PROPERTY RIGHTS ORIENTATIONS OF LANDOWNERS IN TEXAS, UTAH AND COLORADO

A Dissertation

by

MALINI VASUDEVAN NAIR

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

DOCTOR OF PHILOSOPHY

December 2004

Major Subject: Rangeland Ecology and Management

PROPERTY RIGHTS ORIENTATIONS OF LANDOWNERS

IN TEXAS, UTAH AND COLORADO

A Dissertation

by

MALINI VASUDEVAN NAIR

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

DOCTOR OF PHILOSOPHY

Approved as to style and content by:

Urs P. Kreuter (Chair of Committee)	J. Richard Conner (Member)
Fred E. Smeins (Member)	George C. Davis (Member)
Steve G. Whisenant (Head of Department)	

December 2004

Major Subject: Rangeland Ecology and Management

ABSTRACT

Property Rights Orientations of Landowners

in Texas, Utah and Colorado. (December 2004)

Malini Vasudevan Nair, B.S., Kerala Agricultural University;

M.S., Texas A&M University

Chair of Advisory Committee: Dr. Urs P. Kreuter

The debate over allocation of rangeland resources has gained increasing momentum in the 1990's. These days, several constraints are facing landowners, including high estate taxes, reduced profit margins of agricultural/ranching operations and increased legal restrictions in land use. Previous studies point out to strong private property rights among landowners, which have often been assumed to lead to short-term land management goals that are not particularly beneficial to society. This study analyses the multidimensionality of property rights and how this determines the variation in willingness to undertake various ecologically sustainable management practices without compensation and the variation in the perception of threats by the landowner.

A study was conducted on randomly selected landowners in three states, Texas, Utah and Colorado in 2001; an average response rate of 51.3% was obtained across all three states.

A descriptive analysis was conducted, tabulating the identifying characteristics of the respondent rancher/farmer and their property, their opinion regarding the rights and

responsibilities of landowner, their likely willingness to implement different management practices and threats to the future viability of their ranching operation, searching for testable hypotheses.

In analysis of effect of multidimensionality of property rights on the willingness to undertake management practices without compensation, results confirmed the significance of three property rights except the individual property rights scale.

Respondent's perception of the threats to the future viability of future operation was analyzed using directed acyclic graphs (DAG). The DAG revealed several directed edges (causal effects), but the presence of several bi-directed edges (cause and effect being indeterminable) were also identified. The subsequent regression analysis showed no significant property rights scales, but component analyses identified a few significant property rights orientations. The low significance is attributed to the presence of bi-directed edges.

To my parents; Dr. N. Vasudevan Nair and Mrs. N. Padmini Devi, my sister Dr. Neelima Nair and all members of Kayyalam family.

And to all women of the developing world, who struggle every day to make ends meet.

ACKNOWLEDGEMENTS

My deepest appreciation goes to the chair of my committee, Dr Urs P. Kreuter. Thank-you Urs, for being a rock of support during tough times, you gave me confidence and encouragement to follow my own path while making sure that I did not stray too far from the essence of the project at hand. Thank-you for your moral and financial support and for taking a chance on me.

Dr Richard Conner, thank-you for bridging the gap between ecological concepts and economics and encouraging me through bottlenecks of the PhD program with infinite kindness. Dr. Fred Smiens, thank-you for imparting from your deep well of ecological wisdom concepts that will be forever engrained in my brain. Dr George Davis, thank-you for serving on my committee in the Master's and Ph.D. programs, for being an impressive presence in my education and emphasizing the importance of logical thinking and searching of concepts in any theory. Dr. Doug Jackson-Smith thank-you for helping me with the factor analysis concepts in sociology and particularly my dissertation. Dr. David Bessler thank-you for helping me with Directed Acyclic Graph theory and TETRAD analysis and for discussions ranging from J. K. Galbraith to the political climate of Kerala. Dr Tom Knight, for being my first employer in the United States, thank-you for your patient guidance. Dr. Bruce McCarl, Dr. Raghavan Srinivasan, Dr. Ben Wu, Dr. Bob Knight, Dr. David Leatham thank-you for your encouragement at different stages of my education.

My teachers at Kerala Agricultural University, especially Dr. Ravindran Nair, Dr. Sreekantan Nair and Dr. Mercy Cheriyan thank-you for encouraging me to pursue education abroad. My teachers at Holy Angels' Convent High School especially Sister Margery and Sister Theodora, for encouraging us to speak in English, so that it would improve.

I acknowledge my family with great appreciation: My father, for being able to explain Fourier series to me even now, you are my first inspiration. My mother, for taking me to the British Council Library, Trivandrum and encouraging me to write summaries of Bertrand Russell, how I hated it then, but how indebted I am to you now. Thank-you for teaching me to calculate logarithms while other mothers were teaching their daughters how to cook. My sister Neelima for curing all the manufactured illnesses I had with a dose of reality and being a wonderfully loving listener, even through her tough residency years. My cousins, Jayadeep and Jayadev, for listening patiently to my troubles and providing me with whatever support I required, whenever. My Valiyamma for supporting and encouraging my half-baked idea of coming to the States, thank you for being another mother to me. Thank-you Valiyacchan, for encouraging me to take time out to smell the roses. The members of Kayyalam, thank-you for being an inspiration. The members of my father's family, thank-you for being supportive. Thank-you Deeta chechi, Ramesh chetta, Sindu ammayi and Anandan maman for making me miss home a little less.

I honestly think I would not be able to finish my dissertation without the moral support of my friends; Rosarella, Anu, Anupam, Sudha, Lalitha, Murali, Tanveer,

Mankeun, Garen, Eza, Pakki, Edward, Sanjeev, Arjun, KK, Monisha, Veera, Binu, Paul, Uwe, Tasana, Vivane and Carlos, Lisa, Manuelita Ureta, Armen, Eric, Chris, Josh, Emily, Johanna, Judy, Lori, my friends who work at Department of Range Ecology and Management, my friends at Department of Agricultural Economics and at the J. Wayne Stark University Center Gallery.

Finally I want to thank the ranchers in Texas, Utah and Colorado for providing me an opportunity to study their operations.

TABLE OF CONTENTS

CHAPTER Page

LIST OF FIGURES

FIGURE Page

FIGURE Page

LIST OF TABLES

TABLE Page

CHAPTER I

INTRODUCTION

Background and Rationale

Rangelands have been facing increasing pressures in the recent years, including increased population, suburban sprawl, fall in agricultural prices, increased labor prices and frequent droughts (Jackson-Smith et al., 2004). Federal government policies such as the Endangered Species Act (1973) and Clean Water Act (1977) have created additional constraints on rangeland managers. The negative perception of such environmental policies by landowners together with the aforementioned pressures has resulted in many landowners withdrawing from ranching activities, which in turn has accelerated the sale of rural land for non-agricultural purposes (Jackson-Smith et al., 2004). Such shifts in land use often change the way in which land and its resources are managed, including changes in resource use and investment which may have ecological consequences. Established communities with high physical, economic and social capital, generally have more responsible attitudes towards the conservation of natural resources (Wilkinson, 1991). This is a consideration to be utilized in the subsequent analysis for accounting the differences in management practices.

This dissertation follows the style of Journal of Range Management.

Generally, rangelands are characterized by lands that are low in arable potential and are dominated by native plant communities. Worldwide, rangelands encompass almost 6.7 million ha (51% of the earths' surface), which makes them the world's largest land cover category (Holechek et al., 2001). Due to their vastness, they provide essential ecosystem services, upon which humans and other organisms depend. Such services include diverse wildlife habitats, water catchments and filtration systems, atmospheric carbon sinks and forage for livestock (Evans, 1990). In the United States alone, they provide forage and habitat for around 100 million domesticated and wild herbivores (Evans, 1990). In addition, they are the source of the majority of the nation's water resources, endangered species habitat and recreational amenities and wilderness. However, the total area of rangelands in the world is diminishing due to population explosion that has led to the use of increasingly marginal land and in some areas desertification (Holechek et al., 2001). Uncontrolled grazing, burning, wood harvesting for fuel, cultivation and abandonment of semiarid lands are additional reasons for the deterioration and desertification of rangelands (Holechek et al., 2001).

Private rangelands in Texas have been facing many problems in the recent years. High population is causing increased demand and prices for land and the sale of numerous farms and ranches for non-agricultural development. Associated changes in ownership can lead to decreased ecological stability, for example, establishment of high fencing to contain wildlife and first-time ranchers with non-traditional land - use objectives that may be inconsistent with the maintenance of ecosystems. Additional problems that are affecting the management practices of landowners include new

wetland regulations; land use constraints imposed by the endangered species act, and in public land states, restricted access to public rangelands.

Such issues have led to increased landowner concerns over the impact of their private property rights. In addition to the variables stated above, variables such as emotional attachment to property and local community involvement may be important factors affecting property rights orientations (Jackson-Smith et al., 2004). Increased landowner awareness about their property rights may be influenced by socio-demographic and economic characteristics of the landowners. For example, an urban landowner might have a different orientation towards property rights than a rural landowner.

This research aims to identify various factors that affect the property rights orientations of landowners. Examination of causal flow of these variables will lead to several important findings in the dynamic change of property rights inclinations and patterns of change in land ownerships.

Problem Statement

The environmental policies of the Federal and State Governments are changing the way rangeland and its resources are being managed. Such changes are affecting the meaning of private property rights, converting them from a unitary concept to a separable bundle of rights that can be exercised to different degrees and for different purposes. This changing rights structure may pose challenges for land owners in their decision-making process by conflicting with the perception of their property rights. In turn, this may encourage landowners who perceive their property rights to be

compromised to more willingly sell all or part of their land in the face of development pressure, which often leads to land, and habitat fragmentation and adverse effects on the existing natural resources and ecosystem services. The specific objectives and hypothesis of the study follow.

Objectives and Hypotheses

The objective of this project is to identify the role of property rights orientations in modifying the landowners' decisions regarding land and its management practices.

The general hypotheses to be tested are:

H_1: Property rights orientations are influenced by the socioeconomic and demographic characteristics of the landowners.

H_2: Property rights orientations influence management decision on private land.

H_3: Property rights orientations influence landowner involvement in their communities.

H_4: Property rights orientations influence landowners perception of future threats to the ability to manage their land.

Organization of Analyses

The next chapter, Chapter II will incorporate a comprehensive review of literature dealing with development of property rights, studies incorporating the attitudes towards various government programs and the perception of property rights by landowners. First, in Chapter III the respondent characteristics will be analyzed. The characteristics include socio-demographic characteristics, willingness to participate in environmentally conscious management practices and threats facing the future viability of operation. The Chapter IV incorporates the analysis of the attitudes towards

enforcing ecologically sustainable land management practices without compensation. Chapter V includes a causal analysis of threats against the future viability of ranching/farming operation. The final chapter, Chapter VI incorporates a summary of the analysis and the conclusions drawn.

CHAPTER II

LITERATURE REVIEW

Introduction

John Locke, the great English thinker of the 1600's claimed that God had given the earth to man for his support and comfort and matching with his own labor and the existing resources, he can create his own property (Locke, 1956). He continues, "As much as any one can make use of any advantage of life before it spoils, so much he may by his labor fix a property in: whatever is beyond this is more than his share, and belongs to others. Nothing was made by God for man to spoil or destroy" (Locke, 1956). This statement, written in 1688, characterizes much of the property rights debate of today. Questions, such as "How can property rights be divided in such a manner that the division is fair to the people who have labored to earn it?" Or "How do you preserve property for the usage of future generation?" are central to the debate. Questions like, "How do you manage the wise use of property vs. environmental protection?" have influenced views of politicians and voting patterns during the 1990's.

The environmental movement of the 1960's and 1970's created many federal agencies for the conservation and protection of natural resources in the U.S. This extended to all the sectors, including both industrial and agricultural, albeit to varying degrees. In the agricultural sector, where profits were already narrow, there was a perception that the growing environmental regulations would further reduce profit margins and decrease standards of living. In particular, the establishment and the extension of Endangered Species Act created considerable discontent among landowners

(Shogren, 1999). Private landowners felt they were asked to bear an unfair portion of burden of protecting threatened and endangered species because they own a majority of the remaining wetlands and riparian areas and thus much of the endangered species habitat (Shogren, 1999). On public land, the natural resource conservation agencies acted in tightening resource extraction opportunities, thereby creating discontent among grazing and timber permitees and recreational users. Other problems that contributed in heightening the tension between policy and the public included stagnant agricultural and mining sectors where there were extended periods of depressed prices (Cromartie and Wardell, 1999). In addition, high estate taxes and farmland prices discourage the heirs of ranch-owners from continuing with the ranching occupation. Moreover, due to the disparity between the productive and investment values of land, landowners often sell the land for development or recreational purposes, which further undermines the habitat conservation goals of policy-makers (Olson, 1999).

Local government restrictions such as zoning, purchase of development rights (PDR) and purchase of agricultural development rights (PACE) are aimed at constraining the division and sale of rural land. Zoning can cause suburban sprawl thereby reducing environmental quality (Fichel, 1995). In addition, incentive programs aimed at inhibiting land division are often opposed by landowners who do not want their "land development rights" to be restricted and further worry that these rules will reduce the market value of their property (Jackson-Smith et al., 2003). The adverse political realities of land management policy making formulation leads to over-representation in many councils by residents urban areas and who have narrower perspectives of land

issues teamed along with inadequate cost-benefit analysis measures and uncertain environmental risks and impacts make it difficult for them to adhere to any set of environmental ethic (Feldman, 1991).

Researchers and the government agencies are developing several solutions for the above mentioned conflicting problems. For example, uncertainty about environmental risks and impacts are addressed within the National Environmental Policy Act through the development and use of Environmental Impact Statements (EIS). In addition, new methods for use in benefit-cost analyses (eg. Contingent Valuation Measures CVM) are being developed by environmental economists everyday. However analyses of the property rights orientations of landowners has remained rudimentary and unidirectional.

In general, the property rights orientations of landowners are addressed in the literature as a consequence of various government policies, and they are not given the comprehensive treatment as other rights. For example, water rights in United States are treated a multi-dimensional entity in which the rights are layered and are affected by a multitude of issues including urban-rural residential differences, state differences and local differences. Property rights that prevail currently did not arise as an absolute right for the state or for the private citizen, but rather as an amalgamation of interacting forces coming into action even on a single plot of land. Some of the interacting forces are demand for a greater number of land parcels and demand for a cleaner environment. As human population expands and demand for natural resources to sustain that population

grows, a re-examination of current property rights allocation is necessary for the future welfare of humanity and the sustainability of the biosphere.

The Concept of Property Rights

Property rights literature emerged as a theme in economics in the 1960's with the seminal work of R. H. Coase. His works, including "The nature of the Firm" (Coase, 1937) and "The problem of Social Cost" (Coase, 1960) are considered by economists and sociologists as the origin of this body of literature. Other authors such as Armen Alchain and Harold Demsetz (1973) described the evolution of property rights through history. More recently, it was stated that the single most important reason for the evolution of property rights is scarcity of resource (Anderson and Higgins, 2003); if resource supply is infinite, there is no necessity for partitioning of a resource through the assignment of property rights or interference of a third-party such as government. The clearer the partitioning of a resource, the easier the property rights are discovered and enforced in that resource.

In the beginning, rangeland resources in Western USA were plentiful. Ernest Osgood (1929) writes, "There was room for all, and when a cattleman rode up a likely valley or across some well grazed divide, he looked elsewhere for range." This is also applied to many other resources such as water, minerals, satellite orbital paths and internet protocol addresses (Anderson and Higgins, 2003). However, as human population and consequently urban settlements grew, local resource scarcity became more prevalent and people began to occur and people began to redefine what kinds of

legitimate land use activities should be allowed on public and private rangeland (Kreuger 1994).

Property rights are defined for both tangible and intangible assets. In the case of intellectual capital, patents and copyrights define the property rights while in the case of real estate deeds together with nuisance and trespass legislation define the rights to "consume" the property. Generally, ownership is characterized by right to use and profit, right of exclusivity and right of transferability (Anderson and Higgins 2003). The exclusivity of access to resources entitles the owner to choose between the utilization of resource and the consequences of that action. Transferability enables the owner to transfer the asset to another with or without sufficient compensation (Pejovich 1990). Rights to use are always circumscribed by certain rules; if the owners' choice of how a right should be used dominated the actual action of use with probability of one, then the owner is said to have absolute right (Alchian and Demsetz 1973). Partial ownerships can thus be given proportional probabilistic values which may be a mechanism for efficiently allocating resources.

In a capitalistic society, the market demand and supply operates under three assumptions: private ownership of all resources, downward sloping demand curve for goods and zero transaction costs (Pejovich 1990). Coase suggested that the situation of zero transaction costs is not possible in the real-world and thus price determination of a resource through ordinary utility maximization is not valid. He argued that, "In a regime with zero transaction costs, negotiations between parties would lead to arrangements being made to maximize wealth and this is irrespective of initial assignment of rights"

(Coase 1994). Positive transaction costs arise when there is mutual benefit from exchanging commodities, but the exchange does not take place because the transaction costs may be so high as to preclude the exchange taking place. For example, transaction costs may arise in commodity markets as transportation costs and in contract markets as the legal costs in formalizing the transaction (Myles 1995). Transaction costs are generally treated by economists as a negative externality which prevents the market system from being pareto-optimal; i.e. the condition under which it is not possible to transfer resources from one owner to another without making any owner worse-off.

Externalities arise in a tradable bundle of commodities when there is insufficient incentive for a market to function, and the non-creation of a market prevents the system from being pareto-optimal (Myles, 1995). Negative externalities are unaccounted losses created by the use of a resource (e.g. property) to such an extent that the solution is pareto-imperfect for one or more of the participants of the affected system. In general, economic theory suggests that where there are situations of positive transaction costs / negative externalities, corrective governmental interventions are needed to restore pareto- optimality. Measures utilized may include corrective taxation, non-uniform taxation, subsidies, regulations, permitting or licensing, and non-linear pricing. Coase (1994) suggests that in systems with positive transaction costs, such governmental interventions may sometimes produce more equitable results than relying on individual negotiations between individuals.

Even when rights are well defined and have no externalities associated with them resources may be constrained. For example, there are often legal restrictions on

the type and intensity of use of resources and Coase stated that legal system control the economic systems (Coase, 1994). If market transactions were cost free, property rights would have been well-defined and the results of legal actions would be easily forecast (Coase, 1960). This proposition was formalized by Stigler (Stigler, 1989) as Coase theorem, which states, "In a competitive economy with complete information and zero transaction costs, the allocation of resources will be efficient and invariant with respect to legal rules of entitlement." However, in the real world, markets have transaction costs that make it difficult for the legal system to involve and change the arrangement of rights.

Thus when a dispute arises about property rights and when the only efficient allocation of property rights is use of the legal system, the courts should understand the economic workings of the system in question to act without uncertainty. In addition, they should act in such a manner that will involve a minimum amount of transaction costs, because each transaction in the market is associated with costs, such as legal fees, contracting costs, infrastructure for enforcement etc.

In the Industrial Organization literature, the maintenance of property rights system is well researched in contract theory. A contract is an agreement between two or more parties that defines the terms and conditions of a transaction (Church and Ware, 2000), and contract mechanisms align incentives and provide for efficient incentive adaptation among the parties. For example, if the implications of a court sanctioned pecuniary measure for nonperformance of an act that makes a party worse off than performance of that act then there is an alignment of incentives in the contract. The

incorporation of contingencies in the contract further facilitates the efficient adaptation to various situations (Church and Ware, 2000). While contracting often allows industrial resources, the concept can be easily extended to natural resources, and has been in cases like petroleum.

Well defined property rights are necessary for contracting of all resources, whether industrial or natural. According to Young (1992) characteristics of well defined property rights are:

1. Separability/Divisibility - The rights and obligations are specified in terms of the smallest possible bundle. This leads to minimal wastage resources, such as water, and promote sustainable use of natural resources.

2. Transferability - Resources are transferable among individuals because the transfer of resources could be the only way in which pareto-efficient outcomes will result (Young, 1992). Transferability can create ecological links between different parts of ecosystems at risk. For example, in case of water resources, farmers with low-salinity might sell water rights to factories or other farmers with better soils creating an ecological link, if the farmer trades with the industrial water rights. However, transferability can be abused to create monopolies or monopsonies of resource ownership. To prevent creation of such monopolies, we need to add constraints to prevent people from abusing property.

3. Exclusivity - Investors have the right and ability to exclude others from utilizing the resource. The absence of exclusive rights to the resource leads to

the under-investment in the maintenance of the resource and there is excessive investment in its extraction.

4. Enforceability - Resource rights and administrative arrangements should make enforcement of obligations a matter of self-interest. All resources should be administered on a competitive user-pay basis and must be extremely costly to the user to abuse the resource.

5. Investment Security – Security of investment is necessary to ensure sustainable investment. The characteristics that promote sustainable investment are durability and technical and economic efficiency. These characteristics are promoted by exclusive availability of resources and stable political systems in countries involved in the transaction of the resources. Each resource right should also be useable as a security to finance investments associated with the use of the resource transaction. Any modification of the resource package which diminishes the value of the resource and investments should be eligible for compensation.

6. Financial/Collateral Security - An enforceable title whose value with improvements attached is significantly greater than the value of money borrowed to make improvements characterizes a resource with well-defined property rights (Young, 1992). The improvements to the resource should cause the extension of the resource for a significantly longer time.

7. Political Stability – Investing and maintaining a resource in politically unstable regimes is highly risky and it results in underinvestment of the resource.

8. Rights to Compensation - Unless just financial security is allocated for reduction of a user's rights, incentives for investments necessary to maintain productivity are reduced.

9. Low transaction and administrative costs - If the administrative cost of the exclusive use of the resource is exorbitant, it will result in no utilization of the resource.

10. Equitable Distribution - This is comes to action during transfer of a resource right. Transfer of a resource to a single user will promote inequitable and inefficient use and will lead to a monopolistic market of a resource.

As human population grows, scarcity of resources thought plentiful start to become increasingly scarce. Thus, property rights will have to become better defined for a greater number of resources to ensure efficient allocation and use. This will prevent over - exploitation and exhaustion of the resources and the "tragedy of commons".

Property Rights Law

The English law treated the issue of economic unequanimity under the phrases of "reasonable" and "common or ordinary use" (Coase, 1960). The American constitution, written later in 1787, was a bit clearer, treating the property matters under "takings clause" of the Fifth Amendment (1789). The takings clause states, "No person shall be deprived of life, liberty or private property rights without due process of the law nor shall private property be taken for public use without just compensation." (Anon, 2003) Historical evidence suggests that the drafters of the Bill of Rights (1789) included a

takings clause for the safeguard of private property from governmental expropriations for the purpose of construction of a road or other public facility.

Initially the Bill of Rights (1789) did not address the regulation of uses of property by private users. In certain subsequent cases, the U.S. Supreme court ruled that some regulations go too far and could constitute as takings (Georgetown Environmental Law and Policy Institute, 2004). However, such regulatory impacts are ruled as taking only when all or substantial proportion of a property's value is eliminated. Currently, compensation is given to parties only if 1) When their entire estate is permanently or temporarily taken by a government agency and title is transferred to the Government 2) When a regulation for other than health or safety reason takes all or nearly all of the value of the property 3) When the government attaches unreasonable or disproportionate permit conditions on use (Pilon, 2004).

Conversely, if the property rights are defined too narrowly, the private property owners will suffer when a neighbor causes harm to them. For example, they cannot get a legislative support for removing a pollutant emitting plant or a sewage treatment facility located near their property. Some authors have claimed that "As a man is said to have a right to his property, he may be equally said to have a property in his rights. Take one of those rights--one of those sticks in the "bundle of sticks" we call "property"--and you take something that belongs to the owner. Under the Fifth Amendment, compensation must be paid to the owner" (Pilon, 2004).

In the past, some environmental problems were addressed by common law by treating these problems as "nuisance" legislation. In common law literature, two kinds

of nuisance legislation are present, public and private. A private nuisance is "An unreasonable and substantial interference with the use of the land" (Schoenbaum et al., 2002). Liability in nuisance cases is called for acts that are either intentional or unreasonable, or acts that are unintentional and otherwise actionable for negligent and reckless conduct or abnormally dangerous conditions or activities. Another legislation that has been utilized in property rights litigation is "invasion". An invasion, whether public or private is termed unreasonable if the gravity of harm outweighs the utility, or if the harm is of such serious level and burden of compensation is so high that any activity will be economically unfeasible. The invasion might be committed by the government, companies or by private citizens. A public nuisance is an unreasonable interference with the interest of the community or general public. Clarification of the legal terms is important because the effects of the governmental regulations such as Endangered Species Act, Clean Water Act and other riparian regulations and their effects on landowners is to be studied in this project.

The Endangered Species Preservation Act was enacted in the United States in 1966 to conserve species and to stabilize the declining biodiversity in the US. In 1969, the act was amended to include habitat acquisition and in 1973, the act was again amended to include 'critical habitat' designations, even in private lands. These designations, created a situation in which economics and property rights were subordinate to biology (Dwyer et al., 1995). Several high profile cases ensued including *Tennessee Valley Authority v. Hill (1978) and Babbitt v. Sweet Home Chapter of Communities for a Greater Oregon (1995)*. Such cases resulted in Congress offering

remedial measures for landowners adversely affected by this act. In 1982, 'Incidental Taking' was permitted, whereby a landowner was allowed to take some individuals of a species where the majority of species was preserved. Subsequently, in 1995, the Congress released a list of 10 principles, offering major concessions on all regulatory rulings (Dwyer et al., 1995). The various modification of Endangered Species Act and their ramifications are well researched. Several studies (Czech and Krausman, 1999; Elliot et al., 1997) indicate that support for endangered species act is influenced by a host of variables as age, education, gender, ideology and party affiliation. Private property right orientations of landowners are also influenced by these variables (Jackson-Smith et al., 2004). If landowners have strong private property orientations, they will feel that endangered species act and other federal regulations adversely affect their ability to utilize the land.

Perceptions of Property Rights

In general, private property rights systems allow unrestricted utilization of property by the owner, provided that the owner does not harm others in the process of exercising his rights (Greve, 1994). The essence of a society lies in how property rights are defined and what an individual can do with his property that will not harm another person's rights. The meaningfulness of property rights is limited to how far the state and judicial authorities are ready to protect their claims and are ready to prevent others from violating their rights (Jackson-Smith et. al., 2004).

Property rights systems evolve over time, as changes in human demographics affect the public demand for goods and services and as the social values and political

influences evolve. For example, environmentalism, a property rights determinant, evolved through a complex process of political trial and error in which its proponents tried to balance resource mobilization factors and political persuasiveness factors (Buttel, 1992). Moreover, as populations become increasingly urbanized and more dependent on resources derived from rural areas, the social debate about what land use activities are considered legitimate in public and private rangelands will likely intensify (Krueger, 1994 cited by Jackson-Smith et al., 2004)

Property rights orientation of ranchers may be influenced by location specific traditions and values (Fortmann, 1996) while land tenure systems are determined by several factors. They include customary tenures (where customary claims are respected in diverse resources as open range, poaching and allocation of fishing grounds), Gender (Women are less likely to own or control land, to own less amount of land and to feel less secure in their tenure) and land concentration (where concentration of land in the hands of some entities as utility companies, US Forest Service, timber companies and urban vacation homes creates hardship in earning a livelihood from land and decreases the quality of life).

Certain authors identify an influence of a phenomenon called ‘place creation’ in the property rights orientations in landowners. Brandenburg and Carroll (1995) first suggested that creation of a concept called ‘place’ influenced the decisions of the rural residents on how resources within a local river in Washington State should be managed. They concluded that personal experience of a place would change values and increase attachment to a place especially when use of the place was repeated or traditional. They

suggested that natural resource management should incorporate the concept of 'place creation'. Other areas of research focusing on this concept include, conservation planning against fragmentation of woodland resources incorporating the concept of 'place creation' (Tyson and Broderick, 1999), developing conservation strategies for public lands incorporating this idea and the deeper community attachment of rural residents when compared to urban residents (Eisenhauer et al., 2000). Property rights orientations of ranchers are also likely to be influenced by the concept of 'place creation' which could be determined by observing differences between landowners that have traditionally been managing the land and those who are recent land managers (Jackson-Smith et al., 2004). Lifestyle choices such as preference to live in the country also influence the decision to live in a particular area (Jackson-Smith et al., 2004).

Certain other variables that influence property right orientations are size of ranching operation, level of ranch income and availability of extension support. A survey of small-acreage operators in Texas found that they were concerned more about increasing carrying capacity and were unconcerned about the effect that might have on the land, while larger area operators gave consideration to factors such as wildlife conservation and good stewardship (Rowan, 1994; Rowan et al., 1994). In another survey of livestock producers in Utah (Coppock and Birkenfeld, 1999), ecologically sound management practices were found in individuals who had higher level of ranch income. Several hobbyists with less than 50% of their ranch income from non-livestock sources were found to use less-ecologically sound practices. We may discover the property right orientations of these strata of landowners in our analysis.

CHAPTER III

RESPONDENTS CHARACTERISTICS

Introduction

Property rights debates are gaining awareness in the public consciousness for the past few decades. Several legal constraints affecting the management of the land, high estate taxes, and the reduced profitability of agricultural/ranching operations have led to the changes in the property rights orientations of many landowners (Jackson-Smith et al., 2004). Theoretical literature has pointed out that landowners have tended to become more conscious of their individual rights as a result of these increasing pressures. In addition, the increase in public concern over environmental degradation issues has translated to increased awareness among ranchers about the environmental effects of their management practices. This gave rise to complexity of property rights orientations among landowners (Jackson-Smith et al. 2004). In addition, increase in non-resident (absentee) property ownership, urban to rural migration and extended economic depression in many rural areas have also influenced the property rights orientations and thereby the decision-making foci of landowners (Cromartie and Wardell, 1999). Such shifts in landowner perceptions influence the decisions they make about the use of their land, investment in land improvement and acquiring or sale of land.

Methods

Texas has a thriving livestock industry. The ranchers however had started to explore the wildlife and recreational opportunities. Most of the Texas rangelands are privately owned (94%), thus differentiating them from the rangelands in Western United

States of Utah (2/3rd public land) and Colorado (Holechek et al., 2001). Based on the population census of 2000, one below average population growth and one above average population growth county were selected for the study. The counties chosen were: Sutton (low growth) and Llano (high growth) in Texas; Uintah (low growth) and Summit (high growth) in Utah and Routt (low growth) and Moffat (high growth) in Colorado.

The survey of landowners in Texas, Utah and Colorado was conducted using a structured interview protocol. In the initial phase, selected landowners from Texas (14) and Utah (15) were contacted and interviewed to identify major issues concerning their land management practices and private property right orientations. Several issues were identified. This information along with information obtained from previous literature was used to develop a mail survey questionnaire.

Once the initial questionnaire was drafted the applicability of the issues that were identified and the clarity of the questionnaire were tested. The draft questionnaire was tested on 14 selected landowners in Texas and 15 selected landowners in Utah. This selection included landowners whose primary income came from ranching and farming or non-land related activities. Major topics covered were characteristics of land, perceptions about rights and responsibilities of landowners, past and future changes in land-management practices and landowners' socio-democratic information. Using responses and comments obtained from the pre-survey test, the questionnaire was revised.

Next, landowners' names were obtained from each county tax assessors' office. All landowners who had less than 100 acres of agricultural land in 2001 were eliminated

from the list. Landowners with more than 100 acres were made due to the probability of them having some sort of profit derived from operation being higher. A total of 250 landowners were then randomly selected from the remaining landowners in each county to be included in the mailing list

Once the survey sample was selected, the four-step mail-survey procedure developed by Dillman (2000) was used to administer this survey. The steps include:

1. Day 1- Initial mailing of the survey questionnaire and cover letter explaining the purpose of the survey.
2. Day 10- Mailing of remainder/thank-you cards to all survey non-respondents.
3. Day 24- Mailing of replacement questionnaire with cover letter urging them to respond as soon as possible.
4. Day 34- Mailing of the final remainder card to non-respondents.

Response Rates

The survey sample used for analysis was restricted to landowners with at least 100 acres of land and who had productive ranch/farm/enterprises. From the original sample size of 250 landowners, some respondents were rejected because they reported that they reported either that they owned less than 100 acres or they did not have ranching or farming enterprises or have land allocated for wildlife and recreational activities. The final survey sample and response rates are included in Table 1.

Table 1: Response Rate Tabulation across counties surveyed in the analysis of property rights orientations

County	Original sample size	Disqualified	Disqualification rate (%)	Adjusted sample size	Qualified respondents	Adjusted response rate (%)
Llano	250	115	46	135	85	63
Sutton	250	107	43	143	88	62
Texas	500	222	44	278	173	62
Uintah	250	63	38	187	89	48
Summit	250	152	76	102	44	43
Utah	500	215	43	289	133	46
Colorado*	500	-	-	-	-	51

* Colorado survey was conducted by members of Dept. of Sociology, Colorado State University and disaggregate response rates were not available.

An average response rate of the 51% was observed in the Colorado counties. The average response rate across counties was 53%. The high rate of disqualification (43%) was mainly due to a high proportion of respondents landowners who owned more than 100 acres of land did not have any commercial farming/ranching activities, neither did they have any substantial wildlife income, even though their land was classified as agricultural land.

In addition, due to the high disqualification rate we conducted a post survey contact with randomly selected twenty non respondents from the four counties in Texas and Utah in October and November 2002 to ensure that response rate was representative of the survey population in each county. Out of the 80 selected respondents from the unanswered pool, contact was established with 64 respondents. Twenty five respondents refused to answer the questions. Out of the 39 respondents, who were ready to answer

question, 21 were ineligible. Most commonly occurring ineligibility factor was the absence of more than 100 acres of land.

A cross tabular analysis was conducted in SPSS to identify the qualities that are unique to each county in these three states. The results are represented in the following way: First, the results are explained followed by a graphical representation of the results. The corresponding numerical data is given in Appendix B, in table format. The table numbers in the Appendix B correspond to the figure numbers in the text.

Results

Respondent Characteristics

Age, Gender and Education of respondents. Mean age of ranchers in all the counties was 58.7 (Standard Error of Mean = 0.50). The greatest proportion (24.7%) of the respondents in 6 counties belonged to the age category groups 50 -59, with the age distribution in each case being slightly skewed to the right (75% > 50 years of age), i.e. there was a larger presence of older landowners in the response to the survey (Figure 1).

This skewed distribution was most pronounced in Llano County, where are very few people who are below the age of 40 possibly due to its proximity to Austin, and most people who own the property are older non-resident ranchers who own ranch as a weekend getaway.

An overwhelming majority of respondents were male, except in Llano County, where more than 32% of the respondents were female (Figure 2). This might suggest an increased role of females in decision making in the ranching near urban areas. Comparing respondent gender distribution across states we found that at least 25% of the

respondents in Texas, 20% respondents in Utah and 25% respondents in Colorado are female.

Considering education, on average, the greatest proportion of survey respondents were high school graduates followed by 4 year college graduates. The highest proportion of respondents with graduate degrees occurred in Llano County, Texas (33%), while Sutton County had the highest proportion of respondents with 4-year college degrees (Figure 3). This higher level of respondents in Texas with a university degree may be due to the relatively close proximity of Austin, where many professionals with University degrees live and work and may own a rural weekend property. In Utah, the highest proportion of respondents in Uintah County belonged to having a high school diploma category, while the education level of respondents in Summit County had a bimodal distribution, between high school diploma and graduate degree. This may indicate inward movement of more highly educated landowners to the county. In Colorado, Moffat County had highest proportion of respondents with high school diploma (37%), while Routt County had the highest proportion of respondents (31%) in the 4-year college category.

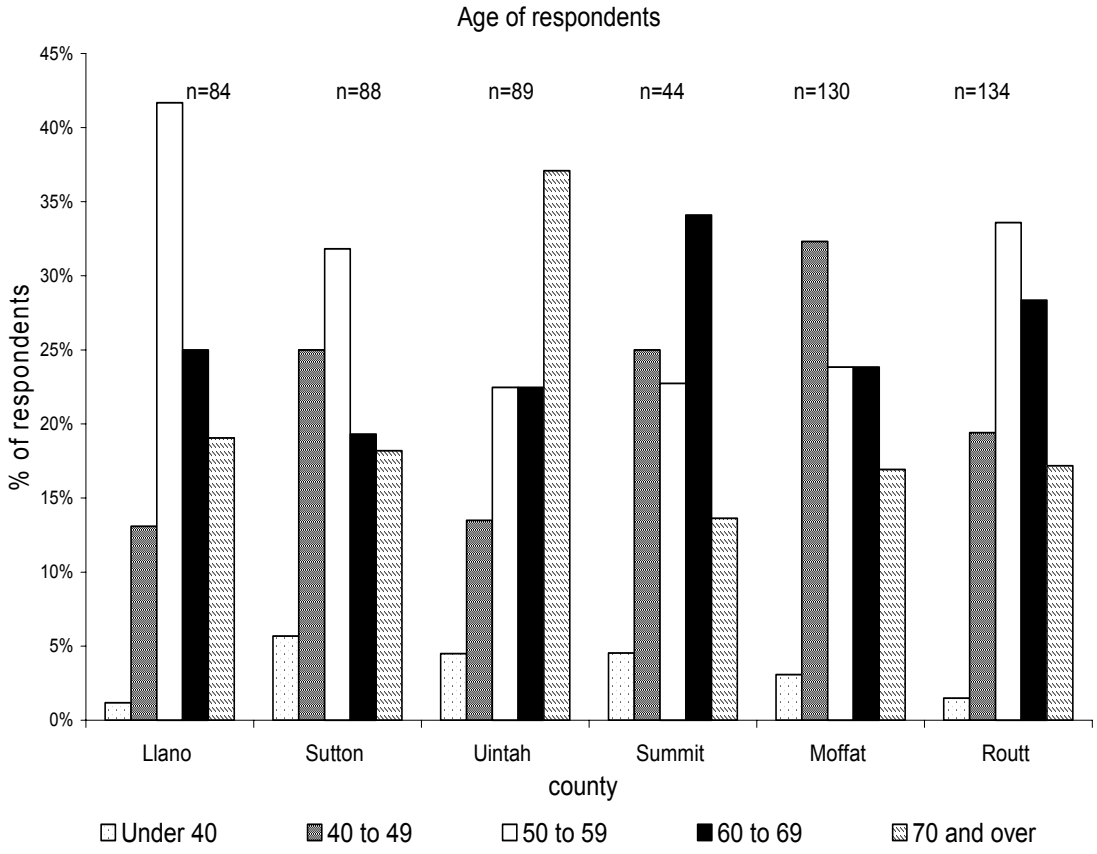


Figure 1: Percentage of respondents that classified according to their age

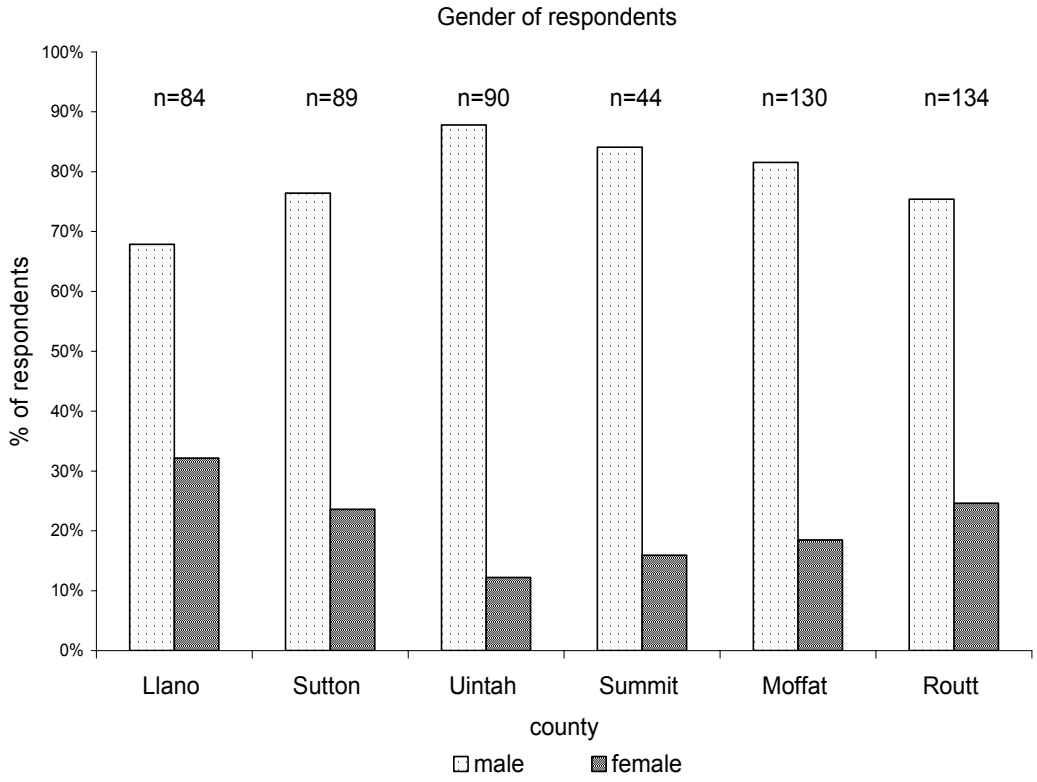


Figure 2: Percentage of respondents classified according to their gender

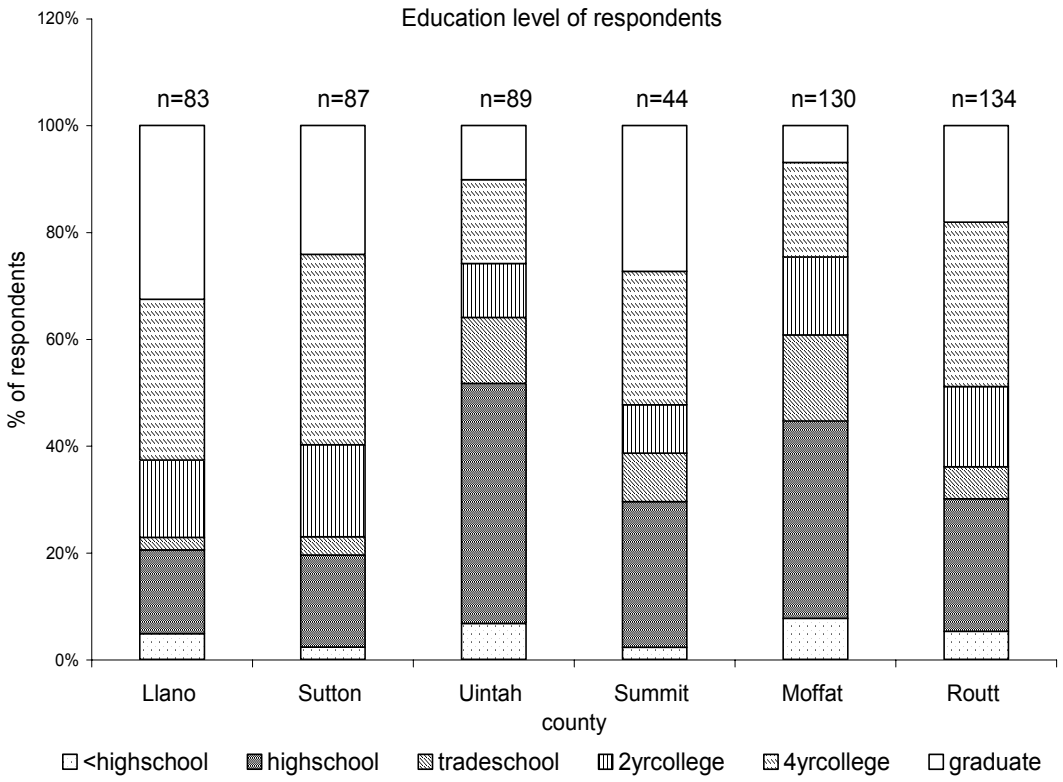


Figure 3: Percentage of respondents classified according to their level of formal education

Residency and Ownership. The Utah counties exhibited the greatest proportion of on property residency (79% and 59%) while the Colorado counties exhibited the greatest proportion of absentee ownership (72% and 68%). Texas respondents were equally distributed between on and off-farm residency (Figure 4). These patterns may be due to the fact that in Colorado and Texas, the counties surveyed are located near urban areas where more landowners may travel to their farms/ranches for weekend retreats. A large majority of respondents (70%) in the counties surveyed grew up on the ranch/farm (Figure 5). However it is interesting to not that 37% of people in Llano County and 32%

of people in Routt County did not grown up on the ranch or farm they currently own, which indicates a higher degree of change in ownership. For majority of ranchers surveyed (53%), the property they own has been in their family for more than one generation (Figure 6). The right skewed length of ownership distribution is consistent in all counties indicating a relatively slow turnover in property ownership in the counties included in the survey.

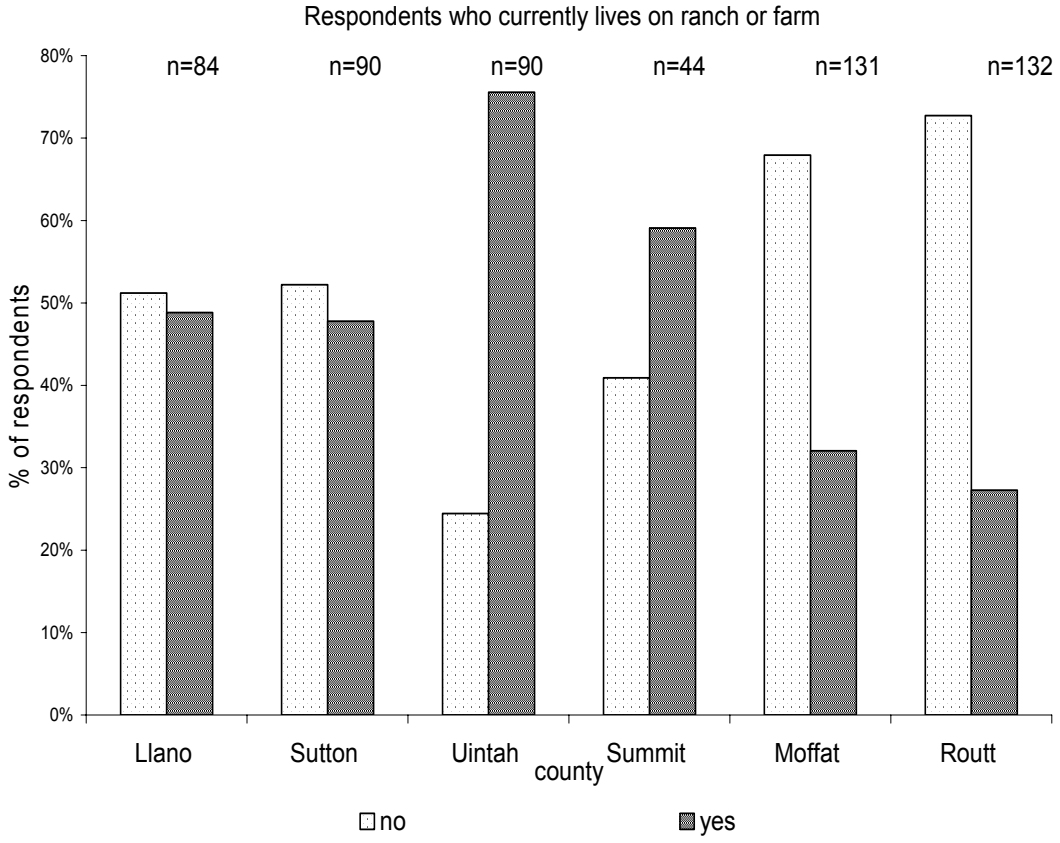


Figure 4: Percentage of respondents classified according to their residence status

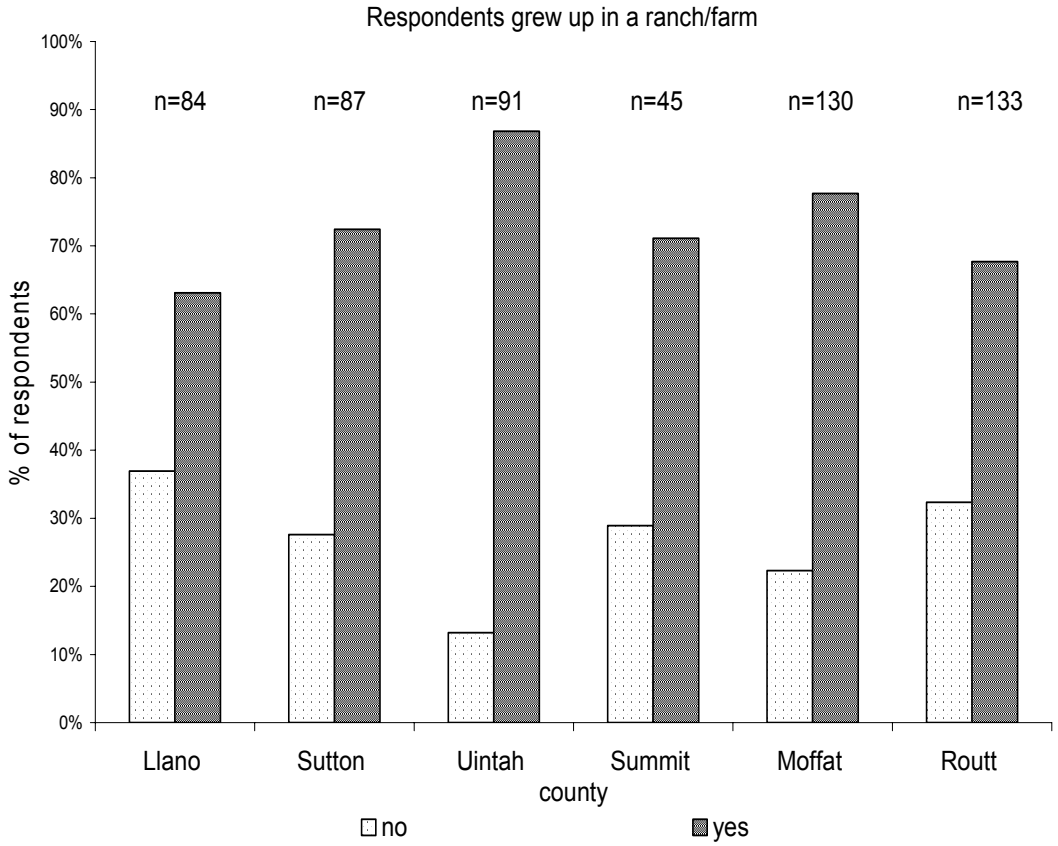


Figure 5: Percentage of residence classified according to them growing up in ranch/farm

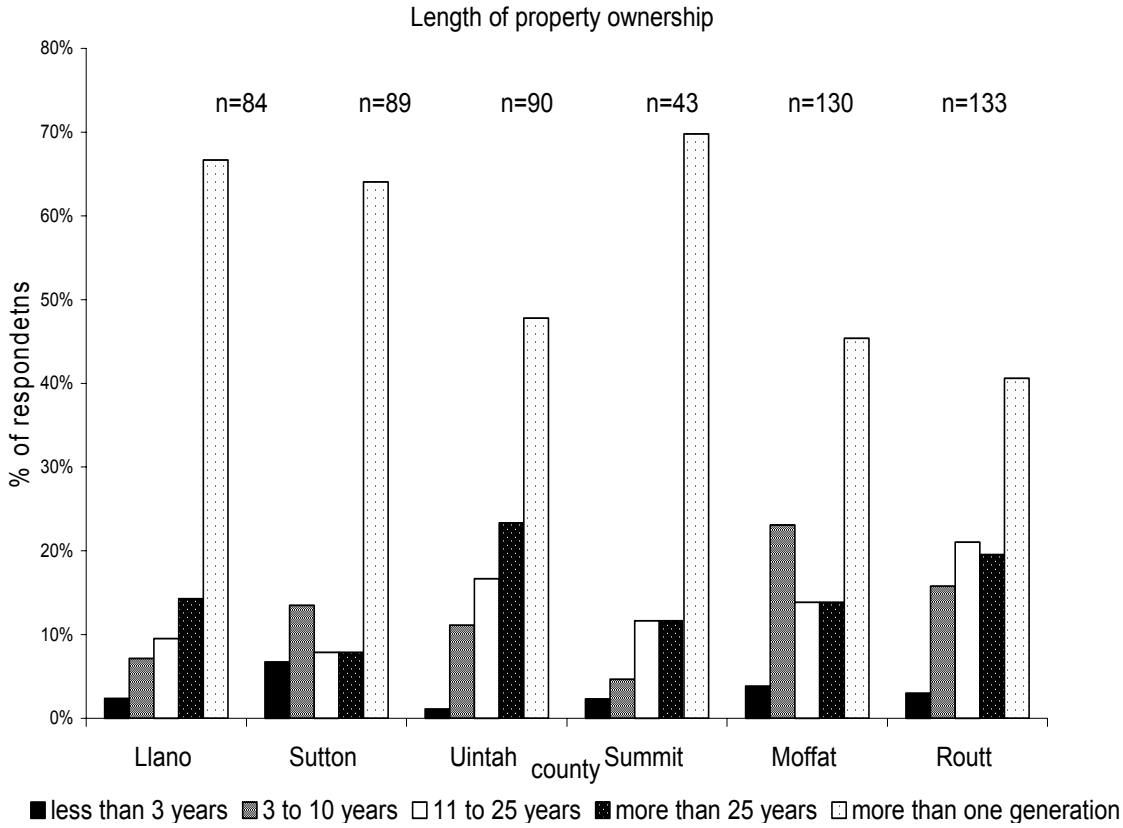


Figure 6: Percentage of respondents classified according to their length of property ownership

Household Total Income and Employment Patterns. The greatest proportion of respondents derived between $25,000 and $50,000 in income in 2001, (Figure 7) followed by the $100,000 to $500,000 income range (Figure 7). However this wealth distribution differed among the respondents with a majority earning more than $75K in both Texas counties while the majority of respondents in Utah and Colorado earned less than $75K and 46% earned less than $50K.

Only in Uintah County (Figure 8) did majority of the respondents depend on the ranch or farm solely for their livelihood, even though the size of the properties in Uintah County was not larger than the other counties. Thus the majority of respondents had some off-ranch /farm income. However, the ratio of farm income to total income of the household was left skewed. The majority of respondents in all the six counties surveyed earned <25% from their land (Figure 9). The highest dependence on farm/ranch income by respondents occurred in Routt County and the least in Llano County (33% and 12% earned more than 50% of total income from farm or ranch). In Moffat County, 20% of respondents belong to the category of higher than 75% of their income coming from ranching/ farming and in Routt County; more than 18% of respondents belong to that category. A similar lack of dependence on land-based income was reported by respondents in terms of profits in 2001. An overwhelming majority (60-75%) of respondents did not show profit in the year 2001 (Figure 10).

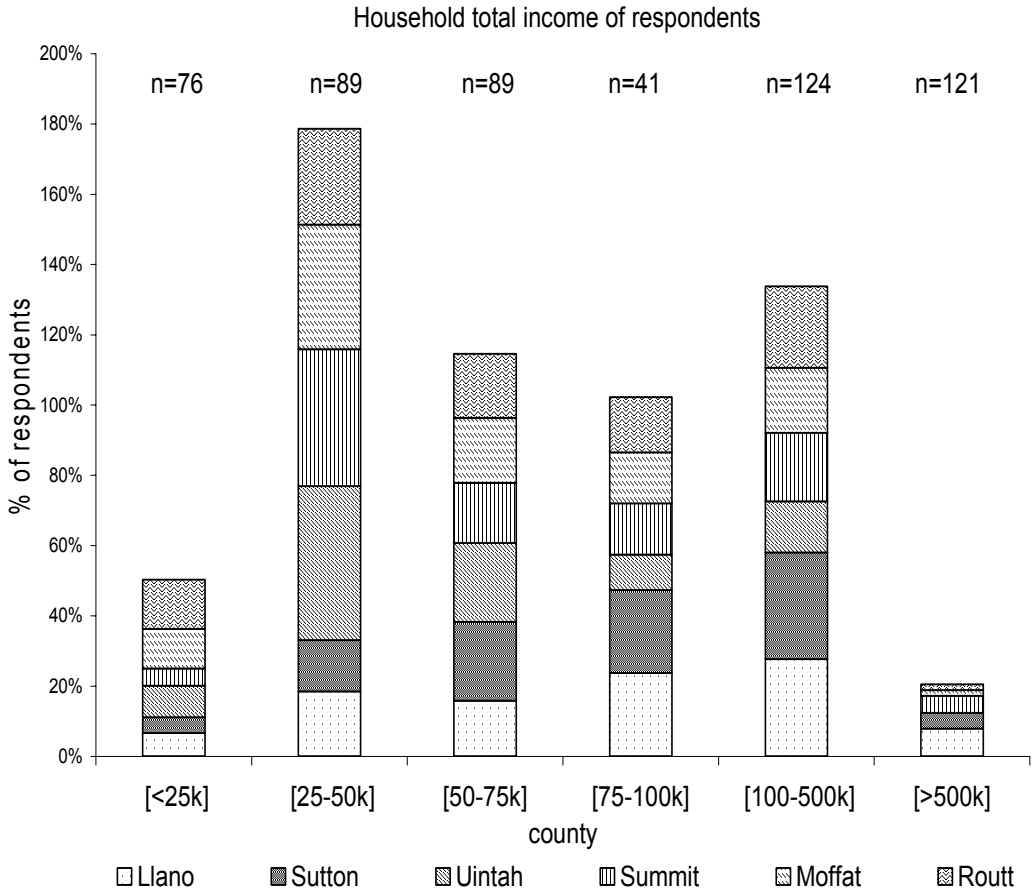


Figure 7: Percentage of respondents classified according to their total household income

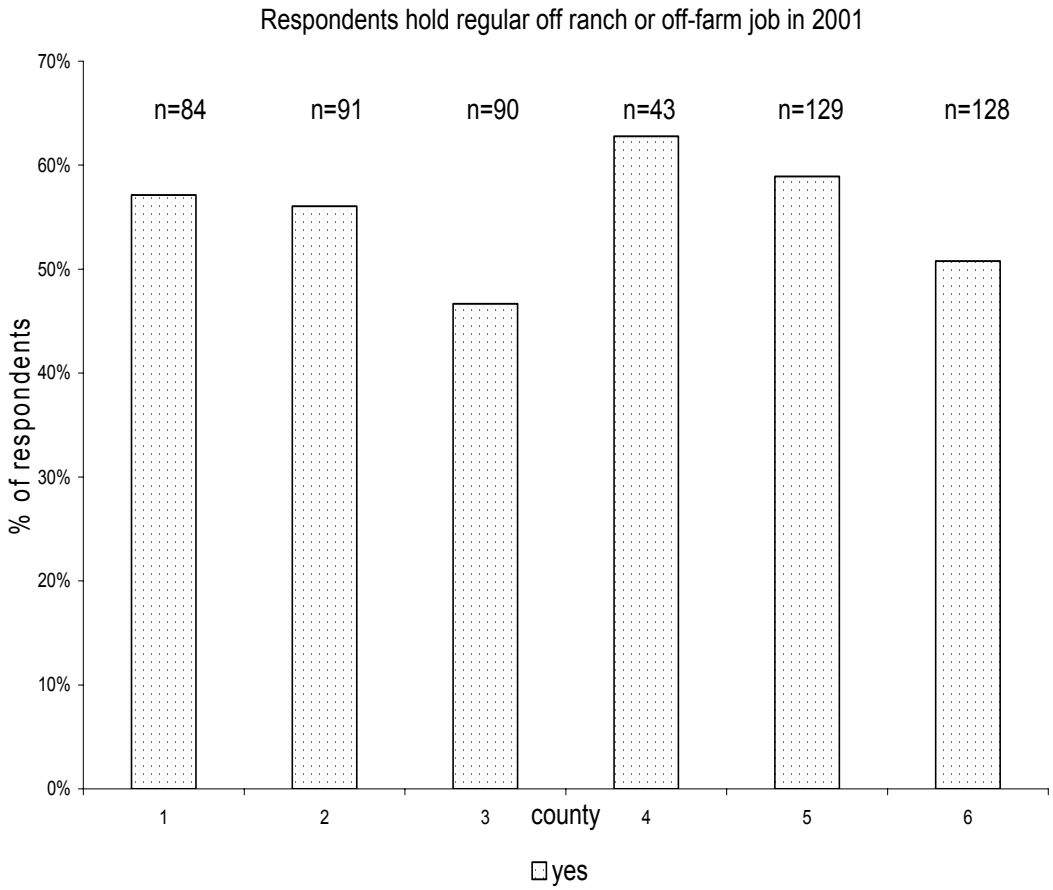


Figure 8: Percentage of respondents classified according to them holding a regular off-ranch or off-farm job

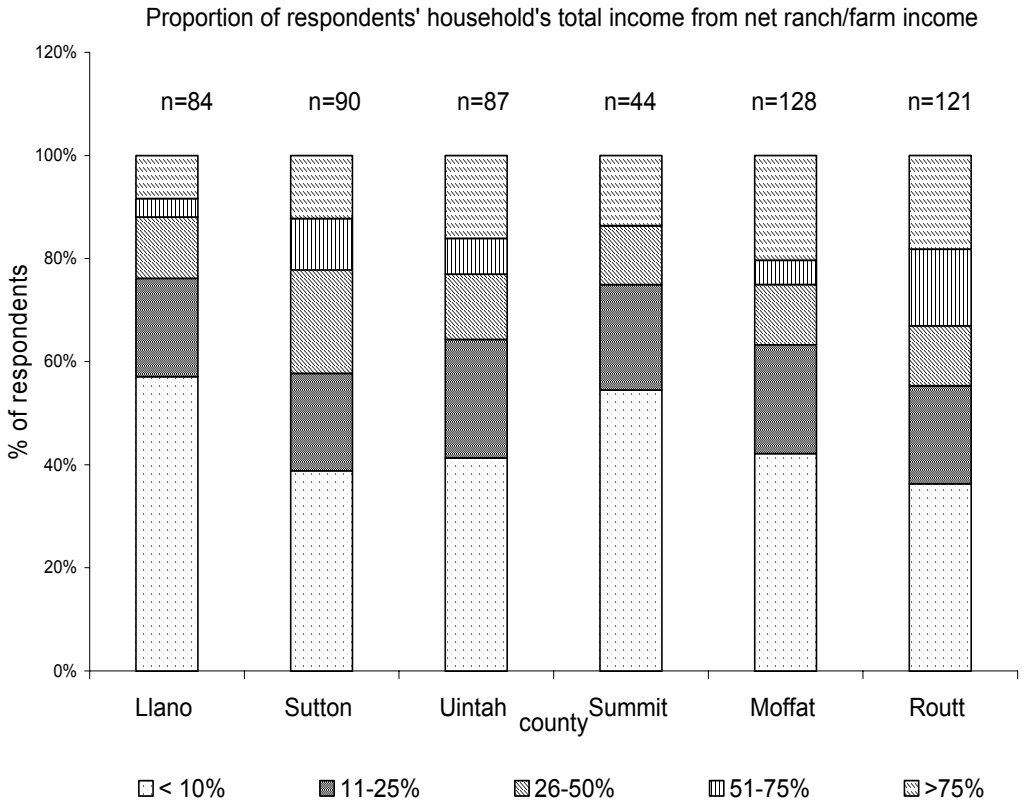


Figure 9: Percentage of respondents classified according to the proportion of their ranch/farm income to total income

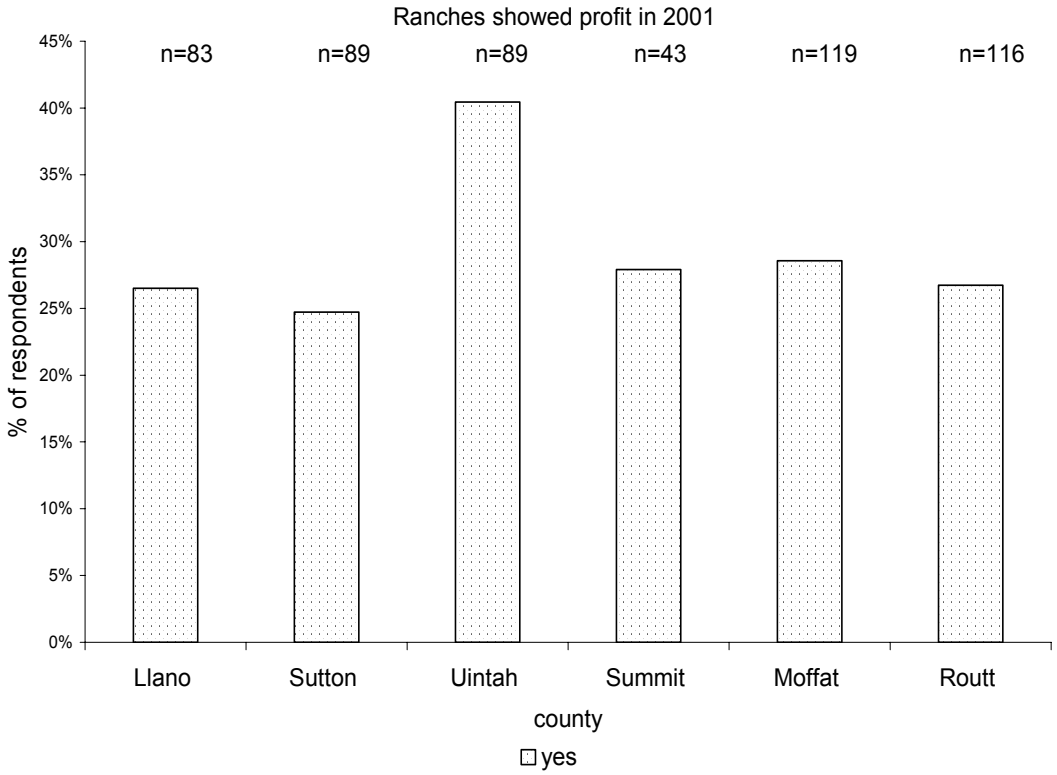


Figure 10: Percentage of ranches that showed a profit in 2001

Property Characteristics

Owned Acres. The highest percentage of respondents in the counties except Sutton and Summit has land below 400 acres (41% in Routt county, 39% in Moffat, 37% in Uintah, 26% in Summit and 10% in Sutton county) (Figure 11) and more than 50% of the respondents owned less than 1000 acres except in Sutton County where the majority of respondents' property sizes exceeded 2500 acres. The larger property sizes in Sutton County may be due to the more remote location or land consolidation of property by some respondents.

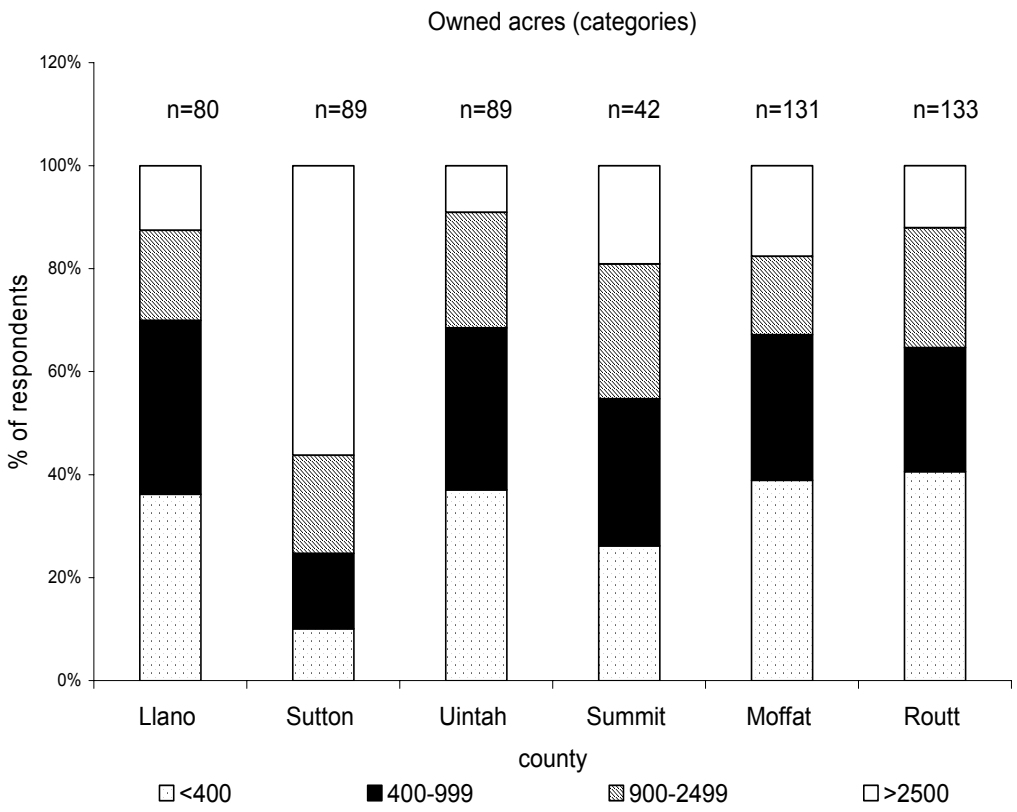


Figure 11: Percentage of respondents classified according to their property size

Type of operation.

a. Type of operation by activity. Overall, most of respondents reported their properties as exclusive livestock operation sector (Figure 12), followed by mixed crop and livestock operation, mixed crop, livestock and wildlife operation, crop cultivation operations. Primary/weekend residence and tourist operations occurred less frequently. Statewide differences included a greater proportion of livestock operations in Texas and a greater proportion of mixed crop and livestock operation in Utah. However, a high

percentage of Texas respondents were also seen to have mixed livestock and wildlife operation with Sutton County having an equal percentage of exclusive livestock operators and mixed wildlife and livestock operators. In Colorado, almost equal numbers of respondents owned exclusive livestock operators or were operating ranches with mixed crop and livestock operations.

b. Type of operation by income. By far the most common source of land-based income in all counties came from livestock (Figure 13). Almost 70% of the ranch income in Uintah respondents came from livestock sales, while more than 60% of the ranch income in Llano and Summit County was derived from livestock sales. The next highest contribution to a respondents' income was native game hunting fees in Texas (Sutton =30% and Llano = 23%) and Crop Sales income in Colorado and Utah (18-27%). Other sources of income such as minerals and government programs contributed little to total land-based income, except in Sutton County, where mineral sales contribute 15% ranch income.

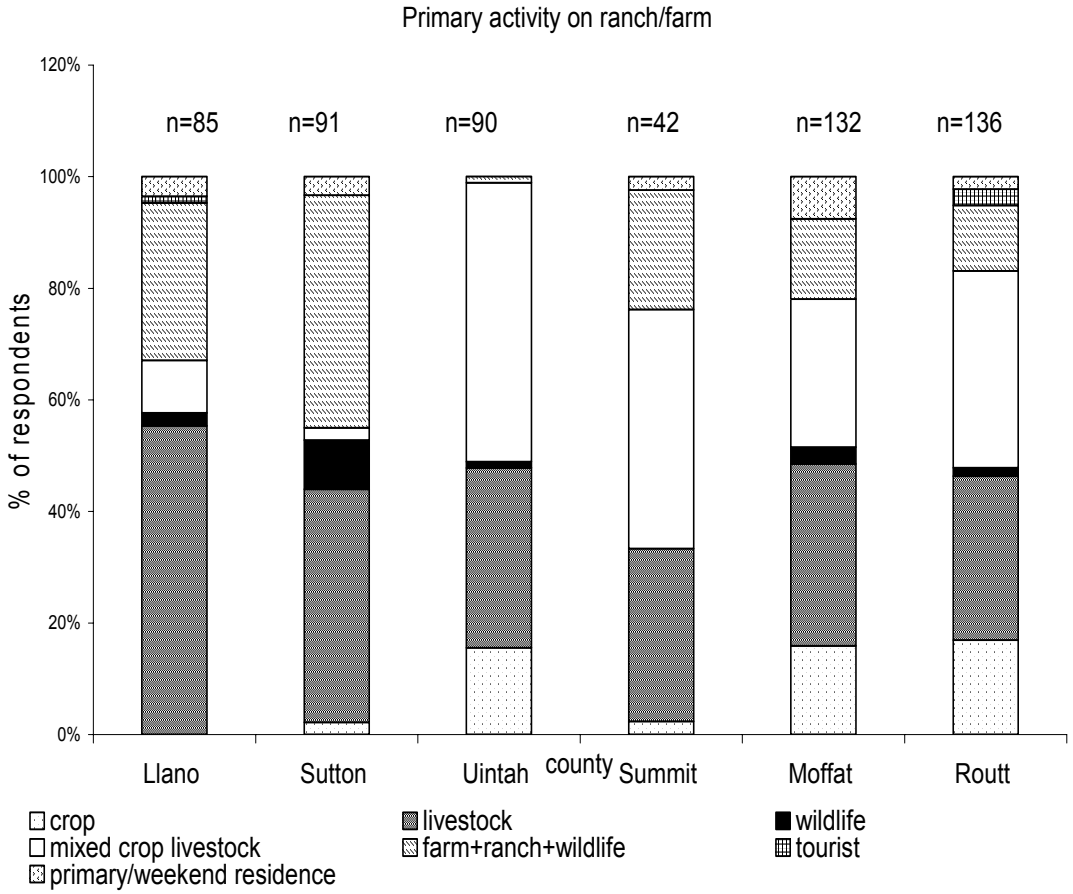


Figure 12: Percentage of respondents classified according to the primary activity undertaken in their property

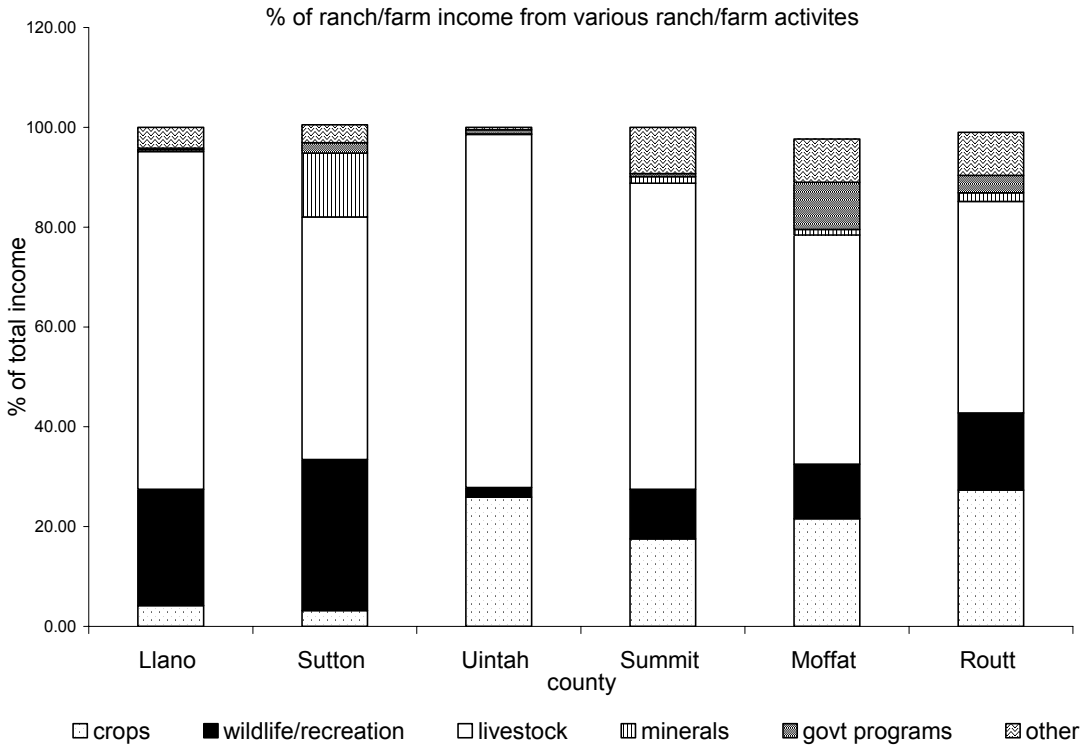


Figure 13: Respondents classified according to the mean percentage contribution to ranch/farm income by various farm/ranch activities

Hunting and Recreational Activities. The provision of free and fee-based access for hunting and recreation was assessed only in Texas and Utah. High percentages of respondents in the Texas counties provide fee based hunting access on their land (Figure 14), 75% in Sutton and 50% in Llano, while only 25% of respondents in the two Utah counties provided fee-based hunting access on their land. Conversely, free family access for hunting was much higher in Utah than in Texas with almost 96% of Uintah County respondents and 78% of the respondents in Summit County reporting free family access, compared to 50% of the respondents in Sutton County and 65% of respondents in Llano

County offered free access to family for hunting. In addition, almost 1/4th of the respondents in Utah also offered free public access, compared with almost no free public access in Texas indicating a much higher level of privacy tendencies in Texas, a private land state, compared to Utah with large areas of public land.

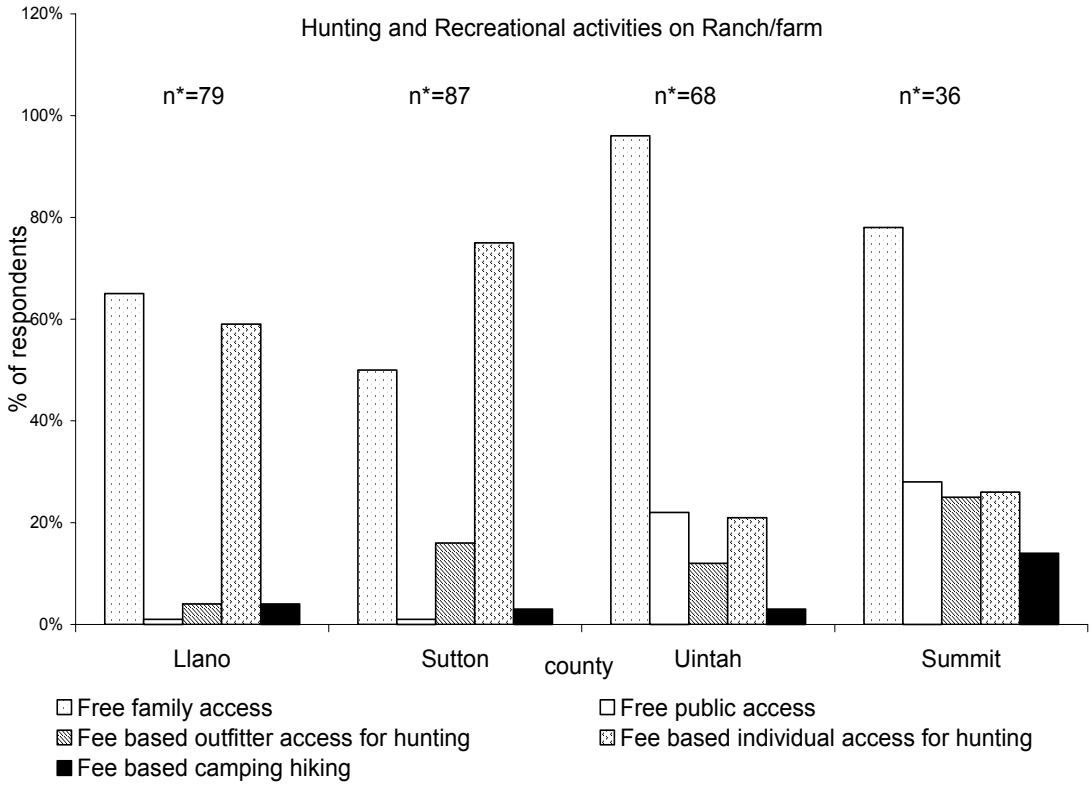


Figure 14: Respondents classified according to various hunting and recreational activities conducted in their ranch

Forage Contribution from Different Sources. By far, the dominant source of forage resources was owned land, majority of respondents graze in their own rangeland (Figure 15), while respondents on average depend upon leased land for 10% of their forage requirements. In Utah and Colorado counties, where there is presence of large quantities of public land, respondents also derived forage resources from federal lands (6.26%) and state owned lands (2.23%).

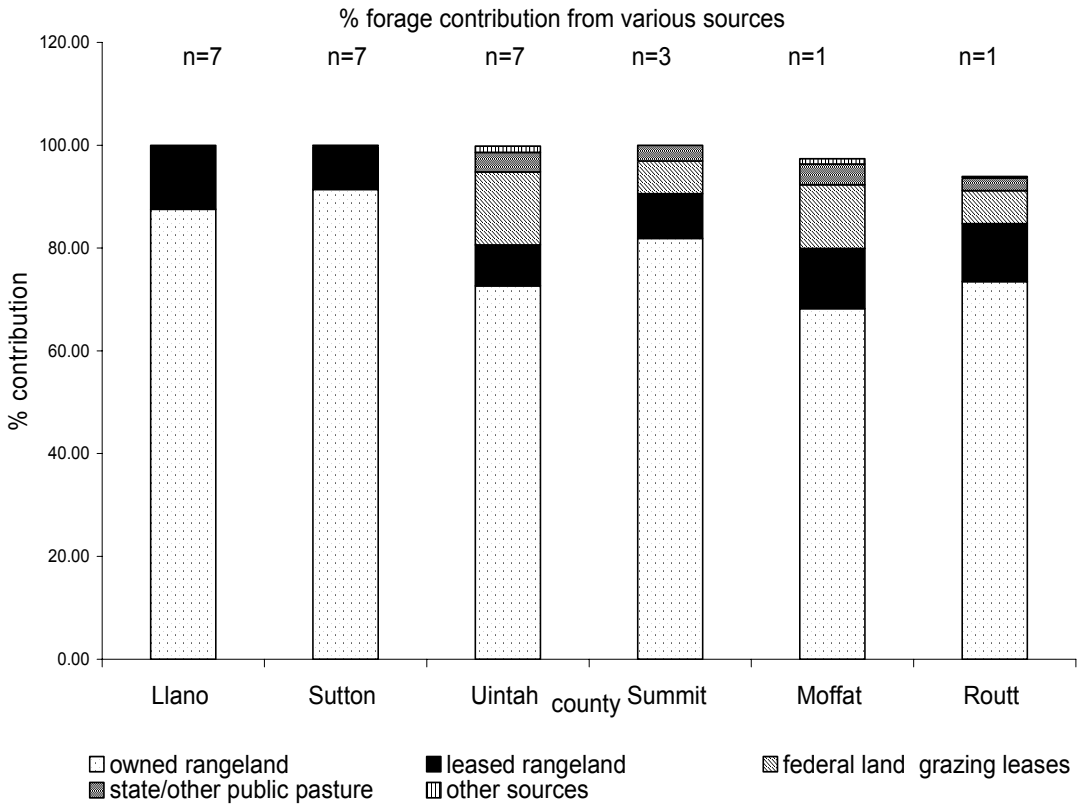


Figure 15: Percentage of forage contribution to respondents by different sources in each county

Labor Provided by Family. Overall, respondents reported that majority of labor used on the land is provided by the family (Figure 16). However labor supply patterns differed among states. In Texas, where large properties occurred, more than 65% ranches were dependent for at least some of the labor upon outside sources, while Colorado respondents depend least upon outside labor. The higher dependence on outside labor by respondents in Texas may be due to the availability of immigrant labor.

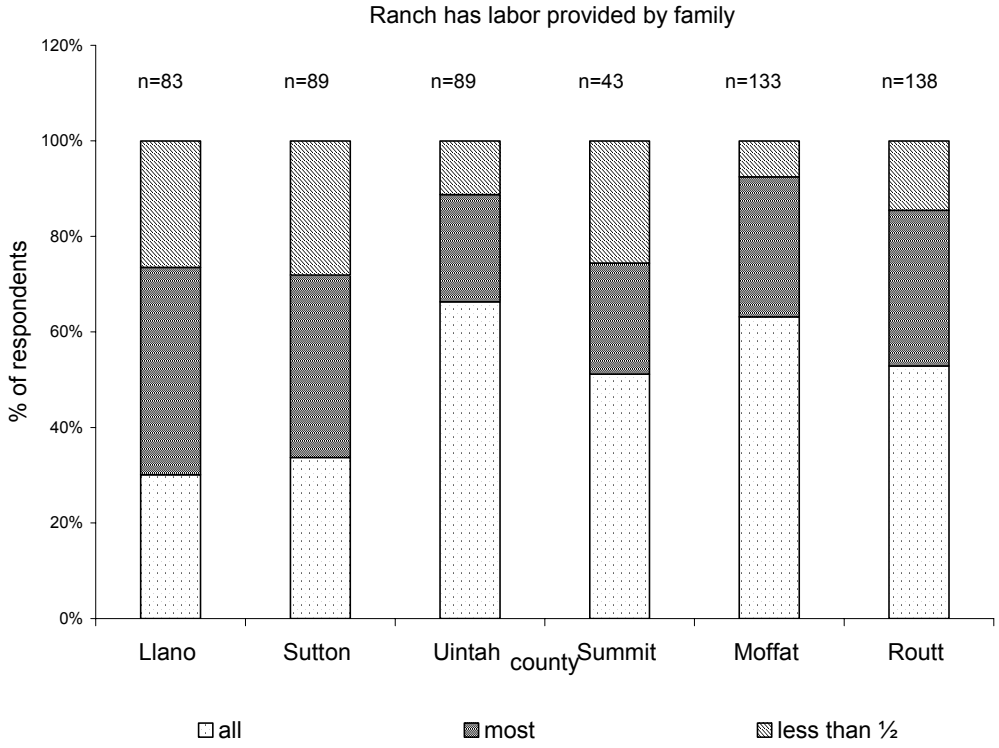


Figure 16: Percentage of respondents classified according to the amount of labor provided by the family

Land Management Activities

Grazing Management. On average, around 73% of the respondents monitor grazing effects on their ranch with relatively little variation (Figure 17). The majority of respondents (80%) across all the counties adjusted stocking rates to suit the availability of forage while 67% of respondents practiced some form of rotational grazing. A higher percentage of respondents practiced rotational grazing in Colorado and Utah than in Texas. A wider variation was found in the provision of water points. More Texas respondents provided evenly distributed water points for livestock compared to Colorado and especially Utah, where only about 25% and 18% respectively used this tool for distributing livestock. On average, 67% of respondents across three states surveyed provided supplemental licks for their livestock and around a quarter of the respondents restricted livestock to riparian areas of their property, though less so in Texas counties than on Utah and Colorado.

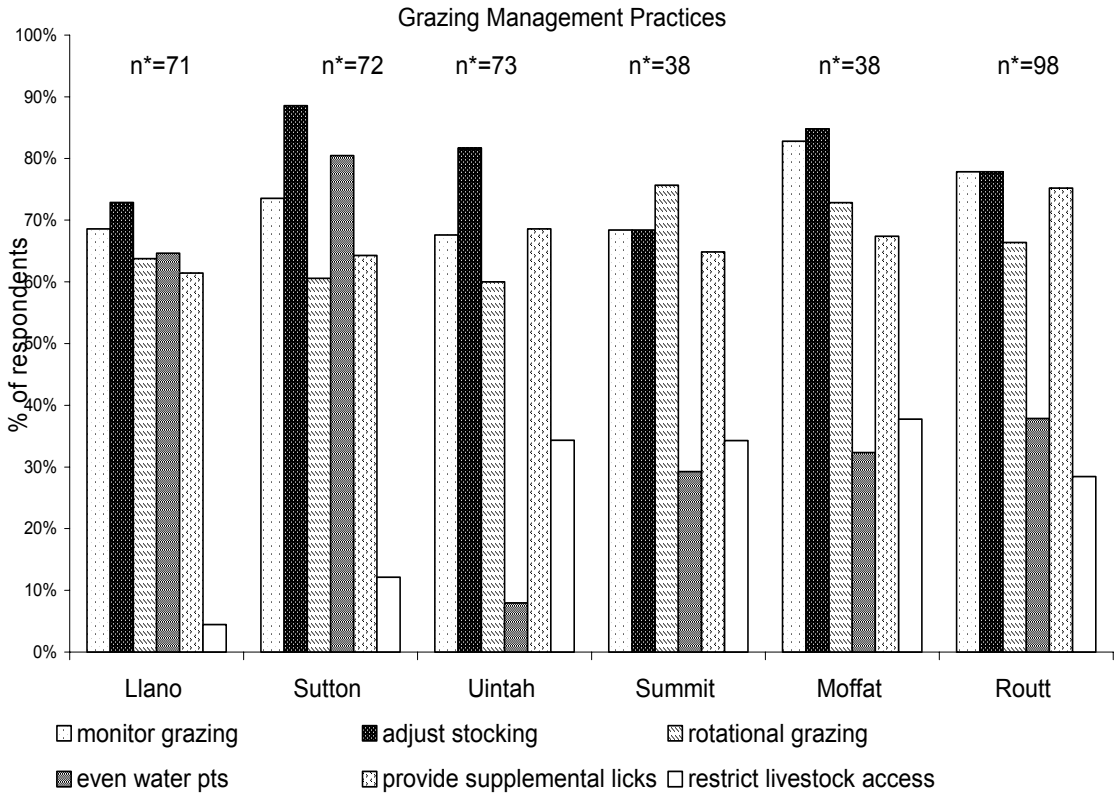


Figure 17: Percentage of respondents conducting various grazing management practice

Brush Management Activities. Only respondents in Texas & Utah counties were questioned about the brush (woody plant) management practices (Figure 18). Overall, targeted mechanical control was the most popular by brush management technique used, but this was used much more by the respondents in Texas (88%) than Utah (43%). Most of the brush management practices are adapted to a greater degree by respondents in Texas than in Utah except for blanketed fire management, mechanical and herbicide management. In Utah ranches, more respondents utilized fire management and herbicide management (57%, 45%). Follow up treatments was conducted more in Utah ranches.

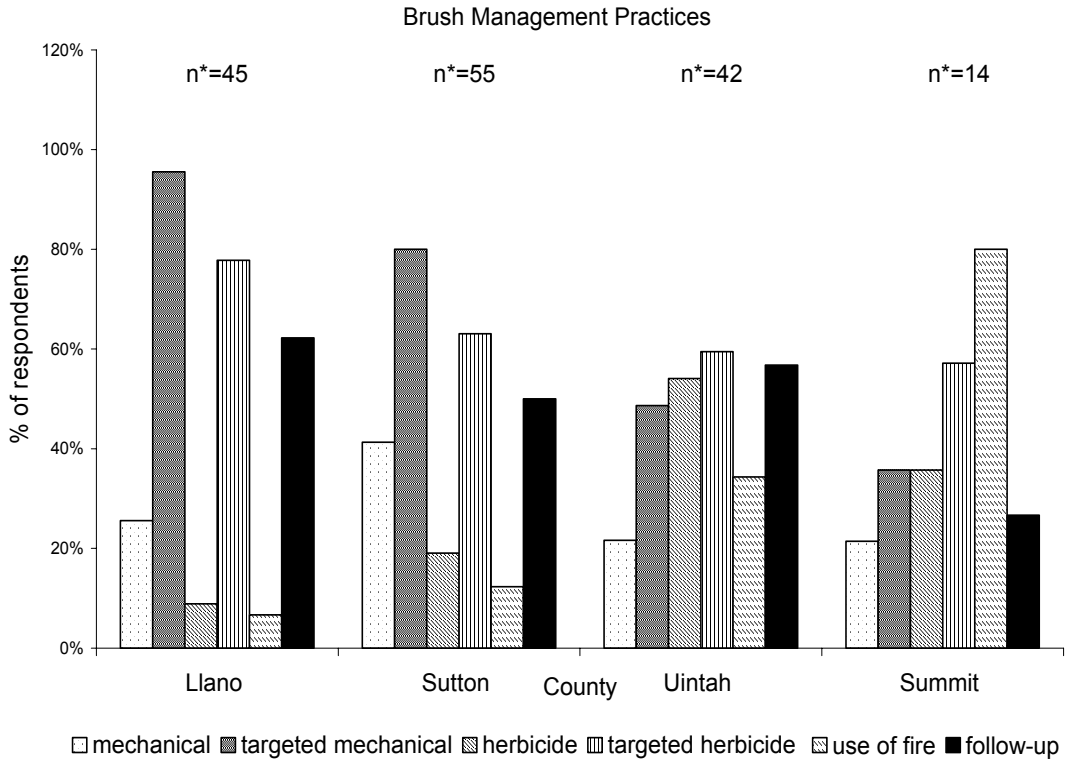


Figure 18: Percentage of landowners classified according to the various brush management activities conducted in their ranch or farm

Wildlife Management Activities. Overall, Texas counties lead in the use of most wildlife management practices except for high fencing (Figure 19). The least adopted practice by all ranchers in all the counties is importing new breeding stock, while the most adopted is supplemental feeding. The innovative nature of Texas respondents is not surprising since their proportional contribution of wildlife to their total income.

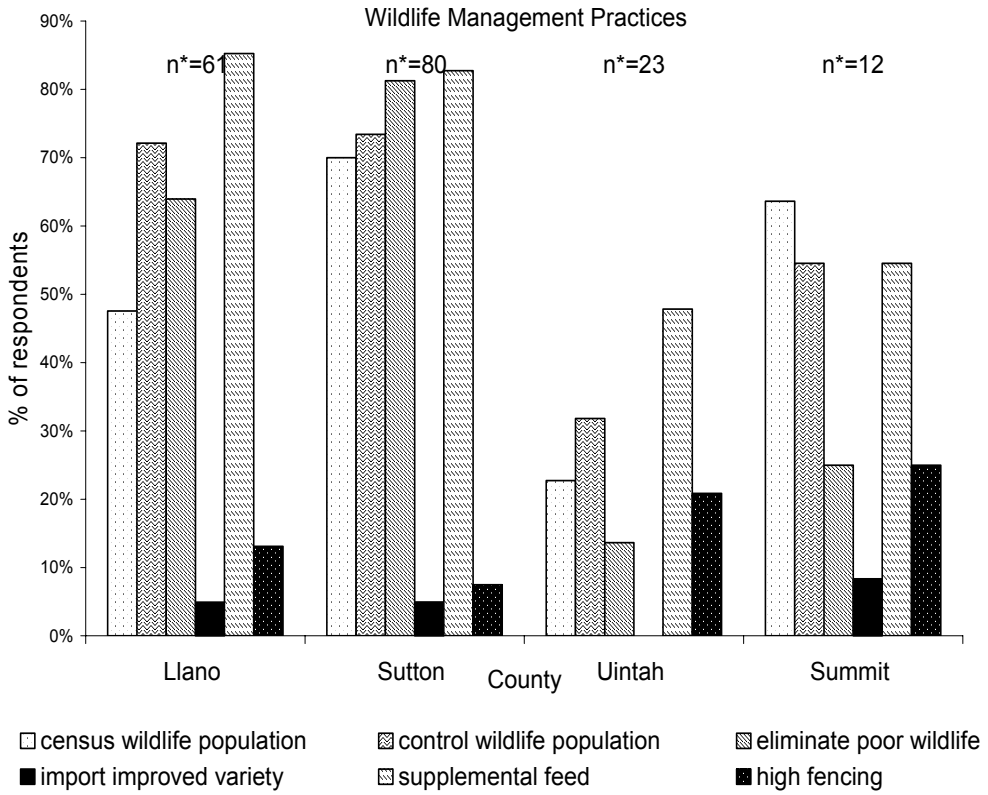


Figure 19: Percentage of respondents classified according to the various wildlife management activities conducted in their ranch/farm

Crop Management Activities. Very few of the respondents in Texas have crop cultivation (Figure 20). Overall, the least adopted cropping practice was limiting irrigation to critical stages of growth (27%) and the most adopted practice (46%) was crop rotation.

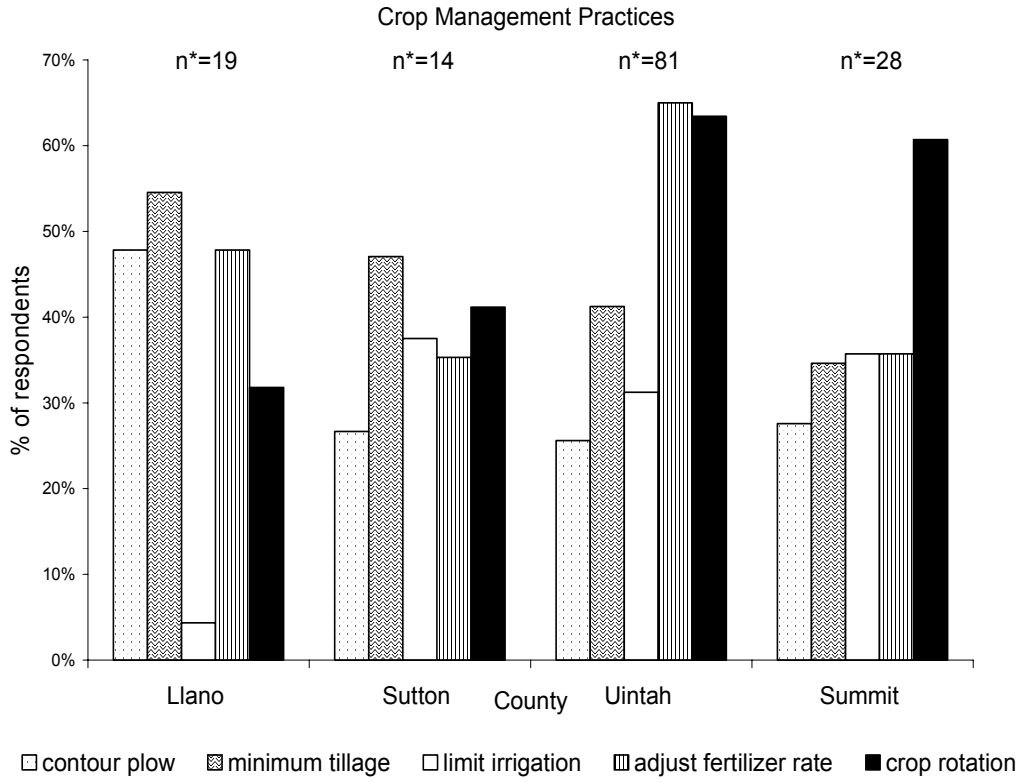


Figure 20: Percentage of respondents classified according to the various crop management activities conducted in their ranch/farm

Rights and Responsibilities

Rights and Responsibilities Regarding the Use of Private Land. Survey respondents were asked several questions about their perspectives about various aspects of property rights. Survey participants were asked to respond based on a seven point scale ranging from -3 (strongly disagree) to + 3 (strongly agree).

Mean response values and the standard error are provided below:

Responses regarding rights of landowners show a positive orientation towards individual rights attributed (Figure 21) especially with respect to right to exclude others from

access to land, transfer ownership of land without restriction, and exclusive use of natural resources on the land. However respondents tended to agree to a slightly lesser degree to the right to do anything on the land as long as it did not infringe upon the rights of others or the local community, and especially to the idea that, "Owner rights include right to do whatever I want". Very tight confidence levels and low standard error indicate the absence of variability in the responses.

A greater degree of variation was observed in the responses to the statements about the landowner responsibilities (Figure 22). While respondents tended to agree with the statements that they need to be good stewards and to leave the land in better shape than when they acquired it, on average, their response to the statement that landowner rights obligated them to take into account the values of the society at large was neutral. Conversely, the respondents disagreed with the statement that property rights placed no obligations upon them as landowners.

Respondents tended to agree with statements that well-defined property rights lead to increase in good land stewardship, respect for one's neighbors and other people),increased investment on land, better relationships and interactions among people (Figure 23). Their level of agreement although positive, was significantly lower for the suggestion that well defined property rights lead to more sustainable use of natural resources in land and landowner interest in broader public concerns.

Respondents tend to strongly agree with the statement that lessee rights should be limited to the rights of access and rights specified in the lease (Figure 24). They also tend to agree, albeit to a slightly lesser extend that landowner rights should supercede

lessee rights and lessee assume more rights than owners intend to give them. They also agree to the statement that owner should be able to determine the stocking rates or the number of animals shot in their land.

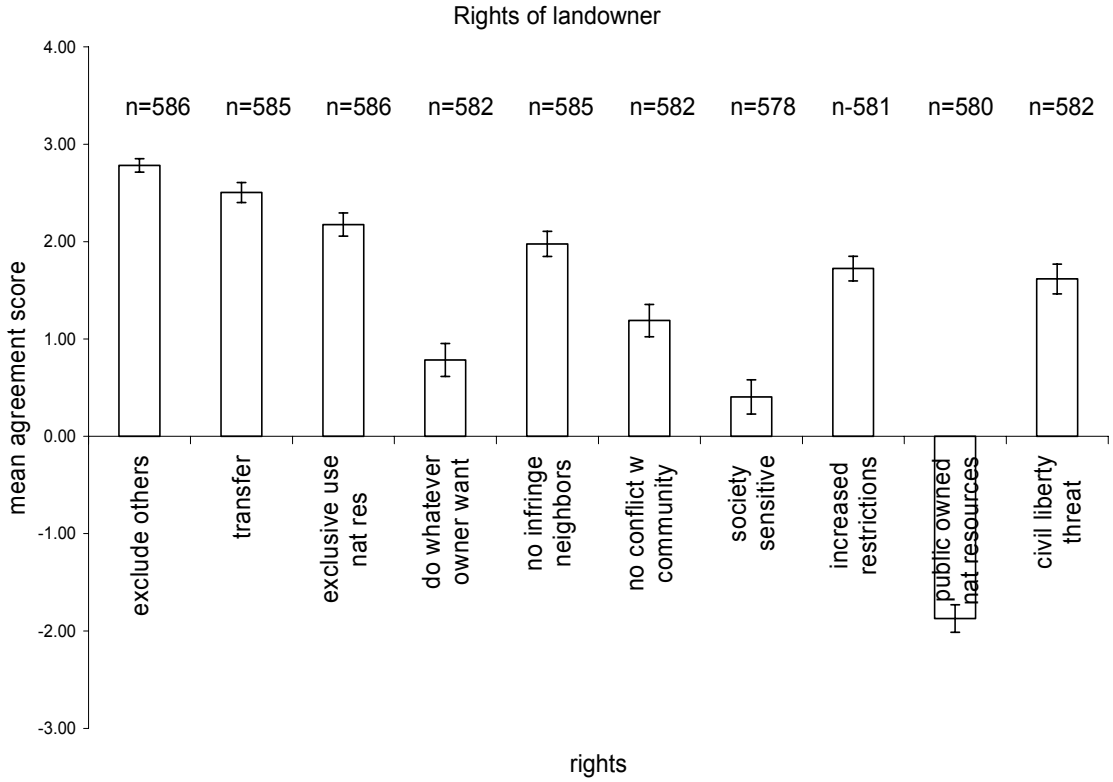


Figure 21: Mean score of respondent opinion about rights of landowners

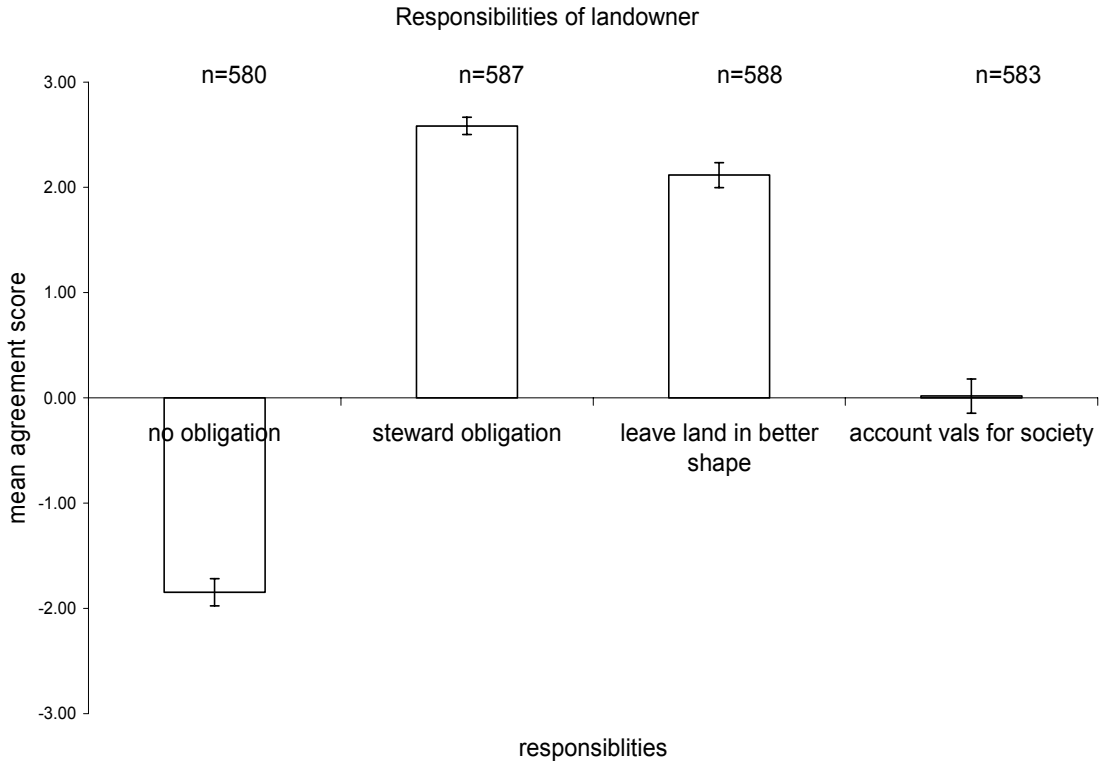


Figure 22: Mean score of respondent opinion about responsibilities of landowner

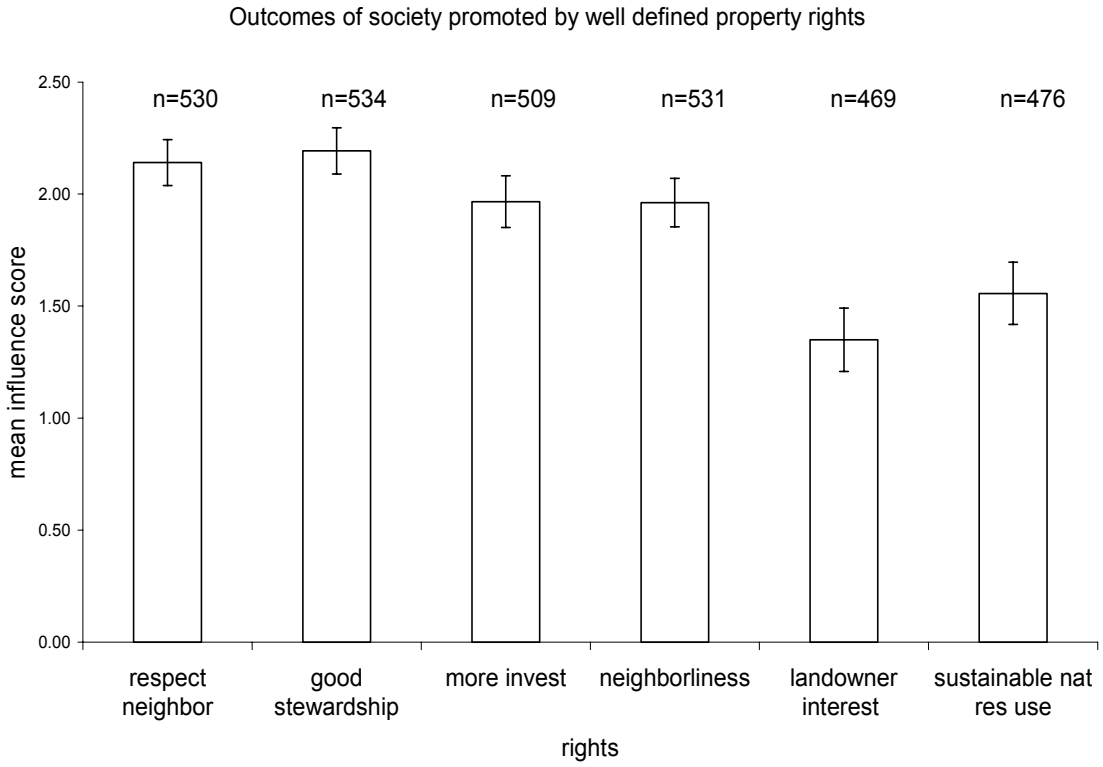


Figure 23: Mean score of respondent opinion about well defined property rights

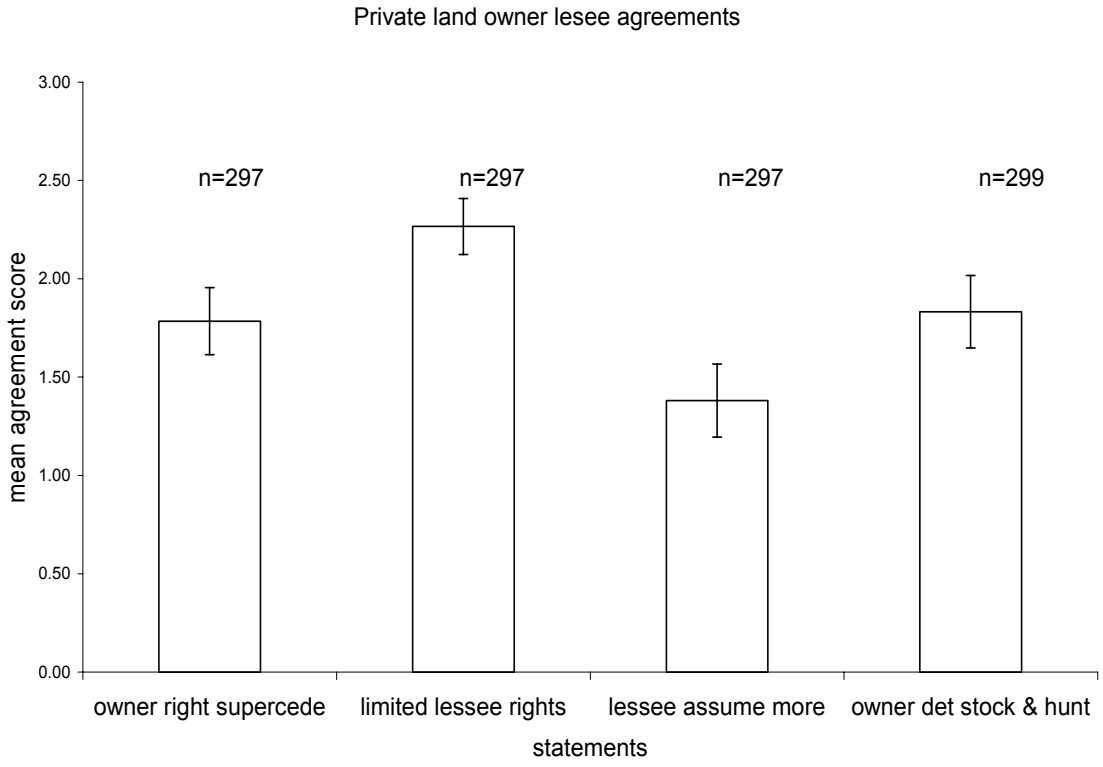


Figure 24: Mean respondent opinion about private land lease agreements

Implementation of Management Practices

Survey participants were asked to respond to a set of statements regarding the implementation of environmentally oriented management practices either voluntarily or not and without compensation. On average, respondents tended to agree most strongly with the idea of having to protect quality and supply of water for downstream users and for use in their own land without being compensated. They also agreed to a lesser extend with the statements regarding the requirement to control noxious weeds and protect wetland and riparian areas without compensation (Figure 25). They tended to

slightly disagree about protect habitat for threatened and endangered species without compensation. They tended to strongly disagree about providing access to the land for hunting of native species. However, respondents are in support of protecting the quality and supply of water for downstream users and protecting the quality and supply of the water used in their own land.

Not surprisingly, responses to the statement regarding management practices undertaken without compensation were more positive than when compensation is provided (Figure 26). However, they still tended to disagree with statements that they are required to provide habitat for endangered species and provide free public access to own land for hunting.

Respondents reported even more willingness to undertake management practices with compensation if they are voluntary rather than enforced. In comparison to the previous set of statements, they tend to agree to a greater degree about controlling noxious weeds, protecting the quality and supplies of water and protecting wetland and riparian areas (Figure 27). In addition they were somewhat willing to provide habitat for endangered species but still unwilling to provide free public access to their land for hunting.

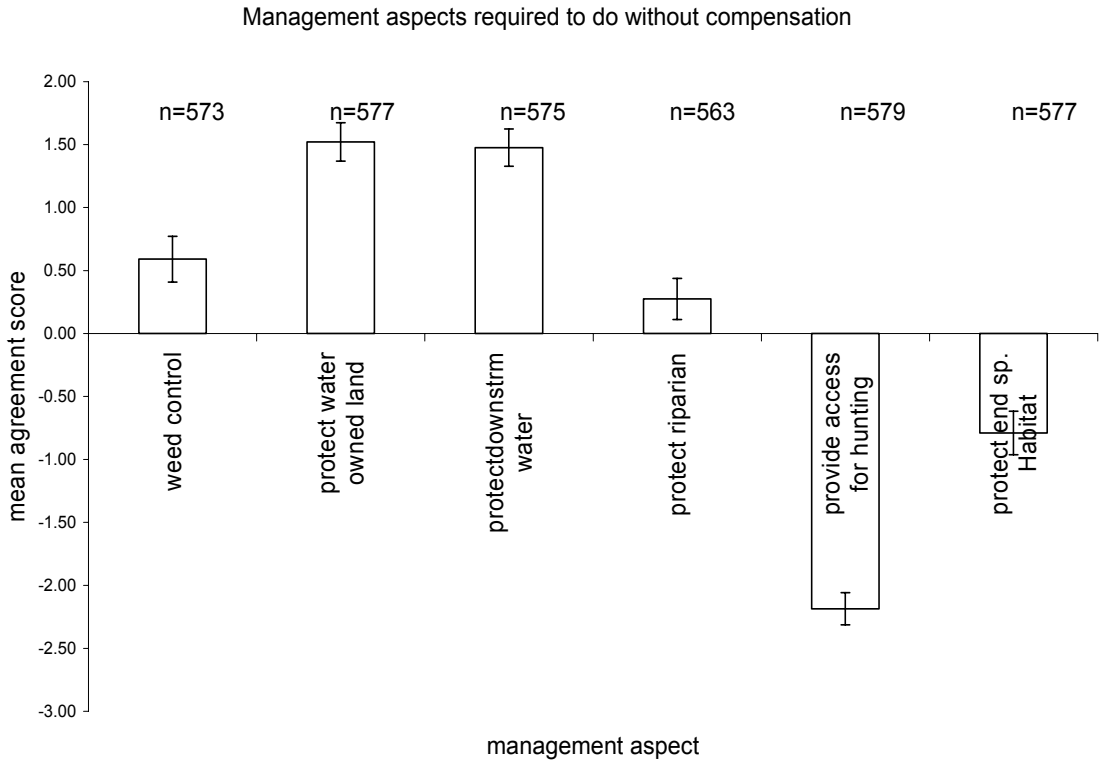


Figure 25: Mean score of respondent opinion about management practices required to be undertaken without compensation

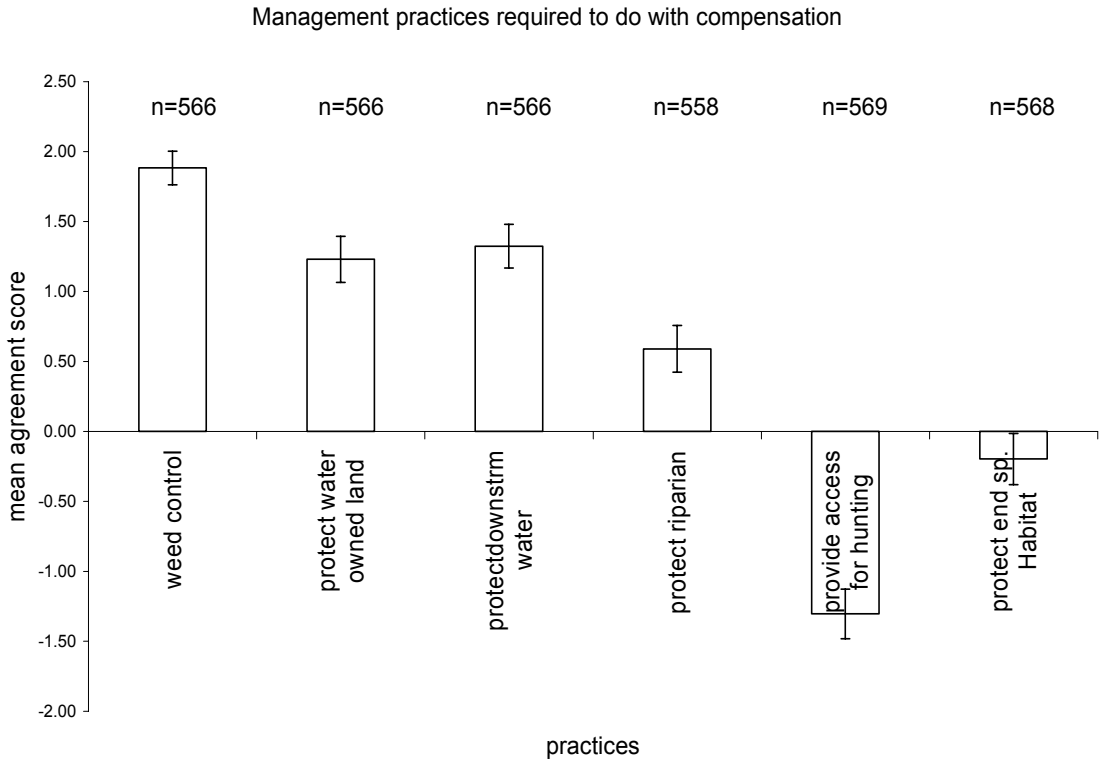


Figure 26: Mean score of respondent opinion about management practices required to be undertaken with compensation

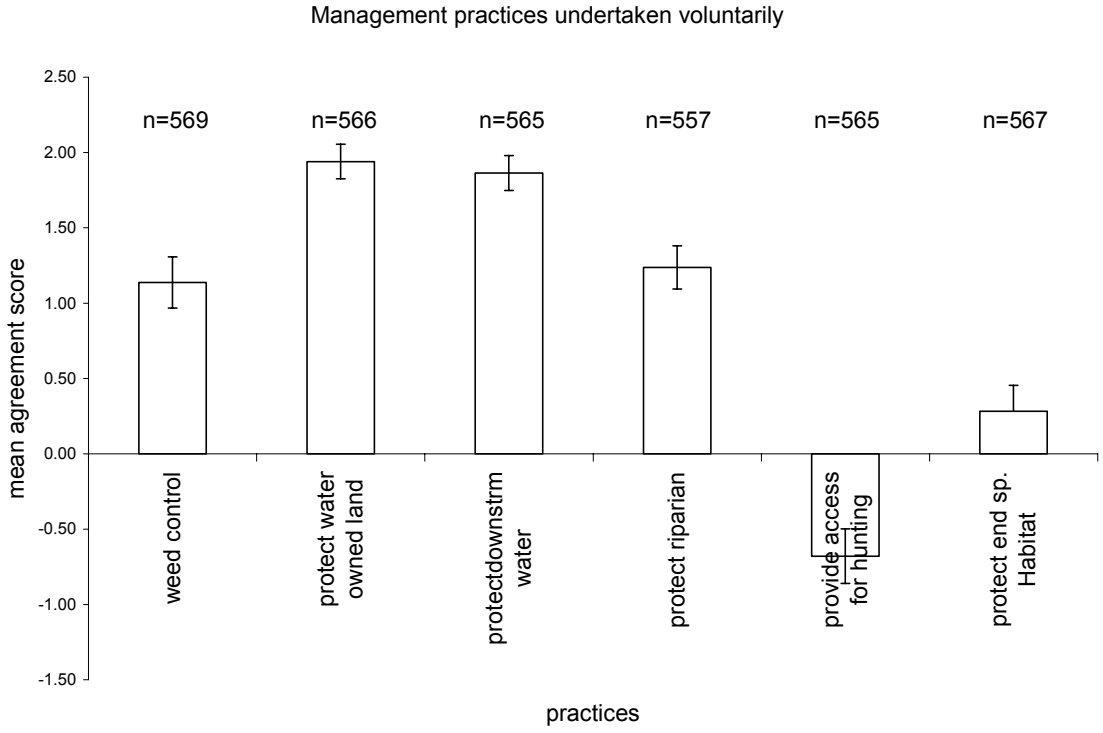


Figure 27: Mean score of respondent opinion about management practices undertaken voluntarily

Statements Regarding Public Lands

Survey participants were also asked to give their opinion about public lands and their management. Respondents tended disagree strongly with the statements that environmental groups are sensitive to the concerns of local ranchers (Figure 28). They are not very supportive of the statements that federal agencies are sensitive to the concerns of local ranchers or that they understand local issues. They also tended to disagree with the statement that the public has a good understanding about effects of grazing on public lands. Respondents tended to agree on issues of equity of natural

resources and public land. The owners also tended to agree that permitees should agree for federal agencies to change grazing permits, but they had no positive or negative reaction to the statement that permitees should have greater say in use of public lands.

Respondents tended to disagree with the idea of privatizing public land through auctions, handing over management authority of federal lands to county government or grazing permitee associations (Figure 29). They also disagreed to a greater degree that the decisions about federal lands be made exclusively by agencies. The only public land management approach was coordinated resource management planning.

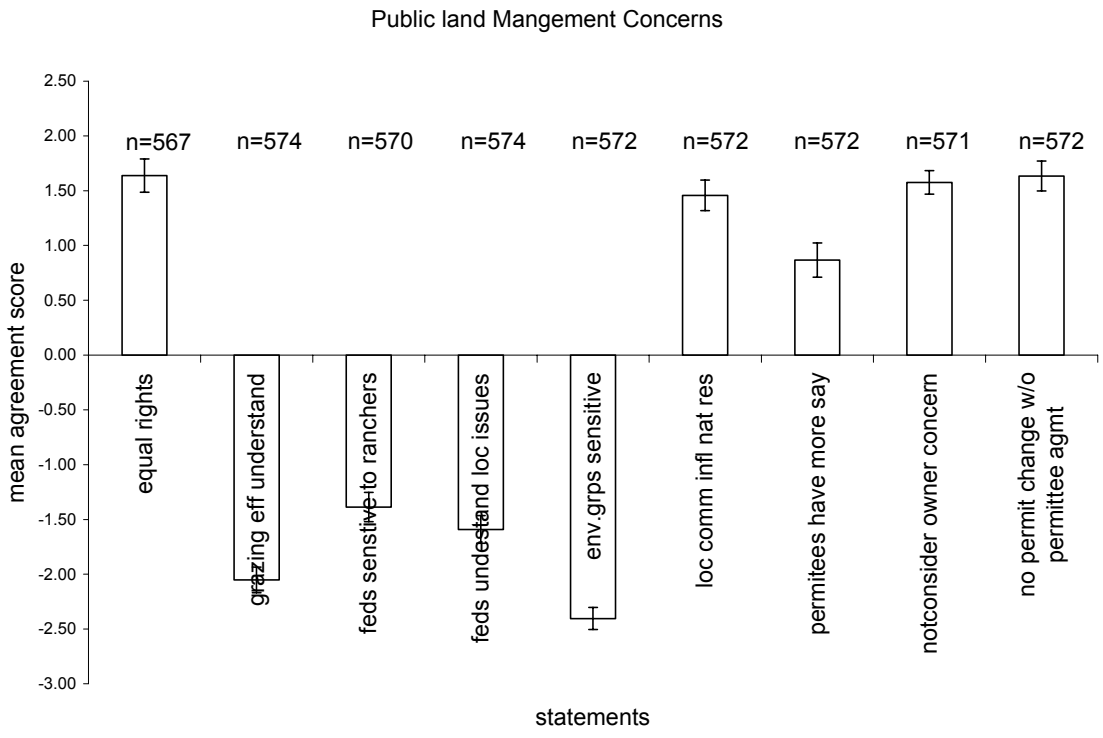


Figure 28: Mean respondent opinion about public land management concerns

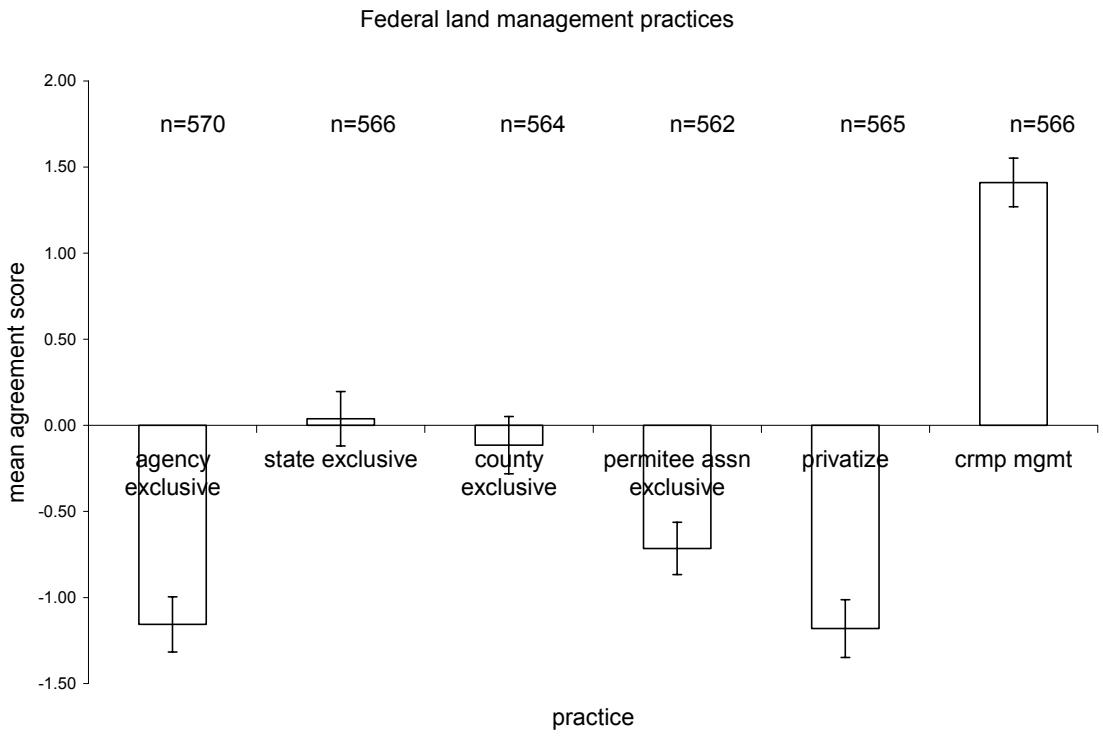


Figure 29: Mean respondent opinion about federal land management

Factors Affecting Viability of Operation

Survey participants were asked to indicate the extent to which they felt various factors are affecting the current viability of the operations.

Respondents felt that all seven stated economic factors negatively affected the production operations (Figure 30). Persistent drought was considered to be the most detrimental, followed by declining profitability of agricultural production; consolidation of agricultural industry, declining prices of the outputs, increasing prices of the inputs particularly fuels, increasing competition from foreign and substitute (pork and chicken)

markets. The standard errors are small and the confidence interval is tight indicating that the attitudes of the respondents do not vary much.

With one exception there was a similar sense that eight social factors were negatively affecting the viability of their operation. The only social factor that was perceived to have a positive factor in public's increased willingness to spend on hunting and other operations (Figure 31). More stringent environmental regulation was perceived to be the most problematic, followed by increased public demand for environmental protection, decline in public support for the ranching/farming community, decreased public support for grazing of livestock on public lands, increased trespass problems, declining financial interest among younger generations in to enter the ranching/farming sector.

No land related factors were perceived to have a positive effect on operational viability either (Figure 32). The factors that respondents found to be most stifling are the high estate and property taxes, followed by expansion of urban land into rural areas, subdivision of the rural land, displacement of wildlife, high market prices of land preventing the acquisition of more land. The least discouraging factor seemed to be the decreased availability of public land for grazing, maybe due to its effect only on Utah and Colorado ranchers.

Landowner perceptions regarding regulatory and government policy effects on their operation were also determined. Slight negative effects were felt by respondents by most of the regulations and government policies that were stated (Figure 33). The most negative effect was perceived to come from restrictions on predator control, followed by

the endangered species habitat regulations, elimination or reduction of public land grazing permits, regulations to protect wetlands and riparian areas, tighter regulations on input use, local and zoning regulation, clean water and effluent discharge regulation. The historical water rights laws, USDA conservation reserve program and environmental quality incentive program are perceived to offer a small positive effect.

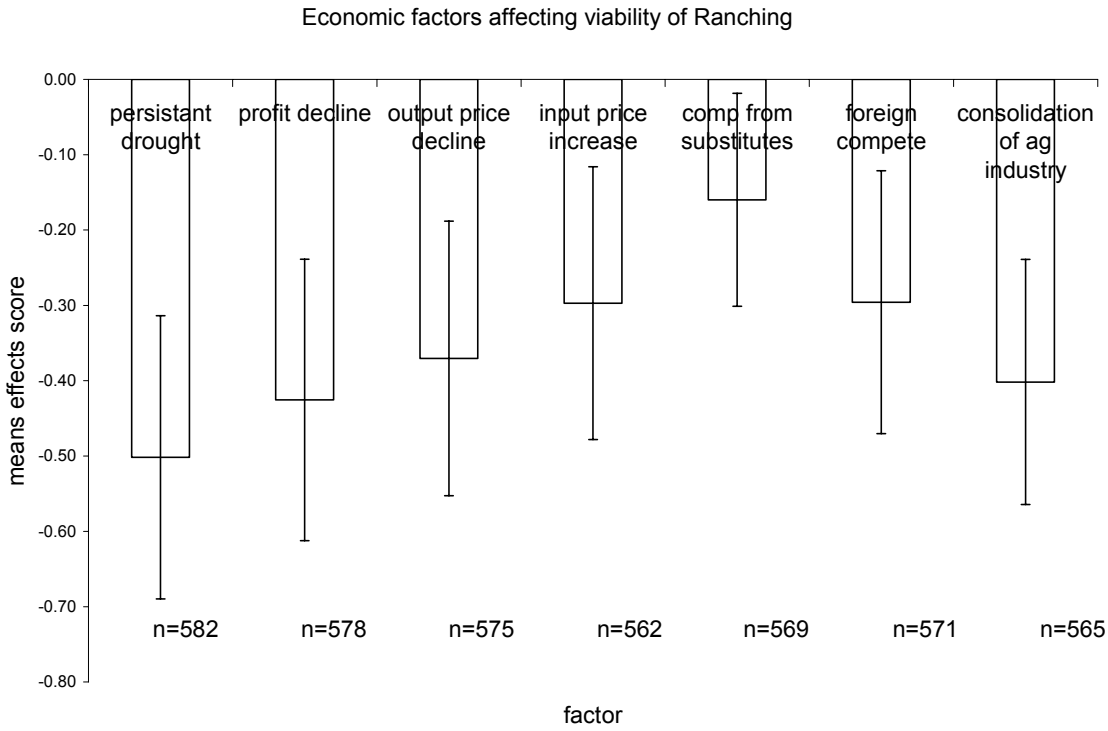


Figure 30: Mean respondent opinion about economic factors affecting the viability of ranching

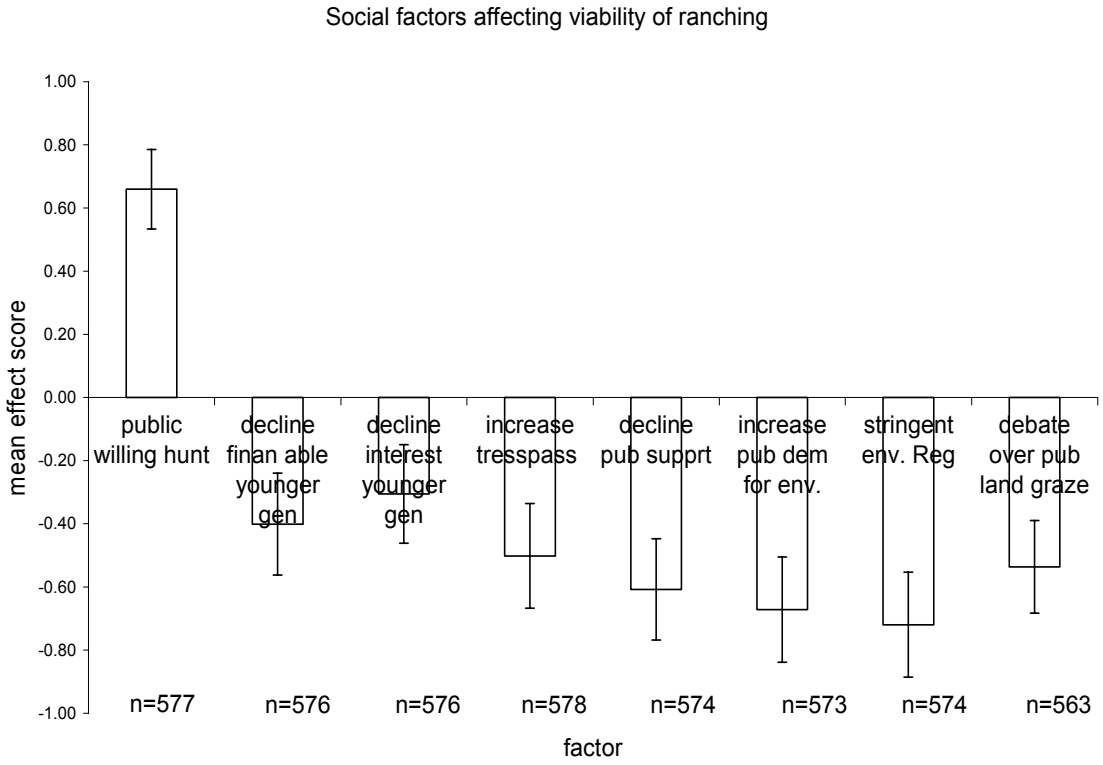


Figure 31: Mean respondent opinion about social factors affecting the viability of ranching

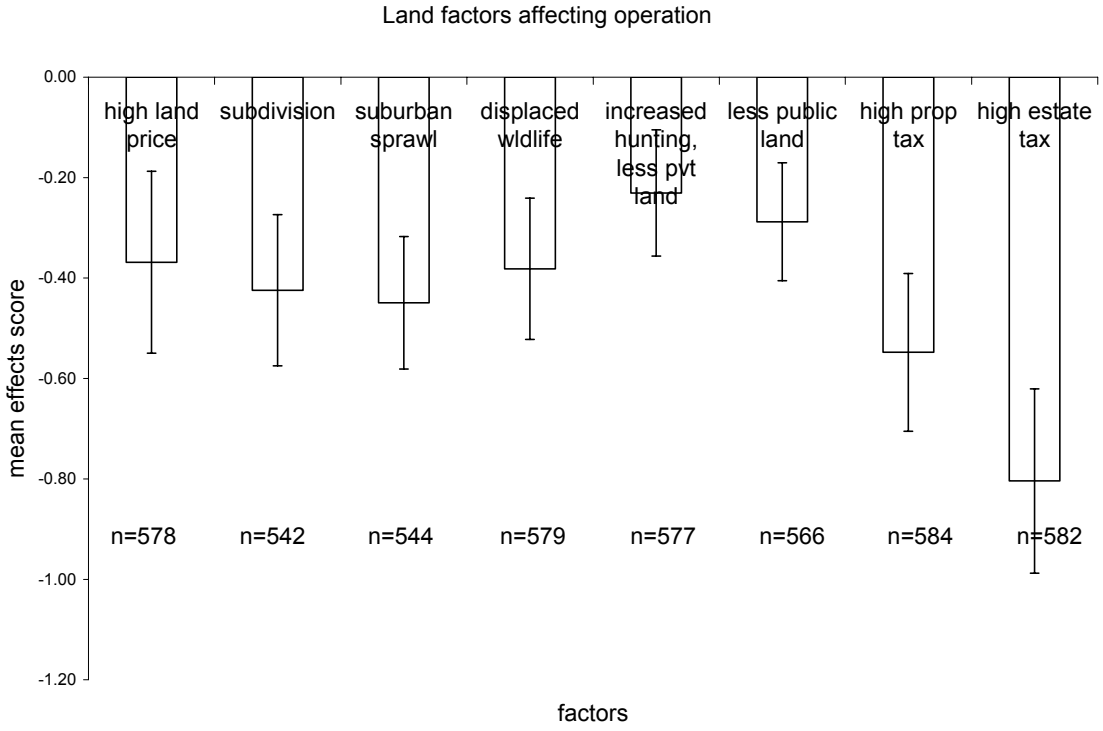


Figure 32: Mean respondent opinion about land-related factors affecting the viability of ranching

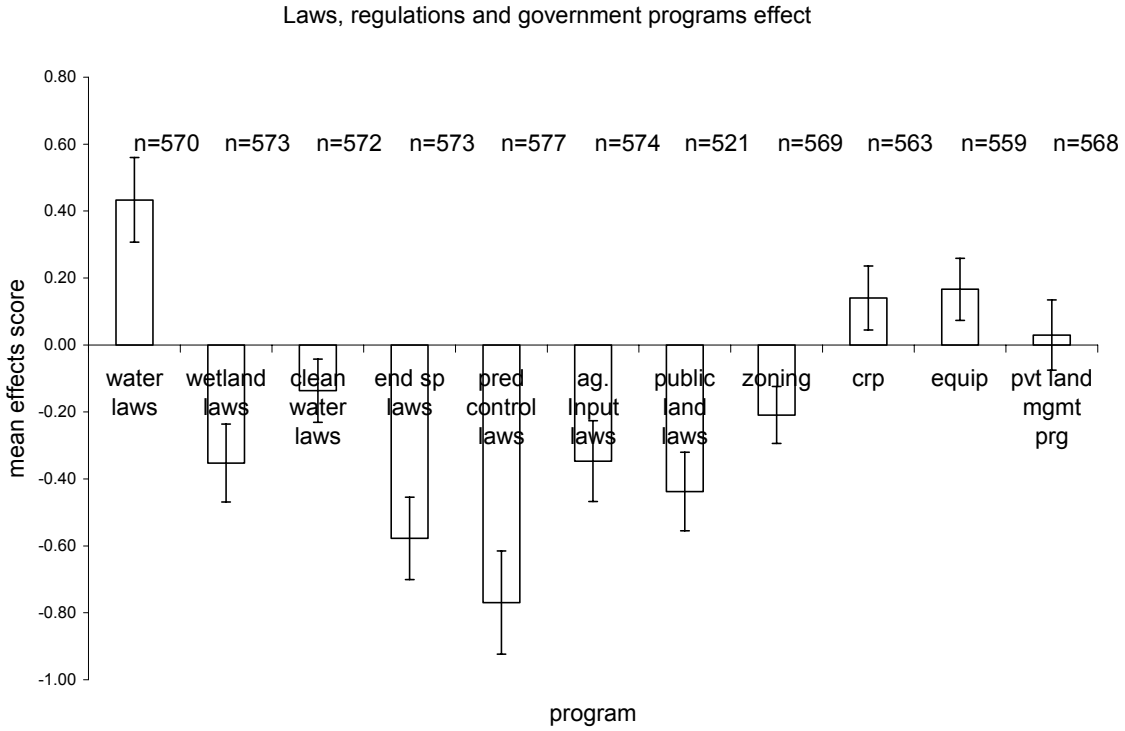


Figure 33: Mean respondent opinion about policy-related factors affecting the viability of ranching

Changes in public policy regarding public land use were not answered by landowners in Texas because of absence of public land grazing in Texas (Figure 34). The Utah and Colorado respondents indicated that increased pressure to reduce livestock on public lands were affecting their ability to survive, that increased trespassing due to increased recreation was creating negative pressure on resources and that loss or injury to cattle, that early uncompensated removal of livestock was creating increase in operating cost. However, they agreed to the statement that coordinated resource management planning was a good approach for future land management.

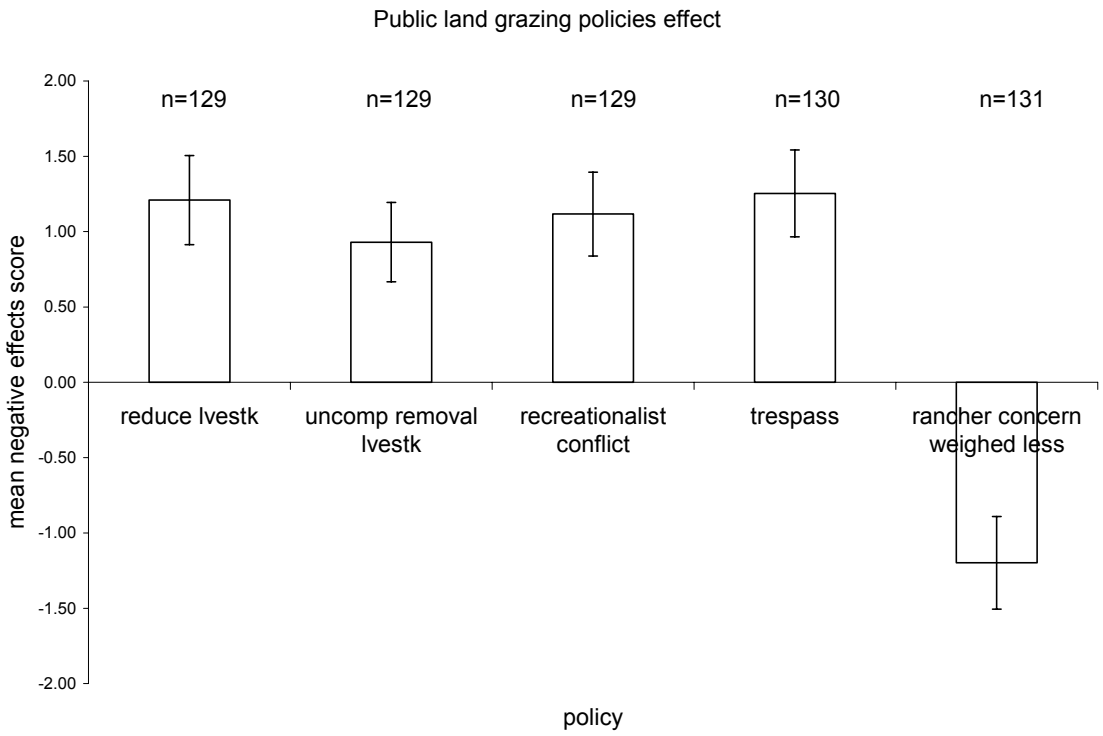


Figure 34: Mean negative effects score of the public policy perceived by ranchers

Future Viability and Plans

Finally survey participants were asked about threats to their future viability and about their plans for next five years. The most serious threat to the future operation was felt to be increased demand for water for non-agricultural operations. This was followed by the decrease of agricultural commodity prices, new endangered sp. listings, increased subdivision of neighboring properties, volatility of commodity prices, restrictions in predator control methods, increased population growth in their area and serious reduction of public land grazing leases (Figure 35).

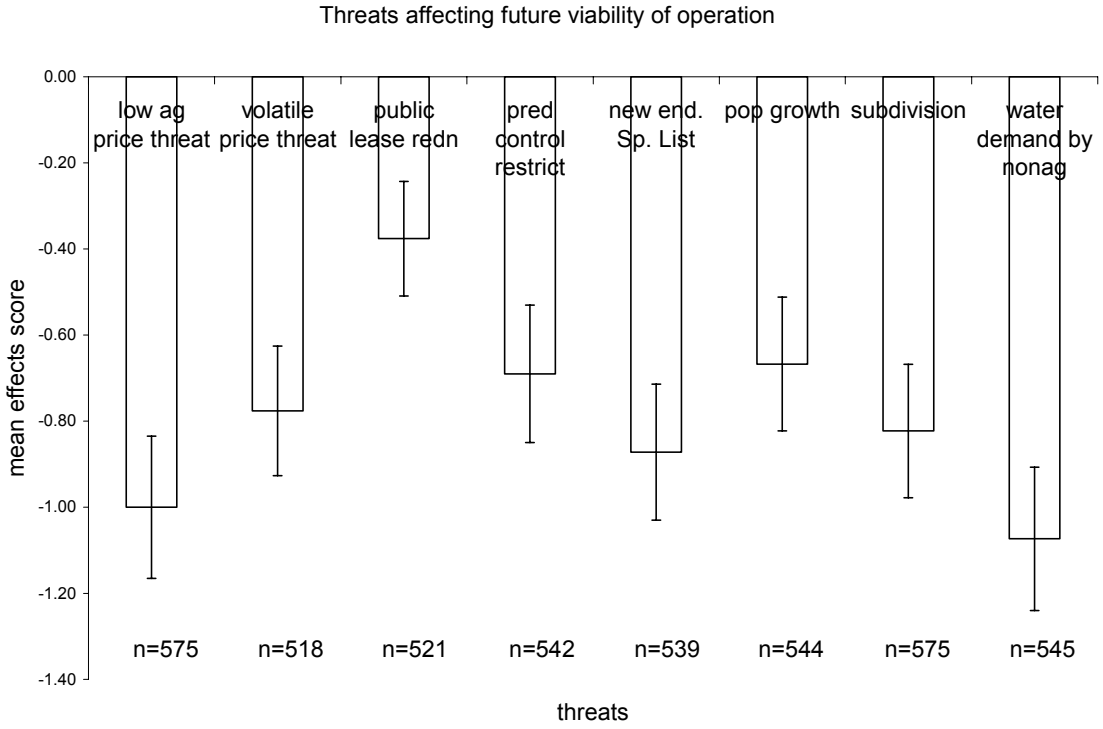


Figure 35: Mean respondent opinion about threats affecting the future viability of ranching

During the next five years, most of the respondents indicated that they intended to seek more non-agricultural income from the land as the primary survival strategy (Figure 36). Conversely, respondents are least likely to relocate the operation or to sell the land to a developer or another rancher/farmer, expand by buying or leasing land, transfer the ownership of the land to someone else, change livestock numbers or to diversify into other ranch or farm enterprises.

The survey respondents also indicated that to counteract the negative forces on their ranch/farm operations during the next five years, they are unlikely to become more involved in local politics, community activities or agricultural interest groups. Conversely they indicated that they are likely to increase household income from off-farm sources, likely to seek legal recourse to defend landowner rights, and to decrease public access to their land (Figure 37).

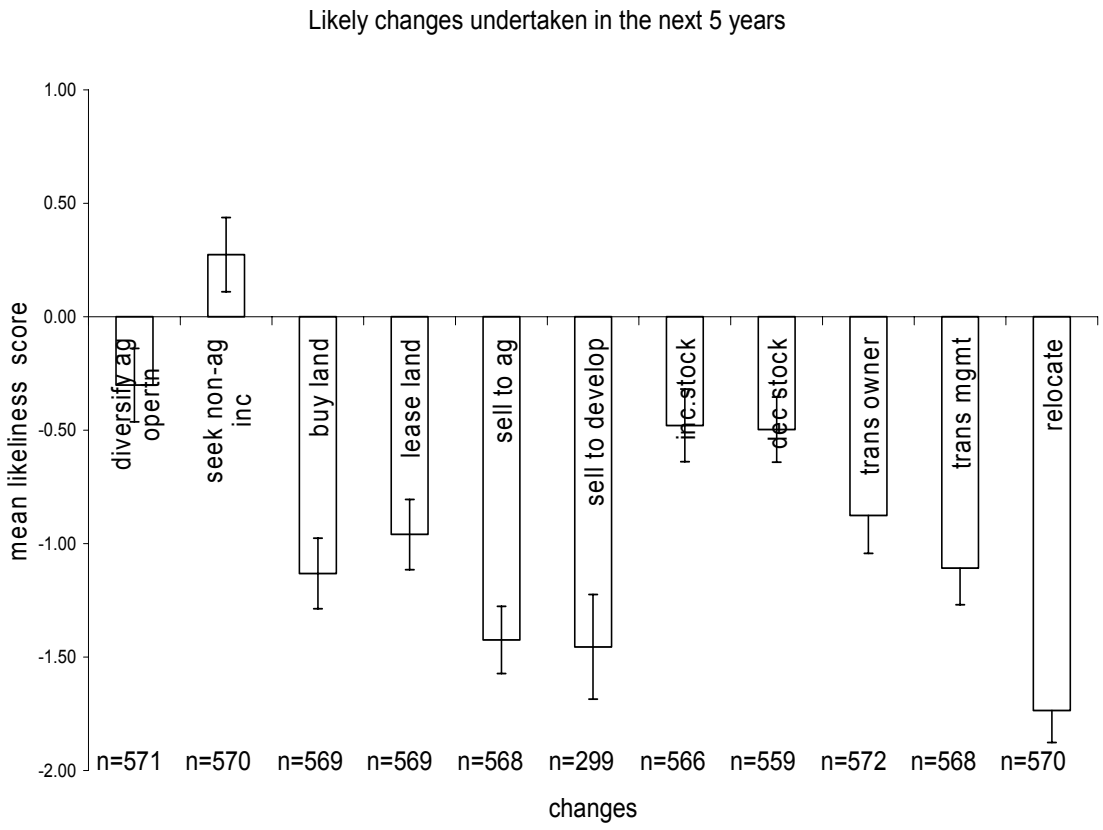


Figure 36: Mean respondent opinion about plans for ranch/farm in the next five years

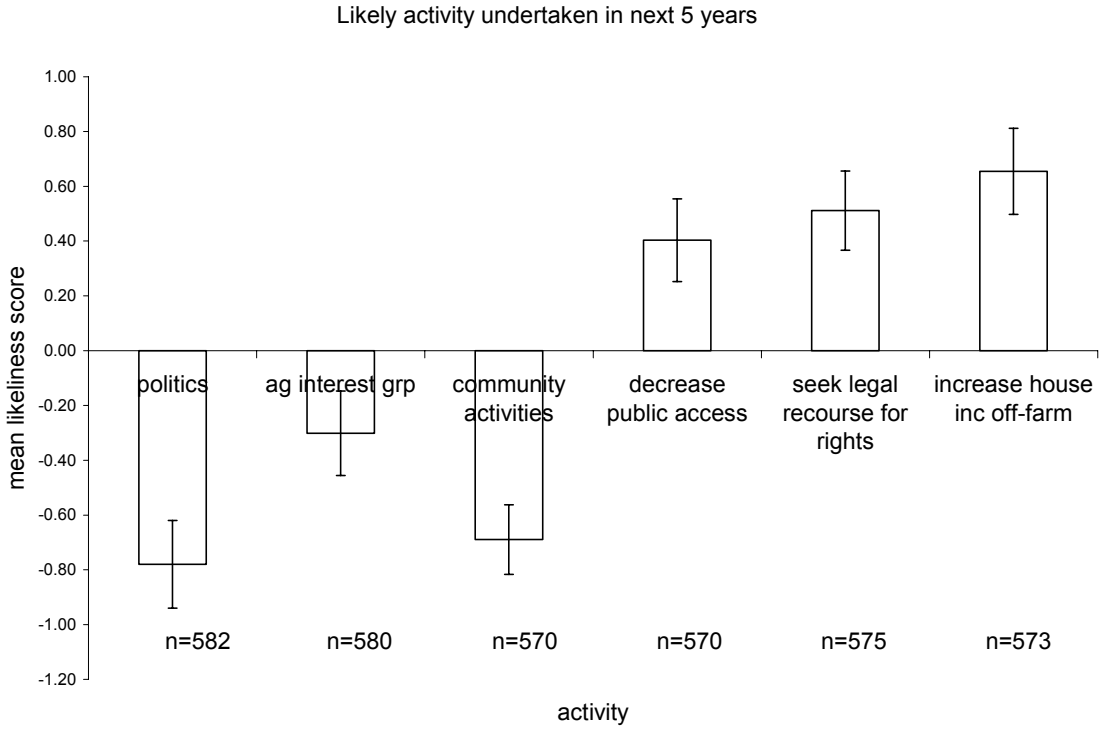


Figure 37: Respondent opinion about other likely activities undertaken in the next five years

Conclusions

The responding landowners show a great reluctance to undertake management practices without compensation but are more willing to undertake these practices with compensation, especially if such management practices are not coerced. This opinion, at first glance, suggests the future direction of policy be incentive-based. However the actual management practices that will be undertaken by landowners will be much less than they indicate, as proven by a study on a survey of small-acreage operators in Texas, which found that they were concerned more about increasing carrying capacity and were

unconcerned about the effect that might have on the land, while larger area operators gave consideration to factors such as wildlife conservation and good stewardship (Rowan, 1994; Rowan et al., 1994). Thus a more landowner-friendly, incentive based approach is the key to future land-management planning. This management planning should be more locally managed than a federal policy. This is because landowners are more willing to relinquish some control to local land management, who they think will understand their problems better. Thus a local, incentive-based approach is the key to future land management decision.

CHAPTER IV

PROPERTY RIGHTS ORIENTATIONS AND MANAGEMENT PRACTICES

Introduction

The property rights debate has persisted in the US for several decades. An increasing number of legal constraints affecting the management of the land, high estate taxes, and the reduced profitability of agricultural/ranching operations have led to changes in the property rights orientations of many landowners (Jackson-Smith et al., 2004). Landowners have tended to become more conscious of their individual rights as a result of these increasing pressures. In addition, the increase in public concern over environmental degradation issues has translated to increased awareness among ranchers about the environmental effects of their management practices. These dynamics have created an increase in the complexity of property rights orientations among landowners (Jackson-Smith et al. 2004). In addition, increase in non-resident (absentee) property ownership, urban to rural migration and extended economic depression in many rural areas have also influenced property rights orientations and thereby the decision-making foci of numerous landowners (Cromartie and Wardell, 1999).

A recent study of landowners in Texas and Utah identified four distinct arguments of the property rights orientations (Jackson-Smith et al. 2004). These dimensions include 1) individual rights: where an individual assumes that his property rights permit him to do what he wishes to do with the property, 2) social responsibility: where the social responsibilities about owning the property is recognized, 3)

stewardship: where an individual private property owners exhibit altruistic tendencies towards environment, 4) Rights erosion: where property owners associate land use and management regulations as threats to their civil liberties. In this study four additive scales of measurement were developed for these property rights orientation categories (Jackson-Smith et al., 2004). The composition of these scales is provided in Appendix C. The analysis of this study revealed that nearly all the respondents agreed that individual property rights allowed landowners to regulate access to their land, transfer ownership of the land and exclusively use natural resources from the land. However, another two-thirds strongly disagreed with the statement that their landowner rights placed no obligations on them. Another two-thirds of the landowners felt their individual property rights were being increasingly threatened (Jackson-Smith et al, 2004).

The widespread nature of rangelands and their provision of an eclectic mix of economic, aesthetic and ecological goods and services result in a wide array of factors that influence landowner management decisions (Jackson-Smith et al, 2004). In previous studies, certain small operators in Texas were found to be concerned more about carrying capacity and short-term profit while larger - area operators were more concerned about wildlife conservation and good stewardship of the land (Rowan, 1994; Rowan et al., 1994). Similarly, a survey of Utah ranchers found that operators with higher incomes often had more ecologically sound ranch management practices than hobbyists who derived less than 50% of their ranch incomes from non-livestock (Coppock and Birkenfeld, 1999). Other factors previously found to influence

management decisions include: lifestyle factors as ‘wanting to live in the country’, and ‘having own meat, milk and eggs’ (Workman and Evans, 1993). Another Texas-based study found that some ranchers with fee-hunting enterprises were 2.4 times more likely to have good range condition, than those without hunting enterprises (Butler and Workman, 1991).

Well defined property rights have been identified as a fundamental requirement for sustainable natural resource management (Ostrom, 2002; Jackson–Smith et al., 2004). Hardin (1968) suggested that under mounting population pressure, poorly defined or unenforceable property rights contribute to the inevitable exploitation of natural resources. Others identify the superiority of well-defined property rights in combating risk in natural resource management (Harnett-White, 1994) and conversely, ecosystem degeneration under poorly defined property rights (Bliss et al, 1998).

The purpose of this study is to identify the influence of the property rights orientations and other socio-demographic variables on management practices required to be undertaken without compensation by landowners in Utah, Texas and Colorado.

Methods

Landowners in the states of Texas, Utah and Colorado were sent a questionnaire in 2002 asking them about their property rights orientations. Responses to survey questions about management practices and property rights orientations were analyzed to develop relationships between landowner’s changes in management practices and their property rights orientations. Specifically responses to the query, ‘To what extend do you agree that you should be required to do each of the following things with your land

without any compensation from the public' were analyzed. The management practices to which survey participants were asked to respond included: control noxious weeds, protect the quality and supply of water used on your land, protect water quality and supply for downstream users, protect wetland and riparian areas, provide access to your land for hunting of native species and protect habitat for threatened and endangered species. The response options ranged from strongly disagree (-3) to strongly agree (+3).

Factor Analysis

A factor analysis was conducted to identify the underlying dimensions of the flow of information in the question about management practices undertaken without compensation. Factor analysis is a technique used to identify a small number of factors which can be used to represent relationships among sets of many inter-related variables (Norusis, 1990). In the case of this question of management practices undertaken without compensation, statements about alternative practices are inter-related. The creation of a scale dependent variable based on these relationships that is slightly continuous using the factor analysis is more useful than the analysis of a cohort of categorical dependent variables, for identifying the rate of change of the dependent variables according to various independent variables. The principal components method of extraction is the most commonly used technique. Here, factors which have an eigenvalue greater than 1 are chosen (Norusis, 1990). Each variable loads differently on the factor.

Once a factor is extracted, the rotation phase tries to minimize the nonzero loadings of the variables in each factor by redistributing the variances of the individual

factors. Orthogonal rotation redistributes the variances into perpendicular. Mathematical methods used to obtain orthogonal rotations of factors include Quartimax, Varimax and Equimax. The methodological terminology is associated with the way in which variances of squared factor loadings are calculated in each variable. Varimax rotation maximizes the variance of squared loadings for each factor. For a factor j, the variance to be maximized is,

$$v_j = \frac{r\sum_{i=1}^{n} b_{ij}^4 - \left(\sum_{i=1}^{n} b_{ij}^2\right)^2}{r^2} \quad \ldots\ldots\ldots\ldots\ldots\ldots (1)$$

where b_{ij} is the loading of i^{th} variable in j^{th} factor, r is the number of factors (Kim and Mueller, 1978). The rotation technique utilized in the factor analysis I conducted was varimax rotation.

Reliability Analysis

A reliability analysis was conducted to find the ability of the scales to hold true in any random sample of the data. Reliability is defined as the degree to which measured differences between individual response values is a representation of the true differences in attributes (Marquis and Marquis, 1977). The most commonly used for reliability is used by Cronbach and is represented by Cronbach's alpha, which is:

$$\alpha = \left(\frac{k}{k-1}\right) \times \left(1 - \left(\frac{\sum s_i^2}{s_{sum}^2}\right)\right) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (2)$$

where s_i^2 represent the variances of k individual items, s^2_{sum} is the variance of the sum of all the items. For example, if there are no true items, the variance of the sum and the

sum of the variances will be the same, therefore the reliability will be zero. The presence of more true items will increase the reliability (Statsoft Inc., 2004).

Hypotheses

In addition to individual variables, the management practices were hypothesized to vary with the proportion of ranch or farm income to total income due to the higher attention to the management practices given by landowners who have greater dependence on the land. The proposed hypothesis is the following:

H_0: Management practices do not vary with several socio-demographic factors as age, property size, formal education, grew up in ranch or farm, currently live in ranch or farm, state of residence, years of ranching experience, total income, proportion of ranch/farm income to total income, wildlife / recreational income, profit in 2001.

H_{0a}: Management practices vary with several socio-demographic factors as age, property size, formal education, grew up in ranch or farm, currently live in ranch or farm, state of residence, years of ranching experience, total income, proportion of ranch/farm income to total income, wildlife / recreational income, profit in 2001

H_1: Management practices do not vary with the different property rights scales.

H_{1a}: Management practices vary with the different property rights scales.

The hypothesis is proposed on the basis of the idea that landowners with their varying property rights orientations would have varying opinions about management practices that were required to be done in the land without compensation.

Results

Response patterns to management practices required to be done without compensation are provided in Table 2.

Table 2: Mean, Standard error of mean and confidence levels of management practices required to do without compensation

Management practices required to do without compensation	Mean ±95% Confidence level	Significance
Control noxious weeds	0.59±0.18	0.000*
Protect the quality and supply of water used on your land	1.52±0.15	0.000*
Protect water quality and supply for downstream users	1.47±0.15	0.000*
Protect wetland and riparian areas	0.27±0.16	0.001*
Provide access to your land for hunting of native species	-2.19±0.13	0.000*
Protect habitat for threatened and endangered species	-0.79±0.17	0.000*

* indicated the response is significantly different from zero, where the attitudes are distributed in a Likert scale; -3 (strongly disagree) to + 3 (strongly agree).

Table 3: State-wise mean and significance of the mean of the management practices required to be undertaken without compensation

Management practices required to do without compensation	Texas	Utah	Colorado
Control noxious weeds	-0.75 (0.00)*	1.34 (0.00)*	1.05 (0.00)*
Protect the quality and supply of water used on your land	1.22 (0.06)	1.86 (0.02)*	1.55 (0.74)
Protect water quality and supply for downstream users	1.40 (0.12)	1.74 (0.06)	1.40 (0.33)
Protect wetland and riparian areas	-0.08 (0.17)	0.26 (0.90)	0.48 (0.01)*
Provide access to your land for hunting of native species	-2.20 (0.82)	-2.15 (0.79)	-2.20 (0.89)
Protect habitat for threatened and endangered species	-1.16 (0.15)	-0.80 (0.93)	-0.56 (0.01)*

- represents the mean value is significantly different from other states

Table 4: F-statistic and significance of state-wide differences for management practices required to be undertaken without compensation

State-wide differences in management practices required to do without compensation	State-wide Differences	Texas & Utah	Texas & Colorado	Utah & Colorado
Control noxious weeds	51.867 (0.000)*	16.274 (0.000)*	14.188 (0.000)*	0.481 (0.488)
Protect the quality and supply of water used on your land	4.424 (0.012)*	24.005 (0.000)*	25.307 (0.000)*	0.831 (0.363)
Protect water quality and supply for downstream users	1.773 (0.171)	10.224 (0.002)*	7.737 (0.006)*	0.963 (0.327)
Protect wetland and riparian areas	4.120 (0.017)*	0.800 (0.372)	2.081 (0.150)	0.106 (0.763)
Provide access to your land for hunting of native species	0.036 (0.964)	2.025 (0.156)	1.995 (0.158)	0.091 (0.745)
Protect habitat for threatened and endangered species	4.283 (0.014)*	0.001 (0.974)	0.087 (0.768)	0.102 (0.750)

* represents significance of the state-wise difference at 95% confidence level, Levene's equal variances assumed.

From Table 2 it can be seen that all the responses are significantly different from zero. Furthermore, it can be seen that the respondents generally agreed with the idea of controlling noxious weeds, protecting the quality and supply of water in their land, protecting the quality and supply of down stream water and protecting wetland and riparian areas without compensation. However they did not agree to the statements of providing public access to land for hunting and protecting endangered species without compensation. Comparing states, respondents in Utah exhibited a significantly higher level of agreement with the idea of protecting the quality and supply of water used in own land (Table 3). The respondents in Colorado were significantly more favorable to the idea of protecting the wetland and riparian areas and less disinclined to protecting habitat for threatened and endangered species without compensation. Landowners in Texas were the least favorably disposed to the idea of controlling noxious weeds without compensation.

The table 4 indicates that the opinion about management practices varied between states only in the cases of: controlling noxious weeds without compensation, protecting quality and supply of water used in own land and protecting the habitat of endangered species. In the case of controlling noxious weeds without compensation, opinion between Texas & Utah and Texas & Colorado differed significantly. In the case of protecting on-site and off-site water quality and supply without compensation, statewide differences were observed in the case of Texas & Utah and Texas & Colorado. The opinions about any of the management practices required to be undertaken without compensation did not vary significantly between Utah and Colorado.

Factor Analysis

The principal components factor analysis with varimax rotation that was used to calculate a scale for six land management objectives (control of noxious weeds, protection of on-site and off-site water supply, protection of wetlands and riparian areas and the provision of land for endangered species habitat and hunting access) resulted in the creation of two component axes as presented in Table 5. The component axes are orthogonal (at right angles) to each other, thus giving an idea of how the variation of responses is distributed in this multi-faceted question (Norusis, 1990).

Table 5: Rotated Component Matrices extracted from the survey participant responses to statements about management practices required to do without compensation

Management practices undertaken without compensation	Component	
	I	II
Control noxious weeds	**0.677**	0.224
Protect the quality and supply of water used on your land	**0.917**	0.092
Protect water quality and supply for downstream users	**0.886**	0.074
Protect wetland and riparian areas	**0.701**	0.332
Provide access to your land for hunting of native species	0.027	**0.883**
Protect habitat for threatened and endangered species	0.375	**0.726**

Extraction Method: Principal Component Method, Rotation Method: Varimax Method

The rotated component matrix yielded two distinct dimensions to responses about required and uncompensated management practices. One dimension included the control of noxious weeds without compensation, protection of the on-site and off-site water supply and protection of wetland and riparian areas. The other dimension included the provision of public access for hunting and the protection of habitat for threatened and endangered. This binomial separation reflects different interest in water and wildlife.

Based on results from factor analysis, two additive subscales were constructed. The first subscale was based on responses to the first four statements while the second additive subscale consisted of the latter two statements (Table 6). The reliability analysis conducted on the two additive scales revealed the Cronbach's alpha of 0.835 for the first subscale and 0.571 for the second subscale (Table 6), a reliability of 0.8 or higher generally considered acceptable for most social science applications (UCLA Academic Technology Services, 2004).

Table 6: Reliability analysis results for the subscales derived from the factor analysis of management practices required to do without compensation

Sub Scale	Items	Scale Mean if item deleted	Cronbachs' Alpha on Standardized items	Mean inter item correlation	Mean item total correlation
Subscale I	Control noxious weeds	3.19	0.835	0.838	0.663
	Protect the quality and supply of water used on your land	2.30			
	Protect water quality and supply for downstream users	2.34			
	Protect wetland and riparian areas	3.52			
Subscale II	Provide access to your land for hunting of native species	-0.79	0.571	0.399	0.399
	Protect habitat for threatened and endangered species	-2.20			

The results of the reliability analysis indicated the items associated with the first scale move together while the items associated with the second scale are generally less coordinated. Multi-dimensionality of the second subscale is unlikely given the results of the factor analysis which shows a higher probability of not moving in unison (Table 4). This indicates that the components of the first subscale can be subjected to a regression analysis, while the two management components included in the second subscale should be analyzed separately. The interpretation of the regression analysis conducted on the first subscale is as follows: Analysis conducted to gauge the change in "environmental consciousness" (Subscale I) with respect to several socio-demographic and property rights orientations variables. Thus separate regression analyses were conducted for the first subscale and the two management categories included in the second subscale.

Regression Analysis

The ordinary least squares regression was chosen to analyze the subscale I, which included 18 independent variables grouped into three categories as shown in Table 7.

Table 7: Results of ordinary least squares analysis of subscale I derived from management practices required to do without compensation

Variable	Standard Coefficient	Standard Error	T-value	P-value
Intercept	**-**	**2.413**	**-2.196**	**0.029**
Acres owned	**-0.129**	**0.000**	**-2.752**	**0.006**
Age of respondent	0.057	0.032	0.981	0.327
Formal education	-0.039	0.192	-0.792	0.429
Grow up in ranch or farm	0.047	0.678	0.942	0.347
Currently live in ranch or farm	**0.086**	**0.589**	**1.832**	**0.068**
Years of ranching or farming experience	0.015	0.026	0.227	0.821
State	**0.253**	**0.382**	**4.814**	**0.000**
Households total income	**0.093**	**0.215**	**1.905**	**0.058**
Livestock income	0.054	0.348	0.842	0.401
Crop income	-0.098	0.346	-1.373	0.171
Proportion of household's total income from net ranch or farm income	-0.035	0.207	-0.703	0.482
Wildlife and recreational income	0.096	0.331	1.235	0.218
Ranch or farm show profit in 2001	-0.033	0.314	-0.705	0.481
Additive scale for rights erosion	**-0.105**	**0.104**	**-2.126**	**0.034**
Additive scale for individual property rights support	0.062	0.088	1.196	0.233
Additive scale for social responsibility	**0.182**	**0.070**	**3.694**	**0.000**
Additive scale for stewardship	**0.238**	**0.127**	**5.161**	**0.000**

- Adjusted $R^2 = 0.179$; **bolded variables are significant at 90% confidence levels**

The regression for subscale I reveal a significant negative relationship between property size on noxious weed and water related land management practices suggesting that the respondents with higher acreage are less willing to adopt such management practices without compensation. The increasing total cost of implementing such practices over large areas may be a factor that contributes to this unwillingness, while smaller landowners would expend lesser total amounts and may have external sources of income to implement them.

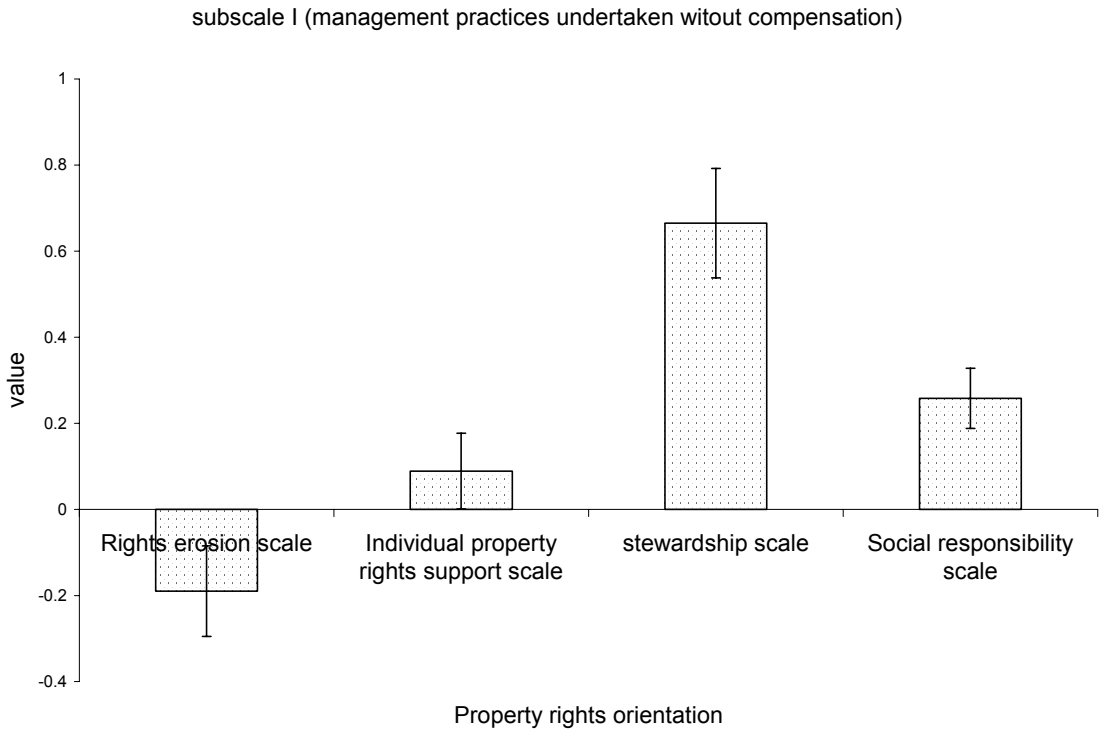
The variables, household total income and whether the landowner currently lives on the ranch or farm are positively correlated with management practice implementation at the 0.10 level of significance. The positive relationships indicate that respondents with higher incomes and those who currently live on their ranch or farm are more

receptive to the suggestion that landowners should undertake without being compensated ecologically sound management with respect to noxious weeds, water and wetland/riparian protection.

The presence or absence of livestock income, crop income and wildlife income did not appear to be significant in the opinion about management practices undertaken without compensation. This may be due to the fact almost every respondent has livestock income.

The additive property rights orientations scales included in the third category of explanatory variables were all highly significant except for individual property rights scale. The additive scale for rights erosion (PR threats) was found to have a significant negative relationship ($p<0.001$) to the land management subscale I; suggesting that respondents who perceived their private property rights to be threatened indicated are less willing to undertake ecologically sound management practices without compensation. Conversely, the additive scales for social responsibility and stewardship were highly significant and positively correlated with subscale I. This indicates that respondents who scored high on the social responsibility property rights orientations and especially those who scored high on the stewardship property rights orientation scale are more willing to undertake the management practices represented by subscale I, than those who scored lower on these scales. The coefficients for the four property rights orientation dimensions (Jackson-Smith et al., 2004) are represented in Figure 38. From this graph, it is evident that rights erosion subscale is the only property rights orientation that has a negative relationship with management subscale I. The stewardship subscale

and the social responsibilities subscales have positive coefficients. The absolute value of the coefficient of stewardship subscale is higher than that of social responsibilities subscale. This indicates that respondents who scored higher on the stewardship subscale are more willing to adopt management practices without compensation than those who scored high on the social responsibilities subscale. The coefficient value of individual rights support is not significantly different from zero. The confidence intervals are very narrow for the stewardship orientation and very wide for the social responsibilities orientations.



Error bars represent Standard error of Mean of the β coefficients

Figure 38: A graphical representation of the relationship between management practices undertaken without compensation and the property rights subscales

The one variable that was found to be highly significant (p = 0.000) is the variable indicating the state of the landowner. Table 3 provides information indicating that the mean differences between the states are significant for almost all components of management subscale I, except for protection of water for downstream users without compensation.

The results of the regressions derived for the provision of access for hunting and the supply of habitat for endangered species are presented in table 8 and 9 respectively.

Table 8: Results of OLS analysis on landowner's response to provide access to land for hunting without compensation

Variable	Standard Coefficient	Standard Error	T-value	P-value
Intercept	**-**	**0.573**	**-4.603**	**0.000**
Acres owned	-0.059	0.078	-1.014	0.311
Age of respondent	**0.197**	**0.084**	**3.165**	**0.002**
Formal education	**-0.095**	**0.049**	**-1.851**	**0.065**
Currently live in ranch or farm	-0.019	0.150	-0.374	0.709
Grow up in ranch or farm	0.006	0.172	0.126	0.900
Years of ranching or farming experience	0.036	0.006	0.525	0.600
State	-0.038	0.095	-0.696	0.487
Households total income	-0.001	0.057	-0.027	0.978
Proportion of household's total income from net ranch or farm income	0.072	0.062	1.158	0.247
Wildlife and recreational income	0.022	0.046	0.457	0.648
Ranch or farm show profit in 2001	-0.018	0.080	-0.356	0.722
Additive scale for perceived PR threats	-0.080	0.027	-1.537	0.125
Additive scale for individual property rights support	-0.002	0.023	-0.034	0.973
Additive scale for social responsibility	**0.141**	**0.018**	**2.717**	**0.007**
Additive scale for stewardship	0.046	0.033	0.959	0.338

R^2 =0.109; **bolded variables are significant at 90% confidence level.**

The analysis of responses to the idea that landowners provide free access to hunting identified four variables that are significant at the 90% level of confidence. These were age (positive), education (negative) and additive scale for social responsibility (positive). Although not significant for management subscale I, the

negative coefficient for education show an increased resistance against allowing free public access for hunting as formal education of respondent increases. Greater awareness among more educated people that there is money to be made in hunting may be reason. This is consistent with the finding that older respondents, who generally have a lower level of education, are more willing to allow free public hunting access. The coefficient for additive scale for social responsibility is highly significant and positive indicating that people who ranked high on the social responsibility were more willing to allow free hunting access on their land.

Table 9: Results of OLS analysis on landowner's response to provide habitat for endangered species without compensation

Variable	Standard Coefficient	Standard Error	T-value	P-value
Intercept	-	0.762	-1.576	0.116
Acres owned	-0.038	0.104	-0.682	0.496
Age of respondent	0.090	0.112	1.518	0.130
Formal education	-0.064	0.065	-1.288	0.198
Grow up in ranch or farm	0.039	0.228	0.798	0.425
Currently live in ranch or farm	0.014	0.199	0.288	0.773
Years of ranching or farming experience	-0.026	0.009	-0.398	0.691
State	**0.122**	**0.127**	**2.333**	**0.020**
Households total income	0.077	0.076	1.523	0.129
Proportion of household's total income from net ranch or farm income	-0.010	0.082	-0.171	0.864
Wildlife and recreational income	**0.115**	**0.063**	**2.542**	**0.011**
Ranch or farm show profit in 2001	0.013	0.106	0.279	0.780
Additive scale for perceived PR threats	**-0.125**	**0.035**	**-2.501**	**0.013**
Additive scale for individual property rights support	0.010	0.030	0.198	0.844
Additive scale for social responsibility	**0.269**	**0.024**	**5.396**	**0.000**
Additive scale for stewardship	0.047	0.043	1.007	0.314

R^2 =0.188; **bolded variables are significant at 90% confidence level.**

In the analysis of responses to the idea that landowners should protect endangered species habitat without compensation (Table 9), the significant explanatory variables were presence of wildlife and recreational income (positive), additive scale of

perceived property rights threats (negative) and additive scale for social responsibility (positive). The landowners who had wildlife or recreational income were the ones whose profit margins were made narrower by providing habitat for endangered species. The variable state is significant which is consistent with data in Table 3, which indicated that respondents in Texas to be more disinclined to provide such protection than respondents from Utah and Colorado. Conversely, the respondents who scored high on the social responsibilities scale had significant and positive scores on the responsibility of landowner to protect habitat of endangered species without compensation. Cleary, respondents who feel that their property rights are being threatened are less willing to adopt any ecologically sound practice, such as providing the habitat for endangered species, while respondents who scored high on the social responsibilities scale, being more altruistic are willing to adopt more ecosystem friendly practices as preserving the habitat.

Summary and Conclusions

The intention of this analysis was to study the attitudes of landowners towards adopting management practices without compensation and the influence of various socio-demographic factors and property rights orientations of landowners on this response. The factor analysis revealed the existence of two orthogonal factor loadings. Two factor subscales were subsequently developed were subject to reliability analysis which indicated only Subscale I (related to noxious weeds, water supply and wetland protection) was robust. Ordinary least squares analyses were conducted; subscale I was used as the dependent variable in the first regression; response of landowners to

provision of land for hunting without compensation as the second dependent variable; and the protection of endangered species habitat as the third dependent variable. The hypothesis, that the property rights orientations do not cause variations in the willingness to participate in uncompensated management practices undertaken without compensation was rejected. The regression analysis revealed strong significance of the additive scale for social responsibility in all three regressions. The landowners who indicated that their private property rights were being threatened showed a strong negative response towards protecting the endangered species habitat and the landowners who scored high on the stewardship scale indicated a significantly strong positive response towards the various weed, water and wetland related compendium of management practices to be adopted without compensation. The state that the landowners live in also significantly influenced the willingness to voluntarily implementing land management practices except in the case of providing land for hunting.

The conclusions are significant for policy–makers who try to formulate new landowner-friendly policies aimed at improving land management. The way that landowners react towards various policies is affected by their private property orientations. The statistical significance of the state variable suggest that the State and Federal agencies should develop policies that are adaptable at a state-level rather than at the national level. Since younger landowners are very unwilling to adopt any management practice without external compensation, the incentive-based approach is likely to become more important in increasing adoption rates of land management

practices that are socially appealing. The analysis also found a number of ranchers who are not willing to adopt any responsible management practices without compensation. This indicates that targeting these landowners with programs aimed at increasing adoption rates may not be optimal with respect to limited public funds. Another productive approach that is suggested by this analysis is to target landowners for incentive based land management programs. This will enhance the probability of adoption and funding effectiveness. The identification of socially responsible landowners could be accomplished through several techniques, for example of key questions could be included in census and separate studies could be conducted across key counties in various states. Once the socially responsible landowners that are innovative adopt the promoted land management practices, such innovations will diffuse to landowners with stronger individual property rights orientations will also adopt the policy, leading to overall higher rates of adoption.

CHAPTER V

PROPERTY RIGHTS ORIENTATIONS AND THREATS TO FUTURE OPERATION

Introduction

Several potential threats to landowners have emerged during the past two decades that inhibit successful and profitable ranching operation. These include; mandatory habitat conservation for endangered and threatened species (Wilcove and Lee, 2003), various grazing management mechanisms as restricting grazing to riparian zones(Harnett-White, 1994 in L. R. White ed.), wetland delineation as part of clean water act (Combs, 1994 in L.R. White ed.), decline & volatility of agricultural commodity prices, low productive value of rangeland products and high growth rate of population – related demand for land (Knight et al. in Jackson-Smith et al., 2004). The interpretation of such changes is perceived as threats by individual landowners who have a more utilitarian-oriented value towards natural resources than the broader public (Bourke and Luloff, 1994). Incentive-based approaches are often valuable for achieving conservation objectives. Examples include the 'Safe Harbor', 'Landowner Conservation Assistance Program' and 'Conservation Banking' programs which have proven useful in protecting endangered species (Wilcove and Lee, 2004).

A recent study of landowners in Texas and Utah identified four distinct arguments of the property rights orientations (Jackson-Smith et al. 2004). These dimensions include 1) individual rights: where an individual assumes that his property

rights permit him to do what he wishes to do with the property, 2) social responsibility: where the social responsibilities about owning the property is recognized, 3) stewardship: where an individual private property owners exhibit altruistic tendencies towards environment, 4) rights erosion: where property owners associate land use / management regulations as threats to their civil liberties. In this study four additive scales of measurement were developed for these property rights orientation categories (Jackson-Smith et al., 2004). A table (Appendix C) delineates the composition of these scales. The analysis revealed that nearly all the respondents agreed that individual property rights allowed the landowners to regulate access to their land, transfer ownership of the land and exclusively use natural resources from the land. This study also reported that around two-thirds of the landowners felt their individual property rights were being increasingly threatened and another two-thirds strongly disagreed with the statement that their landowner rights placed no obligations on them (Jackson-Smith et al., 2004).

Several studies have been conducted to determine the best approach to ameliorating such threats (Wilcove and Lee, 2004; Beaton and Pollock, 1992). No study has so far has been conducted to classify these threats and analyze their causation. This study analyses the intensity of different threats perceived by landowners. To achieve this, index was created to integrate the likelihood of the threat and the impact of the threat on future viability of operation. Using this scale, a causal analysis was conducted which determined the influence of various socio-demographic factors and property rights orientations on the scale. Finally, a multiple regression analysis was conducted to reveal

the change in the threats with respect to a change of the socio-demographic factors and property rights orientations.

It is hypothesized that the perception of threats by landowners varies with the property rights orientations of landowners. Further, landowners who have high scores on the social responsibilities scale would perceive the threats to a lesser degree (have a lesser score for the threat index) than the landowners who have high scores on the individual property rights scale or rights erosion scale.

Methods

Potential threats that landowners may perceive were identified primarily using the proceedings of a workshop entitled 'Private property rights and responsibilities of rangeland owners and managers' (White ed., 1994). In addition, a select group of landowners in Texas (15), Utah (15) was also interviewed for identification of threats to the future viability of operation. Texas and Utah were selected for the study because Texas contains more than 95% privately owned land and Utah had about 2/3rd public land (Holechek, 2001). Thus it was hypothesized that their perceptions of threats would exhibit variation.

From these sources, questions were constructed to determine the "landowner perception" about the level of threat on certain issues and the impact of the threats on the viability of their operation. These issues included lower agricultural commodity prices, more volatile commodity prices, serious reduction of public land grazing leases, greater restrictions on predator control methods, new endangered species listings, increased population growth in your area, increasing subdivision of neighboring properties and

increasing demand for water by non-agricultural properties. The likelihood of these threats affecting the survey participants were classified into three categories, not likely (1), likely (2) and very likely (3). The perception of potential impact on the operation ranged from a strong negative impact (-3) to a strong positive impact (+3).

The survey questionnaire was mailed to 250 randomly selected landowners from two counties each in Texas, Utah and Colorado in 2001. The randomization method used was stratified random sampling. In each state, counties classified into high-growth and low-growth with respect to population was chosen. A county each from the high-growth and low-growth strata was selected randomly to mail the questionnaires. The received responses were coded and entered into SPSS for further analysis.

Factor Analysis

The major objective of the analysis was to obtain a scale variable or threat index for the purpose of data reduction. In the case of the question of how likely the various threats are to occur and if they happen, analysis without a factor analysis would encompass of 16 different dependent variables to be analyzed, if analyzed separately.

Causal Analysis

The scale developed from the factor analysis was subject to a causal analysis using TETRAD IV. TETRAD IV is software developed to identify causal flow of variables. According to the causality delineated by TETRAD IV, a regression analysis was conducted to identify the rate of change of the scale developed with the variables identified in TETRAD IV analysis. The dependent variable used was all threat factors combined (Equation 4). Causal flow analysis of variables is derived from a

methodology developed to determine what constitutes normal behavior and how deviations from normal behavior occur. Deviations from normal behavior are subjective on claims about what happened and what might have happened if circumstances were different. A causal network is represented by a model which denotes the states of the world and how these states could be represented by probabilities (Sprites et al., 2000). A Bayes network is a model that represents all possible states that can exist, where some states occur more frequently than others and this frequency of occurrence is represented by probabilities (Norsys Software Corporation, 2004).

TETRAD IV is software developed to identify causal structure of statistical data. Causal flow among variables can be represented pictorially using a directed graph. The directed graph, Appendix A, is a pictorial representation of correlation and partial correlations in a data set (Bessler, 2002a). The foundation of directed acyclic graphs (DAG) is based upon the notion of inductive causation, where conditional independence relations are examined. In the simplest form, these relations are partial correlations (Swanson, 2002), and this is what TETRAD IV examines for deriving causal relationships.

A directed graph generally has three components, vertices or variables V, M the marks which represent the point of the arrow and E the edge which is a set of ordered pairs (K, M). A directed graph contains only directed edges as represented in Figure 1, while causal associations come in several forms: i) directed edges ($X \rightarrow Y$), where X causes Y ii) bi-directed edges ($X \leftrightarrow Y$) where the causal effect is indeterminate between X and Y, both can cause each other iii) non-directed edges (X_0- Y_0) X and Y does not

have a causal relationship. A directed graph might have a directed relationship as well as an indirect relationship as represented in Appendix A.

In simple theoretical form, let a variable Y be defined in two variables x_1 and x_2. Let x_2 be also a function of x_1 as:

$$Y = f(x_1, x_2) \quad \ldots\ldots (3)$$

$$x_2 = g(x_1) \quad \ldots\ldots (4)$$

thus,

$$Y = f(x_1, g(x_1))$$

and

$$\frac{\partial Y}{\partial x_1} = \frac{\partial f(x_1, x_2)}{\partial x_1} + \left(\frac{\partial f(x_1, x_2)}{\partial x_2} \times \frac{\partial g(x_1)}{\partial x_1} \right)$$

Here a partial derivative of Y upon x_1 will depend on the direct effect of x_1 upon Y $\left(\frac{\partial f(x_1, x_2)}{\partial x_1} \right)$ and the indirect effect of x_1 upon Y $\left(\frac{\partial f(x_1, x_2)}{\partial x_2} \times \frac{\partial g(x_1)}{\partial x_1} \right)$.

The type of directed graph considered in this paper contains no cyclic path, in which there is no path X→Y→V→X. Such graphs, without cyclic paths are termed as Directed Acyclic Graphs (DAG) and have been extensively used in various fields ranging between manpower researches for the NAVY to calibration of satellite data, prediction of pneumonia patients at risk and causal effect of prolonged lead exposure for the lowering of IQ in children (Sprites P., 2004).

A directed acyclic graph is the pictorial representation of conditional independence as given in the equation 5:

$$\Pr(v_1, v_2, v_3, \ldots v_n) = \prod_{i=1}^{n} \Pr(v_i / pa_i) \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots \quad (5)$$

where Pr is the probability of vertices i...n and pa_i is the realization of a subset of variables that precede v_i in order $v_1, v_2, v_3, v_4, v_5, \ldots\ldots\ldots\ldots v_n$. Pearl (2000) proposed a concept called d-separation (direction separation) as a characteristic of conditional independence. In case of three vertices X, Y and Z with a relationship X→Y←Z, Y is called the collider variable while X and Z are d-separated. These variables become d-connected if the relationship is conditioned on Y (Bessler et al., 2002).

TETRAD IV incorporates restrictions placed on regression coefficients of causal regression models or on correlation matrix. A PC algorithm was used, in which there is initially an unrestricted set of relationships between variables. The PC algorithm operates by removing the edges between variables using a step-wise procedure. This step-wise procedure incorporates checking the correlations between variables, removing variables with zero –value for conditional partial correlation with any other variable using Fischer's Z-statistic. Thus the PC algorithm results in a directed 'causal flow' (Bessler et al., 2002). The conditions for the causal Bayesian Network to exist are given in Appendix D.

The dependent variable, all threats combined, and a host of independent variables are subject to causal analysis in TETRAD IV. The variables utilized in the causal analysis are included in Table 10.

Table 10: Variables included in the causal analysis conducted in TETRAD IV

Variable	Composition
All weighted threats scale	Summation of all weighted threats given in table 2
State	State of location of the ranch/farm (Utah, Texas, Colorado)
Age	Categorical variable for age group of landowner
Wldrcinc	Dummy variable for presence or absence of wildlife income for the landowner
Totinc	Total income of the landowner
Ranchtotinc	Proportion of ranch income to the total income for the landowner
Yrs Exp	Ranching/farming experience in years for the landowner
Grew up	Dummy variable for landowner grew up in ranch or farm
Formal ed	Categorical variable for the highest education level achieved by landowner
Profit/Loss	Dummy variable for landowner achieving profit or loss in 2001
Acreage	Categorical variable of acres owned by the landowner
asc_indv	Additive scale for individual property rights orientation
asc_thrt	Additive scale for rights erosion property rights orientations
asc_stew	Additive scale for stewardship orientations
asc_socr	Additive scale for social responsibilities orientations

Table 11: Composition of all weighted threat scale

Variable = Σ		Likelihood	×	Effect
All Weighted threats =	Σ	Likelihood of lower Agricultural Prices		Effect of lower Agricultural Prices
		Likelihood of greater restrictions in predator control		Effect of greater restrictions in predator control
		Likelihood of increased demand in water by non-agricultural interests		Effect of increased demand in water by non-agricultural interests
		Likelihood of increased population growth in your area		Effect of increased population growth in your area
		Likelihood of increased subdivision of neighboring parties		Effect of increased subdivision of neighboring parties
		Likelihood of more volatile agricultural commodity prices		Effect of more volatile agricultural commodity prices
		Likelihood of new endangered species listing		Effect of new endangered species listing
		Likelihood of serious reduction in public land grazing leases		Effect of serious reduction in public land grazing leases

The components of the all weighted threats scale is given in Table 11. The likelihood of the threats affecting the survey participants is illustrated in table 11 and is as represented in equation 4.

$$\text{All weighted threat scale} = \sum_{i=1}^{8}\left(\text{Likelihood of threat}_i \times \text{Effect of threat}_i \times (-1)\right) \ldots\ldots (6)$$

For example, the effect of lower agricultural prices (-3 to +3) multiplied by the likelihood of the lower prices (1 to 3) and then multiplied by -1. This created a weighted scale where values ranged from -72 (8 items* -3 for impact * 3 for likelihood) to +72 (8 items* +3 for impact*3 for likelihood). The multiplication by -1 was to reverse scale values to be more intuitive in terms of measurement. More negative values of the scale indicated that the landowner thinks the threats are more likely and they are impacted more by the threats.

Results

The descriptive statistics for the components of the threat index is given in Table 12 & 13.

Table 12: Means and confidence levels of likelihoods of various threats to the viability of ranch/farm in the future

Likelihood of various threats in the future	Mean ±95% Confidence level	Std. Error
Lower agricultural prices	2.17±0.06	0.03
Greater restrictions in predator control	2.11±0.06	0.03
Increased demand for water by non-agricultural interests	2.39±0.06	0.03
Increased population growth in your area	2.19±0.06	0.03
Increased subdivision of neighboring properties	2.07±0.07	0.04
More volatile agricultural commodity prices	1.99±0.06	0.03
New endangered species listings	2.22±0.06	0.03
Serious reduction of public land grazing leases	2.08±0.07	0.03

Table 13: Means and confidence levels of perceived impact on the future viability of operation caused by the various threats

Effect of future threats	Mean ±95% Confidence level	Std. Error
Lower agricultural prices	-0.08±0.17	0.08
Greater restrictions in predator control	-0.69±0.13	0.08
Increased demand for water by non-agricultural interests	-1.07±0.17	0.09
Increased population growth in your area	-0.67±0.16	0.08
Increased subdivision of neighboring properties	-0.82±0.16	0.08
More volatile agricultural commodity prices	-0.78±0.15	0.08
New endangered species listings	-0.87±0.16	0.08
Serious reduction of public land grazing leases	-0.38±0.13	0.07

The respondents appear to think that the threats stated are more likely to occur than not likely. The most likely threat felt by the respondents is the increased demand of water by non-agricultural interests. The least likely threat felt by the respondents is the volatility of commodity prices. The narrow range of the response represents similarity of opinion among the respondents. The respondents suggest that highest negative impact on the future operation would be caused by the increased demand of water by non-agricultural interests and the lowest negative impact would be by the lower agricultural commodity prices.

The principal components analysis was conducted for extracting the factors emerging from the complex question, 'How the following factors will affect the future viability of the ranch or farm operation?' The factor analyses of the likelihood of the threats loaded into three factors are shown in Table 14.

Table 14: Principal Component Analysis of elements in the likelihood of threats affecting the viability of ranch/farm in the future

Type of Threat	Component		
	I	II	III
Lower agricultural prices	0.100	0.122	**0.890**
Greater restrictions in predator control	0.106	**0.801**	0.230
Increased demand for water by non-agricultural interests	**0.666**	0.323	0.209
Increased population growth in your area	**0.877**	0.145	0.035
Increased subdivision of neighboring properties	**0.864**	0.084	0.093
More volatile agricultural commodity prices	0.127	0.180	**0.865**
New endangered species listings	0.161	**0.754**	0.129
Serious reduction of public land grazing leases	0.183	**0.773**	0.034

*Principal Component analysis with Varimax rotation

High factor loading were found for three separate sets of questions on the three which were theoretically and analytically separable; 1. demand effect: Likelihood of increased demand for water by non-agricultural interests, Likelihood of increased population growth in your area and Likelihood of increased subdivision of neighboring properties, 2. Natural resource policy effects: Likelihood of greater restrictions in predator control, Likelihood of new endangered species listings and Likelihood of serious reduction of public land grazing leases, 3. Price effects: Likelihood of lower agricultural prices and Likelihood of more volatile agricultural commodity prices. However the reliability analyses revealed the usage of these three factors as scales were all somewhat lower than 0.8; population effects (0.787), policy effects (0.729) and price effects (0.769); a reliability of 0.8 or higher being acceptable for most social science applications (Anon 2004 a). Hence an exploration into other forms of scales developed for the threat effects was considered.

Table 15: Principal Component Analysis of elements in the impact of threats affecting the viability of ranch/farm in the future

Effects of future threats	Component I
Lower agricultural prices	0.816
Greater restrictions in predator control	0.812
Increased demand for water by non-agricultural interests	0.854
Increased population growth in your area	0.831
Increased subdivision of neighboring properties	0.795
More volatile agricultural commodity prices	0.781
New endangered species listings	0.818
Serious reduction of public land grazing leases	0.568

No rotation, only one component was extracted

The factor analysis on the impact of the threats revealed one component, with high loading of all the questions as shown in Table 15. However, development of a scale from the impact alone would not convey the complete information, as it does not detail how the landowners perceive the likelihood of the threats. Thus a weighted scale was developed as denoted in equation 4.

A principal components analysis conducted for the weighted scale components is given in Table 16. The factor loadings of each weighted effect on the single component extracted are high. The results indicate that a single additive weighted scale developed from all the threats will suffice.

Table 16: Principal Component Analysis of weighted effects and likelihoods affecting the viability of ranch/farm in the future

Impact of future threats	Component I
Weighted effect & likelihood of lower agricultural prices	0.811
Weighted effect & likelihood of greater restrictions in predator control	0.784
Weighted effect & likelihood of increased demand for water by non-agricultural interests	0.846
Weighted effect & likelihood of increased population growth in your area	0.818
Weighted effect & likelihood of increased subdivision of neighboring properties	0.796
Weighted effect & likelihood of more volatile agricultural commodity prices	0.784
Weighted effect & likelihood of new endangered species listings	0.816
Weighted effect & likelihood of serious reduction of public land grazing leases	0.575

Table 17: Reliability analysis of weighted scales of threats affecting the viability of ranch/farm in the future

Sub Scale	Items	Scale Mean if item deleted	Cronbachs' Alpha on Standardized items	Mean inter item correlation	Mean item total correlation
Weighted All threats scale	Lower agricultural prices	14.823	0.909	0.556	0.709
	Greater restrictions in predator control	15.362			
	Increased demand for water by non-agricultural interests	14.246			
	Increased population growth in your area	15.223			
	Increased subdivision of neighboring properties	14.894			
	Volatile agricultural commodity prices	15.298			
	New endangered species listings	14.949			
	Serious reduction of public land grazing leases	16.344			

A reliability analysis of the weighted scales developed has a very high value for Cronbach's alpha (0.909) (Table 17), indicating that the additive scale that is created from all the questions is reliable in all further analysis. A tetrad analysis was further conducted using this scale, a host of socio-demographic variables (in Table 10) and the property rights orientations to determine the causal flow and the direction of further analysis.

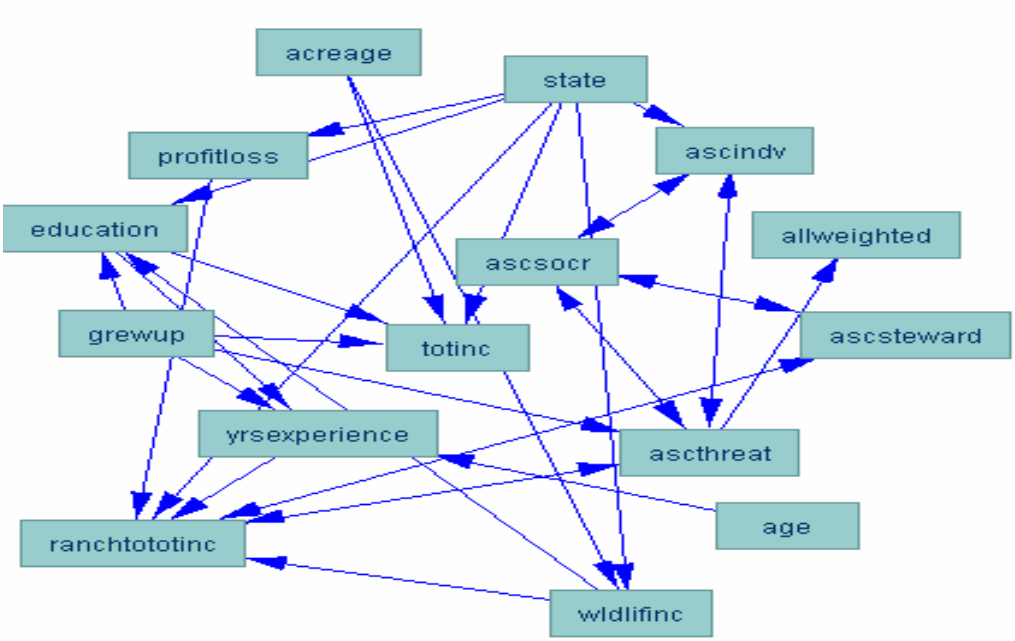
Normality tests were conducted for the "all weighted threats scale". The test indicates a slightly left skewed, but normal distribution (Skewness = -0.746, Kolmogorov-Smirnoff Statistic = $0.083_{(p=0.000)}$). The results of the normality plots are given in Appendix E.

The lower triangular elements of the covariance matrix of the variables listed in Table 10 were fed to TETRAD IV for the causal analysis. The covariance matrix utilized is reproduced in Appendix F.

The directed acyclic graph analysis results are reproduced in Figure 2. The analysis was conducted with specified constraints imposed on the covariance matrix. A procedure called temporal tiers (Sprites et al., 2000) was used to impose these constraints, where a tier structure was assigned the variables to indicate which variable precedes the other in form of a causal order, when the relationship was not revealed by the algorithm. This tier was as follows:

1. State
2. Age, wildlife income, grew up, education, acreage
3. Total income, Years experience, Profit/loss
4. Asc_indv, Asc_socr, Asc_stew, Asc_thrt, ranchtototinc
5. All weighted threats

The upward causal flow between these tiers was forbidden to prevent logical inconsistencies. The results are shown in Figure 39.



* 90% level of significance for the presence of an edge

Figure 39: Directed Acyclic Graph output from the causal analysis of threats to future viability of ranching/farming

The results indicate causal flow as follows:

- State→ profit /loss, education, proportion of ranch to total income, total income, presence of wildlife income, additive scale for individual property rights
- Acreage→ total income, presence of wildlife income
- Profit/loss→ proportion of ranch to total income
- Education→ total income, years of experience
- Grew up → education, total income, years of experience, additive scale for rights erosion
- Years experience → proportion of ranch to total income
- Presence of wildlife income → proportion of ranch to total income, education

- Age → years of experience
- Additive scale for rights erosion → All weighted threats scale

The influence of state on individual property rights orientations is interesting in the sense that State where the landowner lives does not influence any other property rights orientations. However the bidirectional relationship between individual property rights orientations and the other property rights orientations might indicate an indirect relationship. Intuitively, the acreage of land owned by the rancher/farmer has a causal effect on the household's total income and presence or absence of wildlife income, which can be attributed to diseconomies of scale.

Whether the ranch made a profit or loss in 2001 has a causal effect on proportion of ranch income to total household income. Logic and previous literature suggests that ranchers whose depend on the ranch for more of their income would make sure they manage it in a manner to assure profit (Rowan, 1994, 161). Level of formal education of the landowner had a causal effect on total household income and years of ranching or farming experience. A correlation analysis conducted (-0.283) revealed that landowners with higher education also having less experience in ranching or farming. Previous studies in social sciences have established that households with higher education have higher total income.

Whether the landowner grew up in a ranch or farm has a causal effect on education, total household income, years of experience and the additive scale for property rights being increasingly threatened. As landowners who grow up in ranch or farm show a lower level of education ($r = -0.198$), lower level of household income ($r = -$

0.213), higher experience in ranching/farming (r = 0.352) and a higher value in the rights erosion scale (r = 0.193), compared to the other property rights (individual scale (r = 0.140), social responsibility scale (r = -0.135) and stewardship scale (r = 0.035)).

Years of ranching or farming experience have a causal effect on proportion of ranch income to total household income. Generally landowners with higher amount of experience have lesser proportion of ranch to total household income (r = 0.300). These landowners are traditional landowners who have been living in the land for a long time.

Presence of wildlife income has a causal effect on proportion of ranch to total income and education. This may be due to the indirect factor of state influencing the presence of wildlife income, thereby affecting the education levels of ranchers and their total income.

The additive scale of rights erosion has a causal effect on impact and likelihood of the threats, therefore bringing the directed graph inferences together. This indicates that we can proceed with the analysis of all weighted threats as a dependent variable.

Six relationships are bi-directed. These include: Asc_socr ↔Asc_thrt, Asc_socr ↔Asc_indv, Asc_socr ↔Asc_stew, Asc_stew ↔ ranchtototinc, Asc_thrt ↔ ranchtototinc and Asc_thrt ↔ Asc_indv. These bi-directional relationships create problems in the analysis, reducing the significance of items. An instrumental variable technique can be used as a remedy in this case. The instrumental variable technique involves utilization of a variable that 'moves with one set of variables without moving with another set' (Bessler, 2002b, 25). The directed graph shows a variable is clearly partitioned from the jointly determined variables. For example, in our question, Asc_thrt

and ranchtototinc have bi-directed edges. Here we can find a variable state, which is related to ranchtototinc, but not to Asc_thrt. The instrumental variable analysis consists of the following, regress state on ranchtototinc; get the predicted value of ranchtototinc (ranchtototinc^). This variable, ranchtototinc^, which is a form of ranchtototinc, is completely unrelated to any other variable in the DAG and can be used in a regression analysis of any other variable in the DAG.

Such instrumental variables were created for three out the five variables involved in bi-directional edges. The instrumental variables created were:

Asc_thrtpred: Regress Asc_thrt on grewup, obtaining a predicted value for Asc_thrt which does not have an edge with any other variable,

Ranctototincpred: Regress ranchtototinc on Yrsexperience; obtain predicted value for ranchtototinc which does not have an edge with any other variable,

Asc_indvpred: Regress Asc_indv on State; obtain predicted value for Asc_indv which does not have an edge with any other variable.

Regression Analysis

Due to data constraints (i.e. unavailability of variables correlated with the bi-directed variables, but not with any other variable used in the analysis) I could not obtain instrumental variables for Asc_stew and Asc_socr. Hence I utilized the variables as such in the regression.

Ordinary least squares regression procedure was performed with the dependent variable being all weighted threat index and the independent variables being: acreage, age, asc_socr, asc_stew, asc_thrtpred, asc_indvpred, formaled, growup, profit,

ranchtototpred, state, totinc, wldrcinc, yrsexp. The results of the regression analysis are given in the Table 18.

Table 18: Ordinary Least Squares results of various independent variables on sum of all weighted threats

Variable	Standardized Coefficient	Standard Error	T-value	P-value
Constant	-	11.664	1.162	0.246
Acres owned	0.047	0.000	0.840	0.402
Age of respondent	-0.061	0.150	-1.104	0.270
Formal education	**0.104**	**1.131**	**1.763**	**0.079**
Grow up in ranch or farm	0.056	3.759	0.981	0.327
Households total income	0.000	1.255	0.004	0.997
Proportion of household's total income from net ranch or farm income (predicted)	0.056	1.739	0.967	0.334
Wildlife and recreational income	-0.040	3.470	-0.699	0.485
Ranch or farm show profit in 2001	-0.024	1.900	-0.426	0.670
Additive scale for rights erosion (predicted)	0.091	1.805	1.503	0.134
Additive scale for individual property rights support (predicted)	0.023	1.866	0.363	0.717
Additive scale for social responsibility	-0.078	0.406	-1.318	0.188
Additive scale for stewardship	0.049	0.800	0.884	0.378

- Adjusted R^2 of 0.045, **bolded items are significant at 90% confidence level**

The ordinary least squares regression reveals that only one variable, formal education is significant at 90% level of confidence. The coefficient is positive suggesting the increasing education is associated with lesser perception of susceptibility of threats to future operation. The variables rights erosion scale and social responsibility scale are significant at the 80% level of confidence. The social responsibilities scale (Asc_socr) has a negative coefficient, indicating that landowners who scored high on the social responsibilities scale had negative values for the threat index, these landowners were more impacted and they were thought that the threats were more likely to happen.

The coefficient of the predicted value of additive scale for rights erosion (Asc_thrtpred) is positive, suggesting that landowners, who scored high on the property rights being increasingly threatened scale, thought that the threats were less likely to happen. This was an indication that the scales created were logically consistent.

The stewardship property rights orientations showed positive relationship with threat index. The result suggests that landowners with higher stewardship orientations are less worried about threats affecting their future viability and are more determined to operate under trying circumstances. However the variable is not significant in the 90% level, so further interpretation was not conducted.

The non-significance of several items in the analysis may be attributed to the correlation between the items of the analysis. The instrumental variables created to combat that problem were not efficient, although it improved the significance slightly, were not significant at the 90% level.

Component Analysis

Due to the poor explanatory power of the independent variables in the overall regression analysis, separate regression analyses were conducted of the three components identified in the principal component analysis of the likelihood of the threats (Table 14) and the one component arising out of the principal component analysis of the effects of the threat. The results are presented in Table 19(demand subscale), Table 20 (price subscale), Table 21 (policy subscale) and Table 22 (effects of threats subscale).

Table 19: Ordinary Least Squares regression results of various independent variables on demand subscale

Variable	Standardized Coefficient	Standard Error	T-value	P-value
Constant	**-**	**0.656**	**9.323**	**0.000**
Acres owned	-0.093	0.100	-1.554	0.121
Age of respondent	-0.087	0.106	-1.400	0.162
Formal education	0.026	0.063	0.498	0.619
Grow up in ranch or farm	0.005	0.228	0.091	0.928
Households total income	0.020	0.073	0.317	0.711
Proportion of household's total income from net ranch or farm income	0.059	0.074	1.003	0.317
Wildlife and recreational income	-0.026	0.068	-0.540	0.589
Ranch or farm show profit in 2001	0.029	0.105	0.562	0.574
Additive scale for rights erosion	**0.202**	**0.034**	**3.683**	**0.000**
Additive scale for individual property rights support	-0.026	0.030	-0.457	0.648
Additive scale for social responsibility	0.021	0.023	-0.392	0.695
Additive scale for stewardship	-0.023	0.042	-0.464	0.643

- Adjusted R^2 of 0.033, **bolded items are significant at 90% confidence level**

Table 20: Ordinary Least Squares regression results of various independent variables on policy subscale

Variable	Standardized Coefficient	Standard Error	T-value	P-value
Constant	**-**	**0.618**	**7.577**	**0.000**
Acres owned	**0.192**	**0.94**	**3.254**	**0.001**
Age of respondent	-0.012	0.100	-0.202	0.840
Formal education	-0.044	0.058	-0.862	0.389
Grow up in ranch or farm	0.094	0.211	1.789	0.074
Households total income	-0.075	0.067	-1.441	0.150
Proportion of household's total income from net ranch or farm income	0.059	0.070	1.036	0.301
Wildlife and recreational income	-0.069	0.063	-1.446	0.149
Ranch or farm show profit in 2001	-0.019	0.097	-0.380	0.704
Additive scale for rights erosion	**0.143**	**0.031**	**2.688**	**0.008**
Additive scale for individual property rights support	0.013	0.027	0.241	0.810
Additive scale for social responsibility	-0.080	0.022	-1.544	0.123
Additive scale for stewardship	0.071	0.039	1.444	0.150

- Adjusted R^2 of 0.133, **bolded items are significant at 90% confidence level**

Table 21: Ordinary Least Squares regression results of various independent variables on price subscale

Variable	Standardized Coefficient	Standard Error	T-value	P-value
Constant	**-**	**0.446**	**8.623**	**0.000**
Acres owned	**0.126**	**0.067**	**2.088**	**0.037**
Age of respondent	**-0.132**	**0.072**	**-2.113**	**0.035**
Formal education	**0.096**	**0.042**	**1.808**	**0.071**
Grow up in ranch or farm	0.032	0.153	0.591	0.555
Households total income	-0.065	0.050	-1.209	0.227
Proportion of household's total income from net ranch or farm income	0.033	0.051	0.554	0.580
Wildlife and recreational income	-0.010	0.046	-0.199	0.843
Ranch or farm show profit in 2001	-0.051	0.073	-0.985	0.325
Additive scale for rights erosion	**0.111**	**0.023**	**2.004**	**0.046**
Additive scale for individual property rights support	0.010	0.021	0.173	0.863
Additive scale for social responsibility	-0.003	0.016	-0.064	0.949
Additive scale for stewardship	0.006	0.030	0.117	0.907

- Adjusted R^2 of 0.060, **bolded items are significant at 90% confidence level**

From the three separate regressions a number of significant variables were identified. A common significant variable in all the three regressions is the rights erosion scale. This indicates that the respondents who felt that their property rights were being eroded had strong positive responses to all the listed threat factors for the future viability of the ranching/farming. The property size also was a significant factor in explaining the perception of the likelihood of certain threats affecting the future viability of operations. The respondents with larger property size considered all the policy related and price related threats to more likely affect the future viability of ranching/farming operation, than the owners of smaller properties. In addition, age of respondents was found to be significantly related to price related threat factors, with younger respondents perceiving price effect to be more likely to threaten the viability of their operation. Conversely,

landowners with more formal education perceived the price related threats on the future viability of the operation to be less likely.

Table 22: Ordinary Least Squares regression results of various independent variables on effects of threats to the future viability of operation

Variable	Standardized Coefficient	Standard Error	T-value	P-value
Constant	-	4.249	0.279	0.780
Acres owned	**-0.180**	**0.628**	**-2.842**	**0.005**
Age of respondent	0.069	0.679	1.067	0.287
Formal education	**-0.124**	**0.403**	**-2.208**	**0.028**
Grow up in ranch or farm	-0.032	1.393	-0.570	0.569
Households total income	0.020	0.460	0.363	0.717
Proportion of household's total income from net ranch or farm income	0.011	0.484	0.178	0.859
Wildlife and recreational income	**0.162**	**0.393**	**3.185**	**0.002**
Ranch or farm show profit in 2001	0.039	0.686	0.734	0.463
Additive scale for rights erosion	-0.036	0.212	-0.636	0.525
Additive scale for individual property rights support	-0.008	0.195	-0.130	0.897
Additive scale for social responsibility	0.062	0.144	1.110	0.268
Additive scale for stewardship	-0.028	0.287	-0.532	0.595

- Adjusted R^2 of 0.060, **bolded items are significant at 90% confidence level**

In a separate regression of the effects of the various threats on the future viability of ranching operation, none of the property rights orientations scales were significant. The variables that were significant were property size, formal education and presence of wildlife and recreational income. Property size and formal education showed negative slopes in the regression, indicating that the respondents with higher education and higher property sizes indicated a lesser effect of threats to the future viability of operation. The landowners who had wildlife income from their operation indicated that the effects of the threats to the future viability of operation were higher.

Conclusions

A factor analysis was conducted to develop a scale for the likelihood and impact of various threat factors affecting the survey respondents. A weighted scale with high degree of reliability was developed from the factor analysis. A directed acyclic graph analysis (DAG) using TETRAD IV was conducted to identify the causal relationships in the data set. The analysis revealed several relationships in the dataset, some with bi-directed edges that prevented the establishment of cause and effect. Instrumental variables were developed for three of the five variables involved in these relationships. An ordinary least squares regression analysis was conducted using the threat index developed from the factor analysis as dependent variable and the causal variables identified in the DAG analysis as independent variables. The bi-directed variables for which instruments could not be created were incorporated as independent variables. The results of the study revealed only one significant explanatory variable for the likelihood of the threat variable, formal education. The lack of significance of the other variable is attributable to the correlation between the property rights scales and the inability of the instruments developed to resolve this "poor fit" problem. However the reliability of the scale developed and the presence of high number of directed edges in the TETRAD IV analysis indicate there are omitted variables that could have calibrated the scale better.

A separate investigation conducted from the decomposition of the likelihood index of the threats into three subscales identified rights erosion scale, property size, education and age as significant explanatory variables. This indicates the analysis of likelihood of threats responses is more useful when threat scale is decomposed into the

three subcomponents, price, policy and demand. Furthermore, design of landowner-friendly policy should proceed with identifying the perceived local threats to landowners. This could ensure increased adoption of policy.

The design of targeted policy can be achieved by using 'trial and error' or 'systematic method' (Tinbergen, 1967). Systematic method design includes the design of policy when the exact conditions are known. For example, when the exact conditions of an industrial production system are known, design a policy to fit the condition can be developed in a single trial. However, this seldom applies in the design of policy aimed at addressing most social or environmental issues. Here the measurement of attitudes may not be accurate, the instruments used to measure attitudes may not be efficient. Thus a trial based policy is desirable. In the specific case of design of adoptable policy such as environmentally conscious management practices, a pilot target could be chosen and this policy could be tested. The selection of pilot audience would be more meaningful if the landowners with different property rights orientations are chosen. For example socially responsible landowners with low level of threat perceptions towards future viability may have more adoption rate for their management practices than landowners exhibiting more individual property rights orientations. Thus targeted design may be successful in increasing adoption rate.

CHAPTER VI

SUMMARY AND CONCLUSIONS

The natural resource debate in the United States has increasingly been constrained by several economic and legal issues as high estate taxes, reduced profit margins of agricultural/ranching operation, Endangered Species Act (1973) and Clean Water Act (1977). This has created a situation in which ranches have become less-profitable and are increasingly being sold to non-agricultural development (Jackson-Smith et al., 2004, 6). In previous literature, landowners have been assumed to have unidimensional, private property orientations and that those who have stronger property rights perceptions are less inclined to manage the land in a manner that is beneficial to broader society. However, four separate property right orientations were identified for landowners by Jackson-Smith et al. (2004), including: individual rights orientation, social responsibilities orientation, stewardship orientation and rights erosion orientation. My study examines the factors influencing the multi-dimensionality of property rights orientations of landowners and determines how these different dimensions affected the management practices of landowners and their perceptions regarding the threats of the future viability of their ranching/farming operation.

A mail survey was conducted in 2001 in three states, Texas, Utah and Colorado. Two counties were selected from each state, one from a low-growth area and one from a high growth area. A set of pre-interviews were conducted with selected landowners in Texas and Utah to identify the major issues concerning ranching/farming. Information

from these interviews along with issues reported in previous literature were utilized to develop the questionnaire. Results of this study are reported in three papers.

In Chapter III, several identifying features of landowners and their opinions about rights and responsibilities of landowners, land use policy, issues in ranching /farming operation and threats to the future viability of operation were compared. Results emerging from the analysis showed that respondents in Texas had more formal education compared to the landowners in Utah and Colorado. Most respondents in all the three states hold off-ranch/farm job, even though comparison between these three states indicates that largest number of off-ranch/farm job holders in Texas. A majority of the respondents grew up in a ranch or farm and had owned their land for more than one generation. Livestock-related activities are the highest source of ranch/farm income in all three states even though Texas has a sizeable amount of wildlife/recreation derived income (30% of ranch income).

In analyzing the opinions of landowners, it was observed that very few respondents were willing to undertake socially preferred ecologically sustainable management practices without compensation. Comparison of response-differences between states indicated that the respondents in Texas were the least willing to adopt such practices without compensation. Another result that emerged from this analysis was that in comparing mean average scores, respondents were more willing to undertake management practices voluntarily than when coerced to do so through regulation.

The aspect of undertaking socially preferable ecologically-sustainable management practices without compensation was further investigated in the Chapter IV.

Here a factor analysis was conducted to identify the structure and diversity of adoption of sustainable land management practices without compensation. The factor analysis revealed a scale that could be developed from four of the six listed management practices. A regression analysis was conducted to determine the change of this scale with respect the four property rights orientations, which revealed a significant difference in the opinion of the respondents with three property rights orientations. The responses showed a significant difference among attitudes of respondents with social responsibilities, rights erosion and stewardship orientations. From this study it was revealed that the landowners with social responsibilities and stewardship orientations are more willing to adopt management practices without compensation. This study also revealed that respondents with larger property sizes were less willing and respondents with higher total incomes were more willing to implement ecologically sustainable management practices without compensation. The former was attributed to diseconomies of scale (larger properties resulting in higher investment requirement), the latter to the higher investment capacity of respondents with higher household income to make the necessary investments. The conclusions drawn from this analysis include the design of policy to suit the various property rights orientations of landowner. Such a design could include selected policy items for targeted audience, such as landowners with socially responsible (i.e. with high scores on social responsibility orientation and stewardship orientation). This would maximize the investment utility of limited federal funds in management oriented incentive programs.

The Chapter V analyzed the perception of the effects of various threat factors against the future viability of ranching and farming operations. The respondent's perception of the likelihood of the threats separated into three different factors as: demand effect, policy effect and price effect. The perception of the level of impact of threats loaded on one factor. This information was used to create a complex scale incorporating the perceived likelihood and the effect of these threat factors. Subsequently, an analysis was conducted using the directed acyclic graph (DAG) methodology to identify the causal flow of the data among variables in the dataset. Several directed edges (causal relationships) were identified, however the relationships could not be quantified using the regression analysis due to the presence of bi-directed edges (cause and effect unidentifiable) among the property rights orientations subscales. Instrumental variables were developed for three of the five variables involved in bi-directed relationships, but these new variables did not increase significance of the causal relationships. The main deficiency was identified as the absence of variables to account for the bi-directed edges.

Due to the non-significance of several items, a separate analysis was conducted on 4 factors that composed the complex weighted scale. The factors that were subject to separate analyses were the demand effect, policy effect, price effect and the perceived level of impacts of the threat factors. The property rights orientation index representing the rights erosion scale was significant in all three of the regressions conducted for likelihood of threat occurring. Other explanatory variables that were significant include age, property size, formal education, presence of wildlife income. Thus in terms of

significance of variables, the analysis of the separate factors provide a more subtle understanding of threat perceptions than the use of a single weighted threat scale.

Respondents who scored higher on the rights erosion scale perceived the threats to be more likely and the impacts of threats on the future viability of their ranching/farming operation to be higher. Conversely, while respondents with larger property sizes perceived the threats to be more likely, they perceived the impacts of these threats to be less for their operation. Older respondents perceived the price threats to their future operation to be less likely, while respondents with higher level of formal education perceived the threats to have higher impact in the future viability of ranching operation.

This study reinforces the findings of previous studies which indicate the support of endangered species act is influenced by a host of variables including age and education (Czech and Krausman, 1999; Elliot et al., 1997). Another study by Jackson-Smith et al. (2004) indicated that private property rights are influenced by the above variables as well. My study also found that the attitudes regarding adoption of socially desirable management practices varied according to various property rights orientations as well as these socio-demographic variables. This suggests that identification of property rights orientations of landowners may be useful in promoting the socially desirable and ecologically sustainable land management practices. Thus policy aimed at enhancing land management should have a multi-target approach, where targets are identified by the property rights orientations of the landowners. The identification of landowner's property rights orientations could be made through census questionnaire or

area specific study. The targeting of policies could be done at a local scale. Our analysis identified several respondents who have strong individual property rights orientations or who identified that their property right orientations are being progressively eroded. Targeting these landowners may yield a less efficient investment of public funds than if landowners with a high degree of socially responsible property rights orientations are targeted. Latter strategy would be especially fruitful if the targeted landowners are also innovative early adopters with less innovative landowners following their lead, thereby increasing the overall adoption of the policy.

This is the first study aimed at better understanding the subtleties of rural landowner's property rights orientations and the effects of multidimensionality of property rights orientations of landowners in various management practices and perception of threats to viability of future operation. The results were obtained from this pilot-study of landowners in two counties each out of three states in the country are preliminary. These findings call for a comprehensive reinvestigation of the characteristics and attitudes of landowners in more counties and states regarding their property rights and the influence on their management decision. Such a study could extract more information from the bi-directed relationships, thus identifying the omitted variables. Some of the variables investigated could be community attachment, psychological variables, media influence, aggravation issues etc.

This study has importance for future application because population pressure would create scarcity of natural resources, which in turn would demand more efficient allocation of natural resources. More efficient public resource allocation to land

management program could be enhanced when such programs address the multidimensionality of property rights.

LITERATURE CITED

Alchian, A. A., H. Demsetz. 1973. The property rights paradigm. The Journal of Economic History, 33(1) : 16-27.

Anderson, T. L., L. E. Higgins. 2003. Property Rights: A Practical Guide to Freedom and Prosperity. Hoover Institution Press., Stanford. CA.

Anon. 2003. The Fifth Amendment. www.findlaw.com/constitution/ amendment05, Accessed 6/5/2003.

Beaton, W. P., M. Pollock, 1992. Economic Impact of Growth Management Policies surrounding the Chesapeake Bay, Land Economics, 68(4): 434-53.

Bessler, D. A., 2002a. Model Building with Observational Data, Presentation at Universidad Internacional Del Ecuador, Quito, Ecuador, November 2002.

Bessler, D A., 2002b. On World Poverty: Its Causes and Effects. Working Paper, Department of Agricultural Economics, Texas A&M University, College Station, TX.

Bessler, D A., J. Yang. 2003. The structure of interdependence in international stock markets, Journal of International Money and Finance, 22(2): 261-287.

Bessler, D. A., J. Yang, and M. Wongcharupan, 2002. Price Dynamics in the International Wheat Market: Modeling with Error Correction and Directed Acyclic Graphs, Journal of Regional Science, 42 (4): 793-825.

Bliss, J.C., M.L. Sisock, and T.W. Birch. 1998. Ownership matters: Forestland concentration in rural Alabama. Society and Natural Resources. 11: 401-410.

Bourke, L., and A. E. Luloff, 1994. Attitudes towards the management of nonindustrial private forest land, Society and Natural Resources, 7: 445-457.

Brandenburg, A. M., and M. S. Carroll. 1995. Your place or mine? The effect of place creation on environmental values and landscape meanings. Society and Natural Resources. 8: 381-398.

Butler, L. D., and J. P. Workman, 1991. Fee-hunting enterprises, stocking rates, and range condition in the Texas Trans Pecos. Proceedings of IVth International Rangeland Congress, Montpellier, France. Pp. 909-911.

Buttell, F. H. 1992. Environmentalism: Origins, processes and implications for rural development. Rural Sociology. 57(1): 1-27.

Church, J. R. and R. Ware. 2000. Industrial Organization: A Strategic Approach. The McGraw-Hill Book Company., Singapore.

Coase, R. H. 1937. The nature of firm. Economica. 16(4): 386-405.

Coase, R. H. 1960. The problem of social cost. The Journal of Law and Economics. 3: 1-44.

Coase, R. H. 1994. Essays on economics and economists. The University of Chicago Press., Chicago, IL.

Combs, S. 1994. Texas Private Property Rights Legislation, Pp 95-103. *In*: Larry D. White (ed), Private Property Rights and Responsibilities of Rangeland Owners and Managers. Proceedings of a Workshop Held from 23-25 October, 1994, Austin, TX.

Coppock, L. D., and A. H. Birkenfeld. 1999. Use of livestock and range management practices in Utah. Journal of Range Management. 52: 7-18.

Cromartie, J. B., and J. M. Wardell. 1999. Migrants settling far and wide in the Rural West. Rural Development Perspectives 14(2): 2-8.

Czech, B., and P. R. Krausman. 1999. Public opinion on endangered species conservation and policy. Society and Natural Resources. 12 : 469-479.

Dillman, D. A. 2000. Mail and Internet Surveys: The Tailored Design Method. John Wiley and Sons, Inc., New York.

Dwyer, L. E., D. D. Murphy, and P. R. Ehrlich. 1995. Property rights case law and the challenge to the Endangered Species Act. Conservation Biology. 9(4): 725-741.

Eisenhauer, B. W., R. S. Krannich, and D. J. Blahna. 2000. Attachments to special places on public lands: An analysis of activities, reasons for attachments, and community connections. Society and Natural Resources. 13: 421-441.

Elliott, E., B. J. Seldon, and J. L. Regens. 1997. Political and economic determinants of individuals' support for environmental spending. Journal of Environmental Management. 51: 15-27.

Evans, K. E. 1990. Rangeland Research: Past, Present, and Future. USDA-FS. Washington DC. 26 pp.

Feldman, D. L. 1991. Water Resources Management: In Search of an Environmental Ethic. The Johns Hopkins University Press. Baltimore, MD.

Fischel, W. A. 1995. Zoning and the urban environment. 61-88. *In*: Daniel W. Bromley (ed), The Handbook of Environmental Economics. Blackwell Publishers., Cambridge, MA.

Fortmann, L. 1996. Domestic land tenure. Society and Natural resources. 9: 539-547.

Georgetown Environmental Law and Policy Institute. 2004. The Takings Issue. www. law. georgetown.edu /gelpi/takings, Accessed 1/6/2004.

Greve, M. 1994. What are the issues? 3-7. *In*: Larry D. White (ed), Private Property Rights and Responsibilities of Rangeland Owners and Managers. Proceedings of a Workshop Held from 23-25 October, 1994, Austin, TX.

Hardin, G. 1968. The tragedy of the commons. Science, 13: 1243-48.

Harnett-White, K., 1994. Why are property rights important to responsible management? Pp. 25-29. In: Larry D. White (ed), Private Property Rights and Responsibilities of Rangeland Owners and Managers. Proceedings of a Workshop Held From 23-25 October, 1994, Austin, TX.

Holechek, J. L., R. D. Pieper, and C. H. Herbel. 2001. Range Management: Principles and Practices. Prentice Hall, Upper Saddle River, NJ.

Jackson-Smith, D. B., U. P. Kreuter, R. Krannich and L. Swanson. 2003. Influence of Property Rights Orientations on Rangeland Management, Patterns of Land Use Change and Rural Community Stability. A Research Proposal submitted to USDA Cooperative State Research, Education, and Extension Service, Washington DC.

Jackson-Smith, D., U. P. Kreuter, and R. S. Krannich, 2004. Understanding the Multidimensionality of Property Rights Orientations: Evidence from Utah and Texas Ranchers. Working Paper, Utah State University, Logan, UT.

Kim, Jae-on., and C. W. Mueller., 1978. Factor Analysis: Statistical Methods and Practical Issues. Sage Publications, Beverly Hills, CA.

Knight, R. L., 2002. "The ecology of ranching." Pp. 123-144 in Ranching West of the 100th Meridian: Culture, Ecology, and Economics, R.L. Knight, W.C.Gilbert and E. Marston (eds.). Island Press, Washington DC.

Kreuger, W. C. 1994. Achieving responsible rangeland resource management. 143-148. *In* : Larry D. White (ed), Private Property Rights and Responsibilities of Rangeland Owners and Managers. Proceedings of a Workshop Held From 23-25 October, 1994, Austin, TX.

Locke, J. 1956. The Second Treatise of Government: An Essay Concerning the True Original, Extent and End of Civil Government and A Letter Concerning Toleration. The Macmillan Company, New York.

Marquis, S. M. and K. H. Marquis., 1977. Survey Measurement Design and Evaluation Using Reliability Theory: Prepared under a Grant from the Department of Health, Education and Welfare. Rand, Santa Monica, CA.

Morgan, S. L., 2004. Book Review of Causality: Models, Reasoning and Inference. J. Pearl, 2000, Cambridge University Press, in Sociological Methods and Research. 32(3): 411-422.

Morrison, D. E. 1986. How and why environmental consciousness has trickled down. 187-222. *In* : Schnaiberg, A., Watts, N. and A. Zimmerman (eds), Distributional Conflict in Environmental Resource Policy. St. Martins' Press, New York.

Myles, G. D. 1995. Public Economics. Cambridge University Press. Cambridge, UK.

Norsys Software Corporation. 2004. Bayesian Networks. http://www.norsys.com /tutorials /netica/secA/tut_A1.htm, Accessed 08/09/2004.

Norusis, M. J., 1990. SPSS Advanced Statistics Student Guide. SPSS Inc, Chicago, IL.

Olson, A. H. 1999. The Law of the Land. 96-136. *In*: Olson, R. K. and T. A. Lyson (eds), Under the Blade: The Conversion of Agricultural Landscapes. Westview Press, Oxford, Great Britain.

Osgood, E. S. 1929. The Day of the Cattleman. University of Minnesota press, Minneapolis, MN.

Ostrom, E. 2002. Governing the Commons. Cambridge University Press, New York.

Pearl, J. 2000. Causality: Models, Reasoning and Inference, Cambridge, MA: Cambridge University Press.

Pejovich, S. 1990. The Economics of Property Rights: Towards a Theory of Comparative Systems. Kluwer Academic Publishers, Dordrecht, The Netherlands.

Pilon, R. 2004. Protecting Private Property Rights from Regulatory Takings. www.cato.org /testimony/ct-pi210.html, Accessed 1/7/2004.

Rowan, R. C. 1994. Are small-acreage livestock producers real ranchers? Rangelands, 16(4): 161-166.

Rowan, R. C., H. W. Ladewig and L. D. White. 1994. Perceptions vs. recommendations: A rangeland decision-making dilemma. Journal of Range Management. 47: 344-348.

Schoenbaum, T. J., Rosenberg, R. H. and H. D. Doremus. 2002. Environmental Policy Law: Problems, Cases and Readings. Foundation Press, New York.

Shogren, J.F. (editor). 1999. Private Property and the Endangered Species Act: Saving Habitats, Protecting Homes. University of Texas Press, Austin, TX.

Sprites P., 2004. TETRAD Project Homepage. www.phil.cmu.edu/projects/tetrad, Accessed 6/5/2004

Sprites, P., Glymour, C., and Richard Scheines. 2000. Causation Prediction and Search. Cambridge, MA: The MIT Press.

Statsoft Inc. 2004. Reliability and Item Analysis. http://www.statsoft.com /textbook/streliab.html, Accessed 08/09/2004.

Stigler, G. J. 1989. Two notes on Coase Theorem. Yale Law Journal. 99: 631-633.

Swanson, N. R. 2002. Review of Causality: Models, Reasoning and Inference. J. Pearl, 2000, Cambridge University Press, in Journal of Economic Literature, 40: 925-926.

Tinbergen, J. 1967. Economic Policy: Principles and Design. 4th Edition. Rand McNally, Chicago, IL.

Tyson, C. B. and S. H. Broderick. 1999. A strategic approach to promoting estate conservation planning for combating land fragmentation. Society and natural Resources. 12: 693-702.

UCLA Academic Technology Services. 2004. What does Cronbach's Alpha do? http://www.ats.ucla.edu /stat/spss/faq/alpha.html, Accessed 08/09/2004.

White, L. R. (editor), 1994. Private Property Rights and Responsibilities of Rangeland Owners and Managers. Proceedings of a Workshop Held From 23-25 October, 1994, Austin, TX.

Wilcove, D. S., and J. Lee., 2004. Using economic and regulatory incentives to restore endangered species: Lessons learnt from three new programs. Conservation Biology, 18(3): 639-645.

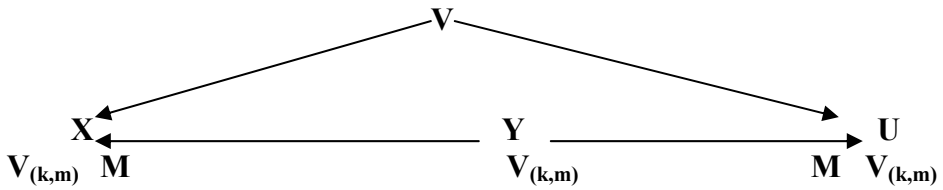
Wilkinson, K P. 1991. The Community in Rural America. Greenwood Press, New York.

Workman, J. P., and S. G. Evans. 1993. Utah Ranches – An Economic Snapshot. Rangelands 15(6): 253-255.

Young, M. D. 1992. Sustainable investment and resource use: Equity, environmental integrity and economic efficiency. *In*: Jeffries, J. N. R. (ed) Man and Biosphere series 9. UNESCO, Paris, Parthenon Publishing, Carnforth. U. K. 176 pp.

APPENDIX A

Pictorial Representation of a Directed Acyclic Graph



- A variable V causes both X and Z. V influences Y indirectly through both X and U. There is a "direct path" of X→Y and "backdoor path" X ←V→U←Y. $V_{(k,m)}$ represents a vertex and (k,m) are the ordered pairs that are identify the vertex. M represents the arrow-head of the edge.(Bessler, 2002b)

APPENDIX B

Tabulation of Descriptives of Respondents

Table B1: Percentage of Respondents classified according to their age

County	……Age Groups ……					Total # respondents
	<40	40-49	50-59	60-69	>70	
Llano	1%	13%	42%	25%	19%	84
Sutton	6%	25%	32%	19%	18%	88
Uintah	4%	13%	22%	22%	37%	89
Summit	5%	25%	23%	34%	14%	44
Moffat	3%	32%	24%	24%	17%	130
Routt	1%	19%	34%	28%	17%	134
Total # respondents	18	124	169	142	116	569

Table B2: Percentage of respondents classified according to Gender

County	……..Gender ……..		Total # Respondents
	Male	Female	
Llano	68%	32%	84
Sutton	76%	24%	89
Uintah	88%	12%	90
Summit	84%	16%	44
Moffat	82%	18%	130
Routt	75%	25%	134
Total # Respondents	448	123	571

Table B3: Percentage of respondents classified according to education level

County	……..Education Level ……						Total # Respondents
	<High school	High school	Trade school	2-year college	4-year college	Graduate	
Llano	5%	16%	2%	14%	30%	33%	83
Sutton	2%	17%	3%	17%	36%	24%	87
Uintah	7%	45%	12%	10%	16%	10%	89
Summit	2%	27%	9%	9%	25%	27%	44
Moffat	8%	37%	16%	15%	18%	7%	130
Routt	5%	25%	6%	15%	31%	18%	133
Total # Respondents	30	161	49	79	145	102	566

Table B4: Percentage of respondents classified according to residence at the farm or ranch

County	…….Currently lives on Ranch or Farm ……		Total # respondents
	Yes	No	
Llano	49%	51%	84
Sutton	48%	52%	90
Uintah	76%	24%	90
Summit	59%	41%	44
Moffat	32%	68%	131
Routt	27%	73%	132
Total # respondents	315	256	571

Table B5: Percentage of respondents classified according to their growing up on a ranch or a farm

County	……Grew Up in Ranch/Farm ……		Total # Respondents
	Yes	No	
Llano	63%	37%	84
Sutton	72%	28%	87
Uintah	87%	13%	91
Summit	71%	29%	45
Moffat	78%	22%	130
Routt	68%	32%	133
Total # Respondents	418	152	570

Table B6: Percentage of respondents classified according to their length of property ownership

County	……..……Length of Property Ownership (years) ……					Total # respondents
	< 3	3-10	11-25	>25	>1 generation	
Llano	2%	7%	10%	14%	67%	84
Sutton	7%	13%	8%	8%	64%	89
Uintah	1%	11%	17%	23%	48%	90
Summit	2%	5%	12%	12%	70%	43
Moffat	4%	23%	14%	14%	45%	130
Routt	3%	16%	21%	20%	41%	133
Total # respondents	19	81	81	89	299	569

Table B7: Percentage of respondents classified according to their total household income

County	……..Household's total income…….						Total # respondents
	<25K [series1]	25-50k [series2]	50-75k [series3]	75-100k [series4]	100-500k [series5]	>500k [series6]	
Llano	7%	18%	16%	24%	28%	8%	76
Sutton	4%	15%	22%	24%	30%	4%	89
Uintah	9%	44%	22%	10%	15%	0%	89
Summit	5%	39%	17%	15%	20%	5%	41
Moffat	11%	35%	19%	15%	19%	2%	124
Routt	14%	27%	18%	16%	23%	2%	121
Total # respondents	50	159	104	91	120	16	540

Table B8: Percentage of respondents classified according to them holding an off-farm job

County	……Hold off-farm job in 2001 ……..		Total # respondents
	No	yes	
Llano	43%	57%	84
Sutton	44%	56%	91
Uintah	53%	47%	90
Summit	37%	63%	43
Moffat	41%	59%	129
Routt	49%	51%	128
Total # respondents	256	309	565

Table B9: Percentage of respondents classified according to percentage of their farm /ranch income to net income

County	…..Proportion of household's total income from net ranch or farm income..…					Total # respondents
	<10%	11-25%	26-50%	51-75%	>75%	
Llano	57%	19%	12%	4%	8%	84
Sutton	39%	19%	20%	10%	12%	90
Uintah	41%	23%	13%	7%	16%	87
Summit	55%	20%	11%	0%	14%	44
Moffat	42%	21%	12%	5%	20%	128
Routt	36%	19%	12%	15%	18%	121
Total # respondents	241	112	73	42	86	554

Table B10: Percentage of respondents classified according to their operation showing profit in 2001

County	……..…Did operation show profit in 2001..……		Total # respondents
	Yes	No	
Llano	27%	73%	83
Sutton	25%	75%	89
Uintah	40%	60%	89
Summit	28%	72%	43
Moffat	29%	71%	119
Routt	27%	73%	116
Total # Respondents	382	157	539

Table B11: Percentage of respondents classified according to their property size

County	..…..……Property Size (Acres) ……..				Total # respondents
	<400	400-999	900-2499	>2500	
Llano	36%	34%	18%	13%	80
Sutton	10%	15%	19%	56%	89
Uintah	37%	31%	22%	9%	89
Summit	26%	29%	26%	19%	42
Moffat	39%	28%	15%	18%	131
Routt	41%	24%	23%	12%	133
Total # respondents	187	149	113	115	564

Table B12: Percentage of respondents classified according to their primary activity on ranch or farm

County	……Primary activity on ranch or farm …….							Total # respondents
	crop	Livestock	Wildlife	Mixed crop and livestock	Crop livestock and wildlife	Tourist	Primary/weekend residence	
Llano	0%	55%	2%	9%	28%	1%	4%	85
Sutton	2%	42%	9%	2%	42%	0%	3%	91
Uintah	16%	32%	1%	50%	1%	0%	0%	90
Summit	2%	31%	0%	43%	21%	0%	2%	42
Moffat	16%	33%	3%	27%	14%	0%	8%	132
Routt	17%	29%	1%	35%	12%	3%	2%	136
Total # respondents	61	210	17	156	107	5	20	576

Table B13: Percentage of respondents classified according to their contribution towards total ranch/farm income by various ranch/farm activities

County	……Percentage contribution towards ranch /farm income by various ranch/farm activities …….					Total # respondents
	Crops	Livestock	Wildlife / Recreation	Gov. prg. Payments	Other activities	
Llano	4.17	67.69	23.29	0.28	4.17	88
Sutton	3.16	48.58	30.29	2.06	3.63	41
Uintah	25.89	70.76	1.95	0.85	0.49	82
Summit	17.51	61.34	9.95	0.59	9.27	87
Moffat	21.58	45.90	10.93	9.47	8.68	123
Routt	27.29	42.37	15.50	3.50	8.60	133
Avg % income	16.60	56.11	15.32	2.79	5.81	554

Table B14: Hunting and recreational activities in ranch/farm

County	……..Hunting and recreational activities……					Total # respondents	
	Free family Access	Free public access	Fee based outfitter access for hunting	Fee based individual access for hunting	Fee based camping hiking	Minimum	Maximum
Llano	65%	1%	4%	59%	4%	79	81
Sutton	50%	1%	16%	75%	3%	86	88
Uintah	96%	22%	12%	21%	3%	67	68
Summit	78%	28%	25%	26%	14%	35	36
Total # respondents	187	27	34	137	13	268	272

Table B15: Forage contribution to the ranch/farm from different sources

County	……..……% forage contribution from different sources……..					Total # respondents
	Federal land grazing leases	Other sources	Leased rangeland	Owned rangeland	State/public Pasture	
Llano	0%	0%	12.43%	87.57%	0%	70
Sutton	0%	0.21%	8.37%	91.41%	0%	70
Uintah	14.17%	1.23%	7.94%	72.67%	3.81%	70
Summit	6.35%	0%	8.68%	81.91%	3.06%	34
Moffat	12.4%	1.02%	11.71%	68.22%	4.03%	103
Routt	6.42%	0.33%	11.26%	73.48%	2.45%	123
Average % contribution	6.56%	0.47%	10.06%	79.21%	2.23%	470

Table B16: Percentage of respondents classified according to presence of labor provide by their family in ranching operation

County	……Labor provided by family ……			Total # respondents
	All	Most	Less than 1/2	
Llano	30%	43%	27%	83
Sutton	34%	38%	28%	89
Uintah	66%	22%	11%	89
Summit	51%	23%	26%	43
Moffat	63%	29%	8%	133
Routt	54%	33%	14%	138
Total # respondents	293	184	98	575

Table B17: Grazing management activities in ranch/farm

County	……..….Grazing Management Activities……..…….							Total # respondents	
	Monitor grazing	Adjust stocking	Continuous grazing	Rotational grazing	Even water points	Supplemental licks	Restrict livestock riparian	Minimum	Maximum
Llano	69%	73%	46%	64%	65%	61%	4%	67	82
Sutton	74%	89%	40%	61%	80%	64%	12%	66	87
Uintah	68%	82%	33%	60%	8%	69%	34%	67	88
Summit	68%	68%	11%	76%	29%	65%	34%	35	41
Moffat	83%	85%		73%	32%	67%	38%	0	133
Routt	78%	78%		66%	38%	75%	28%	109	140
Total # respondents	337	363	86	299	238	307	111	344	571

Table B18: Brush management activities in ranch/farm

County	.....…..Brush management Activities……..…….						Total # respondents	
	Fire manage	Herbicide Manage	Mechanical Manage	Follow-up treatment	Targeted herbicide	Targeted mechanical	Minimum	Maximum
Llano	7%	9%	26%	62%	78%	96%	43	45
Sutton	12%	19%	41%	50%	63%	80%	63	66
Uintah	34%	54%	22%	57%	59%	49%	37	67
Summit	80%	36%	21%	27%	57%	36%	14	15
Total # respondents	53	41	48	86	106	118	157	193

Table B19: Wildlife Management Activities

County	……Wildlife management Activities……..……..						Total # respondents	
	Control Pop	Census wildlife	Import New breed	Eliminate Poor	Supple. Feed	High Fencing	Minimum	Maximum
Llano	72%	48%	5%	64%	85%	13%	61	61
Sutton	73%	70%	5%	81%	83%	8%	79	81
Uintah	32%	23%	0%	14%	48%	21%	22	23
Summit	55%	64%	8%	25%	55%	25%	11	12
Total # respondents	115	97	8	110	136	22	173	177

Table B20: Crop management activities in ranch/farm

County	……..…Crop Management Activities……..…….					Total # respondents	
	Contour Plow	Crop Rotation	Minimum Till	Limit Irrigation	Adjust Fertilizer	Minimum	Maximum
Llano	48%	32%	55%	4%	48%	22	23
Sutton	27%	41%	47%	38%	35%	15	17
Uintah	26%	63%	41%	31%	65%	80	80
Summit	28%	61%	35%	36%	36%	26	28
Total # respondents	115	97	8	110	136	143	148

Table B21: Averages and Confidence levels of statements regarding rights as a landowner

Statements regarding rights	Significance ($p<0.05$)	Mean ±95% Confidence level	Std. Error
Owner rights include excluding others from access to land	0.00*	2.78±0.07	0.04
Owner rights include right to transfer ownership of land without restriction	0.00*	2.50±0.10	0.05
Owner rights allow exclusive use of natural resources	0.00*	2.18±0.12	0.06
Owner rights include the right to do whatever I want	0.00*	0.78±0.17	0.09
Owner rights allow me to do anything with the land as long as I do not infringe upon others rights	0.00*	1.98±0.13	0.07
Owner rights allow me to do anything with the land as long as do not conflict with local community	0.00*	1.19±0.17	0.09
Owner rights should be sensitive to values and interests of society at large	0.00*	0.40±0.17	0.07
Owner rights have become increasingly restricted over time	0.00*	1.72±0.13	0.07
Natural resources on my land belong to the society, which allows the public to restrict land use	0.00*	-1.87±0.14	0.07
Restrictions on my rights as a landowner are a threat to my civil liberty	0.00*	1.62±0.16	0.08

* represent the rejection of the null hypothesis that the mean value of the statement is equal to zero

Table B22: Averages and Confidence levels of statements regarding responsibilities as a landowner

Statements regarding responsibilities	Significance (p<0.05)	Mean ±95% Confidence level	Std. Error
Owner rights place no obligations on me	0.00*	-1.85±0.13	0.07
Owner rights obligate me to be a good steward of my land and to maintain it in good condition for future generations	0.00*	2.58±0.08	0.04
Owner rights should obligate them to leave the land in better shape than when I acquired it	0.00*	2.12±0.12	0.06
Owner rights should obligate me to take into account the values and interests of society at large	0.84	0.02±0.16	0.08

* represent the rejection of the null hypothesis that the mean value of the statement is equal to zero

Table B23: Averages and Confidence levels of values that well defined property rights promote in the society

Statements regarding well-defined property rights	Significance (p<0.05)	Mean ±95% Confidence level	Std. Error
Respect for one's neighbors and other people	0.00*	2.14±0.10	0.05
Good land stewardship	0.00*	2.19±0.10	0.05
Increased investment on land	0.00*	1.97±0.12	0.05
Better relationships and interactions among people	0.00*	1.96±0.11	0.08
Landowner interest in broader public concerns	0.00*	1.35±0.14	0.07
More sustainable use of natural resources in land	0.00*	1.56±0.14	0.07

* represent the rejection of the null hypothesis that the mean value of the statement is equal to zero

Table B24: Averages and Confidence levels of attitudes towards statements regarding private land leases

Statements about private land leases	Mean ±95% Confidence level	Std. Error
Landowners rights should supercede that of the lessee	1.78±0.17	0.09
Lessee rights limited to rights of access and rights specified in the lease	2.27±0.14	0.07
Lessee assume more right than owners intend	1.38±0.19	0.09
Owners should exclusively determine stocking rates or # animals shot	1.83±0.18	0.09

Table B25: Averages and Confidence levels of management practices undertaken without compensation

Management practices required to do without compensation	Significance (p<0.05)	Mean ±95% Confidence level	Std. Error
Control noxious weeds	0.00*	0.59±0.18	0.09
Protect the quality and supply of water used on your land	0.00*	1.52±0.15	0.08
Protect water quality and supply for downstream users	0.00*	1.47±0.15	0.08
Protect wetland and riparian areas	0.001*	0.27±0.16	0.08
Provide access to your land for hunting of native species	0.00*	-2.19±0.13	0.07
Protect habitat for threatened and endangered species	0.00*	-0.79±0.17	0.09

* represent the rejection of the null hypothesis that the mean value of the statement is equal to zero

Table B26: Averages and Confidence levels of management practices required to do with compensation

Management practices required to do with compensation	Significance (p<0.05)	Mean ±95% Confidence level	Std. Error
Control noxious weeds	0.00*	1.88±0.12	0.06
Protect the quality and supply of water used on your land	0.00*	1.23±0.15	0.08
Protect water quality and supply for downstream users	0.00*	1.32±0.16	0.06
Protect wetland and riparian areas	0.00*	0.59±0.17	0.08
Provide access to your land for hunting of native species	0.00*	-1.30±0.18	0.09
Protect habitat for threatened and endangered species	0.03*	-0.20±0.18	0.09

* represent the rejection of the null hypothesis that the mean value of the statement is equal to zero

Table B27: Averages and Confidence levels of management practices voluntarily done with compensation

Management practices like to do voluntarily with compensation	Significance (p<0.05)	Mean ±95% Confidence level	Std. Error
Control noxious weeds	0.00*	1.14±0.17	0.09
Protect the quality and supply of water used on your land	0.00*	1.94±0.11	0.06
Protect water quality and supply for downstream users	0.00*	1.86±0.12	0.06
Protect wetland and riparian areas	0.00*	1.24±0.14	0.07
Provide access to your land for hunting of native species	0.00*	0.68±0.18	0.09
Protect habitat for threatened and endangered species	0.00*	0.28±0.17	0.09

* represent the rejection of the null hypothesis that the mean value of the statement is equal to zero

Table B28: Averages and Confidence levels of attitudes towards statements regarding public lands

Public lands	Significance ($p<0.05$)	Mean ±95% Confidence level	Std. Error
Public land belongs equally to members of public	0.00*	1.64±0.15	0.08
Public has a good understanding about effects of grazing on public lands	0.00*	-2.05±0.12	0.06
Federal agencies are sensitive to concern of local ranchers	0.00*	-1.39±0.13	0.07
Federal agencies understand local issues	0.00*	-1.59±0.13	0.06
Environmental groups are sensitive to concerns of local ranchers	0.00*	-2.40±0.10	0.05
Local communities should specially influence natural resources on public lands	0.00*	1.46±0.14	0.07
Permitees should have a greater say in use of public land	0.00*	0.87±0.16	0.08
Owners would willingly accept decisions about public land use if land managers considered their concerns	0.00*	1.58±0.11	0.07
Agencies not able to change the grazing permit without agreement from permitees	0.00*	1.63±0.14	0.08

* represent the rejection of the null hypothesis that the mean value of the statement is equal to zero

Table B29: Averages and Confidence levels of attitudes towards statements regarding federal land management

Federal land management	Significance ($p<0.05$)	Mean ±95% Confidence level	Std. Error
Decisions about the use of federal lands should be made exclusively by agencies	0.00*	-1.16±0.16	0.08
Management authority of fed lands given to state government	0.63	0.04±0.16	0.08
Management authority of fed lands given to county government	0.17	-0.12±0.17	0.08
Management authority of fed lands given to grazing permitee assns	0.00*	-0.72±0.15	0.08
Fed lands should be privatized through public auctions	0.00*	-1.18±0.17	0.08
Fed lands should be managed through CRMP	0.00*	1.41±0.14	0.07

* represent the rejection of the null hypothesis that the mean value of the statement is equal to zero

Table B30: Averages and Confidence levels of attitudes towards statements regarding economic factors affecting viability of operation

Economic factors affecting viability of operation	Significance ($p<0.05$)	Mean ±95% Confidence level	Std. Error
Effect of persistent drought resulting in low production	0.00*	-0.50±0.19	0.10
Effect of declining profitability of agricultural and livestock operation	0.00*	-0.43±0.19	0.10
Effect of declining prices of agricultural inputs	0.00*	-0.37±0.18	0.09
Effect of increasing prices of inputs	0.00*	-0.30±0.18	0.09
Effect of increasing competition from pork and chicken	0.00*	-0.16±0.14	0.07
Effect of increasing competition from foreign markets	0.03*	-0.30±0.17	0.09
Effect of increasing consolidation in the broader agricultural industry (e.g., meat packers, grain millers, input suppliers etc.)	0.00*	-0.40±0.16	0.08

* represent the rejection of the null hypothesis that the mean value of the statement is equal to zero

Table B31: Averages and Confidence levels of attitudes towards statements regarding social factors affecting viability of operation

Social factors affecting viability of operation	Significance (p<0.05)	Mean ±95% Confidence level	Std. Error
Effect of increased public willingness to spend more on hunting and rec.	0.00*	0.66±0.13	0.06
Effect of declining financial ability of younger generations to take over operations	0.00*	-0.40±0.16	0.08
Effect of declining interest among younger generations in ag.	0.00*	-0.31±0.16	0.08
Effect of increased trespass problems due to growing pop	0.00*	-0.50±0.17	0.08
Effect of decline in public support	0.00*	-0.61±0.16	0.08
Effect of increase in public demand for environmental protection	0.00*	-0.67±0.17	0.08
Effect of more stringent environmental regulation	0.00*	-0.72±0.17	0.08
Effect of increasing public debate over grazing of livestock in public lands	0.00*	-0.54±0.15	0.07

* represent the rejection of the null hypothesis that the mean value of the statement is equal to zero

Table B32: Averages and Confidence levels of attitudes towards statements regarding land related factors affecting viability of operation

Land related issues affecting viability of operation	Significance (p<0.05)	Mean ±95% Confidence level	Std. Error
Effect of high market price for land.	0.00*	-0.37±0.18	0.09
Effect of subdivision of surrounding land	0.00*	-0.42±0.15	0.08
Effect of expansion of urban land issues	0.00*	-0.45±0.13	0.07
Effect of increased impact of displaced wildlife operation	0.00*	-0.38±0.14	0.07
Effect of increased demand for hunting and other rec, reducing availability of private land	0.00*	-0.23±0.13	0.06
Effect of decreased availability of public land for grazing	0.00*	-0.29±0.12	0.06
Effect of high property taxes	0.00*	-0.55±0.16	0.08
Effect of high estate taxes	0.00*	-0.80±0.18	0.09

* represent the rejection of the null hypothesis that the mean value of the statement is equal to zero

Table B33: Averages and Confidence levels of attitudes towards statements regarding laws, regulation and government programs affecting viability of operation

Laws, regulations and government programs affecting management	Significance (p<0.05)	Mean ±95% Confidence level	Std. Error
Effects of historical water rights laws	0.00*	0.43±0.13	0.06
Effects of regulations to protect wetlands and riparian areas	0.00*	-0.35±0.12	0.06
Effect of clean water and effluent discharge regulations	0.00*	-0.14±0.09	0.05
Effect of endangered species habitat regulations	0.00*	-0.58±0.12	0.06
Effect of greater restrictions on predator control	0.00*	-0.77±0.15	0.08
Effect of tighter regulations on fertilizer, pesticide or herbicide use	0.00*	-0.35±0.12	0.06
Effect of elimination or reduction of public land grazing permits	0.00*	-0.44±0.12	0.06
Effect of county or local land use and zoning regulations	0.00*	-0.21±0.09	0.04
Effect of USDA conservation reserve program	0.00*	0.14±0.10	0.05
Effect of USDA environmental quality incentive program	0.00*	0.17±0.09	0.05
Effect of state sponsored private land wildlife management programs	0.58	0.03±0.11	0.05

* represent the rejection of the null hypothesis that the mean value of the statement is equal to zero

Table B34: Averages and Confidence levels of attitudes towards statements regarding changes in public policy affecting viability of operation

Changes in Public policy affecting viability of operation	Significance (p<0.05)	Mean ±95% Confidence level	Std. Error
Increased pressure to reduce livestock on public lands affect ability to survive	0.00*	1.21±0.30	0.15
Uncompensated forced early removal of livestock from public lands increased operating costs	0.00*	0.93±0.26	0.13
Increased use of public lands by recreationalists resulted in loss of injury to cattle etc	0.00*	1.12±0.28	0.14
Increased use of public lands by recreationalists resulted in increased trespass	0.00*	1.25±0.29	0.15
Ranchers and farmers concerns weighed equally with others at public meetings	0.00*	-1.20±0.31	0.16

* represent the rejection of the null hypothesis that the mean value of the statement is equal to zero

Table B35: Averages and Confidence levels of attitudes towards statements regarding threats that affect future viability of operation

Threats affecting future viability of operation	Significance (p<0.05)	Mean ±95% Confidence level	Std. Error
Lower agricultural commodity prices	0.00*	-1.00±0.17	0.08
More volatile ag. Commodity prices	0.00*	-0.78±0.15	0.08
Serious reduction of public land grazing leases	0.00*	-0.38±0.13	0.07
Greater restrictions on predator control methods	0.00*	-0.69±0.16	0.08
New endangered sp. listings	0.00*	-0.87±0.16	0.08
Increased pop growth in your area	0.00*	-0.67±0.16	0.08
Increased subdivision of neighboring properties	0.00*	-0.82±0.15	0.08
Increased demand for water by non-agricultural interests	0.00*	-1.07±0.17	0.08

* represent the rejection of the null hypothesis that the mean value of the statement is equal to zero

Table B36: Averages and Confidence levels of landowner's plans for the ranch in the next five years

Plans for the next 5 years	Significance (p<0.05)	Mean ±95% Confidence level	Std. Error
Diversify into other ranch or farm enterprises	0.00*	-0.30±0.16	0.08
Seek more non-agricultural income from your land	0.00*	0.27±0.16	0.08
Expand by buying more ranch or farm land	0.00*	-1-13±0.16	0.08
Expand by leasing more ranch or farmland	0.00*	-0.96±0.16	0.08
Sell land to another rancher or farmer	0.00*	-1.42±0.15	0.08
Sell land to a non farmer or developer	0.00*	-1.45±0.23	0.12
Increase livestock numbers	0.00*	-0.48±0.16	0.08
Decrease livestock numbers	0.00*	-0.50±0.14	0.07
Transfer ownership of your ranch or farm to someone else	0.00*	-0.88±0.17	0.09
Transfer management of your ranch or farm to someone else	0.00*	-1.11±0.16	0.08
Relocate the operation	0.00*	-1.74±0.14	0.07

* represent the rejection of the null hypothesis that the mean value of the statement is equal to zero

Table B37: Averages and Confidence levels of landowner's plans for the next five years

Other plans over the next five years	Significance ($p<0.05$)	Mean ±95% Confidence level	Std. Error
Become more involved in local politics	0.00*	-0.78±0.16	0.08
Become politically more involved in agricultural interest groups	0.00*	-0.30±0.15	0.08
Become less involved in community activities	0.00*	-0.69±0.13	0.06
Decrease public access to your land	0.00*	0.40±0.15	0.08
Seek legal recourse to defend your landowner rights	0.00*	0.51±0.14	0.07
Increase household income from off-farm sources	0.00*	0.65±0.16	0.08

* represent the rejection of the null hypothesis that the mean value of the statement is equal to zero

APPENDIX C

Composition of additive Property Rights Scales created from responses to questions regarding rights and responsibilities of landowners

Scale	Composition
Individual Rights Scale (additive responses to the statements in the next column)	My landowner rights include the absolute right to do whatever I want with my land without for what others prefer. My landowner rights allow me the exclusive use of natural resources provided by the land. My landowner rights include the rights to transfer ownership of my land to others without restriction.
Social Responsibilities Scale (additive responses to the statements in the next column)	My landowner rights must be sensitive to the values and interests of society at large. My landowner rights should obligate me to take into account the values and interests of society at large. Natural resources on my land belong to the society, which allows the public to restrict land uses that cause resource damage.
Stewardship scale (additive responses to the statements in the next column)	My landowner rights obligate me to be a good steward of my land and maintain it in good condition for future generation. My landowner rights obligate me to leave the land in better shape than when I acquired it.
Rights erosion subscale (additive responses to the statements in the next column)	Restrictions on my rights as a landowner are a threat to my civil liberty. My landowner rights include the rights to exclude others from access to my land. My landowner rights have become increasingly restricted over time.

APPENDIX D

Conditions of Existence of a Bayesian Network

There needs to be several conditions for directed graphs to exist (Pearl, 2000, 42: 43). He states,

Let P(v) be a probability distribution on a set of V of variables, and let $P_x(v)$ denote the distribution resulting from the intervention do(X=x) that sets a subset X of variables to constants x. Denote by P_* the set of all interventional distributions $P_x(v)$, X $\subseteq$ V, including P(v), which represents no intervention (i.e., X =∅). A DAG is said to be causal Bayesian network compatible with P_* if and only if the following three conditions hold for every $P_x \in P_*$

1. $P_x(v)$ is Markov relative to G

2. $P_x(v_i)$ =1 for all $V_i \in X$ whenever v_i is consistent with $X=x_i$.

3. $P_x(v_i/pa_i) = P(v_i/pa_i)$ for all $V_i \notin X$ whenever pa_i is consistent with X =x.

A simpler explanation is found in Bessler et al. (2002, 798), where the conditions are elucidated as:

1. Causal flow need to be conditioned on only the parents and not grandparents or other relatives to capture the full probability distribution of the variable.

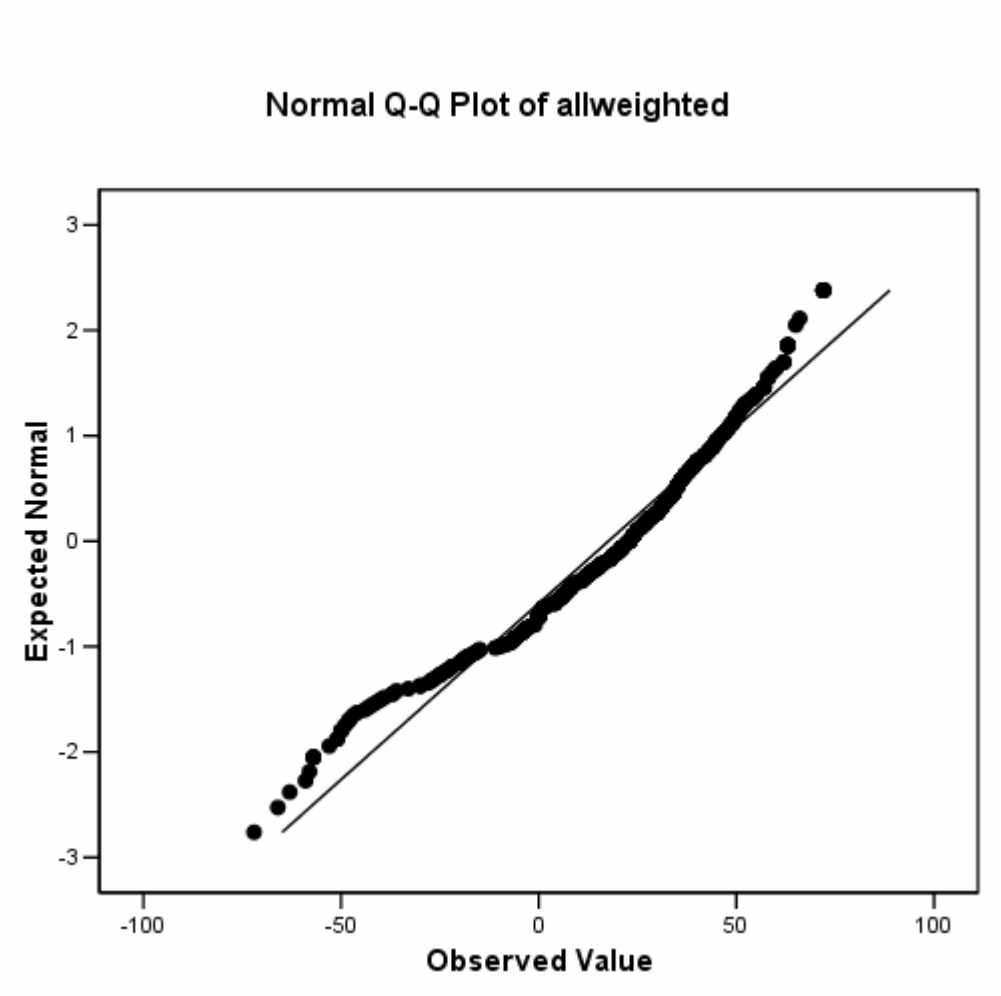
2. Consider two variables, X and Y in the subset V. A graph G capturing the relation between X and Y is faithful to the probabilities in V if and only if there is an edge between X and Y.

3. There should be no omitted variables Z that causes an apparent relation between X and Y while the graph erroneously shows an edge between X and Y.

The syntax of P (Y| do X) is interpreted by Pearl (2000) as P (Y|X) although some authors (Morgan, 2004, 413) dispute this, suggesting Pearl's terminology omits the relationship between X and X. However I proceed with Pearl's terminology.

APPENDIX E

Normal Probability Plot for All Weighted Threat Index



APPENDIX F

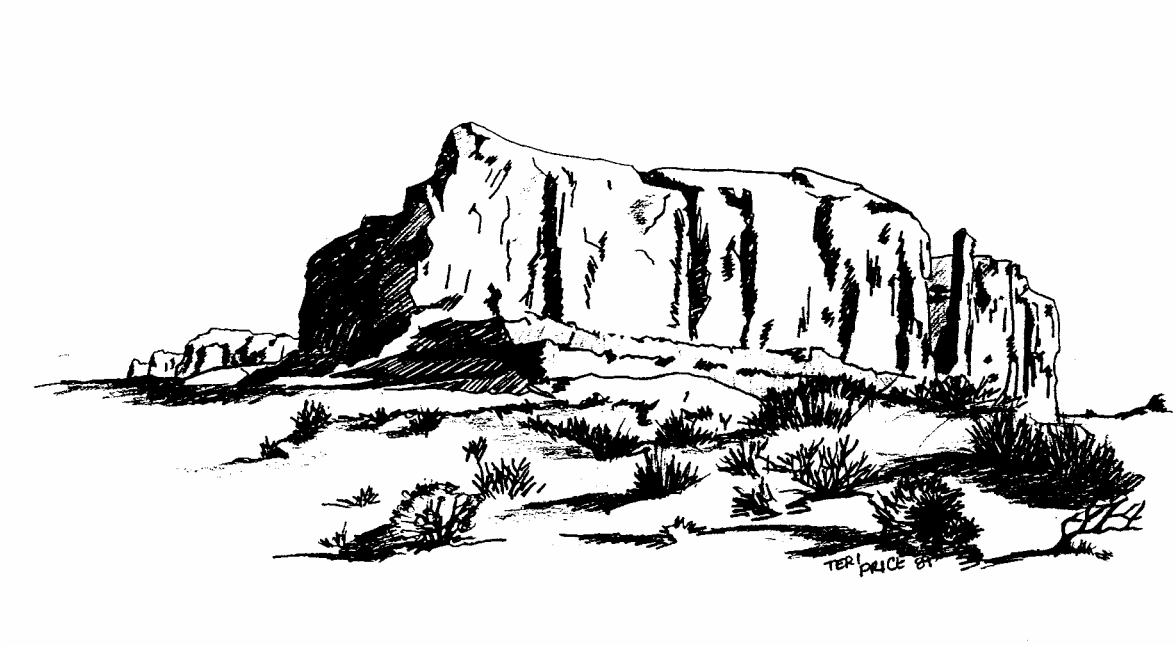
Lower Triangular Elements of Covariance Matrix of different variables of analysis of threats to future viability of ranch or farm

	VARIABLES														
	state	Allweighted	asc_ indv	asc_socr	asc_ stew	asc_ thrt	age	Wldrc inc	tot inc	prop	yrs exp	grow up	formal ed	profit	acres
State	0.730														
Allweighted	0.388	891.321													
asc_ indv	-0.804	2.904	12.229												
asc_ socr	0.173	-12.279	-5.207	19.134											
asc_ stew	-0.050	2.115	0.288	1.620	4.309										
asc_ thrt	-0.093	11.594	4.067	-3.469	0.274	9.598									
Age	-0.266	-25.355	4.713	1.661	1.006	-2.385	122.256								
Wldrc inc	-0.089	0.245	0.065	-0.046	-0.010	0.103	-0.517	0.246							
tot inc	-0.193	0.895	-0.109	0.285	0.037	-0.060	-1.345	0.085	1.883						
Prop	0.283	3.087	-0.212	-0.191	0.391	0.626	0.483	0.142	-0.038	2.213					
Yrs exp	0.740	9.167	7.097	-4.003	1.747	5.476	96.692	-0.020	-3.491	6.985	244.766				
grow up	0.023	0.914	0.222	-0.268	0.035	0.272	0.200	-0.005	-0.133	0.102	2.506	0.207			
formal ed	-0.294	3.996	-0.493	0.278	-0.289	0.016	-1.513	0.196	0.611	-0.222	-4.688	-0.141	2.447		
profit	-0.119	-0.605	0.240	0.129	0.054	0.096	1.397	-0.005	0.015	0.205	2.011	0.021	-0.080	0.753	
Acres	-492.134	22000.22	2151.893	-2040.709	-465.790	1063.084	-2547.449	1026.595	2905.672	2290.049	12419.582	-49.453	2342.086	567.209	13293910 3.062

APPENDIX G

Ranching and Farming in Texas and Utah

Understanding the Challenges Facing Landowners and Operators



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

Institute for Social Science Research on Natural Resources
Utah State University
UMC 0730Logan,
UT 84322-0730

We are asking that this questionnaire be completed by the addressee or by the individual most knowledgeable about this ranch or farm (if applicable).

If you encounter a question that does not apply to your ranch or farm, 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, Utah residents should contact Dr. Richard Krannich (at 435-797-1241 or by email at rkranich@hass.usu.edu); Texas residents should contact Dr. Urs Kreuter (at 979-845-5583 or by email at 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 an operating ranch or farm that includes at least 100 acres of private lands?

☐ No → Please stop here and return the survey in the envelope provided.
☐ Yes → **Please go to SECTION A below and complete the rest of the questionnaire.**

If you do not own or operate a ranch or farm, you have completed the survey. It is important we hear back from everyone who receives a survey, even if they are not involved in farming or ranching. We thank you for taking the time to place the entire questionnaire in the enclosed addressed envelope, and return it to us. No postage is necessary. We appreciate your assistance and cooperation.

SECTION A – CHARACTERISTICS OF YOUR RANCH OR FARM

We want to begin by asking about your ranching or farming operation. Please fill in the requested information or check ONE box that best describes you or your ranch/farm, unless otherwise stated.

A1. ***In which county is your ranch or farm primarily located?*** _____

A2. ***How would you describe your role at this ranch or farm?***

☐ I am the person who makes most of the day-to-day management decisions and I have an ownership interest in this ranch or farm.
☐ I am one of several key decision makers with an ownership interest in this ranch or farm
☐ I am the spouse of a key decision maker with an ownership interest in this ranch or farm
☐ I am a hired farm manager with no ownership interest in this ranch or farm
☐ Other (Please describe: _____)

A3. ***How is your ranch or farm business organized?***

☐ Sole proprietorship (single family or individual operation)
☐ Family partnership
☐ Non-family partnership
☐ A family corporation
☐ A non-family corporation
☐ Other (e.g., Estate, trust, etc. Please describe_____)

A4. ***How much of the total ranch or farm labor on your operation is provided by you or members of your family?***

☐ All ☐ Most ☐ Less than ½ (most labor done by paid, nonfamily workers)

A5. ***What is the primary activity on your ranch or farm?*** *(Check only ONE box)*

☐ Mainly crop production
☐ Mainly livestock production
☐ Mainly a wildlife operation
☐ Mixed crop and livestock operation
☐ Farm or ranch combined with wildlife operation
☐ Tourist operation (e.g., dude ranch, bed and breakfast, etc.)
☐ Primary residence or weekend hideaway that generates no significant income

A6. ***Approximately what percent of your ranch or farm income is derived from each of the following activities?*** *(Please be your answers total to 100%)*

- Income from the sale of crops _____%
- Income from the sale of livestock _____%

- Income from the sale of dairy products _____%
- Income from the sale of wildlife or exotic species as breeding stock _____%
- Fees for hunting of native game species _____%
- Fees for hunting exotic wildlife (European deer, African antelope, etc.) _____%
- Income from recreation related activities (other than hunting) _____%
- Government program payments _____%
- Mineral sales and leases _____%
- Other (Please specify _____) _____%

Total = 100%

A7. ***How many acres of land do you OWN in your ranch/farm operation?*** _____

A8. ***Did you raise crops as part of your ranch or farm business in 2001?***

☐ No → Please skip to question A9 on the next page.

☐ Yes → Please answer the following questions.

(a) ***How many acres of cropland were used for the following purposes?***

Irrigated cropland used primarily to raise hay	_____ acres
Irrigated cropland used primarily to raise other crops	_____ acres
Unirrigated cropland used primarily to grow crops	_____ acres
Other cropland uses (specify: _____)	_____ acres
Total cropland acres operated in 2001=	_____ **acres**

(Total should be sum of above components)

(b) ***Which of the following CROPPING PRACTICES do you generally use?***

	Don't Use	*Use*
Contour plowing	☐	☐
Crop rotation	☐	☐
Minimum tillage	☐	☐
Limit irrigation to critical growth stages (e.g., germination, seed set)	☐	☐
Adjust fertilizer rates across fields based on soil nutrient differences	☐	☐

A9. ***Did you raise livestock as part of your ranch or farm business in 2001?***

☐ No → Please skip to question A11 on the next page.

☐ Yes → Please answer the following question.

(a) ***How many of each of the following livestock did you have on Jan. 1, 2002?***
(*If you have none of a particular kind, write a 0.*)

Type of animal	*# of animals*
Mature beef cows and bulls	_____
Dairy cows (lactating or dry) and bulls	_____
Beef or dairy heifers, stockers, and calves	_____
Mature ewes, goats, rams and bucks	_____
Lambs or goat kids	_____
Horses	_____
Other (specify: _____)	_____

A10. ***Did you graze any LIVESTOCK as part of your farm or ranch business in 2001?***

☐ No → Please skip to question A11 on the next page.

☐ Yes → Please answer the following questions.

(a) ***Approximately what percent of the total forage consumed by your grazing livestock in 2001 came from the following types of land?*** *(Please be sure your answers total to 100%.)*

Type of Grazing Land	*% of Total Forage*
Private pasture or rangeland that you own	_____ %
Private pasture or rangeland that you leased from other landowners	_____ %
Federal lands on which you had grazing leases	_____ %
State or other public lands on which you had grazing leases	_____ %
Other (specify: _____)	_____ %

Total = 100%

(b) ***Which of the following grazing management practices do you generally use?***

	Don't Use	*Use*
Regularly monitor grazing resources	☐	☐
Adjust stocking rates according to changes in amount of forage	☐	☐
Use a continuous year round grazing system	☐	☐
Use rotational grazing and/or resting system or herd livestock	☐	☐
Provide relatively evenly distributed water points	☐	☐
Place supplemental licks away from water points	☐	☐
Restrict livestock access to riparian areas	☐	☐

A11. ***Is brush a problem on your land?*** No ☐ Yes ☐

A12. ***Do you actively MANAGE BRUSH on private lands that are part of your operation?***

☐ No → skip to A13

☐ Yes → Please answer the following questions.

(a) ***Which brush management practices do you use?***

	Don't Use	*Use*
Use regular follow-up treatments as part of planned brush control program	☐	☐
Use fire as an integral part of a brush control program	☐	☐
Mechanical brush treatments on a broad scale (e.g., chaining)	☐	☐
Herbicide brush treatments on a broad scale (e.g., aerial spraying)	☐	☐
Targeted herbicide application to small patches or individual plants	☐	☐
Targeted mechanical brush removal of small patches or individual plants	☐	☐

(b) ***How important are the following goals in your brush management decisions?***

	Not Important	*Slightly Important*	*Moderately Important*	*Important*	*Very Important*
Increase forage production	☐	☐	☐	☐	☐
Improve wildlife habitat	☐	☐	☐	☐	☐
Increase water yield	☐	☐	☐	☐	☐
Remove brush only when it is very dense	☐	☐	☐	☐	☐
Minimize expenditures on brush control	☐	☐	☐	☐	☐
Minimize time spent managing brush	☐	☐	☐	☐	☐

A13. ***Do you actively manage your property to promote WILDLIFE?***

☐ No → Please skip to A14 below.

☐ Yes → ***Which of the following WILDLIFE MANAGEMENT practices do you allow?***

	Don't Use	*Use*
Census wildlife populations	☐	☐
Actively control wildlife population size	☐	☐
Improve herd quality by selectively eliminating poor quality wildlife	☐	☐
Import improved wildlife breeding stock	☐	☐
Supply supplemental feed to wildlife	☐	☐
High fencing to increase control over the wildlife on your land	☐	☐

A14. **Do you allow *HUNTING OR RECREATION ACTIVITIES on your ranch or farm?***

☐ No → Please skip to Section B on the next page.

☐ Yes → ***Which of the following activities do you allow?***

	Don't Allow	*Allow*
Free access to family, friends, employees for hunting, fishing, recreation	☐	☐
Free public access for hunting, fishing or birding	☐	☐
Fee-based access to outfitters, groups, or clubs for hunting or fishing	☐	☐
Fee-based access to individuals for hunting or fishing	☐	☐
Fee-based camping, hiking, horse riding, or other recreation activities	☐	☐

SECTION B – RIGHTS & RESPONSIBILITES REGARDING THE USE OF PRIVATE LANDS

This section requests information about your perceptions about landowner rights and obligations and the use of natural resources on your land.

Please indicate your opinion about each statement below by circling a number between "-3" to "+3" Minus three (-3) indicates very strong disagreement, 0 indicates a neutral opinion, and +3 indicates very strong agreement.

B1. ***To what extent do you agree or disagree with each of the following statements about your RIGHTS as a landowner?***

-3 = strongly disagree … 0 = neutral … +3 = strongly agree							
My landowner rights include the *right to exclude others* from access to my land.	-3	-2	-1	0	+1	+2	+3
My landowner rights include the *right to transfer ownership* of my land to others without restriction.	-3	-2	-1	0	+1	+2	+3
My landowner rights allow me the *exclusive use* of the natural resources provided by the land.	-3	-2	-1	0	+1	+2	+3
My landowner rights include the *absolute right* to do whatever I want with my land without regard for what others prefer.	-3	-2	-1	0	+1	+2	+3
My landowner rights allow me to do anything with my land so long as my actions *do not infringe upon my neighbors' rights.*	-3	-2	-1	0	+1	+2	+3
My landowner rights allow me to do anything with my land so long as my actions *do not conflict with the interests and values of the local community.*	-3	-2	-1	0	+1	+2	+3
My landowner rights must be sensitive to the *values and interests of society at large.*	-3	-2	-1	0	+1	+2	+3
My rights as a landowner have become *increasingly restricted* over time.	-3	-2	-1	0	+1	+2	+3
Natural resources on my land *belong to society*, which allows the public to restrict land uses that cause resource damage.	-3	-2	-1	0	+1	+2	+3
Restrictions on my rights as a landowner are a *threat to my civil liberty.*	-3	-2	-1	0	+1	+2	+3

B2. ***To what extent do you agree or disagree with each of the following statements about your RESPONSIBILITIES as a landowner?***

-3 = strongly disagree … 0 = neutral … +3 = strongly agree							
My landowner rights place *no obligations* on me.	-3	-2	-1	0	+1	+2	+3
My landowner rights obligate me to be a *good steward of my land* and to maintain it in good condition for future generations	-3	-2	-1	0	+1	+2	+3
My landowner rights should obligate me to *leave the land in better shape* than when I acquired it.	-3	-2	-1	0	+1	+2	+3
My landowner rights should obligate me to *take into account the values and interests of society at large.*	-3	-2	-1	0	+1	+2	+3

B3. ***To what extent do you think that WELL-DEFINED PROPERTY RIGHTS promote each of the following outcomes in society?*** *(Circle the number that best represents your views or check the box if you are not sure of your answer.)*

-3 = very negatively influences … 0 = has no effect … +3 = very positively influences								*Unsure*
Respect for one's neighbors and other people	-3	-2	-1	0	+1	+2	+3	☐
Good land stewardship	-3	-2	-1	0	+1	+2	+3	☐
Increased investment in the land	-3	-2	-1	0	+1	+2	+3	☐
Better relationships and interactions among neighbors	-3	-2	-1	0	+1	+2	+3	☐
Landowner interest in broader public concerns	-3	-2	-1	0	+1	+2	+3	☐
More sustainable use of natural resources on the land	-3	-2	-1	0	+1	+2	+3	☐

B4. ***In which of the following conservation programs have you participated in the last 5 years?*** *(Check all that apply)*

☐ USDA Conservation Reserve Program (CRP)
☐ USDA Environmental Quality Incentive Program (EQIP)
☐ State-sponsored private land wildlife management programs
☐ Cooperative wildlife management planning with other landowners

The next set of questions seeks your views on how landowners like you should manage their land under a range of conditions (with or without compensation by the public).

B5. ***To what extent do you agree that you should be REQUIRED TO DO each of the following things with your land WITHOUT ANY COMPENSATION from the public?***

-3 = strongly disagree … 0 = neutral … +3 = strongly agree							
Control noxious weeds	-3	-2	-1	0	+1	+2	+3
Protect the quality and supply of water used on your land	-3	-2	-1	0	+1	+2	+3
Protect water quality and supply for downstream users	-3	-2	-1	0	+1	+2	+3
Protect wetland and riparian areas	-3	-2	-1	0	+1	+2	+3
Provide access to your land for hunting of native species	-3	-2	-1	0	+1	+2	+3
Protect habitat for threatened and endangered species	-3	-2	-1	0	+1	+2	+3

B6. ***To what extent do you agree that you should be REQUIRED TO DO each of the following PROVIDED YOU RECEIVE ADEQUATE COMPENSATION from the public?***

-3 = strongly disagree … 0 = neutral … +3 = strongly agree							
Control noxious weeds	-3	-2	-1	0	+1	+2	+3
Protect the quality and supply of water used on your land	-3	-2	-1	0	+1	+2	+3
Protect water quality and supply for downstream users	-3	-2	-1	0	+1	+2	+3
Protect wetland and riparian areas	-3	-2	-1	0	+1	+2	+3
Provide access to your land for hunting of native species	-3	-2	-1	0	+1	+2	+3
Protect habitat for threatened and endangered species	-3	-2	-1	0	+1	+2	+3

B7. ***How likely do you think that landowners like you would VOLUNTARILY DO each of the following PROVIDED THEY RECEIVE ADEQUATE COMPENSATION from the public?***

-3 = very unlikely … 0 = neutral … +3 = very likely							
Control noxious weeds	-3	-2	-1	0	+1	+2	+3
Protect the quality and supply of water used on your land	-3	-2	-1	0	+1	+2	+3
Protect water quality and supply for downstream users	-3	-2	-1	0	+1	+2	+3
Protect wetland and riparian areas	-3	-2	-1	0	+1	+2	+3
Provide access to your land for hunting of native species	-3	-2	-1	0	+1	+2	+3
Protect habitat for threatened and endangered species	-3	-2	-1	0	+1	+2	+3

B8. ***To what extent do you agree with the following statements about PRIVATE LAND LEASES?***

-3 = strongly disagree … 0 = neutral … +3 = strongly agree							
In disputes over lease agreements, landowners' rights should supercede the rights of the lessee.	-3	-2	-1	0	+1	+2	+3
Lessee's rights should be limited to the right of access and rights to farm, graze livestock, or hunt wildlife as specified in the lease.	-3	-2	-1	0	+1	+2	+3
Lessees often assume more rights than landowners intend to convey.	-3	-2	-1	0	+1	+2	+3
Landowners should exclusively determine the stocking rates or number of wild animals shot under a lease agreement.	-3	-2	-1	0	+1	+2	+3

B9. ***To what extent do you agree with each of the following statements about PUBLIC LAND?***

-3 = strongly disagree … 0 = neutral … +3 = strongly agree							
Public land belongs equally to all members of the American public	-3	-2	-1	0	+1	+2	+3
The public generally has a good understanding about the effects of grazing on public lands.	-3	-2	-1	0	+1	+2	+3
Federal agencies are sensitive to the concerns of local ranchers.	-3	-2	-1	0	+1	+2	+3
Federal agencies adequately understand local issues and conditions.	-3	-2	-1	0	+1	+2	+3
Environmental groups are sensitive to concerns of local ranchers.	-3	-2	-1	0	+1	+2	+3
Local area communities should have special influence on how natural resource management decisions are made on public land.	-3	-2	-1	0	+1	+2	+3
Since grazing permitees pay to use public land while recreationists usually don't, permitees should have a greater say in the use of public land.	-3	-2	-1	0	+1	+2	+3
Landowners would more willingly accept decisions about public land use if land managers seriously considered their concerns.	-3	-2	-1	0	+1	+2	+3
Agencies should not be able to change grazing permits without input agreement from the permitees.	-3	-2	-1	0	+1	+2	+3

B10. ***To what extent do you agree with each of the following statements about FEDERAL LAND MANAGEMENT?***

-3 = strongly disagree … 0 = neutral … +3 = strongly agree							
Decisions about the use and management of Federal lands should be made exclusively by the *agencies assigned to administer them.*	-3	-2	-1	0	+1	+2	+3
The management authority for Federal lands should be handed over to *state government.*	-3	-2	-1	0	+1	+2	+3
The management authority for Federal lands should be handed over to *county government.*	-3	-2	-1	0	+1	+2	+3
The management authority for Federal lands should be handed over to *associations of grazing permitees.*	-3	-2	-1	0	+1	+2	+3
Federal land should be privatized through public auctions.	-3	-2	-1	0	+1	+2	+3
Federal lands should be managed through *coordinated resource management planning* (CRMP) that involves all interested parties.	-3	-2	-1	0	+1	+2	+3

SECTION C – IMPACT ON RANCHES AND FARMS

In recent years various economic, social, and political factors have influenced the way public and private lands are managed. In this section we are seeking information about how your ranch or farm operation has been affected by these external forces.

For each of the possible forces listed below, please indicate how your operation has been influenced positively or negatively over the last 5 years. In each case, circle the number between –3 and +3 that best reflects your experiences.

C1. ***How have each of the following ECONOMIC FACTORS affected the viability of your ranch or farm operation?***

-3 = very strong negative effect … 0 = no effect … +3 = very strong positive effect							
Persistent drought resulting in low production.	-3	-2	-1	0	+1	+2	+3
Declining profitability of agricultural and livestock production.	-3	-2	-1	0	+1	+2	+3
Declining prices for agricultural products.	-3	-2	-1	0	+1	+2	+3
Increasing prices of inputs.	-3	-2	-1	0	+1	+2	+3
Increasing competition for beef from pork and chicken.	-3	-2	-1	0	+1	+2	+3
Increasing competition from foreign markets.	-3	-2	-1	0	+1	+2	+3
Increasing consolidation in the broader agricultural industry (e.g., meat packers, grain millers, input suppliers, etc.).	-3	-2	-1	0	+1	+2	+3

C2. ***How have each of the following SOCIAL FACTORS affected the viability of your ranch or farm operation?***

-3 = very strong negative effect … 0 = no effect … +3 = very strong positive effect							
Increased public willingness to spend more money on recreation and hunting activities	-3	-2	-1	0	+1	+2	+3
Declining financial ability of younger generations to take over farm or ranch operations.	-3	-2	-1	0	+1	+2	+3
Declining interest among younger generations in ranching or farming as a way of life.	-3	-2	-1	0	+1	+2	+3
Increased trespass problems on ranch or farm operations due to growing population and declining respect for private property	-3	-2	-1	0	+1	+2	+3
Decline in public support for ranching and agriculture.	-3	-2	-1	0	+1	+2	+3
Increasing public demand for environmental protection.	-3	-2	-1	0	+1	+2	+3
More stringent environmental regulations.	-3	-2	-1	0	+1	+2	+3
Increased public debate and controversy over the grazing of livestock on public lands.	-3	-2	-1	0	+1	+2	+3

C3. ***How have each of the following LAND RELATED ISSUES affected the viability of your ranch or farm operation?***

-3 = very strong negative effect … 0 = no effect … +3 = very strong positive effect							
High market prices for land that exceed the productive value of land in your area.	-3	-2	-1	0	+1	+2	+3
Subdivision of land surrounding or near your ranch or farm.	-3	-2	-1	0	+1	+2	+3
Expansion of urban land uses and the associated restrictions on rural land use options.	-3	-2	-1	0	+1	+2	+3
Increasing impact of displaced wildlife populations due to increased human activity in your area.	-3	-2	-1	0	+1	+2	+3
Increased demand for hunting and other recreation activities has reduced the availability of private land for grazing in your area.	-3	-2	-1	0	+1	+2	+3
Decreased availability of public lands for grazing livestock.	-3	-2	-1	0	+1	+2	+3
High property taxes.	-3	-2	-1	0	+1	+2	+3
High estate (death) taxes.	-3	-2	-1	0	+1	+2	+3

C4. ***How have each of the following LAWS, REGULATIONS, AND GOVERNMENT PROGRAMS affected your ability to manage your land the way that you would like to?***

-3 = very strong negative effect … 0 = no effect … +3 = very strong positive effect							
Historical water rights laws in which older water rights supercede more recent water rights.	-3	-2	-1	0	+1	+2	+3
Regulations to protect wetlands and riparian areas.	-3	-2	-1	0	+1	+2	+3
Clean water and effluent discharge regulations.	-3	-2	-1	0	+1	+2	+3
Endangered species habitat regulations.	-3	-2	-1	0	+1	+2	+3
Greater restrictions on predator control.	-3	-2	-1	0	+1	+2	+3
Tighter regulations on fertilizer, pesticide or herbicide use.	-3	-2	-1	0	+1	+2	+3
Reduction or elimination of public land grazing permits.	-3	-2	-1	0	+1	+2	+3
County or local land use and zoning regulations that restrict high density livestock production systems	-3	-2	-1	0	+1	+2	+3
USDA Conservation Reserve Program (CRP)	-3	-2	-1	0	+1	+2	+3
USDA Environmental Quality Incentive Program (EQIP)	-3	-2	-1	0	+1	+2	+3
State sponsored private land wildlife management programs.	-3	-2	-1	0	+1	+2	+3

C5. ***Did you rely on public land leases for grazing any of your livestock in 2001?***

☐ No → Please skip to Section D on the next page.

☐ Yes → ***To what extent do you agree with each of the following statements about the effects of CHANGES IN PUBLIC LAND GRAZING POLICIES on your operation?***

-3 = strongly disagree … 0 = neutral … +3 = strongly agree							
Increased pressure to reduce livestock on public land is affecting your ability to survive as an independent operator	-3	-2	-1	0	+1	+2	+3
Uncompensated forced early removal of livestock from public land has increased your operating costs	-3	-2	-1	0	+1	+2	+3
Increased use of public land by recreationists has resulted in loss of or injury to cattle, destruction of fencing, etc.	-3	-2	-1	0	+1	+2	+3
Increased use of public lands by recreationists has resulted in increased trespass on your nearby private land	-3	-2	-1	0	+1	+2	+3
At public meetings to address conflicts over public land use, ranchers' and farmers' concerns are usually weighed equally with those of other interests	-3	-2	-1	0	+1	+2	+3

SECTION D – FUTURE PLANS

In this section we would like you to share your concerns and plans for the future.

The next question lists some possible threats to ranching and farming in the West.

D1. ***Please indicate how you think each of the following factors will affect the future viability of your ranch or farm operation.*** *(For each type of threat, please circle the answer that indicates how likely you think it is to occur, and then, how you think your operation would be affected by such a change if it occurred.)*

TYPE OF THREAT	*Likelihood* *NL = not likely* *L = likely* *VL = very likely*			*Impact on your operation* *-3 = strong negative impact …* *0 = no impact …* *+3 = strong positive impact*						
Lower agricultural commodity prices.	NL	L	VL	-3	-2	-1	0	+1	+2	+3
More volatile agricultural commodity prices.	NL	L	VL	-3	-2	-1	0	+1	+2	+3
Serious reduction of public lands grazing leases.	NL	L	VL	-3	-2	-1	0	+1	+2	+3
Greater restrictions on predator control methods.	NL	L	VL	-3	-2	-1	0	+1	+2	+3
New endangered species listings.	NL	L	VL	-3	-2	-1	0	+1	+2	+3
Increased population growth in your area.	NL	L	VL	-3	-2	-1	0	+1	+2	+3
Increased subdivision of neighboring properties.	NL	L	VL	-3	-2	-1	0	+1	+2	+3
Increased demand for water by non-agricultural interests.	NL	L	VL	-3	-2	-1	0	+1	+2	+3

D2. ***Over the next 5 years, how likely are you make the following changes to your ranch or farm operation?***

-3 = very unlikely … 0 = uncertain … +3 = very likely							
Diversify into other ranch or farm enterprises.	-3	-2	-1	0	+1	+2	+3
Seek more non-agricultural income from your land.	-3	-2	-1	0	+1	+2	+3
Expand by buying more ranch or farmland.	-3	-2	-1	0	+1	+2	+3
Expand by leasing more ranch or farmland.	-3	-2	-1	0	+1	+2	+3
Sell land to another rancher or farmer.	-3	-2	-1	0	+1	+2	+3
Sell land to a nonfarmer or developer.	-3	-2	-1	0	+1	+2	+3
Increase livestock numbers.	-3	-2	-1	0	+1	+2	+3
Decrease livestock numbers.	-3	-2	-1	0	+1	+2	+3
Transfer ownership of your ranch/farm to your someone else.	-3	-2	-1	0	+1	+2	+3
Transfer management of your ranch/farm to someone else.	-3	-2	-1	0	+1	+2	+3
Relocate the operation.	-3	-2	-1	0	+1	+2	+3

D3. ***Over the next 5 years, how likely are you to do the following things?***

-3 = very unlikely … 0 = uncertain … +3 = very likely							
Become more involved in local politics.	-3	-2	-1	0	+1	+2	+3
Become politically more involved in agricultural interest groups.	-3	-2	-1	0	+1	+2	+3
Become less involved in community activities.	-3	-2	-1	0	+1	+2	+3
Decrease public access to your land.	-3	-2	-1	0	+1	+2	+3
Seek legal recourse to defend your landowner rights.	-3	-2	-1	0	+1	+2	+3
Increase household income from off-farm sources.	-3	-2	-1	0	+1	+2	+3

D4. Considering your current financial situation and your age, and assuming that the current agricultural economic situation were to continue for the next 10 or so years, ***how many years do you estimate you will be able to continue ranching or farming?*** *(Check the ONE box for the answer that best applies to your situation.)*

- ☐ I will be unable to continue in 2002 or am already out of ranching or farming.
- ☐ One more year.
- ☐ 2 or 3 years.
- ☐ 4 or 5 years.
- ☐ 6 to 10 years
- ☐ Indefinitely – I have sufficient ranch or farm income to sustain my operation and make an adequate living in the long run.
- ☐ Indefinitely – I or my spouse (or both) have sufficient off-ranch or off-farm income to make an adequate living and offset any current ranch or farm losses.

D5. ***What do you expect to happen to your ranch or farm when you quit or retire?*** *(Check the ONE box for the answer that best applies to your situation.)*

- ☐ I expect a child or other relative will continue my ranch or farm operation.
- ☐ I expect to sell my ranch or farm to a rancher or farmer who is not related to me.
- ☐ I expect to lease my croplands and pastures to a working farmer or rancher.
- ☐ I expect to continue living here on the land, without ranching or farming it.
- ☐ I expect to sell my land to a non-farm or non-ranching person.
- ☐ I am not sure what will happen.
- ☐ Other (specify:_____)

SECTION E – PERSONAL INFORMATION

For us to compare the responses of people with similar or different characteristics, we ask you to provide us some information about yourself and your family. Please remember that **ALL INFORMATION THAT YOU PROVIDE WILL BE TREATED IN THE STRICTEST CONFIDENCE**.

E1. ***In which year were you born?*** _____

E2. ***What is your gender?*** ☐ Male ☐ Female

E3. ***What is your highest level of formal education?***

- ☐ Some high school or less
- ☐ High school diploma or equivalent
- ☐ Trade school/formal apprenticeship
- ☐ Completed 2-year college degree
- ☐ Completed a four-year college degree
- ☐ Completed a graduate degree

E4. ***Did you or your spouse grow up on a ranch or farm?***

You	☐	No	☐	Yes			
Your spouse	☐	No	☐	Yes	☐	Not married	

E5. ***Since age 18, how many years of ranching or farming experience do you have?*** _____

E6. ***For how long have you or your family owned this ranch or farm?*** *(Check only ONE box)*

- ☐ Less than 3 years
- ☐ 3-10 years
- ☐ 11-25 years
- ☐ More than 25 years (single generation)
- ☐ More than one generation (How many generations? _____)
- ☐ I manage but don't own the ranch or farm

E7. ***Do you currently live on your ranch or farm?***

☐ No → Please skip to question E8 below.
☐ Yes → Please answer the following questions.

(a) ***How far from your ranch or farm do you live?***

☐ Less than 10 miles from your ranch or farm
☐ 11-50 miles from your ranch or farm
☐ 51 to 100 miles from your ranch or farm
☐ More than 100 miles from your ranch or farm

(b) ***In what type of community do you live?***

☐ The country or small rural community (under 2,500 population)
☐ Small town (2,500-5,000 population)
☐ Small city (5,000-25,000 population)
☐ Medium-sized city (25,000-50,000 population)
☐ Large city (50,000-250,000 population)
☐ Very large city or metropolitan area (over 250,000 population)

E8. ***In which of the following types of associations or organizations in your community are you or your spouse involved?*** *(Check the most appropriate box for each)*

Not involved	*Somewhat involved*	*Very involved*	
☐	☐	☐	Church groups (choir, church board, Relief Society, etc.)
☐	☐	☐	Civic organizations (Rotary, Kiwanis, VFW, etc.)
☐	☐	☐	Non-church related athletic/recreation groups (softball, soccer, etc.)
☐	☐	☐	Educational/school groups (PTA/PTO, band boosters, etc.)
☐	☐	☐	Youth-oriented organizations (4-H, Scouts, etc.)
☐	☐	☐	Community government (village, town, county boards, etc.)
☐	☐	☐	Ranch/farm organizations (Farm Bureau, Cattlemens Assn., etc.)
☐	☐	☐	Others (Please describe _____)

SECTION F – FINANCIAL OVERVIEW

Finally, to properly understand differences among landowners' perceptions about their rights, we must gather some basic financial information. Often, non-agricultural people concerned about environmental issues don't appreciate the economic stresses that ranchers and farmers face. Your willingness to share some limited financial information will enable us to provide an accurate report on the status of ranchers and farmers to public policy makers who make decisions about rural land.

We understand that you may be uncomfortable sharing this information with an outsider. However, we want to assure you that **YOUR RESPONSES WILL BE KEPT STRICTLY CONFIDENTIAL**, and we will never release them to 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.

F1. ***Please check the category that most accurately reflects your overall level of investment in fixed improvements on your ranch or farm during the last five years.*** *(By fixed improvements we mean such things as contouring, fixed irrigation systems, fencing, water facilities, roads, brush clearing, etc. Please do not include moveable equipment or operating expenses such as fertilizer, supplemental feeds, veterinary expenses, etc. in this estimate.)*

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

F2. ***Did your ranch or farm show a profit in 2001?***

☐ No ☐ Yes ☐ Not Sure

F3. ***In 2001, did you have any regular off-ranch or off-farm job?***

☐ No ☐ Yes

F4. ***In 2001, did your spouse have any regular off-ranch or off-farm job?***

☐ No ☐ Yes ☐ Not Married

F5. ***What proportion of your household's total income usually comes from your net ranch or farm income?***

☐ under 10% ☐ 11-25% ☐ 26-50% ☐ 51-75% ☐ over 75%

F6. ***How has the proportion of your household's total income obtained from your ranch or farm changed during the last 10 years?***

☐ Increased ☐ Decreased ☐ Stayed about the same

F7. ***Please check the category that best represents your household's total income before taxes in 2001?*** *(Include net ranch or farm income, income from wages, salaries, nonfarm businesses, rental payments, investments, retirement accounts, and any other major 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

Please write any other comments or suggestions that can help us better understand the situation of ranches and farms like your own.

THANK YOU FOR TAKING THE TIME TO FILL OUT THIS QUESTIONNAIRE. Your participation is greatly appreciated. Please send the competed questionnaire to us in the enclosed postage-paid envelope. If you wish to receive a summary of the survey results, please check the box below.

Would you like to receive a summary of the results of this study once they are available?

☐ No ☐ Yes

VITA

Name	Malini Vasudevan Nair
Permanent Address	"Kayyalam", Karayogamandiram Lane, Kaithamukku Trivandrum, Kerala, India-695024
Education	Texas A&M University, College Station, Texas, U.S.A Doctor of Philosophy, Rangeland Ecology and Management, *December 2004*. Master of Science, Agricultural Economics, *December1999*. Kerala Agricultural University, Trivandrum, Kerala, India Bachelor of Science, Agricultural Sciences, *May 1995*.
Presentation	'Bhopal Gas Tragedy- A Legal, Economic and Environmental Perspective' Poster presentation at Safety – 2004, Annual meeting of American Society of Safety Engineers, Las Vegas, NV.
Working Papers	'Wavelet Transform Analysis of Vegetation Pattern in South-West Niger', Working Paper, Texas A&M University.
Employment	Research/Teaching Assistant, Texas A&M University, 1997-2004. Docent, J. Wayne Stark Art Galleries, Texas A&M University.2003-2004 . Agricultural Extension Officer, Kerala, India.1995-1996.