which of the following do you think would be the most suitable model for prescribed fire associations across Texas?*** (Check only ONE box)

- ☐ One-tiered structure consisting of local prescribed burn organizations and no regional or state-level associations
- ☐ Two-tiered structure consisting of regional associations each of which has multiple local chapters but no state level representation (current model for EPPBA)
- ☐ Two-tiered structure consisting of a single statewide association with many local chapters but no regional associations
- ☐ Three-tiered structure consisting of a state-level advocate for all regional associations each of which has multiple local chapters
- ☐ Three-tiered structure consisting of a state-level board representing all regional associations each consisting of multiple local chapters
- ☐ Other (Please describe: _____)

E4. ***Please suggest how the EPPBA could be improved.*** Continue on back if necessary.

_____

_____

_____

_____

_____

***Please write any other comments or suggestions that can help us better understand your perception about the use of fire as a rangeland management tool or other factors affecting your ranching or farming operation.***

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**THANK YOU FOR TAKING THE TIME TO FILL OUT THIS QUESTIONNAIRE.**

Your participation is greatly appreciated.

Please send the completed questionnaire to us in the enclosed postage-paid envelope.

# APPENDIX B

Table B1. Percent of respondents that live on their property.

| Live on property | Frequency | Valid Percent |
|---|---|---|
| No | 197 | 53.82 |
| Yes | 167 | 45.62 |
| No Response | 2 | 0.54 |
| Total | 366 | 100 |

Table B2. Percent of PBA members and non-members that live on their land.

| Live on Property | Non-member | | EPPBA Member | | Total |
|---|---|---|---|---|---|
| No | 131 | 59.55% | 62 | 43.97% | 193 |
| Yes | 88 | 40.00% | 78 | 55.32% | 166 |
| No Response | 1 | 0.45% | 1 | 0.71% | 2 |
| Total | 220 | | 141 | | 361 |

# APPENDIX C

Table C1. How important are each of the following range management objectives?

| | Total (N=355) | | Members (N=141) | | Non-members (n=220) | |
|---|---|---|---|---|---|---|
| Objectives | Mean | 95% | Mean | 95% | Mean | 95% |
| Improve grass supply | 2.59 | 0.09 | 2.80 | 0.11 | 2.45 | 0.14 |
| Improve browse/forbs prod | 1.99 | 0.14 | 2.31 | 0.19 | 1.81 | 0.19 |
| Improve wildlife habitat | 2.15 | 0.13 | 2.37 | 0.17 | 2.00 | 0.18 |
| Control woody plants | 2.49 | 0.10 | 2.75 | 0.09 | 2.32 | 0.14 |
| Protect riparian areas | 0.81 | 0.19 | 1.16 | 0.30 | 0.59 | 0.24 |
| Increase stream flow | 0.86 | 0.20 | 1.12 | 0.33 | 0.71 | 0.24 |
| Increase soil fertility | 1.78 | 0.14 | 1.79 | 0.25 | 1.77 | 0.17 |
| Increase $CO_2$ capture | 0.89 | 0.16 | 1.16 | 0.28 | 0.74 | 0.20 |

Table C2. Satisfaction with the amount of each vegetation type on your land.

| | Total | | Member | | Non-members | |
|---|---|---|---|---|---|---|
| Vegetation type | Mean | 95% | Mean | 95% | Mean | 95% |
| Grassland | -0.54 | 0.18 | -0.78 | 0.27 | -0.39 | 0.23 |
| Prickly pear and other cacti | 1.18 | 0.21 | 1.29 | 0.33 | 1.10 | 0.29 |
| Live oak dominate | 0.16 | 0.15 | 0.27 | 0.18 | 0.09 | 0.22 |
| Juniper dominate | 0.64 | 0.21 | 0.97 | 0.35 | 0.39 | 0.27 |
| Mesquite dominate | 0.92 | 0.20 | 0.90 | 0.33 | 0.90 | 0.26 |
| Mixed brush | 0.62 | 0.15 | 0.68 | 0.25 | 0.57 | 0.19 |

Table C3. Knowledge concerning the ecology and use of fire as a management tool.

| | Total | | Member | | Non-member | |
|---|---|---|---|---|---|---|
| Knowledge | Mean | 95% | Mean | 95% | Mean | 95% |
| Nutrient Cycling | 2.02 | 0.14 | 2.32 | 0.19 | 1.81 | 0.19 |
| Woody Plant | 1.29 | 0.13 | 1.73 | 0.20 | 1.01 | 0.16 |
| Habitat | 1.98 | 0.11 | 2.40 | 0.14 | 1.73 | 0.16 |
| Cool Season | 1.40 | 0.18 | 1.93 | 0.23 | 0.99 | 0.26 |
| Warm Season | 1.76 | 0.15 | 2.30 | 0.16 | 1.33 | 0.22 |
| Treatment Comparisons | 1.55 | 0.11 | 1.82 | 0.15 | 1.38 | 0.15 |
| Fire Planning | 1.98 | 0.12 | 2.19 | 0.18 | 1.83 | 0.16 |

Table C4. Reason for landowners not using prescribed fire.

| | Total | |
|---|---|---|
| Reasons | Mean | 95% |
| Small property | -1.01 | 0.27 |
| Forage loss | 0.16 | 0.28 |
| Min effect on woody plants | -0.30 | 0.24 |
| Insufficient knowledge | 0.83 | 0.26 |
| Insufficient resources | 1.08 | 0.21 |
| Lack of PBAs | -0.01 | 0.25 |
| Legal concerns | 0.66 | 0.22 |
| Min burn plan assistance | 0.56 | 0.26 |

Table C5. What would encourage you to incorporate fire as a management tool?

| | Total | |
|---|---|---|
| Encouragement method | Mean | 95% |
| Cost-share forage loss | 1.29 | 0.23 |
| Cost-share fire breaks | 1.80 | 0.20 |
| Reduce legal liability | 2.08 | 0.18 |
| Fire mgmt and safety training | 1.51 | 0.20 |
| Assistance with burn plans | 1.82 | 0.19 |
| Fire depts. assist with PB | 1.65 | 0.20 |
| Provision of fire equipment | 1.69 | 0.20 |

Table C6. Landowner reasons for using fire.

| | Total | | Member | | Non-member | |
|---|---|---|---|---|---|---|
| Reasons | Mean | 95% | Mean | 95% | Mean | 95% |
| Problem plants | 2.35 | 0.15 | 2.59 | 0.13 | 1.86 | 0.32 |
| Increase diversity | 2.09 | 0.22 | 2.26 | 0.25 | 1.76 | 0.43 |
| Improve forage | 2.32 | 0.22 | 2.47 | 0.19 | 2.03 | 0.54 |
| Improve habitat | 1.92 | 0.21 | 2.05 | 0.25 | 1.64 | 0.38 |
| Reduce biomass | 0.82 | 0.32 | 0.90 | 0.23 | 0.66 | 0.54 |
| Lower cost | 2.18 | 0.22 | 2.44 | 0.24 | 1.66 | 0.43 |
| Less hazard (chemicals) | 1.01 | 0.30 | 0.95 | 0.40 | 1.13 | 0.47 |
| Easier to implement | 1.24 | 0.30 | 1.24 | 0.38 | 1.24 | 0.53 |
| PBA present | 1.50 | 0.31 | 2.23 | 0.29 | 0.05 | 0.43 |
| Assist w/ burn plan | 1.46 | 0.31 | 1.80 | 0.41 | 0.79 | 0.41 |

Table C7. Criteria that would encourage you to use prescribed fire more frequently as a land management tool.

| | Total | | Member | | Non-member | |
|---|---|---|---|---|---|---|
| Encouragement | Mean | 95% | Mean | 95% | Mean | 95% |
| Cost-share | 1.65 | 0.26 | 1.70 | 0.32 | 1.55 | 0.48 |
| Reduce Liability | 2.19 | 0.19 | 2.31 | 0.22 | 1.96 | 0.39 |
| Fire training opportunity | 1.38 | 0.29 | 1.54 | 0.36 | 1.06 | 0.48 |
| Increase assistance w/ burn plan | 1.38 | 0.28 | 1.42 | 0.36 | 1.29 | 0.48 |
| Increase assistance of fire depts. | 0.93 | 0.32 | 0.85 | 0.42 | 1.08 | 0.50 |
| Provision of fire equipment | 1.36 | 0.28 | 1.53 | 0.34 | 1.03 | 0.49 |
| Increase rep. at State level by PBA | 1.62 | 0.27 | 1.97 | 0.30 | 0.89 | 0.50 |

Table C8. Level of interest in the following type of contractual arrangements

| | Total | | Member | | Non-member | |
|---|---|---|---|---|---|---|
| Contractual Arrangement | Mean | 95% | Mean | 95% | Mean | 95% |
| 5-yr performance contract | 1.13 | 0.21 | 1.52 | 0.32 | 0.82 | 0.28 |
| 10-yr performance contract | -0.18 | 0.24 | 0.08 | 0.40 | -0.39 | 0.31 |
| 5-yr lease agreement | -1.13 | 0.23 | -1.17 | 0.37 | -1.13 | 0.29 |
| 10-yr lease agreement | -1.53 | 0.20 | -1.72 | 0.29 | -1.40 | 0.28 |
| Long-term easement | -1.72 | 0.20 | -2.15 | 0.29 | -1.44 | 0.28 |
| Transferable contracts | -1.10 | 0.23 | -1.14 | 0.37 | -1.07 | 0.29 |
| Group contract | -1.20 | 0.22 | -1.29 | 0.34 | -1.15 | 0.29 |

Table C9. To what extent do you agree that these are valuable membership benefits of the EPPBA (PBA members only)?

| Benefits | Mean | 95% CI |
|---|---|---|
| Greater availability of expertise | 2.78 | 0.16 |
| Assistance w/ burn plans | 2.54 | 0.20 |
| Fire/safety training opportunity | 2.59 | 0.19 |
| Availability of shared fire equip. | 2.61 | 0.19 |
| More labor on burn days | 2.69 | 0.23 |
| Reduced landowner liability | 2.64 | 0.32 |
| Improved landowner relationships | 2.33 | 0.24 |
| Improved relations w/ fire dept | 2.18 | 0.32 |
| State/Fed relationships | 1.77 | 0.25 |
| Landowner rep at State level | 2.20 | 0.36 |

Table C10. Regression analysis showing knowledge of fire effects and knowledge of fire as a management tool.

| | Fire knowledge (model 1) | | | Fire as management tool (model 2) | | |
|---|---|---|---|---|---|---|
| R | 0.274 | | | 0.166 | | |
| Adj. $R^2$ | 0.072 | | | 0.024 | | |
| F | 23.871 | | | 8.377 | | |
| P | 0.000 | | | 0.004 | | |
| | Beta | t | P | Beta | t | P |
| Livestock income | 0.021 | 0.361 | 0.718 | -0.056 | -0.966 | 0.335 |
| Year born | -0.060 | -1.071 | 0.285 | -0.059 | -1.028 | 0.305 |
| Annual income | 0.061 | 1.088 | 0.278 | 0.077 | 1.342 | 0.181 |
| Live on property (residence) | 0.011 | 0.187 | 0.852 | -0.050 | -0.857 | 0.392 |
| Wildlife habitat improvement | 0.109 | 1.944 | 0.053 | 0.047 | 0.813 | 0.417 |
| Acres | 0.090 | 1.597 | 0.111 | 0.011 | 0.185 | 0.854 |
| Control invasives | 0.274 | 4.886 | 0.000 | 0.166 | 2.894 | 0.004 |
| Forage supply | 0.045 | 0.748 | 0.455 | 0.002 | 0.035 | 0.972 |
| Income from property | 0.080 | 1.399 | 0.163 | 0.010 | 0.177 | 0.860 |
| Wildlife income | 0.040 | 0.702 | 0.483 | -0.037 | -0.650 | 0.516 |

Table C11. Regression analysis showing perceptions toward insufficient resources and legal concerns.

| | Insufficient resources (model 3) | | | Legal concerns (model 4) | | |
|---|---|---|---|---|---|---|
| R | 0.218 | | | 0.215 | | |
| Adj. $R^2$ | 0.042 | | | 0.041 | | |
| F | 9.353 | | | 9.187 | | |
| P | 0.003 | | | 0.003 | | |
| | Beta | t | P | Beta | t | P |
| Livestock income | -0.046 | -0.651 | 0.516 | 0.025 | 0.346 | 0.730 |
| Year born | 0.016 | 0.225 | 0.822 | 0.015 | 0.214 | 0.831 |
| Annual income | -0.005 | -0.074 | 0.941 | 0.045 | 0.626 | 0.532 |
| Live on property (residence) | -0.065 | -0.909 | 0.364 | 0.044 | 0.619 | 0.537 |
| Wildlife habitat improvement | 0.038 | 0.533 | 0.595 | 0.001 | 0.016 | 0.987 |
| Acres | -0.218 | -3.058 | 0.003 | -0.215 | -3.031 | 0.003 |
| Control invasives | -0.043 | -0.604 | 0.547 | -0.058 | -0.815 | 0.416 |
| Forage supply | -0.033 | -0.460 | 0.646 | 0.018 | 0.248 | 0.804 |
| Income from property | -0.064 | -0.882 | 0.379 | 0.051 | 0.705 | 0.482 |
| Wildlife income | -0.033 | -0.462 | 0.645 | -0.121 | -1.711 | 0.089 |

Table C12. Regression analysis showing landowner perceptions of cost-share programs and reduced liability for increasing fire use.

| | Cost-share (model 5) | | | Reduced Liability (model 6) | | |
|---|---|---|---|---|---|---|
| R | 0.204 | | | 0.362 | | |
| Adj. $R^2$ | 0.032 | | | 0.033 | | |
| F | 4.239 | | | 1.341 | | |
| P | 0.042 | | | 0.222 | | |
| | Beta | t | P | Beta | t | P |
| Livestock income | -0.092 | -0.919 | 0.361 | -0.261 | -1.860 | 0.066 |
| Year born | 0.004 | 0.039 | 0.969 | 0.064 | 0.609 | 0.544 |
| Annual income | -0.111 | -1.118 | 0.266 | -0.108 | -0.999 | 0.321 |
| Live on property (residence) | 0.036 | 0.352 | 0.726 | 0.101 | 0.918 | 0.361 |
| Wildlife habitat improvement | 0.135 | 1.345 | 0.182 | 0.096 | 0.780 | 0.437 |
| Acres | -0.036 | -0.364 | 0.717 | 0.124 | 1.136 | 0.259 |
| Control invasives | 0.204 | 2.059 | 0.042 | -0.006 | -0.053 | 0.958 |
| Forage supply | 0.127 | 1.237 | 0.219 | 0.142 | 1.202 | 0.233 |
| Income from property | 0.063 | 0.622 | 0.535 | 0.132 | 1.176 | 0.243 |
| Wildlife income | 0.037 | 0.371 | 0.711 | -0.090 | -0.637 | 0.526 |
| Burn association member | -0.011 | -0.103 | 0.918 | 0.114 | 1.009 | 0.316 |

Table C13. Regression analysis showing landowner feelings toward assistance with fire plan/issues.

| | Assistance w/ fire plans (model 7) | | |
|---|---|---|---|
| R | 0.321 | | |
| Adj. $R^2$ | 0.002 | | |
| F | 1.024 | | |
| P | 0.430 | | |
| | Beta | t | P |
| Livestock income | -0.137 | -0.960 | 0.339 |
| Year born | 0.016 | 0.147 | 0.883 |
| Annual income | -0.182 | -1.651 | 0.102 |
| Live on property (residence) | 0.177 | 1.582 | 0.117 |
| Wildlife habitat improvement | 0.036 | 0.291 | 0.772 |
| Acres | -0.006 | -0.057 | 0.954 |
| Control invasives | 0.041 | 0.363 | 0.718 |
| Forage supply | 0.205 | 1.714 | 0.090 |
| Income from property | -0.049 | -0.434 | 0.665 |
| Wildlife income | -0.078 | -0.543 | 0.589 |
| Burn association member | 0.084 | 0.735 | 0.464 |

# VITA

Name: Justin Bradley Woodard

Address: 3613 Imperial
Midland, TX 79707

Education: B.S., Wildlife Ecology and Management, Texas A&M University, 2003

M.S., Rangeland Ecology and Management, Texas A&M University, 2005

Work Experience:

Texas Parks and Wildlife Department
Mason Mountain Wildlife Management Area (Mason, TX)
Region 2 Wildlife Intern

Texas A&M University
Department of Records Management

Texas Parks and Wildlife Department
Mason Mountain Wildlife Management Area (Mason, TX)
Region 2 Interpretive Intern