UNDERSTANDING PARTICIPATION IN WILDLIFE CONSERVATION PROGRAMS ON PRIVATE LANDS

A Dissertation

by

MICHAEL GREGORY SORICE

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 2008

Major Subject: Wildlife & Fisheries Sciences

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Approved by:

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ABSTRACT

Understanding Participation in Wildlife Conservation Programs on Private Lands.

(December 2008)

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Chair of Advisory Committee: Dr. Robert B. Ditton

One major lesson derived from the implementation of the Endangered Species Act (ESA) over the past 30 years is that direct regulation is not the only nor the optimal way to protect endangered species on working lands because of an undue burden imposed on private landowners. The role of a voluntary conservation program is to rearrange incentives so that society bears the cost rather than the landowner. Employing a survey research methodology, I used theories of reasoned action and random choice to explore landowners' stated preferences for conservation programs.

I found landowners' stated interest in compensation programs to be moderate at best. For those willing to consider programs involving endangered species, associating land management requirements for species conservation with direct benefits to the landowner is important, but perhaps not as important as ensuring that the program provides adequate financial incentives, consideration of the term of the program, and a level of certainty regarding the landowner's future obligations under the ESA. Landowners are not a homogenous group. I identified two classes of landowners according to preferences for program structure. One group was highly sensitive to program structure, aside from financial incentives, while the other was likely to participate if adequately compensated with financial and technical assistance. These differences related to opinions on endangered species protection and dependence on their land for income.

Voluntary incentive programs increasingly are a popular tool to maintain and enhance conservation; however, these programs are only successful insofar as landowners choose to enroll. This research demonstrates that improving recovery efforts on private lands requires program administrators to have a more complete understanding of landowners' views on endangered species and conservation programs in general, as well as their motivations for owning and operating their land. By doing so, programs with broader appeal and greater efficacy can be designed and implemented.

For my parents

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Thanks go to my friends, colleagues and the department staff for making my time at Texas A&M University a great experience. I also want to extend my gratitude to all the central Texas landowners who were willing to participate in the study. Finally, thanks to my mother, father, and sisters for their encouragement and patience while I figured out what I wanted to be when I grew up.

NOMENCLATURE

ESA	U.S. Endangered Species Act or 1973
LRRP	Leon River Restoration Project
RCS	Recovery Credit System

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CHAPTER I
INTRODUCTION

Based on the precept that biodiversity contributes to human well-being and survival (Millennium Ecosystem Assessment 2005) much attention has been devoted to the fact that the human footprint (i.e., population growth and resource consumption) is rapidly increasing biodiversity loss (Dirzo and Raven 2003). A primary driver of biodiversity loss is land conversion due to agriculture, forestry and urbanization (Vitousek et al. 1997). According to Stein et al. (2000), almost 60 percent of U.S. landscapes have been altered in major ways.

Private lands are integral to stemming biodiversity loss because over 60 percent of the U.S. is privately owned (Lubowski et al. 2006). While the United States supports more large-scale ecosystem than any other nation (Steelman 2002), Shen (1987) estimates that from 21 to 52 percent of major terrestrial ecosystem types are not represented in this country's protected areas. Additionally, protected areas tend to have less productive soils and occur at higher elevations compared to private lands (Scott et al. 2001). Stein et al. (2000) estimate that one third of species are at risk of extinction in the U.S. and the GAO (1995) estimates that 90 percent of species listed as endangered have habitat on nonfederal lands. Private lands constitute the greatest proportion of the nonfederal lands with 78% of endangered species having some or their entire habitat on these lands.

Given the under-representation of ecosystem types in protected areas and the dependence of endangered species on private lands, successful biodiversity conservation hinges on the private landowner. Early attempts to stem biodiversity loss on public and private lands in the United States primarily relied on regulation and enforcement strategies. As a contemporary example, the Endangered Species Act (ESA) of 1973 has been a central policy tool in biodiversity protection in the United States.

This dissertation follows the style of *Society and Natural Resources*.

The ESA continues to enjoy much popular support despite being characterized as one of the most divisive environmental policies in the country (Norris 2004). The support lies with the spirit of the ESA itself, which mandates efforts to recover threatened and endangered species, while criticism largely stems from implementation. A lack of funding, problems with enforcement (Bean 1998), an over-reliance on biologists to solve social conflict (Kellert 1994), a heavy-handed approach to implementation, and a bureaucratic structure that precludes organizational learning, flexibility, and adaptability (Clark 1997) has led to a policy that is effective at preventing extinction but ineffective at promoting recovery (Norris 2004).

The command-and-control approach of the ESA (as originally implemented) requires landowners to fully bear the costs of recovery even though society gains benefits from increased biodiversity. It unintentionally creates perverse incentives for landowners to manage property in ways that harm endangered species (e.g., Lueck and Michael 2003) and alienates land stewards who might otherwise take steps to protect endangered species on their own. Information collection about species populations and conservation on private land consequently occurs at suboptimal levels because, in most cases, private landowners can refuse to allow the federal government to access their land (Polasky and Doremus 1998). Since the implementation of the ESA as a tool to protect imperiled species, private landowners have had little reason to engage in beneficial land management practices that help listed species (Bean 1998).

Within the last two decades the use of incentive programs as a means to help protect endangered species on private lands has increased greatly (e.g., Parkhurst and Shogren 2003; Land Trust Alliance 2005). Incentives work by using the carrot of monetary and nonmonetary rewards rather than the stick of land-use restrictions or prosecution for harming a listed species (Shogren 2005). The logic of the incentive is that because the benefits of endangered species protection accrue to the entire nation, the burden (i.e., cost) is shifted from the individual landowner to society through a government agency or private organization. Incentives serve to balance power between

two actors in such a way that interactions between the two are more collaborative than coercive.

OBJECTIVES

The purpose of this dissertation is to investigate the role incentives can play in endangered species recovery on private lands. Specifically, I investigate landowner willingness to enroll in a compensation program that protects and maintains endangered species habitat on a portion of a landowner's land. First, using the theory of reasoned action (Ajzen and Fishbein 1980) I predict landowner intentions to enroll in a currently existing program (see Wilkins 2004) using attitudes, norms, and background characteristics of landowners. Second, using random utility theory, I examine landowner preferences for the structure of performance contracts that vary the levels of financial incentives, technical assistance, assurances, contract lengths, and expected outcomes. The first approach focuses on landowner-related factors that influence the decision to enroll in a particular program. The second approach examines how program structure itself affects decisions to enroll.

DEFINITIONS

The following are the definitions of terms used in this study:

Compensation Program: a voluntary program in which enrolled landowners receive monetary and/or nonmonetary compensation to offset the opportunity costs associated with managing land to provide a net benefit endangered species.

Incentive: "any inducement specifically intended to motivate private landowners to conserve endangered species on their property" (Hadlock and Beckwith 2002, p. 200)

Incentive Program: see *compensation program*.

Landowner: For the purpose of this research, a landowner is private citizen, corporation, or company that has some degree of ownership interest in a parcel of land.

Part-Worth Utility: the proportion of utility that can be attributed to a specific attribute (Hensher et al. 2005, p. 703).

Performance Contract: a legal instrument in which an enrolled landowner receives full benefits from the compensation program once the criteria of the program (e.g., land management objectives) are fully completed

Utility: a relative measure of satisfaction or happiness that an alternative yields to an individual (Hensher et al. 2005, p. 707).

Working lands: non-urban land in which an actor with the authority to specify resource use designates and/or actively manages that land so that other goals (e.g., economic) are prioritized over ecological goals (including but not limited to ecosystem function, ecosystem services, biodiversity protection). An actor can refer to either an individual (e.g., a single landowner) or corporate groups that act as a single unit (e.g., the U.S. Forest Service).

BACKGROUND

With a downward trend in land conversion to grazing lands and an upward trend in conversion to urban areas (Lubowski et al. 2006), the importance of conservation on working lands increasingly has been recognized as integral to stemming biodiversity loss (Rosenzweig 2003; Tscharntke et al. 2005; Firbank 2005; Pimentel and Stachow 1992). Working lands are non-urban lands in which an actor with the authority to specify resource use designates and/or actively manages that land so that other goals (e.g., economic) are prioritized over ecological goals. They make up much of the 90 to 95% of the earth's land surface not in reserves. An actor can refer to either an individual or to corporate groups that act as a single unit; thus, working lands can be publicly or privately owned. With its mandate to provide multiple uses of forest lands, the U.S. Forest Service is an example of a federal agency that actively manages a working landscape. Private working lands are managed by companies, corporations, and private citizens (GAO 1995).

In this dissertation, I focus on two specific types of working lands: military lands and private lands. Military lands represent only 3 to 4% of all federal lands yet they harbor over three times the number of listed, candidate, or proposed species under the ESA than any other federal agency (Stein et al. 2008). As a federal agency the military

must comply with environmental laws and regulations such as the Endangered Species Act. The army, for example, actively promotes the recovery of 188 listed species as well as others that are imperiled (Queen 2006).

Overall, the military, and specifically the army, has taken its role in endangered species recovery seriously but considers endangered species an encroachment issue, one which impedes its ability to carry out its mission to train troops for the provision of national defense. The military currently is looking to other members of the working landscape to offset some of this conservation burden.

By engaging private landowners proximate to military lands, the military can reduce restrictions on training, for example, and enhance endangered species recovery by protecting more habitat across a wider geographic range. The primary obstacle to obtaining private landowner cooperation is the perverse incentive structure created by the historical implementation of the ESA. Incentive programs increasingly have been advocated and implemented as a means to rearrange the incentive structure so that landowners are more likely to cooperate with recovery efforts by engaging in some form of beneficial land management.

My research is based on a pilot project in central Texas that engages private landowners in endangered species habitat management and protection in order to offset some training activities of the local army installation. The Fort Hood Military Reservation encompasses approximately 87,890 ha (217, 180 ac) in Bell and Coryell Counties in Texas. Currently, Fort Hood provides infrastructure and training lands for over 40,000 uniformed troops. Training includes brigade-level maneuver exercises live weapons firing, and aviation training. At the same time, almost one third (32%) of the military reservation provides suitable habitat for two federally listed endangered songbirds. The black-capped vireo (*Vireo atricapilla*) was listed by the U.S. Fish and Wildlife Service in 1987. Although its habitat is quite variable it can be characterized as early successional habitat consisting of a patchy distribution of broadleaf shrubs within a matrix of grasses. The golden-cheeked warbler (*Dendroica chrysoparia*) nests in mature juniper-oak woodlands often found in relatively moist areas including steep slopes and

canyons. Although exact composition may vary, Ashe juniper (*Juniperus ashei*) is necessary for nest construction. As Pekins (2006) notes, these species share habitat in different successional stages. Roughly speaking, warbler habitat can revert to vireo habitat if degraded, and if vireo habitat is left alone it can transform into warbler habitat. Currently, 6,967 ha (17,216 ac) of the military reservation is considered suitable habitat for the black-capped vireo and 21,422 ha (52,935 ac) is considered suitable for the golden-cheeked warbler.

In 2005, the U.S. Fish and Wildlife Service rendered a new biological opinion which reduced the designated core habitat for each of the two songbirds. In order to prevent a net loss of species recovery as a result of this action, Fort Hood engaged surrounding landowners in long-term conservation easements and programs such as Safe Harbor (see Rappaport Clark and Dalton 1999) as well as shorter-term programs. One short-term program, the Leon River Restoration Project, was a cost-share program focusing on rangeland restoration and management in central Texas (Wilkins 2004). Because the management techniques employed in this project benefited the black-capped vireo and the golden-cheeked warbler, it was reconceived as a proof-of-concept project for the newly introduced recovery credit system (RCS) (Hall 2008). Recovery crediting is a new tool within the habitat credit trading framework that includes conservation banking. The RCS currently is authorized only to work between the federal government, who purchases credits, and private landowners who provide habitat. Unlike conservation banking, credits can be secured by a term contract but only if the negative impacts to be offset are temporary themselves. The RCS provides a recovery tool that, like Safe Harbor, contains a "net benefit" provision requiring credits be used to enhance a species current status. One added benefit of this system is that it can incorporate more of the working landscape in recovery efforts. Some landowners may be willing to contribute to endangered species recovery but not on a permanent basis. Additionally, the RCS has the potential to include critical habitat across a wider geographic area than a conservation bank.

As a result of these efforts, the Department of Defense and the Fort Hood military installation were interested in understanding the willingness of landowners to participate in both long-term and short-term projects. This information is critical to the success of the program and also helps to create a strategy to solicit landowner participation.

THEORETICAL FRAMEWORK

My research seeks to understand factors that influence choices to enroll in a compensation program for endangered species; however, I was not able to observe actual behavior. Consequently, my research relies on stated preferences for programs. Both approaches I use are members of the family rational choice theories. Rational choice means that individuals are behaving in an optimal fashion, in a manner where they "can be deemed to be doing the best they can for themselves, given their objectives, resources, and circumstances, as they see them" (Abell 2000, p. 223). Ben-Akiva and Lerman (1985, p. 38) define rational behavior as "a consistent and calculated decision process in which the individual follows his or her own objectives, whatever they may be." There are many critiques of this approach to understanding behavior but these models do have predictive validity. Abell even argues that rational choice approaches to behavior are the "least bad" (p. 224) for understanding some types of human behavior.

I use two different rational choice modeling techniques to approach the question of landowner participation in conservation programs. Approaches that assume rational behavior are useful when the behavior of interest is voluntary, when the decision to act lends itself to deliberation, and when the behavior is easily performed. These same conditions were met for my research in which landowners were presented an option to enroll in a voluntary program to protect and maintain endangered species habitat. Although I did not observe actual behavior, behavioral intentions (Ajzen and Fishbein 2005) and stated preference choice models (Adamowicz et al. 1997; Earnhart 2001) tend to be a good predictor of actual behavior under these same conditions.

Theory of Reasoned Action

The theory of reasoned action (Ajzen and Fishbein 1980) is what Timmermans (1984) calls a compositional approach to stated preference evaluation in which an overall utility value for a behavioral object is calculated. The reasoned action approach to understanding and predicting behavior assumes individuals deliberately process information, weigh the positive and negative arguments of engaging in a particular behavior, and then incorporate this information in their decision to act. It assumes that this decision to act, the behavioral intention, is the direct antecedent to actual behavior (Fishbein and Ajzen 1975). The behavioral intention is described by Eagly and Chaiken (1993, 168) as a "person's motivation in the sense of his or her conscious plan to exert effort to carry out a behavior." There are two distinct determinants of a behavioral intention. The normative component is the social pressure an individual feels from salient referent groups to engage (or not engage) in a behavior. Normative beliefs about what specific referent groups (e.g., family) believe an individual should do lead to an overall evaluation of social pressure to act. The utilitarian component (Eagly and Chaiken 1993) involves the positive and negative outcomes the individual believes will occur as a result of engaging in a behavior. These behavioral beliefs provide a cognitive foundation from which the formation of an attitude toward the behavior occurs. This attitude is an overall positive or negative evaluation of executing the behavior of interest.

Because behavioral intention is posited to predict behavior, the TRA is limited to voluntary behaviors (Ajzen and Fishbein 1980; Eagly and Chaiken 1993). In response to criticisms that some behaviors are not simple, easily performed, or completely under volitional control, Ajzen (1991) introduced the theory of planned behavior which added perceived behavioral control as a third distinct determinant of behavioral intention. Perceived behavioral control is a combined measure of self-efficacy, an individual's perception about how easy or difficult it is to engage in a behavior, and beliefs about the extent to which performing the behavior is up to the individual (Ajzen 2002).

The TRA has been used in a wide variety of fields (see Ajzen and Fishbein 2005; Eagly and Chaiken 1993) including natural resource management. For example, the

TRA has been used to understand support for policies such as the National Park Service's controlled burn policy (Bright et al. 1993) as well as policy initiatives related to trapping (Manfredo et al. 1997) and wildland preservation voting intentions (Vaske and Donnelly 1999). Some work has been conducted on proenvironmental behavior such as water conservation (e.g., Trumbo and O'Keefe 2005) and recycling behavior (Jones 1990).

Random Utility Theory

Random utility theory also operates under the assumption of rational behavior. It assumes that individuals faced with a choice between multi-attribute goods will choose an alternative that provides them with the greatest utility (i.e., satisfaction) (McFadden 1974). For example, when presented with two different incentive program contracts, the choice modeling technique assumes that a private landowner will choose the one that makes him or her the happiest. While the landowner considers all personally-relevant factors during the decision-making process a researcher cannot account for all of these factors involved. Consequently, choice models are probabilistic, decomposing the utility (U_j) of enrolling in a particular incentive program into what a researcher can observe (V_j) for a set of program attributes (A) as well as other unobserved factors (ε_j). This random utility model is formally represented as:

$$U_j = V_j(A) + \varepsilon_j$$

As Manski (1977) notes, utilities are treated as random variables not because the individual is not acting rationally, but because of the failure of the researcher to account for all characteristics of the alternatives in the model.

This approach has been applied to a number of different nonmarket goods (Adamowicz et al. 1998) to understand preferences for and potential behavioral responses environmental issues and policy changes including ecotourism (Hearne and Salinas 2002), environmental risk (Casey et al. 2008; Travisi and Nijkamp 2008), wetland mitigation (Bauer et al. 2004), forest management (Boxall and Macnab 2000), and outdoor recreation (Bullock and Lawson 2008; Hunt et al. 2005; Sorice et al. 2007).

Situating Compensation Programs in a Social Dilemma Framework

A social dilemma encompasses a class of situations in which an individual's short-term self interest competes with the long-term interest of a group. In terms of this research, the short-term self interest is land conversion for agriculture while the long-term group interest is maintaining or restoring habitat to protect endangered species (i.e., maintaining biodiversity) in order to support ecosystem function and services that enhance human well-being.

Endangered species recovery often is not situated in a social dilemma framework. As a result, it can be relatively easy to overlook the perverse incentive structure created by the historical implementation of the ESA. Some scholars critique incentive programs as rewarding landowners for engaging in behaviors they should be engaging in anyway (e.g., Raymond and Olive 2008). Under a social dilemma framework, however, compensation programs are not considered rewards. Instead, they are a way of rearranging a perverse incentive structure so that endangered species recovery occurs at a more optimal level.

Using random utility theory as a behavioral model, I investigate ways to rearrange the incentive structure that will increase landowner cooperation with endangered species protection on private lands. Specifically, I examine four factors that make up a compensation program (financial incentives, technical assistance, contract length, and assurances against future regulation) as well as two expected outcomes of enrolling (improving your own land and help the endangered species). Instead of asking landowners to indicate preferences for individual factors, I combined all factors into hypothetical performance contract profiles. Landowners then evaluate a series of contract profiles and choose the ones in which they would enroll.

PREVIOUS RESEARCH

Research on incentive programs tends to be atheoretical and almost exclusively focuses on explaining or predicting landowner participation. A number of variables have been identified as salient to participation. For example, Kraft, Lant & Gillman (1996) asked farmers in four states about their willingness to participate in the Water

Quality Incentive Program. Under the program, farmers developed water quality protection programs in return for a per-acre incentive of up to $3,500 per year for a three to five year period. Using a discrete choice framework, the authors found an increased probability of participation by farmers who owned their land (rather than leasing), who were more educated, had more positive attitudes toward government involvement in wetland regulations, had worked with a National Resource Conservation Service (NRCS) representative in the past year, and who had a higher percentage of their gross farm sales from specialty crops.

Nagubadi, McNamara, Hoover & Mills (1996) also used a discrete choice framework to examine factors influencing Indiana non-industrial private forest (NIPF) landowners participation in two forestry incentive programs. In the first program, the assessed value of an enrolled owner's land is reduced to $1 per acre and free technical assistance was provided by the state's natural resources department. For this program, landowner age and total acres owned were significantly and positively related to program participation. NIPF owners possessing land primarily for commercial use had a 20% higher probability of participating. Owners using consulting foresters/biologists/soil conservation agents were more likely to participate as well as those belonging to forestry organizations. Landowners who feared a loss of property rights or management options were less likely to participate in this program (p-value < 0.10). Finally, the number of years since landowners acquired their first acre of wooded land was negatively related (with p-value < 0.10) to participation. This was an unexpected result and the authors posit that it may reflect the difference between recent and early land purchasers or that the timber may have already been cut, providing no substantial benefits.

The second program investigated by Nagubadi, McNamara, Hoover & Mills (1996) was a cost-share program. For this model, landowners possessing land primarily for commercial use was the only variable significantly (and positively) related to participation. On-site residence, membership in forestry organizations, and an attitude

variable regarding willingness to sell an easement on their woodland were positively related to cost-share program participation at $p = 0.10$.

Research conducted on incentive programs for protecting endangered species on private land is more salient to off-site conservation of endangered species. Kline et al. (2000), for example, examined the willingness of private forest landowners to adopt harvest restrictions to protect or enhance riparian habitat in return for federal income tax deduction. They found that many private forest landowners were motivated to operate their land for reasons other than timber production. Specifically, the more a private forest owner depends on the land for timber sales the less willing they are to participate. This finding was fairly consistent across income categories. Landowners who depend on their land for income require a higher economic incentive than landowners who operate their land either for recreational or mixed objectives. Although the paper was framed as benefiting coho salmon restoration, it is unclear whether the researchers actually framed the purpose of the no-harvest buffer around riparian areas as a program for the benefit of endangered species or for the general ecosystem in the survey instrument.

Langpap (2004) examined the demographic and land characteristics influencing participation in incentive programs designed to provide habitat for endangered species in western Oregon and Washington. The likelihood of participation was positively related to the importance a landowner places on the wildlife habitat provided by the forest, the number of acres owned, and membership in conservation organizations. Participation was negatively correlated with the landowner's age. Marginal findings included a negative likelihood of participation related to years of ownership, total acreage owned, and the important of aesthetic enjoyment of the forest. No statistically significant relationship was found with the importance of investment or the commercial value of the forest. A useful finding here is that the landowner's perceived risk of regulation under the Endangered Species Act did not have statistically significant influence on the probability of participation; 60% of the respondents felt that the chance that activity on their property would be restricted by the ESA was less than half. From this Langpap

concludes that landowners who are more likely to participate in the program may not focus as much on managing their land for profit.

Langpap (2006) then considered the effects of program structure on participation by examining the effects of assurances, cost sharing, incentive payments, and technical assistance on the probability that private landowners would engage in increasing levels of effort to manage their land for endangered species. Cost sharing provided a weak incentive while assurances provided the strongest incentive. Combining financial incentives with assurances, however, markedly increased a landowner's potential effort to manage their land for endangered species. Technical assistance did not provide any substantive incentive. Finally, in this study, demographic variables, property size, and residence were not related to participation or efforts.

Research on non-industrial private forest (NIPF) landowners in North Carolina focused on incentives to protect the red-cockaded woodpecker (RCW), a federally endangered species. Zhang & Mehmood (2002) and Mehmood & Zhang (2005) looked at determinants of participation in the U.S. Fish and Wildlife Service's Safe Harbor Program for the RCW. Using logistic regression to explain participation, Mehmood & Zhang (2005) found the following variables to be significant and positively related to participation:

- Acreage,
- The possible presence of RCWs (measured by presence of active nests within one mile of a landowner's land and the amount of mature pine),
- The use of burning, chemical, and/or mechanical methods of understory control,
- Landowner perceptions of the degree of risk of RCWs relocating onto their land ($p < 0.10$),
- Landowner attitudes toward RCW and endangered species protection, and
- Whether a landowner was introduced to Safe Harbor by a consulting forester

Only one variable, looking at whether landowners believe the Safe Harbor program would weaken their property rights, was significant and negatively related to participation.

The positive coefficients for the possible presence of RCWs and perceived degree of risk were explained as landowners wanting to enroll now to protect their investments and remove future uncertainties. Thus, the higher the risk, the more likely a landowner is to enroll. Furthermore, the higher the perception that property rights would be taken away, the less likely a landowner was to enroll.

Table 1. Qualitative differences in landowner characteristics of central Texas ranchers based on Cearley-Sanders (2005).

Item	Born to the Land (BTL)	Agricultural Business	Reborn to the Land
Age	Oldest	Slightly younger than BTL	Youngest
Ranching Experience	Most	Middle	Least
Land size	Medium to Large	Large	Small
Land tenure	Long	Short	Short
Percent income from ranching	High	High	Low
Level of connection to land	High (spiritual)	Low (Profit oriented)	High (aesthetic and recreational)
Sense of stewardship	Strong	?	Strong
Attitude toward government assistance	Negative	Negative	Neutral
Receive government assistance	Yes	No	No
Interaction with federal/state/ local agencies	Likely	Unlikely	Somewhat Likely

Finally, Cearly-Sanders (2005) used a qualitative approach to explore the relationship between characteristics of central Texas landowners and their willingness to participate in incentive programs to enhance endangered species habitat. Of the 56 responses, 11% indicated no willingness to participate, 59% initially indicated no willingness but then said they would if certain conditions were met, 13% initially

indicated a willingness conditional on having their concerns met, and 18% indicated a willingness to participate. Due to a lack of a random sample of landowners, however, her results are not generalizable beyond her sample. However, they are useful in this research because they used landowners from central Texas and ask about endangered species protection. Additionally, Cearley-Sanders couched their willingness to participate within three types of landowners: *Born to the Land*, *Agricultural Business*, and *Reborn to the Land* (Table 1). She suggests that *Reborn to the Land* landowners were the most likely to enroll in an incentive program while *Agricultural Business* landowners were least likely to enroll.

PURPOSE AND ORGANIZATION OF THE DISSERTATION

My dissertation begins with two stand-alone papers that explore the intentions of landowners in central Texas to enroll in a performance contract based on the initial Leon River Restoration Project and the current recovery credit system. As much of the literature relates socio-demographic variables to landowner participation in compensation programs, I begin the first paper with an empirical exploration of the role of landowner and land-use characteristics in predicting participation in the endangered species program. These items to not perform well in predicting landowner intentions to enroll. I then add landowners' perceived outcomes of enrolling, interest in participating in other programs, and past participation in programs to identify useful predictors of landowner enrollment. Coupling the land management benefits of the species and the landowner enhances participation while landowner beliefs that they won't be able to make their own land-use decisions decrease participation. This exploratory study suggests that finding potential participants largely is a matter of finding landowners who desire the same land management benefits. For example, landowners who have restored their rangeland in the past five years were much more likely to participate than those that have not.

With confirmation that landowner characteristics cannot be used as an effective proxy for understanding participation in compensation programs, I apply the theory of reasoned action to the same endangered species program as in the first paper. The

results of this analysis show that landowner attitudes toward enrolling contribute the most to the predictive ability of the reasoned action model. Subjective norm, the perceived social pressure to enroll, was not statistically significant but further analysis reveals that it remains an essential component in the model. Other behavioral predictors are useful to help identify potential participants, but they only make small contributions to prediction.

The first two papers look at landowner characteristics and social variables related to enrollment in a particular program with a fixed structure. I also was interested in understanding how the program structure itself influences participation. My third paper presents results from a choice experiment in which landowners decided between performance contracts that varied by the types and levels of incentives offered. I found two distinct landowner groups with varying preferences for performance contracts. This heterogeneity in landowner preferences has implications for optimizing conservation through landowner recruitment and the design of compensation programs.

CHAPTER II
RECOVERY OF ENDANGERED SPECIES ON PRIVATE LANDS: PROSPECTS FOR INCENTIVE PROGRAMS

INTRODUCTION

As a consequence of the implementation of some provisions of the Endangered Species Act (ESA), many private landowners intentionally do not engage in land management behaviors that benefit endangered species and some refuse to cooperate in recovery efforts at all (Bean 1998). Private property rights sometimes are invoked to refuse government access to potential habitat and populations. Refusing access not only impedes species conservation directly but also information collection which is useful in determining a species' status and level of recovery (Brook et al. 2003; Polasky and Doremus 1998). In many cases, the implementation of the ESA actually has created perverse incentives in which, rather than cooperate, landowners engage in preemptive habitat destruction to prevent use by an endangered species (e.g., Lueck and Michael 2003).

There have been many suggestions made about how to correct the equity, fairness, and trust issues that ultimately lead private landowners to choose not to cooperate in endangered species recovery (Hadlock and Beckwith 2002). For example, Brook et al. (2003) recommend using social networks to communicate information and increasing the use of collaborative processes. Pointing to successful agricultural incentive programs such as the Conservation Reserve Program (16 USC ss 3831 et seq), Bean (1998,:10707) takes a strong stance on this issue by saying that "without positive incentives, the Act's goals are unlikely to be achieved." Thompson Jr. (2006) agrees with Bean and adds that a focus on reserves to the exclusion of the surrounding working landscape (i.e., farms and ranches) increases the chances that recovery efforts will ultimately fail. An incentive, as discussed in Hadlock and Beckwith (2002, 200), is "any inducement specifically intended to motivate private landowners to conserve endangered species on their property." Incentives may be monetary or nonmonetary. Monetary incentives can include direct financial assistance in the form of subsidies (e.g.,

Conservation Reserve Program) or conservation easements; market-based methods such as mitigation banking or tradable credits; or, incentives based on tax reform. Nonmonetary incentives focus on reducing uncertainty, increasing nonmonetary benefits to the landowner, and balancing power between the landowner and the administering agency (by creating opportunities for collaboration rather than relying on coercion). Many conservation programs have since emerged that provide monetary and nonmonetary incentives for landowners to protect endangered species habitat on their land (e.g., Ginn 2005, Chapter 9).

Recovery efforts are likely to fail without incentives to encourage beneficial land management (Bean 1998; Thompson Jr. 2006). A current understanding of landowners, their orientation toward endangered species and incentives programs, and their willingness to participate in these programs is important for successful endangered species recovery. I examined the intentions of landowners to enroll in a cost-share program to protect and maintain endangered species habitat in central Texas. Specifically, the objectives of this study were to: 1) examine the relationship between landowner characteristics and potential enrollment, and 2) examine the role of beliefs about the consequences of enrolling as well as past behavior as factors related to decision making among landowners.

Previous Research

Past research on the adoption of conservation practices and enrollment in conservation programs that provide incentives to engage in beneficial land management practices has examined landowner and land use characteristics. For example, studies have focused on factors influencing the adoption of conservation practices (e.g., Korsching and Hoban 1990) as well as interest in participating in conservation programs to prevent soil erosion (see, Lockeretz 1990), improve water quality (Kraft et al. 1996; Thurow et al. 2001), improve range productivity (Kreuter et al. 2005), and enhance or maintain wildlife habitat (Olenick et al. 2004).

While the results aren't entirely consistent, the current understanding is that younger, more educated, and higher income landowners are more pro-environment (e.g.,

Jones and Dunlap 1992), less likely to exhibit strong property rights orientations (Jackson-Smith et al. 2005), or antipathy for endangered species (Kellert 1996). Thus, one might expect that younger, more educated, and higher income landowners will be more likely to participate in a cost-share conservation program.

Additional work on rural landowners suggests that different types of landowners may be more willing to participate in cost-share programs (Cearly-Sanders 2005; Raedeke et al. 2001; Kline et al. 2000). Landowners who are absentee, manage fewer acres, have not been in the community for long, and who operate their land mostly for enjoyment rather than income are expected to be more likely to cooperate in cost-share programs. Reading et al. (1994) found that landowners who had not been in the community for long were more supportive of ecosystem management. Cearly-Sanders (2005) found that this general type of landowner was more amenable to an endangered species cost-share program in central Texas.

Landowners who rely on their land to provide income for their families are likely to view cost-share programs differently than landowners using their land for recreation, an investment, or as a hobby ranch. Olenick et al. (2005), for example, found that potential participants in land management programs to enhance ecosystem services derived a greater proportion of their income from their land than potential non-participants (also see, Kreuter et al. 2004). Studies where endangered species are involved suggest the opposite. Brook et al. (2003) found that the more economically dependent landowners were on agriculture, the more they disagreed that landowners should be responsible for species conservation; and, they were more likely to manage their land to decrease the chance of endangered species occupying it. Kline et al. (2000) found that the more a private forest owner depended on the land for timber sales the less willing they were to adopt harvest restrictions in exchange for a federal income tax deduction. Cearly-Sanders (2005) concluded that dependence on land was a discriminating factor in a landowner's interest to enroll in a program for endangered species. Larger landholders were less likely to be interested.

Dependence on land is usually considered a landowner characteristic alongside other socio-demographic items. Here, I explore the usefulness of income dependence as a proxy for other landowner characteristics such as absentee landownership, property size and other. I hypothesize that landowner characteristics are related to dependence on the land for income but not to enrollment in cost-share programs. I expect that landowners who are absentee, manage less acres, have not been in the community for a long time, and who manage their land for enjoyment will be less dependent on their land for income. Furthermore, I expect landowners who are less dependent on their land to be more willing to enroll in a cost-share program for endangered species.

Some authors (e.g., Lockeretz 1990) have criticized studies that relate landowner characteristics to conservation behaviors. Although landowner characteristics may be related to behavior, they generally do not perform well in predicting specific behaviors (Ajzen and Fishbein 1980). Short of observing actual behavior, the best predictors of behavior are other behavioral items. For example, Eagly and Chaiken (1993) discuss the importance of past behavior on predicting future behavior. Additionally, behavioral intentions are deliberate plans to act that are created just before an action occurs and can be useful in predicting behavior. Fishbein and Ajzen (1975) conceptualize the behavioral intention as the immediate antecedent of behavior. Behavioral intentions tend to be good predictors of actual behavior when the behavior of interest is voluntary, the individual deliberately weighs the positive and negative outcomes of engaging in the behavior, and when the behavior is easily performed (see McCleery et al. 2006 for a review). I expect that behavioral intentions related to the behavior of interest should improve prediction because the program is voluntary, it lends itself to deliberation, and it is not difficult to enroll in a program.

METHODS

The population of interest in this study was landowners around the Fort Hood military installation who have potential habitat for two endangered songbirds, the endangered black-capped vireo (*Vireo atricapilla*) and the golden-cheeked warbler (*Dendroica chrysoparia*). The black-capped vireo is a small songbird that breeds locally

in central Texas and winters in Mexico. Vireo habitat can become unsuitable due to improper brush clearing, fire suppression, overbrowsing, and urbanization (Texas Parks and Wildlife Department 2004a). Habitat can be improved as the result of active land management that restores rangeland by selectively clearing Ashe juniper (*Juniperus ashei*) and regenerating rangeland grasses using prescribed burning (Texas Parks and Wildlife Department 2004b). The golden-cheeked warbler is a habitat specialist that primarily breeds in mixed hardwood forests in central Texas containing mature juniper trees and nests predominantly in stands occurring on steep slopes and in canyons (Ladd and Gass 1999). Fort Hood is the largest block of a relatively small amount of federal land in the breeding range of the species. As such, it is considered a key area for the management of the species. However, due to the predominance of private lands in the species breeding range, recovery will occur only with the cooperation of private landowners To maintain consistency with previous research (i.e., Wilkins 2004), this study sampled from the population of landowners in the Leon, Bosque, and Lampasas watersheds in all or part of six counties surrounding Ft. Hood including: Bell, Bosque, Coryell, Hamilton, Lampasas, and McLennan County in central Texas (Figure 1).

Sampling

A sampling frame was constructed by identifying landowners with at least 10 hectares and a moderate to high potential for having golden-cheeked warbler habitat on their property. The 10-hectare requirement for inclusion in this study was derived from two factors. First, literature on golden-cheeked warbler habitat requirements indicates that golden-cheeked warblers may have territory densities as small as 4 hectares (Anders and Dearborn 2004; Ladd and Gass 1999; Peak 2004); although, they may require larger patches of habitat in which to breed (Arnold et al. 1996; Coldren 1998; Magness et al. 2006). Second, current ownership trends in central and east Texas are toward smaller properties. Wilkins, Hays, Kubenka et al. (2003) classified current landownership in Texas based on three size classes: 41 to 202 hectares (100 to 500 acres), 202 to 809 hectares (500 to 2000 acres), and greater than 809 hectares (2000 acres). I did not bind the study frame by the habitat constraints of the golden-cheeked warbler because

program administrators can aggregate smaller land parcels held by landowners with less than 41 hectares into larger conservation units. Additionally, because golden-cheeked warblers inhabit areas that are increasingly fragmenting and/or urbanizing, it is of interest to survey landowners with less than 41 hectares. Ten hectares was ultimately chosen as the lower bound because, ignoring issues regarding minimum habitat patch size, it is sizeable enough to accommodate a breeding pair and it is of interest given current demographic trends in land ownership.

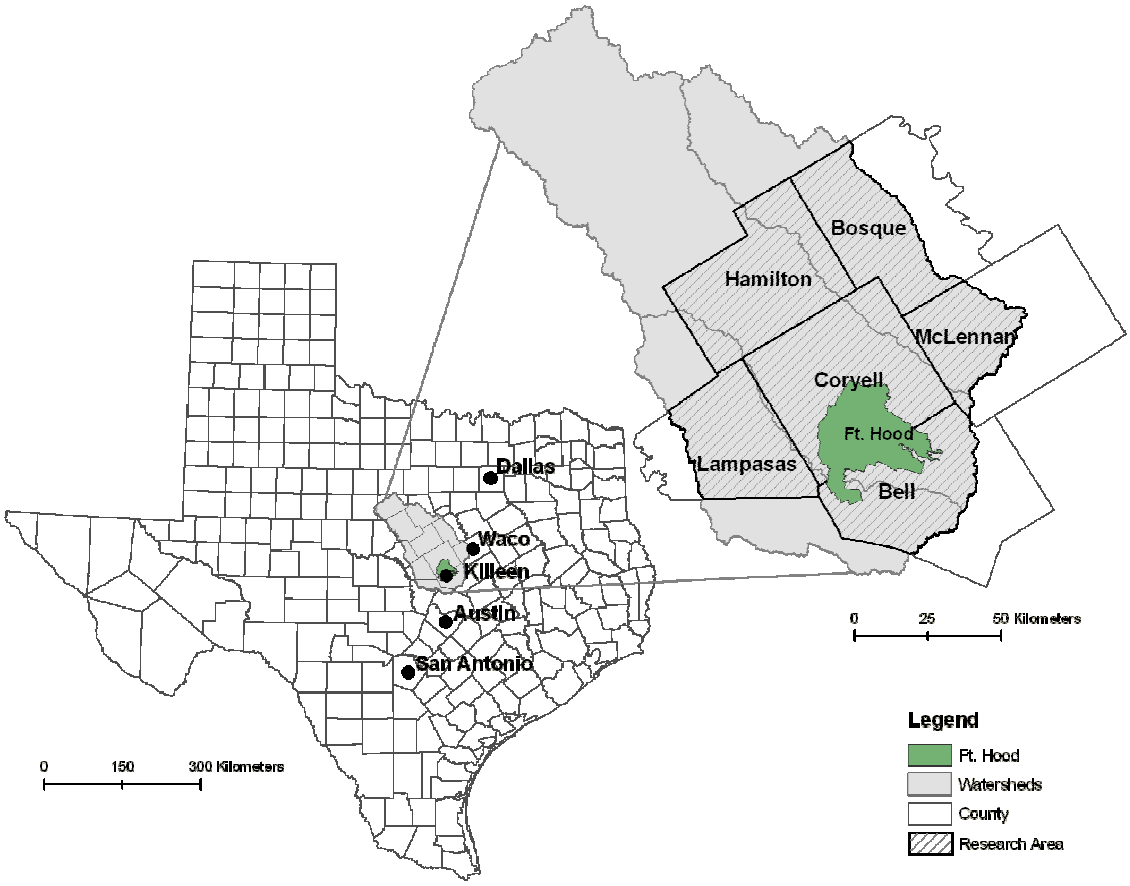

Figure 1. Location of study area. Research area included landowners in six counties around the Ft. Hood army installation within one of three watersheds.

I obtained landowner information from each county's tax appraisal district. Because I was interested in landowners with potential habitat, a golden-cheeked warbler

habitat model, created by Jones (2006), was overlaid on tax appraisal data using GIS. I selected landowners with a moderate to high probability of having golden-cheeked warbler habitat. Finally, I submitted the landowner information to a consumer information company to obtain phone numbers.

I stratified the sample by county simply to facilitate data collection and treated the results as a random sample. Because endangered species issues are not salient for most landowners (e.g., Raymond and Olive 2008), I was concerned about the response rate and utilized the following four steps in the research protocol. First, I sent a letter to a subset of landowner mailing addresses advising them that I would be calling regarding a project on wildlife conservation and then called about one week later. For landowners who agreed to participate, the first author and two other interviewers trained by the first author conducted a face-to-face structured interview focusing on land-use and landowner characteristics. At the end of the 15-minute interview, the interviewer left a self-administered questionnaire containing the conservation program items with the participant along with a small watercolor print of a local landscape as a thank-you gift. To ensure a suitable response rate for the self-administered questionnaire I used a rolling reminder procedure adapted from the Dillman (2000) mail survey technique. One week after each round of interviews, I sent a thank you/reminder postcard followed 3 weeks and 7 weeks later by a reminder letter and replacement questionnaire. Interviewing began in April 2007 and ended in November, 2007. This research was approved by Texas A&M University's Office of Research Compliance (Protocol #2006-0011).

Measuring Behavioral Intentions, Landowner Characteristics, and Dependence

The dependent variable was a behavioral intention to enroll in a cost-share program to protect and maintain endangered species habitat. It was modeled on the Leon River Restoration Project (LRRP), a local cost-share program focusing on juniper removal to improve water flow, water quality, reduce fire potential and improve grassland wildlife habitat. This program has since evolved into a proof-of-concept pilot project for a new conservation tool, the recovery credit system (RCS) (Hall 2008), which focuses on improving endangered species recovery. For this study, I retained the same

program structure of the original LRRP but reframed it in terms of a cost-share program targeting habitat for two endangered bird species. The two bird species involved are the black-capped vireo and golden-cheeked warbler, but I did not specifically mention them. I was interested in the idea of an endangered species program and did not want the actual species to confound decision making. It certainly was possible, however, for landowners in the area to deduce the species involved. In addition, although it is a well-regarded, successful program, I did not label the program because I wanted landowners to concentrate on the attributes of the project. Again, it was possible for landowners to deduce that I was asking about the LRRP. Landowners were provided with the following description of the program:

> This program is run by a local non-profit group in central Texas. Landowners volunteer for the program and enroll in a 5-year performance contract to manage their land for two species of endangered birds. It provides 85% cost sharing to landowners to clear Ashe juniper, also called cedar, and to conduct a prescribed/controlled burn on a portion of their land. The contract also includes preserving some areas of mature oak-juniper woodlands on steep slopes and in canyons. The program provides assistance with the management plan and conducts the brush clearing and burn for the landowner. The benefits of this program include improved grazing capacity, ground & surface water conservation, and enhanced wildlife habitat. After the contract expires and the performance criteria are met, the landowners are reimbursed the remaining 15% of the costs (minus the costs for the prescribed burn) and are free to operate the land in whatever way they desire.

Landowners were then asked how likely or unlikely they were to enroll in this program using a 7-point scale from 1 = "Extremely Unlikely" and 7 = "Extremely Likely."

Landowner demographics considered in this study were age, education (1 = "Two-Year Degree or Less," 2 = "Some College," 3 = "College Degree," and 4 = "At Least Some Graduate or Professional School"). Annual household income for the year

2006 was coded as 1 = "Less than $60,000," 2 = "$60,000 to $119,999," and 3 = "$120,000 or More." Two dummy variables were created for absentee landowners. A landowner was considered absentee if they did not live on their land and if they considered their land to be in a different community from which they resided. A partial absentee landowner did not live on their property but considered their land to be in the same community.

Based on their findings, Raedeke et al. (2001) speculated that a landowner's identity as a rancher or farmer may play a role in decision making. Using qualitative research, Bliss and Martin (1989) found identity to be a central construct in understanding management motivations of non-industrial private forest owners. I expected a landowner's identity as a rancher or farmer to be positively related to their dependence on their land for income. Using a scale where 1 = "Strongly Disagree" and 7 = "Strongly Agree," landowners were asked to respond to these three statements: "Farming/ranching says a lot about who I am," "I consider myself a rancher," and "I consider myself a farmer". These three items had a high level of reliability (Cronbach's alpha = 0.81) and were averaged together to create the identity variable.

I also measured a landowner's rootedness to the community. Rootedness includes the number of years a landowner's place has been in their family and the extent to which the landowner feels a sense of history and a sense of pride about their family's history (Tuan 1980). (Note that landowners in this area commonly refer to their property as their "place.") Two items were used to assess this sense of history on the land. Using the same 7-point scale from "Strongly Disagree" to "Strongly Agree" landowners responded to these two statements: "My place represents my family history" and "I am proud of my family's history on this place." The number of years the place has been in the family was log transformed to reduce skew, the three items were standardized, and an additive index was created (Cronbach's alpha = 0.76). I also measured the number of years the landowner owned his or her place, transformed it to reduce skew, and allowed it to covary with rootedness.

The single-item variable, "Enjoy" measured whether a landowner operated his/her land "purely for the enjoyment of it" using a 7-point scale from "Strongly Disagree" to "Strongly Agree." Because 42% of landowners strongly agreed with this statement, a dummy variable was created where 1 = "Strongly Agree" and 0 = "Moderately Agree or Less."

The major land characteristic of interest was the number of hectares a landowner managed. "Decision hectares" includes any additional hectares leased in by the landowner but removes any hectares leased out. Decision hectares was highly skewed right and was log transformed.

Many studies operationalize a landowner's dependence on land for income using a fairly objective measure of the percent of annual household income derived from activities on a landowner's property. In this research I found that this item suffered from a relatively high item-nonresponse rate (12%). My measure of dependence involved three items measured on a 7-point scale from "Strongly Disagree" to "Strongly Agree." The three items, "My place is an important source of income," "My place is a business," and "My place is a way to financially provide for my family," were averaged to create a composite score (Cronbach's alpha = 0.89).

Stewardship was measured using two items. Using a 7-point scale from "Strongly Disagree" to "Strongly Agree" landowners were first asked to respond to a general statement, "I have an obligation to maintain my land in good condition for future generations." They also indicated their agreement for a wildlife-oriented stewardship item, "It is my responsibility to take care of all wildlife that use my place."

I measured a series of expected outcomes that may influence a landowner's intention to enroll in the program. They were created based on the results of a focus group with landowners in the target study area. Landowners were asked about potential consequences of enrolling using a 7-point scale from 1 = "Extremely Unlikely" to 7 = "Extremely Likely." Negative outcomes included the potential for future governmental regulation of their land, not receiving needed technical assistance, having too much paperwork, not receiving adequate financial compensation, constraints on ability to

make their own land-use decisions, and losing control over who accesses their land. Positive outcomes included improving the land and helping the target endangered species.

Behavioral items included two measures of past behavior and two measures of behavioral intentions related to the program. First, landowners were asked to indicate if they had participated in a number of federal (e.g., USDA Conservation Reserve Program) or state programs (e.g., state-sponsored private land wildlife management programs) within the past 10 years. A dummy variable called "Past Programs" was created to indicate whether a landowner participated in at least one of these programs. Because the primary land management practice of the LRRP and the current RCS is restoring early successional habitat by clearing juniper, landowners were asked if they had cleared juniper on their land within the past 5 years and a dummy variable, "Brush," was created where 1 = "Yes." Second, I measured three behavioral intentions relating to a landowner's willingness to enroll in a general cost-share program to "set aside a portion of my land as wildlife habitat," "set aside or restore a portion of my land as habitat for an endangered species," and to "control brush, such as Ashe juniper (cedar), on a portion of my land." These items were measured using a 7-point scale from 1 = "Extremely Unlikely" and 7 = "Extremely Likely."

Data Analysis

To understand factors that may predict enrollment I used logit models for binary and ordinal outcomes because the assumptions for OLS regression (i.e., multivariate normality and normal distribution of the error term) were not met. The two dependent variables in this study (i.e., dependence on land for income and behavioral intention to enroll) represent underlying continuous variables. For this reason I use a latent variable model where y^* represents a latent, unobserved variable. For logistic regression, the observed y for an individual, i, is 1 if $y_i^* > 0$ and 0 if $y_i^* \leq 0$ (Long 1997).

I regressed dependence on landowner characteristics using an ordinal logit. Dependence on land for income was originally scored as the average of 3 items measured on a 7-point scale but converted to a 3-level ordinal variable. Landowners

scoring a 1 or 2 (39% of the sample) on the original measure were classified as having low dependence, medium dependence was assigned to landowners scoring between 3 and 5 (39% of the sample), and landowners scoring a 6 or 7 on the scale (23% of the sample) were placed in the category of high dependence.

The 7-point behavioral intention to enroll in the program was recoded into a binary variable where 1 = "Likely" and 0 = "Unsure or Unlikely." Intention was then regressed on landowner characteristics using logistic regression to examine the potential for the dependence item to act as a mediator. Finally, intention was regressed on dependence, the 8 belief outcomes, and the 3 behavioral items using a block regression format. The block logistic regression allowed me to observe the change in model fit (i.e., pseudo R^2) as I controlled for groups of variables. Odds ratios (e^{β}) are reported in the tables and the percent change in odds ($[e^{\beta} - 1]*100\%$) are used to interpret the results. All interpretations of statistically significant variables are given with the consideration that all other variables in the model are held constant. Block regression models are compared using likelihood ratio tests and I report the McKelvey and Zavoina's R^2, which is calculated based on predicting a continuous latent variable underlying the observed outcomes in the data (Long 1997). Additionally, because of the latent variable model, it is appropriate to compare the contribution of each variable to the model using fully standardized coefficients as is done in OLS regression (Long 1997).

Tolerances were used to check for multicollinearity and no problems were found. Finally, in this study I set a 90% level of confidence because some of these variables have not been previously used to characterize landowners. Thus, I consider this work somewhat exploratory and would like to identify explanatory variables for further investigation.

RESULTS

I calculated a phone response rate of 45% of 542 landowners using the American Association for Public Opinion Research (2006) standards. Of the 245 self-administered questionnaires left with the participants, 214 were returned for a self-administered

survey response rate of 87%. Of these, 202 cases were usable. Using list-wise deletion for all variables, the sample size used for the logistic models was 144.

Landowner Characteristics

The average age of landowners in the sample was 64 years (sd = 11). A majority were male (87%), white (97%), and not Spanish/Hispanic (98%). Nearly two-thirds of the sample (63%) had an education level of trade school, an apprenticeship, a 2-year degree, or higher.

The average area owned was 141 hectares (sd = 183 hectares) with a median of 75 hectares. A plurality (42%) of landowners owned between 41 and 202 hectares. On average, landowners managed 163 hectares (sd = 360) with a median of 49 hectares. About 13% leased out their entire property in the past year resulting in 0 decision hectares and 64% managed between 10 and 202 hectares.

Landowners had owned their land for an average of 21 years (sd = 15 years) and 19% were absentee landowners who did not live on their land and who considered their land to be in a separate community from their residence. Absentee landowners lived an average of 50 (sd = 60) miles from their place.

Most landowners (53%) operated their land for crops, livestock, or both; and, 29% incorporated wildlife as part of their primary land management objective. The majority of landowners (83%) had a job that was not directly related to agriculture and of these almost one third (32%) were retired. On average, landowners relied on their land for 14% of their annual household income and most (78%) relied on the land for 15% or less of their annual income.

Landowners strongly considered themselves to be land stewards. Most landowners (90%) strongly agreed that they have an obligation to maintain land in good condition for future generations. The majority of landowners (68%) also strongly agreed with the statement that it is their responsibility to take care of all wildlife that use their place.

Dependence on Income from Land

The ordinal logit regressing dependence on land for income on socio-economic characteristics was significant ($LR\chi^2 = 91.92$, df = 12, $p < 0.001$) and fit well ($R^2_{M\&Z} = 0.547$; Table 2). Five variables contributed to the model. Holding other variables constant, landowners with at least some graduate or professional school have odds of depending on income from their land that are 63% lower than landowners with a two-year degree or less. For every increase in income category, the odds of having greater dependence (i.e., being in a higher dependence category) decrease by 38%. The odds of being more dependent on one's land are 74% lower for landowners who strongly agreed that they operate their land for enjoyment compared to landowners who answered otherwise. For every unit increase in the level of rootedness, the odds of increased dependence increase by 36%. For every level increase in a landowner's identity as a rancher, the odds of being dependent on the land for income increase by 65%. Comparing fully standardized regression coefficients, identity ($\beta = 0.34$) made the most important contribution to the model followed by rootedness ($\beta = 0.28$), enjoyment ($\beta = -0.25$), graduate or professional school education ($\beta = -0.17$), and income ($\beta = -0.14$). Identity and rootedness were over 1.5 times as important as education and income in contributing to the model. The logistic regression of the program behavioral intention on landowner characteristics was not significant ($LR\chi^2 = 16.25$, df = 12, $p = 0.1801$) indicating that socio-economic information was not useful in predicting whether a landowner was likely to enroll in the program.

Table 2. Odd ratios of an ordinal logit regressing perceived dependence on land for income on landowner and land-use characteristics.

Variable	Odds Ratio	Std. Err.	p-value
Age	1.0120	.0210	0.565
Education			
Two-Year Degree or Less			
Some College	.6177	.3417	0.384
College Degree	.4629	.2551	0.162
At Least Some Grad/Professional School	.3711	.1938	0.058
Income	.6242	.1582	0.063
Identity	1.6483	2198	< 0.001
Absentee	.7374	.4638	0.628
Partial Absentee	.9145	.5789	0.888
Decision Hectares	1.091	.0674	0.160
Years Property Owned	.8929	.1282	0.430
Rootedness	1.3591	.1360	0.002
Enjoy	.2598	.1044	0.001
Cut point 1	-0.0754		
Cut point 2	2.7644		
N	145		
LL	-109.4421		
AIC	246.8841		
$R^2_{M\&Z}$	0.547		

Intentions to Enroll in Cost-Share Programs

Landowners generally were split about enrolling in cost-share conservation programs. Slightly more than half (53%) indicated that they would enroll in a program to set aside a portion of their land as wildlife habitat. Less than half (40%) indicated an intention to enroll in a general program to set aside or restore a portion of their land as habitat for an endangered species. This increased to 50% for the endangered species program.

Although significant at the 90% confidence level, dependence, by itself, was not particularly useful in predicting intentions to enroll ($LR\chi^2 = 2.86$, df = 1, p = 0.0906; $R^2_{M\&Z} = 0.06$). When combined with belief outcomes related to enrolling in Model 1, dependence makes a stronger contribution to the model ($LR\chi^2 = 4.77$, df = 1, p = 0.0289; Table 3). The model fit was good ($R^2_{M\&Z} = 0.44$) and four variables

significantly contributed to the prediction of intention to enroll. First, for each level increase in dependence on the land for income, the odds of being likely to enroll decreases by 47%. For every level increase in the likelihood of helping the target endangered species, the odds of being likely to enroll increase by 35%. Each level increase in the perceived likelihood of improving one's land by enrolling increases the odds of being likely to enroll by 78%. Finally, for every increase in the perceived likelihood that enrolling will decrease one's ability to make their own land-use decisions, the odds of being likely to enroll decrease by 40%. Comparing standardized coefficients, improving land ($\beta = 0.39$) and losing the ability to make land-use decision ($\beta = -0.36$) made the strongest contribution to the model followed by helping the endangered species ($\beta = 0.20$) and dependence on the land for income ($\beta = 0.20$).

Behavioral intention items were added in Model 2. These items are considered to be ancillary because they measure intentions to enroll in generic programs to set aside wildlife habitat and to control juniper. Both land management goals are related to the program but not directly related to endangered species per se. The model fit improved over Model 1 ($LR\chi^2 = 16.13$, $df = 2$, $p < 0.001$) with an $R^2_{M\&Z} = 0.52$. Landowner dependence on land for income and helping endangered species are no longer important. Improving land and losing the ability to make land-use decisions are similar to Model 1. As the level of agreement with the behavioral intention to enroll in a cost-share program to set aside wildlife habitat increases, the odds of being likely to enroll in the endangered species program increase by 27%. As the level of agreement with the behavioral intention to enroll in a program to clear juniper increases by one level, the odds of being likely to enroll increase by 30%. Again, the strength with which a landowner believes enrolling will improve his or her land made the strongest contribution to the model ($\beta = 0.32$) followed by losing the abililty to make land-use decision ($\beta = -0.27$), and the behavioral intention items ($\beta_{Wildlife} = 0.22$, $\beta_{Brush\ Control} = 0.21$).

The two past behavior items in Model 3 improved model prediction over Model 2 ($LR\chi^2 = 7.41$, $df = 2$, $p = 0.025$, $R^2_{M\&Z} = 0.59$). Whether a landowner had previously participated in a conservation or wildlife management program within the past 10 years

(past program) was not significant. A measure of whether a landowner cleared juniper on their land within the past 5 years did contribute to the model. Landowners who cleared juniper have odds of being likely to enroll that are 255% greater than those who have not cleared brush. The belief outcomes of improving land and losing the ability to make land-use decisions retained their significance as did the wildlife habitat behavioral intention item. However, with the addition of the brush control past behavior item, the behavioral intention of enrolling in a program to control juniper is no longer statistically significant. The standardized coefficients once again show that improving land (β = 0.36) and losing the ability to make land-use decisions (β = -0.27) made strong contributions to predicting intention to enroll in the endangered species program. Clearing brush in the past 5 years (β = 0.23) and the wildlife habitat behavioral intention (β = 0.21) made moderate contributions to prediction.

DISCUSSION

Landowner response to the general behavioral intentions to enroll in a program to protect wildlife habitat and endangered species habitat serve as a baseline to understand initial reactions to programs in general. Overall, just over half considered enrolling in a cost-share program for wildlife and this dropped when the wildlife concerned involved endangered species. This is important but not surprising given recent work by Kreuter et al. (2006) who found that landowners in Colorado, Texas, and Utah generally disagreed with the normative statement that landowners should protect endangered species habitat without compensation from the public. Furthermore, ranchers in Texas disagreed more strongly with this statement than either ranchers in Colorado or Utah. Similarly, Raymond and Olive (2008) found that 41% of landowners had a negative reaction to the idea that they should bear the costs of protecting endangered species without incentives. Brook et al. (2003) found a positive correlation between landowners who disagreed that they should "bear financial responsibility" for conservation and landowners indicating they managed their property to minimize the chance of an endangered species occupying it. Thus, programs directed toward endangered species recovery have a much higher burden to overcome to achieve the acceptance and enrollment levels of farm bill

programs; but, even participation in farm-bill programs can be low (see Kraft et al. 1996; Smith et al. 2007).

Table 3. Odds ratios showing block regression of LRRP behavioral intention on outcomes of enrolling, behavioral intentions, and past behavior.

Variable	Model 1 Beliefs	Model 2 Beliefs & Behavioral Intentions	Model 3 Beliefs, Behavioral Intentions, & Past Behavior
Intercept	0.1186	0.0096**	0.0039**
Dependence	0.5319*	0.6802	0.6854
Future Government Regulation	1.0303	1.1262	1.1134
Help Endangered Species	1.3534*	1.2240	1.2482
Improve Land	1.7838***	1.6823***	1.8541***
Technical Assistance	0.9736	0.9576	0.9374
Paperwork	0.9990	0.9452	0.9776
Land-Use Decisions	0.5917***	0.6524**	0.6322**
Land Access	1.2830	1.2801	1.3672
Financial Compensation	1.0653	1.0037	0.9613
Wildlife Habitat Program Behavioral Intention		1.2736**	1.2885**
Brush Control Program Behavioral Intention		1.3018**	1.2137
Past Program Control Brush			0.9498
			3.5508***
N	144	144	144
LL	-75.6864	-67.6223	-63.9194
AIC	171.3727	159.2446	155.8389
$R^2_{M\&Z}$	0.436	0.518	0.586

*$p \leq .010$, **$p \leq 0.05$ ***$p \leq 0.01$

While previous research and prevailing hypotheses lead to predictions that younger, more educated landowners with smaller parcels as well as those who do not rely on their land for income would be more amenable to enrolling in programs, I failed to detect such a relationship. The literature supports this idea that background characteristics generally are poor predictors of specific behaviors (Ajzen and Fishbein 1980). When relationships are found, they are often sample-specific. Segmenting landowners by demographic characteristics may be useful to group landowners based on general attitudes toward conservation programs. Doing so, however, may ignore important landowner groups (e.g., those with large land holdings) and recruitment for conservation programs may occur at a suboptimal level. Programs cannot rely on simple socio-demographic information to understand or predict participation. Instead, social variables such as beliefs and motivations are needed to fully understand participation in conservation programs. These items can account for the multiple satisfactions that landowners derive from their land; that is, landowners likely have multiple reasons for owning and operating land (Bliss and Martin 1989), and thus obtain multiple satisfactions from doing so. Socio-demographic inquiries cannot capture this aspect of being a landowner.

I did find support for the idea that landowner and land-use characteristics are related to a landowner's perceived level of dependence on their land for income. The notion derived from Jackson-Smith et al. (2005) that younger, more educated landowners would be less dependent on their land for income was supported. Landowners who identified themselves as ranchers and who had strong roots in their community were more dependent on their land for income. There was partial support that dependence on land may help to explain intentions but more work needs to be done here. Regardless, I prefer this measure of dependence over the traditional measure asking about the percent income derived from activities on the land. This index is more akin to a motivation (i.e., operating land to obtain income) and characterizes the way in which a landowner thinks about and approaches operating his or her land. It should be a more stable measure than the traditional measure because, for example, it can account

for landowners who made poor business decisions or who suffered due to weather conditions in the past year.

I found that landowners, regardless of demographic characteristics, were willing to participate in the program when they expect to receive direct benefits from doing so. The importance of direct benefits was demonstrated by the important contributions of the outcome expectations related to improving land as well as the importance of the past behavior of restoring rangeland by clearing juniper. Concerns about future regulations or financial compensation as outcomes of enrolling did not influence intention. This is similar to Langpap (2004), who found that there was not a high perceived risk of regulation under the ESA for landowners in Oregon and Washington.

The behavioral items enhanced prediction but also provide practical insights into enrollment. Those that have cleared juniper in an effort to improve their rangeland are the most likely to enroll. In this case, finding enrollees may be a matter of finding landowners interested in clearing juniper in order to improve their rangeland. Working with the Natural Resource Conservation Service, for example, program administrators may be able to invite landowners from the waiting lists of programs like EQIP to participate in this program.

Finally, concern about losing the ability to make land-use decision was important in this model. Landowners recognize their responsibilities to neighbors, their community, and society in general and seem to be willing to consider the impacts of their actions for the greater good of society (Jackson-Smith et al. 2005). At the same time, however, landowners value their independence and autonomy (e.g., Peterson and Horton 1995). Raymond and Olive (2008) found this manifest in a sample of landowners within endangered Indiana bat (*Myotis sodalis*) territory. On one hand, landowners in Indiana conceived of property as an intrinsic right, exempt from government influence. Yet, they recognized some level of social responsibility and were willing to cooperate by accepting "reasonable" (495) limits on private land use. In another study, landowners responding to a qualitative question asking why landowners do not enroll in conservation programs despite familiarity with programs cited concern

about government control over their land-use decisions as the primary factor (Smith et al. 2007). Mehmood and Zhang (2005) found that landowners who expressed concerns about privacy and private property rights were less likely to enroll in the U.S. Fish and Wildlife Service Safe Harbor program. This finding that losing the ability to make land-use decisions has a negative influence on intention to enroll may reflect a threat to the core values of landowners. This may help to explain why landowners are more amenable to short-term conservation programs compared long-term programs (e.g., Olenick et al. 2005).

One limitation of this study is that I was only able to measure behavioral intention and not actual behavior. Although from a theoretical point of view intention predicts behavior, a number of factors can intervene including, for example, the degree to which an intention remains stable over time. I have confidence in the measure because intentions predict actual behavior well when the target behavior is voluntary in nature such as enrolling in a conservation program (Ajzen and Fishbein 1980).

MANAGEMENT IMPLICATIONS

Farm and ranch lands make up a significant portion of private lands in the U.S. (Lubowski et al. 2006) and farming and ranching activities can benefit many listed species. To date, U.S. Fish and Wildlife Service recovery efforts have largely ignored the so-called working landscape (Thompson Jr. 2006) but this has started to change with programs such as Safe Harbor (Rappaport Clark and Dalton 1999) and the recovery credit system (Hall 2008). I show that coupling land management benefits within a conservation program for endangered species is important in obtaining landowner participation in endangered species recovery. In central Texas, the black-capped vireo benefits from the management of juniper and prescribed burning. Landowners also benefit from these management actions because they restore healthy rangeland. Thus, conservation programs can enhance participation by taking advantage of any management technique that dovetails with a landowner's land management goal. Additionally, programs may be able to use one species as an umbrella for other species. The golden-cheeked warbler, for example, requires reservation of mature mixed

hardwood stands. In the program discussed here, the landowner enrolls to obtain the benefits provided by managing land for both endangered songbirds while also permitting areas to be reserved for the golden-cheeked warbler. Although an opportunity cost exists for the term of the contract, the land is improved and available once the contract expires.

Lessons for conservation program design derived from this research should be considered within the parameters of this endangered species program structure. Providing direct land improvement benefits to landowners seems to be important and is likely to be important in other compensation programs. Additionally, some programs negotiate with landowners and then take a monitoring and enforcement role for the length of the program (e.g., a conservation easement). Those programs that are more collaborative with landowners (i.e., share power) and permit landowners some control over their enrolled land are likely to be more attractive programs than those that do not.

CHAPTER III
USING THE THEORY OF REASONED ACTION TO PREDICT INTENTIONS TO ENROLL IN AN INCENTIVE PROGRAM TO PROTECT ENDANGERED SPECIES

INTRODUCTION

One of the unequivocal achievements of the U.S. Endangered Species Act (ESA) is what Norris (2004, 290) characterizes as "institutionalized conservation considerations in federal agencies." Under Section 7 of the ESA federal agencies are prohibited from taking actions or engaging in projects that may jeopardize a species or its habitat. This prohibition includes activities on federal lands as well as other activities that either receive federal dollars or require federal permits.

Military lands represent only 3 to 4% of all federal lands yet, compared to all other land-holding federal agencies, harbor the largest concentration of species that either are listed, candidates for listing, or proposed to be listed (Stein et al. 2008). About 23% of these imperiled species use or rely on military lands with U.S. Army lands alone accounting for 15%. Given the importance of military lands to assist in recovery efforts and biodiversity protection, the Department of Defense has taken its role seriously and worked to integrate wildlife conservation into the working landscape of military training and operations (Boice 2006).

The Fort Hood military installation, located on forested oak-juniper mesas about halfway between Austin and Waco, Texas serves as the training ground for the Army's largest armored force. The 87,890-hectare installation also serves as breeding grounds for two endangered songbirds. The black-capped vireo (*Vireo atricapilla*) is a small songbird that breeds locally in central Texas and winters in Mexico. Vireos tend to prefer early successional habitat, patchy distribution of broadleaf shrubs within a matrix of grasses. Ashe juniper (*Juniperus ashei*) is a native, invasive tree species that crowds out grassland and degrades vireo habitat. Brush clearing and prescribed burning are the primary habitat management strategies for maintaining vireo habitat. The golden-cheeked warbler (*Dendroica chrysoparia*) is a habitat specialist that primarily breeds in

mixed hardwood forests in central Texas containing mature Ashe juniper trees and nests predominantly in stands occurring on steep slopes and in canyons (Ladd and Gass 1999). Because of its requirement for mature juniper, the primary management strategy for this species is to reserve land. As Pekins (2006) notes, the birds share habitat in different successional stages. Roughly, if left alone, vireo habitat becomes warbler habitat; and, if burned, warbler habitat reverts to vireo habitat. Fort Hood has taken an active role in the recovery of these two species and has exceeded recovery goals for each through intensive research on demographics, population trends, and threats, and by using adaptive management techniques to find ways, for example, to execute armored vehicle maneuvering in and around bird habitat (Pekins 2006).

Despite the proactive efforts undertaken by Fort Hood, endangered species still represent an encroachment issue in that Army training is restricted as a result of the songbirds' presence. At the same time, Fort Hood faces other encroachment issues arising from land-use changes outside of its boundaries. Boice (2006) discusses the importance of cooperating on natural resource management with landowners outside installation boundaries to reduce potential restrictions on training while enhancing endangered species recovery. As argued by The Nature Conservancy (2008) on their website, the loss of mission capability can ultimately lead to base closure and an overall loss in conservation benefit. The off-site program reduces the potential loss of mission capability. Off-site conservation also protects more habitat across a wider geographic range which enhances overall recovery efforts by reducing risk from catastrophic events (Texas A&M Institute for Renewable Natural Resources 2008). It helps to correct the knowledge gap regarding endangered species use of private lands as discussed by Polasky and Doremus (1998) and demonstrates how endangered species recovery can be integrated into a working landscape (Thompson Jr. 2006). Programs such as the Private Lands Initiative at Fort Bragg, North Carolina have been successful in protecting endangered species habitat outside the Fort Bragg boundaries while reducing land-use restrictions within the installation (Housein 2006).

Fort Hood already has engaged in some off-site conservation planning and implementation through the Leon River Restoration Project (LRRP) (Wilkins 2004) as well as other tools such as permanent conservation easements and Safe Harbor agreements (Cloud 2005). The LRRP uses performance contracts with provisions for landowners to receive full benefits from the program once the criteria of the program are fully completed. The program focuses on brush clearing, specifically Ashe juniper, to restore rangeland and improve water flow and water quality. Landowners enroll in the LRRP for a 5-year term and receive an 85% cost share for management costs. The program assists with the management plan and implements the required brush clearing and prescribed burn. These land management techniques enhance vireo habitat. Land enrolled in the program that contains mature juniper is reserved as golden-cheeked warbler habitat. The 15% paid by the landowner is set in an escrow account and returned to the landowner once the performance criteria are met (minus the cost of the prescribed burn). The enrolled landowner is assured against future land regulation through Texas Parks & Wildlife Department code 12.0251 which prohibits department biologists from disclosing any information obtained from private land consultations to other persons or agencies.

The successful design and implementation of the LRRP led to a pilot project to demonstrate a functional recovery credit system in which private landowners participate in a voluntary program to enhance black-capped vireo and golden-cheeked warbler habitat in exchange for financial incentives and technical guidance. The purpose of this study was to assist Fort Hood in identifying landowners willing to engage in a conservation program to protect and maintain habitat for the golden-cheeked warbler and the black-capped vireo. Given that the LRRP focused on rangeland restoration in general and that the RCS pilot study focuses on endangered songbirds, my objectives in this study were to predict landowners' intentions to enroll in a conservation program specifically designed to enhance endangered species habitat and to understand factors that influence their decision to enroll.

Conceptual Framework

Previous research in central Texas suggests that younger landowners who own land for recreational reasons are more likely to enroll than either landowners who viewed their property with a strong profit motive or those who were born and raised on their land and relied on their land as a source of income (Cearly-Sanders 2005). Socio-demographic characterization like this can be useful to segment landowners based on their general dispositions or attitudes toward conservation programs in general. Predictive ability, however, diminishes greatly when considering specific behaviors (Ajzen and Fishbein 1980). In this study, I was interested in predicting intention to enroll in a specific performance contract. Thus, I utilized the theory of reasoned action (TRA) to predict and explain landowner willingness to enroll.

The reasoned action approach to understanding and predicting behavior assumes that individuals deliberately process information, weigh the positive and negative arguments of engaging in a particular behavior, and then incorporate this information in their decision to act. It assumes that this decision to act, the behavioral intention, is the direct antecedent to actual behavior (Fishbein and Ajzen 1975). The behavioral intention is described by Eagly and Chaiken (1993, 168) as a "person's motivation in the sense of his or her conscious plan to exert effort to carry out a behavior." There are two distinct determinants of a behavioral intention. The normative component is the social pressure an individual feels from salient referent groups to engage (or not engage) in a behavior. Normative beliefs about what specific referent groups (e.g., family) believe an individual should do lead to an overall evaluation of social pressure to act. The utilitarian component (Eagly and Chaiken 1993) involves the positive and negative outcomes the individual believes will occur as a result of engaging in a behavior. These behavioral beliefs provide a cognitive foundation from which the formation of an attitude toward the behavior occurs. This attitude is an overall positive or negative evaluation of executing the behavior of interest. Figure 2 shows the schematic representation of the TRA.

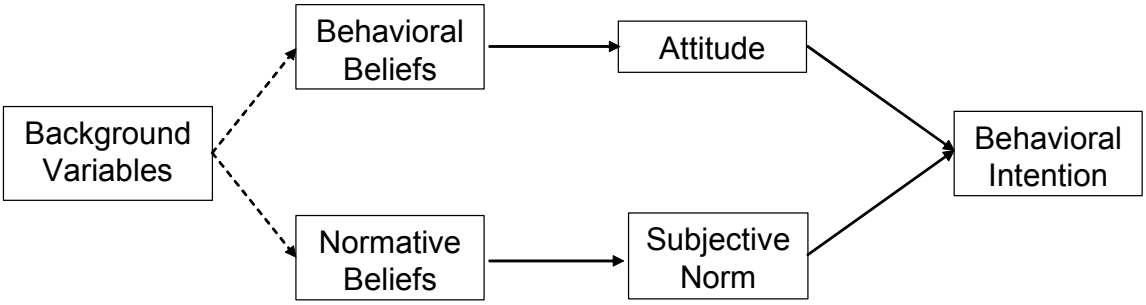

Figure 2. Graphic representation of the Theory of Reasoned Action.

Because behavioral intention is posited to predict behavior, the TRA is limited to voluntary behaviors (Ajzen and Fishbein 1980; Eagly and Chaiken 1993). In response to criticisms that some behaviors are not simple, easily performed, or completely under volitional control, Ajzen (1991) introduced the theory of planned behavior which added perceived behavioral control as a third distinct determinant of behavioral intention. Perceived behavioral control is a combined measure of self-efficacy, an individual's perception about how easy or difficult it is to engage in a behavior, and beliefs about the extent to which performing the behavior is up to the individual (Ajzen 2002a).

The reasoned action approach is appropriate when the behavior of interest is voluntary, when the decision to act lends itself to deliberation, and when the behavior is easily performed. This was the case for my research question in which landowners were presented an option (measured as an intention) to enroll in a voluntary program to protect and maintain endangered species habitat. Although I did not observe actual behavior, behavioral intention tends to be a good predictor of actual behavior under these same conditions (Ajzen and Fishbein 2005).

The theory of reasoned action has been used in a wide variety of fields (see Ajzen and Fishbein 2005; Eagly and Chaiken 1993) including natural resource management. For example, the TRA has been used to understand support for policies such as the National Park Service's controlled burn policy (Bright et al. 1993) as well as policy initiatives related to trapping (Manfredo et al. 1997) and wildland preservation voting intentions (Vaske and Donnelly 1999). Some work has been conducted on

proenvironmental behavior such as water conservation (e.g., Trumbo and O'Keefe 2005) and recycling behavior (Jones 1990).

Although some research specifically has examined landowner willingness to protect endangered species on private lands, the work has largely focused on socio-demographic variables as they relate to participation. For example, studying factors influencing participation in an incentive program to provide endangered species habitat in Oregon and Washington, Langpap (2004) found participation was positively related to the importance a landowner places on wildlife habitat provided by the forest, the number of acres owned, and membership in conservation organizations. As discussed above, these generally are individual characteristics. Ajzen and Fishbein (1980) would argue that the relationship between characteristics and participation should be mediated by attitudinal and normative factors. Luzar and Diagne (1999) used a reasoned action formulation of attitudes and subjective norm related to participating in the Wetlands Reserve Program, a USDA program that purchases permanent easements and provides up to 75% cost-share for wetland restoration. They allowed attitude and subjective norm to covary with (rather than mediate) external factors such as wetland acres owned, gender, etc. and found that attitude toward enrolling but not subjective norm contributed to prediction of participation.

I expect a positive relationship between behavioral beliefs, attitudes and intention to enroll. That is, landowners who believe that the outcome of enrolling will be positive will have more positive attitudes toward enrolling and will indicate a greater likelihood of enrolling. The role of the normative component is less clear. In much of the reasoned action literature, subjective norm is weakly related to intention (see Armitage and Conner 2001). In fact, Luzar and Diagne (1999) found that subjective norm did not contribute to prediction of participation in the Wetlands Reserve Program. This does not surprise me given that landowners are known to be highly independent, self-motivated decision makers (e.g., Peterson and Horton 1995). I believe the null hypothesis of no effect may be supported for subjective norm.

Ancillary Behavioral Intentions

Since Fishbein and Ajzen's (1975) conception of the behavioral intention as the proximal cause of behavior, intention has become an important component of theories of human social behavior (Ajzen and Fishbein 2005). My research had a large practical component to it, to help the Department of Defense understand who (e.g., what types of landowners) would be most likely to enroll in a program. As discussed above, I did not expect a socio-demographic analysis to provide a complete picture of landowner participation. The TRA focuses on important social variables but ones that might be difficult for agencies and organizations to use to identify potential program participants. To improve prediction of behavioral intention I added behavioral intention items related to the program's attributes including setting aside wildlife habitat and clearing juniper on a portion of an individual's land.

Intention to enroll in a program to set aside wildlife habitat served as a general measure of a landowner's willingness to conserve wildlife on their land. Based on the authors' personal experience questions that refer to "wildlife" are usually conceived by landowners in this area as relating to deer, quail and other game species. Clearing juniper is of interest to landowners because of its invasive nature. It crowds out grasses, forbs and other rangeland shrubs and negatively affects water flow and water quality. Therefore, clearing juniper is an integral component of rangeland improvement and restoration efforts. In central Texas, landowners who operate their land for crops and livestock tend to prefer little to no juniper whereas landowners who operate their land for wildlife (i.e., deer) and for recreational/aesthetic purposes prefer modest amounts of juniper cover (Thurow et al. 2001). I expect that landowners interested in enrolling in either a wildlife habitat or juniper clearing performance contract will be more likely to enroll in the endangered species performance contract.

Past Behavior

Research within the reasoned action and planned behavior frameworks demonstrate that past behavior can be a good predictor of behavioral intention and subsequent behavior. Furthermore, past behavior is often not fully mediated by attitude

or normative components and can account for a significant amount of variance (Ajzen and Fishbein 2005). There are a number of reasons suggested as to why this occurs (see Ajzen 2002b; Rhodes and Courneya 2003). For this research, I was interested more in the predictive validity of past behavior in helping to explain intention than in its proper fit within the TRA framework.

Similar to the behavioral intention items above, the past behavior items used can be considered ancillary; that is, they do not directly correspond to the behavioral intention. Landowners were asked about participation in past conservation programs including farm bill agricultural programs, wildlife conservation programs as well as wildlife management programs (e.g., co-operative planning with other landowners). Additionally, landowners were asked about clearing juniper on their land. As discussed above, many landowners endeavor to improve their rangeland and water flow by removing young juniper. I expect both items to be positively related to enrolling in the endangered species performance contract.

Trustworthiness and Natural Resource Agencies

I was interested in landowner perceptions about the trustworthiness of natural resource agencies. These opinions are referred to by Paxton (1999) as abstract trust. It differs from specific trust in that one cannot specifically trust the government. Instead, one can have confidence that government will perform as expected (Hardin (2000) cited in Liljeblad 2003). Paxton notes that a person can evaluate trustworthiness of institutions because people trust expert systems to encapsulate their interests. Levi and Stoker (2000, 491) conclude that judgments about trustworthiness of government "are generalized judgments that influence whether citizens endorse or reject existing authorities and public policy or institutional reforms." The more trustworthy citizens perceive the government to be, the more likely they are to cooperate and comply with regulations. Trustworthiness of natural resource agencies can be an important characteristic given the history of command-and-control tactics to protect and manage natural resources. I include trustworthiness of natural resource agencies because agencies either fund many incentive programs run by nongovernmental organizations or

administer these programs themselves. I expect increased trustworthiness to be related to positive beliefs regarding the outcome of enrolling (i.e., behavioral beliefs) as well as normative beliefs.

METHODS

Sampling

The population of interest in this study was landowners around the Fort Hood military installation who have potential habitat for the black-capped vireo and the golden-cheeked warbler. To maintain consistency with previous research (i.e., Wilkins 2004), my study sampled from the population of landowners in all or part of six counties surrounding Ft. Hood including: Bell, Bosque, Coryell, Hamilton, Lampasas, and McLennan County.

I constructed a sampling frame using landowner information obtained from each of the six county tax appraisal districts. For each county, I used GIS to overlay a golden-cheeked warbler habitat model created by Jones (2006) and selected landowners with a moderate to high probability of having golden-cheeked warbler habitat. I further restricted the sampling frame to landowners with at least 10 hectares (25 acres) because it is sizeable enough to accommodate a breeding pair (e.g., Anders and Dearborn 2004) and it is of interest given the current demographic trend in Texas land ownership toward smaller-sized properties (Wilkins, Brown et al. 2003). Finally, landowner information was submitted to a consumer information company and available phone numbers were obtained resulting in a sampling frame of 542 landowners.

Sampling was stratified by county only to facilitate data collection and the results were treated as a random sample. Because endangered species issues are not salient for most landowners (e.g., Raymond and Olive 2008), my research protocol involved four steps. First, I sent a letter to the landowner's mailing address advising them that I would be calling regarding a project on wildlife conservation. For landowners who agreed to participate, a face-to-face structured interview was conducted focusing on land-use and landowner characteristics. All interviews were conducted by the first author and two interviewers trained by the first author. At the end of the 15-minute interview, a self-

administered questionnaire containing the programmatic items was left with the participant along with a thank-you gift, a small watercolor print of a local landscape. To ensure a suitable response rate for the self-administered questionnaire I used a rolling reminder procedure adapted from the Dillman (2000) mail survey technique. One week after each round of interviews, I sent a thank you/reminder postcard followed 3 weeks and 7 weeks later by a reminder letter and replacement questionnaire. Interviewing began in April 2007 and ended in November, 2007.

Measurement and Analysis

The self-administered questionnaire assessed landowner intention to enroll in a cost-share program to protect and maintain endangered species habitat using a single-item measure. The program structure was identical to a small rangeland restoration pilot project already implemented in the area (see Wilkins 2004); however, I did not refer to the project title and reframed it as an endangered species protection program (incorporating brush control). Using a seven-point scale where from *extremely unlikely* to *extremely likely*, landowners were asked about enrolling in the following program within the next six months:

> This program is run by a local non-profit group in central Texas. Landowners volunteer for the program and enroll in a 5-year performance contract to manage their land for two species of endangered birds. It provides 85% cost sharing to landowners to clear Ashe juniper, also called cedar, and to conduct a prescribed/controlled burn on a portion of their land. The contract also includes preserving some areas of mature oak-juniper woodlands on steep slopes and in canyons. The program provides assistance with the management plan and conducts the brush clearing and burn for the landowner. The benefits of this program include improved grazing capacity, ground & surface water conservation, and enhanced wildlife habitat. After the contract expires and the performance criteria are met, the landowners are reimbursed the remaining 15% of the costs (minus the costs for the prescribed burn) and are free to operate the land in whatever way they desire.

The Theory of Reasoned Action incorporates specific methods for measuring attitude, the subjective norm, and their related beliefs (see Ajzen 2002a).[1] I directly assessed landowners' attitudes toward enrolling using three 7-point scales that were

scored from -3 to +3.[2] Landowners evaluated enrolling on an instrumental level (*extremely foolish* to *extremely wise*); an experiential level (*extremely undesirable* to *extremely desirable*); and, an overall evaluation (*very bad* to *very good*). A summed index (Cronbach's alpha = 0.92) was created.

I constructed the subjective norm using two 7-point scales scored from -3 to +3. The first item asked landowners how people important to them would feel if they enrolled in this program (*strongly disapprove* to *strongly approve*). The second item asked whether important referents thought the landowner should enroll in the program (*definitely false* to *definitely true*). These items were summed to create an index ($r = 0.78$, $p < 0.01$).

I assessed landowner beliefs about enrolling in the program using a list of eight salient outcomes identified by a focus group of landowners in the area. These included outcomes related to the potential for future land-use regulation, helping the endangered species, improving their land, getting technical assistance, the amount of paperwork, making their own land-use decisions, having people they do not know access their land, and receiving adequate financial compensation. Using a seven-point scale from -3 to +3, landowners rated the likelihood that each outcome would occur (*extremely unlikely* to *extremely likely*) as well as an evaluation of the outcome (*extremely undesirable* to *extremely desirable*). For each landowner, the belief strength was multiplied by the evaluation and all eight items were summed to create an overall behavioral belief score.

Two specific referent groups, family and other landowners, were used to assess perceived normative pressures to enroll the program. Respondents were asked to indicate the truth of the statements that each of these two groups thought the landowners should enroll (*definitely false* to *definitely true*) and their motivation to comply with what each referent group: "What [group] thinks about enrolling…is important to me." These items were scored in a unipolar fashion from 1 to 7. For each landowner, the normative belief strength was multiplied by the motivation to comply and two were summed to create an overall normative belief score.

Two ancillary behavioral intentions were used to assess landowner behavioral intentions related to the land management goals of the program. They were assessed separately from the target program and prefaced with the following text:

> Assume each performance contract below compensates you for fair market value or economic loss and tell us how likely it is that you would enroll based on each land management goal.
> If given the opportunity within the next 6 months, I intend to enroll in a performance contract where I receive a financial incentive to…

The first item asked landowners about their intention to enroll in a performance contract to "set aside a portion of my land as wildlife habitat." The second item asked landowners to indicate their intention to enroll in a performance contract to "control brush, such as Ashe juniper (cedar), on a portion of my land." Each item was measured using a 7-point scale from *extremely unlikely* to *extremely likely*.

I assessed past behavior related to previous participation in a conservation program as well as the land-management technique of clearing juniper. First, a binary variable was created to indicate whether landowners had participated in a conservation program or a wildlife management program within the past 10 years. Second, a binary variable indicated whether landowners had cleared juniper on a portion of their land within the past 5 years.

I also incorporated a number of external factors in this model. Ajzen and Fishbein (1980) argue that all other factors including individual characteristics are mediated by beliefs and thus can be considered as background factors; thus, there is no reason for these factors to be directly related to behavior. For this research I included age and education (*1 = College, Graduate, or Professional Degree*, *0 = Other*) to control for landowners who may be more pro-environment (Jones and Dunlap 1992). Similarly, research suggests that landowners who do not rely on their land for income are more likely to engage in conservation behaviors or in conservation programs (Olenick et al. 2005; Kline et al. 2000). I used three items to control for this. First, a binary variable was created by identifying those landowners who were employed outside the agricultural field. Second, I included the size of a property that a landowner actually

manages.[3] It was log transformed to reduce positive skew. Third, an index was created from three items to assess a landowner's perceived dependence on the land for income. These were measured using a 7-point Likert scale from *strongly disagree* to *strongly agree* and included the following items: "My place is an important source of income," "My place is a business," and "My place is a way to financially provide for my family" (Cronbach's alpha = 0.89).

I also placed the agency trust items as background factors. General perceptions of the trustworthiness of natural resource agencies are not salient beliefs related to enrollment per se. Instead they are more diffuse and may influence these beliefs. The trustworthiness of three agencies, Natural Resources Conservation Service (NRCS), Texas Parks and Wildlife Department (TPWD), and the Agricultural Extension Service, was assessed along five dimensions: honesty, confidentiality, confidence, competence, and fidelity using a single question for each measured on a 7-point scale from *strongly disagree* to *strongly agree*. To capture an overall level of trustworthiness, an index was created for each agency. Cronbach's alphas for the NRCS, TPWD, and Agricultural Extension were 0.88, 0.85, and 0.82 respectively.

I employed OLS regression to examine each of the model's hypotheses. First, the standard TRA model was estimated including the background variables used in this study. Second, two additional predictor variables, past program participation and intention to enroll in a wildlife habitat program were added. Finally, two brush control items were added: intention to enroll in a juniper-clearing program and past behavior related to clearing juniper. Improvement in prediction is assessed using the change in model fit (i.e., R^2). Except where noted, adjusted R^2 values are reported. To produce OLS estimates that incorporate missing-data uncertainty, missing data were estimated using a multiple imputation process (see Allison 2002) (*PROC MI* and *PROC MIANALYZE* in *SAS version 9.1.3*). Because some variables were transformed, standardized regression coefficients are reported.

Finally, because I added new variables for the purpose of improving prediction, I conducted a commonality analysis to partition the model's variance into its constituent

parts. Commonality analysis uses structure coefficients (r_s), the bivariate correlation between a predictor variable in the model and the predicted outcome ($\hat{y}$), to "evaluate which predictors do or could produce the predicted outcome scores" (Courville and Thompson 2001, 240). Structure coefficients are an essential complement to standardized coefficients (β) when understanding the contribution of a variable to prediction in a regression analysis (Thompson and Borrello 1985). For example, a predictor variable may have a strong correlation with the dependent variable but have near-zero beta weight because other correlated predictors in the model share explanatory ability. Consulting only standardized beta weights in this instance would lead to the erroneous conclusion that the variable does not contribute to prediction. The output reported here represents the amount of variance a predictor or combination of predictors shares with the overall variance (i.e., the R^2).[4] As discussed by Reichewin Zientek and Thompson (2006), regression coefficients where both $\beta = 0$ and $r_s = 0$ indicate a worthless predictor. Instances in which both coefficients are large indicate a good predictor. When r_s is large but β is zero, the predictor is good but "denied productive credit" (p. 300) because of multicollinearity. Finally, when β is large but r_s is near 0, the predictor indirectly improves prediction.

RESULTS

I calculated a phone response rate of 45% of 542 landowners using the American Association for Public Opinion Research (2006) standards. Of the 245 self-administered questionnaires left with participants, 214 were returned for a self-administered survey response rate of 87%. Of these, 202 cases were usable (e.g., complete). Four additional individuals were removed because they did not provide an answer on the dependent variable. The final sample size considered in this analysis was 198.

The average age of landowners in the sample was 64 years (sd = 11). A vast majority were male (87%), white (97%), and not Spanish/Hispanic (98%). More than one-half (54%) completed a 4-year college degree, or higher.

The average area owned was 141 hectares (sd = 183 hectares) with a median of 75 hectares. A plurality (42%) of landowners owned between 41 and 202 hectares. On

average, landowners managed 163 hectares (sd = 360) with a median of 49 hectares. About 13% leased out their entire property in the past year resulting in 0 managed hectares and 64% managed between 10 and 202 hectares.

Landowners had owned their land for an average of 21 years (sd = 15 years) and 19% were absentee landowners who did not live on their land and who considered their land to be in a separate community from their residence. Absentee landowners lived an average of 50 (sd = 60) miles from their place. The majority of landowners (83%) were retired or had a job that was not directly related to agriculture. On average, landowners relied on their land for 14% of their annual household income and most (78%) relied on the land for 15% or less of their annual income.

Table 4. Descriptive statistics for variables used in the Theory of Reasoned Action.

Variable	Mean	Std Dev	Range
Behavioral Intention	4.01	2.26	1 to 7
Attitude	3.22	4.86	-9 to +9
Behavioral Beliefs	2.98	15.54	-72 to +72
Subjective Norm	0.32	3.18	-12 to +12
Normative Beliefs	32.29	21.41	2 to 98
Age	64.30	11.62	26 to 92
Hectares Managed	161.85	360.61	0 to 3351
Agency Trustworthiness			
Natural Resource Conservation Service	4.79	1.28	1 to 7
Texas Parks & Wildlife Department	4.97	1.16	1 to 7
Agricultural Extension Service	5.02	1.20	1 to 7
Depend	3.88	2.17	1 to 7
	Percent		
College Degree or Higher	53		
Non-Agricultural Job	50		

Theory of Reasoned Action

Landowners, on average, were unsure about enrolling in the performance contract (Table 4). Although landowners generally expressed positive attitudes and beliefs, they were very weak. When considering family and other landowners, respondents on average felt social pressure to not enroll but the subjective norm, the evaluation of the perceived social pressure to enroll, was very close to zero indicating that, on average, landowners overall did not perceive positive or negative pressure to enroll.

When intention was regressed on attitude and subjective norm, the model explained 40% of the variance (Figure 3). The standardized coefficient for attitude was large ($\beta = 0.53$) and uniquely explained over one-third (38%) of the model's variance (see Model 1 in Table 5). Subjective norm had a small standardized coefficient ($\beta = 0.14$, $p = 0.07$) and had nearly zero unique ability (1%) to predict variance in intention to enroll. On the surface, it may seem that subjective norm is not an important component of predicting intention to enroll in the endangered species program. However, 60% of the variance explained by the model can be attributed to the common variance between attitude and subjective norm. Consequently, subjective norm is an important component of the model despite the fact that it makes little unique contribution to prediction.

Despite the weak relationship between subjective norm and intention, normative beliefs and subjective norm were strongly correlated ($\beta = 0.77$), indicating that landowners felt pressure to comply with salient referents (i.e., other landowners and their family) even if it did not ultimately influence their intention to enroll. Behavioral beliefs were positively and significantly related to attitude ($\beta = 0.37$) indicating that as expected outcomes of enrolling become more positive, attitude toward enrolling becomes more positive. Of all the background factors considered, only the trustworthiness of the Texas Parks & Wildlife Department was related to beliefs. Specifically, an increasing perception of trustworthiness marginally was related to beliefs about the outcome of enrolling ($\beta = 0.15$, $p = 0.09$) and was significantly associated with increased social pressure from salient referents to enroll ($\beta = 0.22$).

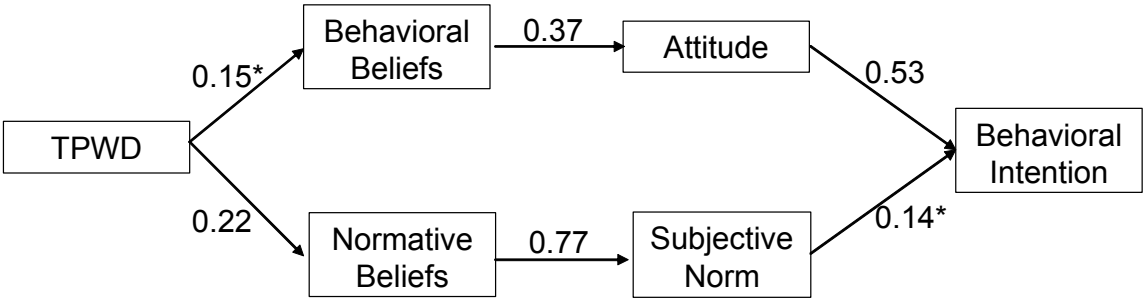

Figure 3. Theory of reasoned action model including statistically significant background variables. Standardized coefficients are reported. All variables are statistically significant at $p < 0.05$ except those marked with a "*" are significant at $p < 0.10$. For the prediction of intention ($n = 198$), $R = 0.63$ and $R^2_{adj} = 0.40$.

Table 5. Variance partitioning for each model using commonality analysis. "Partition" indicates the contribution of the item to the overall variance. For each model the partition should sum to the R2 for that model. The "Percent of Total" indicates the relative contribution of each item in the model and is equal to (Partition/R^2)*100%.

Model	R^2	Item	Partition	% of Total
1	0.40	Unique to Attitude	0.15	38%
		Unique to Subjective Norm	0.01	2%
		Common to Attitude, Subjective Norm	0.24	60%
2	0.47	Unique to Attitude	0.08	17%
		Unique to Subjective Norm	0.01	1%
		Unique to Past Program	0.00	1%
		Unique to Wildlife Habitat Program	0.06	12%
		Common to Attitude, Subjective Norm	0.10	21%
		Common to Attitude, Past Program	0.00	1%
		Common to Attitude, Wildlife Habitat Program	0.06	12%
		Common to Subjective Norm, Past Program	0.00	0%
		Common to Subjective Norm, Wildlife Habitat Program	0.01	1%
		Common to Past Program, Wildlife Habitat Program	0.00	1%
		Common to Attitude, Subjective Norm, Past Program	0.00	-1%
		Common to Attitude, Subjective Norm, Wildlife Habitat Program	0.15	31%
		Common to Attitude, Past Program, Wildlife Habitat Program	0.01	2%
		Common to Subjective Norm, Past Program, Wildlife Habitat Program	0.00	0%
		Common to Attitude, Subjective Norm, Past Program, Wildlife Habitat Program	0.00	0%
3	0.53	Unique to Attitude	0.07	13%
		Unique to Subjective Norm	0.01	2%
		Unique to Past Program	0.00	0%
		Unique to Wildlife Habitat Program	0.01	3%
		Unique to Brush Control Program	0.03	5%
		Unique to Brush Clearing	0.03	5%
		Common to Attitude, and Subjective Norm	0.11	20%
		Common to Attitude, Wildlife Habitat Program	0.02	3%
		Common to Attitude, Brush Clearing	0.01	2%
		Common to Wildlife Habitat Program, Brush Control Program	0.03	5%

Table 5. continued.

Model	R^2	Item	Partition	% of Total
		Common to Wildlife Habitat Program, Brush Clearing	0.01	2%
		Common to Attitude, Subjective Norm, Wildlife Habitat Program	0.07	13%
		Common to Attitude, Wildlife Habitat Program, Brush Control Program	0.03	5%
		Common to Wildlife Habitat Program, Brush Control Program, Brush Clearing	0.01	3%
		Common to Attitude, Subjective Norm, Wildlife Habitat Program, Brush Control Program	0.07	13%
		Common to Attitude, Wildlife Habitat Program, Brush Control Program, Brush Clearing	0.01	2%
		Common to Attitude, Subjective Norm, Wildlife Habitat Program, Brush Control Program, Brush Clearing	0.01	1%
		Other Common Variance[a]	0.01	3%

[a]This category contains all other combinations of variables each of which explains less than 1% of the R^2 value.

When previous participation in a conservation/wildlife management program and a landowner's intention to enroll in a performance contract to set aside wildlife habitat were added to the model, the amount of variance explained (adjusted R^2) increased to 46% (Figure 4). The wildlife habitat behavioral intention significantly contributed to the model while the past program participation variable ($p = 0.30$) did not. Interpreting this result using the unstandardized coefficient ($b = 0.27$), for every one-level increase in the likelihood of enrolling in a wildlife habitat program the likelihood of enrolling in the endangered species performance contract increases by 0.27 on average. The commonality analysis (see Model 2 in Table 5) shows that compared to Model 1 the wildlife habitat program decreases the unique contribution of attitude to the model. The variance common to attitude and subjective norm (21% of the total R^2) as well as these two items with the wildlife habitat intention (31% of the total R^2) is important in predicting intention.

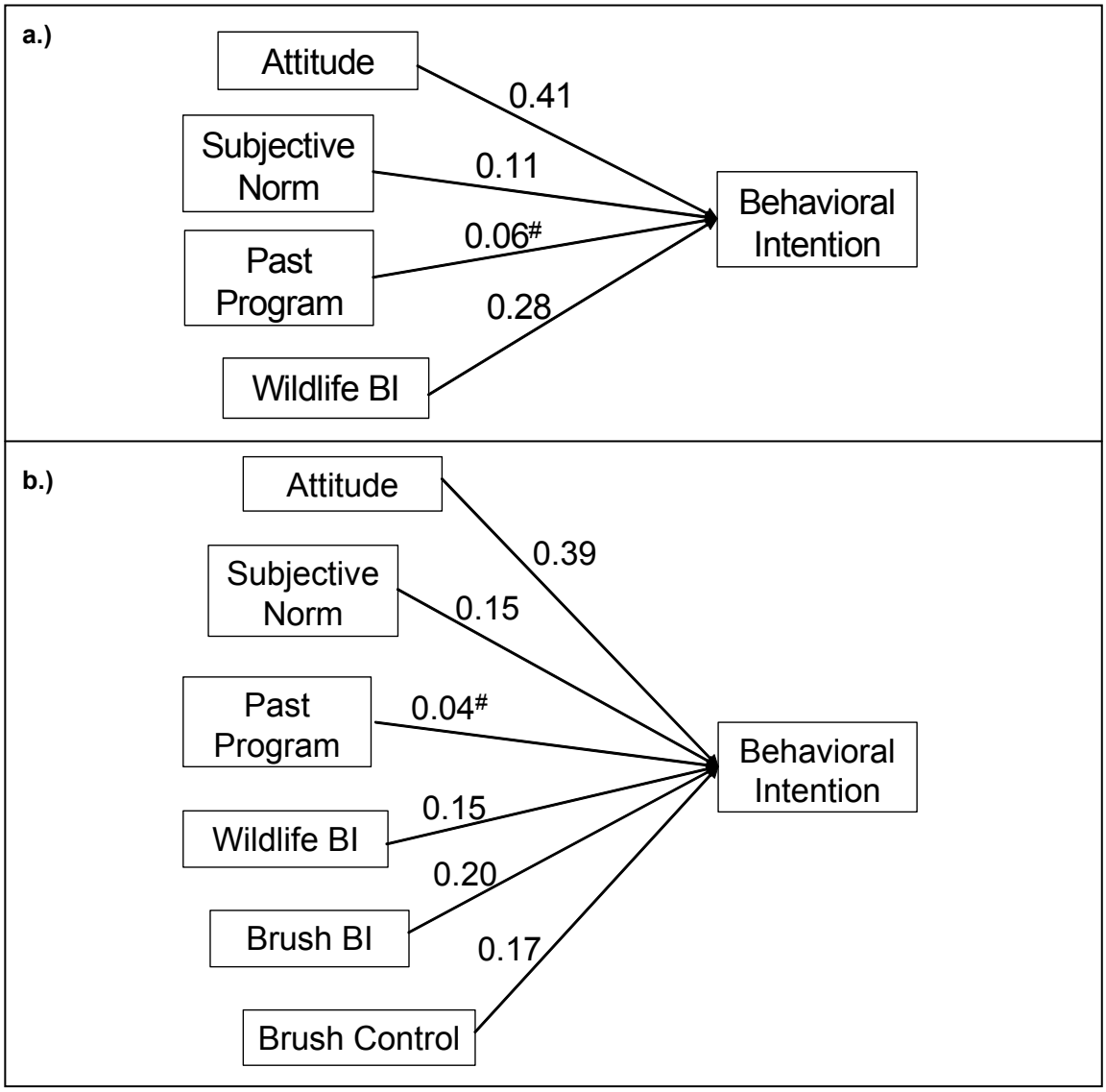

Figure 4. Adding ancillary items to improve prediction. a.) Past program is a binary variable indicating whether a landowner has participated in a wildlife conservation or management program in the past 10 years. Wildlife BI is a behavioral intention item asking landowners about enrolling in a program to set aside habitat for wildlife. Standardized coefficients are reported. All variables are statistically significant at $p < 0.05$ except those marked with a "#." For the prediction of intention (n = 198), R = 0.68 and R^2_{adj} = 0.46. b.) Adding brush-related items. Brush control is a binary variable indicating whether a landowner has cleared juniper on their land within the past 5 years.. Brush BI is a behavioral intention item asking landowners about enrolling in a program to clear juniper on their land. Standardized coefficients are reported. All variables are statistically significant at $p < 0.05$ except those marked with a "#." For the prediction of intention (n = 198), R = 0.73 and $R^2_{adj} = 0.52$.

The final model incorporated two items related to brush control (Figure 3b) and model fit improved again (adjusted $R^2 = 0.52$). Interpreting this result using the unstandardized coefficient, every one-level increase in the likelihood of enrolling in a program to control juniper is associated with an average 0.21 increase in the likelihood of enrolling in the endangered species program. Additionally, the likelihood of enrolling in the endangered species program is 0.77 higher on average for landowners who have cleared juniper on their land in the past five years compared to those that have not cleared juniper. Again, both attitude and subjective norm were important in prediction. The brush control items each uniquely accounted for 5% of the overall variance explained (see Model 3 in Table 5). The common variance between attitude, subjective norm, and the wildlife habitat program (13%) as well as between attitude, subjective norm, the wildlife habitat program, and the brush control program (13%) are important components of overall variance.

DISCUSSION

My results suggest that the basic theory of reasoned action predicts private landowners' intentions to enroll in an endangered species conservation program quite well with good-fitting models (adjusted R^2 ranged from 0.40 to 0.53). Fishbein and Ajzen (1975) discuss that the relative weights of the attitudinal and normative components should be expected to vary across behaviors and, within a behavior, across populations. My finding that attitude had a stronger relationship to intention than subjective norm was consistent with Armitage and Conner's (2001) meta-analysis. However, as the commonality analysis for the Model 1 showed, most of the variance (60%) was shared by subjective norms and attitudes. Despite the lack of a unique contribution, subjective norms are an integral component of the reasoned action model.

Since their original conception of reasoned action Fishbein and Ajzen (1975) have contended that variables not specified by the TRA have only an indirect effect through attitude, subjective norm or by affecting the relative weights of each via moderation or mediation. This seems to be the case here. Compared to Model 1, the unique contribution of attitude to explaining variance was less than half as much in

Model 2 and even less in Model 3. Thus, the explanatory power of the added variables seems to be borrowing to some degree from the attitude variable. This can be seen in the variance shared by attitude and the wildlife habitat program behavioral intention (12% of the total variance explained in Model 2). Despite the shared variance, the model's adjusted R^2 did increase with the additional variables indicating that these items provided a unique contribution to prediction beyond attitude and subjective norm.

Although adding the ancillary behavioral intentions reduced the contribution of attitude to predicting intention, they are not a component of attitude. The ancillary behavioral intentions violate the reasoned action principle of compatibility because they are not related to enrolling in the endangered species program per se. Instead, they are related to the land-management goals within the endangered species program. Although empirically correlated with attitude, they do not represent an attitude toward the behavior. At the same time, because they are behavioral intentions, they should be fairly proximate to behavior. For these reasons, I regressed intention directly on these items rather than positioning them elsewhere in the TRA model. Based on my findings, I believe that for a multiattribute dependent variable additional behavioral predictors related to key attributes may help to explain unique variance. This is an area for further research.

These additional behavioral items also offer some practical insight into ways to find and recruit private landowners. Landowner characteristics generally were not related to behavioral or normative beliefs about enrolling. Despite support from some of the literature (e.g., Cearly-Sanders 2005; Langpap 2004; Raedeke et al. 2001), a suboptimal strategy to recruit landowners for this program would be to segment the population by socio-demographic characteristics. Instead, a better strategy would be to seek landowners interested in having or improving wildlife habitat on their land, landowners interested in improving their land by clearing juniper, and landowners with favorable attitudes towards the program in general. Extension specialists, for example, could identify potential participants through their workshops and other events. The Natural Resource Conservation Service may cooperate by providing the program with

landowners on the waiting list for Farm Bill programs like the Environmental Quality Incentives Program. The program itself could directly recruit landowners interested in clearing juniper by holding public meetings.

In many ways, the conservation program examined in this study represents an ideal program structure. The landowner who successfully completes the contract pays only the costs of the prescribed burn, enhances the availability and quality of forage for livestock on their land, has no obligation to the endangered species once the contract is complete, and has very strong confidentiality assurances from the state. The main drawback of this program is administrative; it is expensive to implement. Although I view incentive programs such as this one as correcting the perverse incentive structure created by the historical implementation of the Endangered Species Act (Bean 1998; Mann and Plummer 1995), others have criticized programs as rewarding land management behavior that landowners should be doing anyway (e.g.,Raymond 2006). Thus, some question remains about whether and how much society should pay to private landowners to protect endangered species, especially if agreements are not in perpetuity. Similar to Kline et al.'s (2000) finding that higher incentive levels are needed to elicit participation from some types of landowners compared to others, even higher incentive levels likely are needed for endangered species-related programs as compared to other wildlife and general conservation programs.

Given this ideal program structure, about half of the landowners indicated an intention to enroll. The question here relates to whether this is a high or low level of potential cooperation. Given the brevity of the program description (i.e., lack of detail) I believe 50% can serve as a lower bound of cooperation. At the same time, this research focused only on program structure and not implementation. Cooperation rates surely are influenced by factors such as who implements the program and how it is administered.

The question about cooperation rate also highlights a limitation of this research. Although the TRA tends to predict behavior well when the target behavior is voluntary and the decision to act is deliberative rather than driven by affect or impulse, I did not actually observe behavior. The program on which this study was based (Wilkins 2004)

was real but I stripped its name and reframed it as endangered species protection, thus creating a hypothetical scenario. Consequently, I am limited to discussing prediction of intentions. Previous research demonstrates the potential disconnect between attitudes, intention and behavior. For example, Pager and Quillian (2005) found a discrepancy between employers' expressed attitudes and actual behaviors toward hiring ex-offenders and/or blacks leading them to conceive of attitudes as principled beliefs held by the employers. Based on this and other research on explicit and implicit attitudes, I only can speak to the "principled intentions" of landowners.

One final limitation is that I investigated a specific program type (i.e., performance contract) and a specific program structure. As a result, my findings and discussion must be qualified by the program examined here. Future research should consider landowners' preferences for different types of programs and program structure including the tradeoffs landowners are willing to make. Work in this area already has begun. Langpap (2004; 2006), for example, compares different levels of incentives, assurances, and technical assistance to understand the potential for private landowner's to protect endangered species and finds potential for programs to be successful.

CONCLUSION

Landowners who have positive attitudes toward enrolling and share the same land management objectives as the program tend to be those who indicate an intention to enroll. External variables related to landowner or land characteristics generally were not related to intention. Given a nearly ideal program structure, landowner interest in participating was moderate at best. Programs like this one, with high levels of compensation, likely are not sustainable from a policy perspective. Programs can become more self sustaining (i.e., cost effective) by incorporating market mechanisms. For example, the recovery credit system's auction approach requires landowners to bid the levels of cost share, technical assistance and contract length. As landowners learn about the experience of participants through observation and social networks, more may be willing to participate (Rogers 1995).

NOTES

1. We originally included two perceived behavioral control items for Ajzen's (1991) theory of planned behavior but both items (measured on a 7-point Likert-type scale) were highly skewed with 51% strongly agreeing with the statement "I could enroll if I wanted to" (mean = 5.6, sd = 1.8, median = 7) and 74% strongly agreeing with the statement "Enrolling is entirely up to me" (mean = 6.2, sd = 1.6, median = 7). Ajzen and Madden (1986, 459-460) note that when perceived behavioral control is high, "the concept of perceived behavioral control becomes largely irrelevant for prediction of behavior and the theory of planned behavior reduces to the theory of reasoned action."
2. An optimal scaling analysis was conducted to determine if bipolar or unipolar scaling was used.
3. Hectares managed was calculated as Hectares Owned + Hectares Leased In – Hectares Leased Out.
4. Those interested in the exact logic and formulas for this technique can consult Seibold and McPhee (1979) and Rowell (1996). We used Nimon et al.'s (2008) code written for the statistical software package, R, to compute commonality coefficients.

CHAPTER IV
THE INFLUENCE OF PROGRAM STRUCTURE ON PARTICIPATION IN AN ENDANGERED SPECIES CONSERVATION PROGRAM

INTRODUCTION

The importance of conservation on working lands increasingly has been recognized as integral to stemming biodiversity loss. Rosenzweig (2003), for example, argues that a sole focus on reservation and restoration strategies to protect biodiversity will ultimately fail. Empirical evidence shows that human-dominated ecosystems can provide adequate connectivity between reserved lands and even increase biodiversity by maintaining land in early and mid-successional states (Tscharntke et al. 2005; Firbank 2005; Pimentel and Stachow 1992). Working lands make up much of the 90 to 95% of the earth's land surface not in reserves. For example, agricultural lands in the U.S. currently account for 52% of the nation's 2.3 billion acres (Lubowski et al. 2006). Shen (1987) estimates that from 21 to 52% of major terrestrial ecosystem types are not represented in protected areas in the United States. Scott et al. (2001) show that nature reserves tend to have less productive soils and occur at higher elevations compared to other lands. Many imperiled species use or rely on working lands for habitat. The GAO (1995) estimated that 90% of species listed as endangered in the U.S. have habitat on nonfederal lands and that a number of these species rely on private lands for habitat.

Given the under-representation of ecosystem types in protected areas and the dependence of endangered species on private lands, successful recovery efforts hinge on the private landowner. Early attempts to stem biodiversity loss on public and private lands in the United States relied solely on regulation and enforcement strategies. As a contemporary example, the Endangered Species Act (ESA) of 1973 has been a central policy tool in biodiversity protection in the United States.

Although the Endangered Species Act was meant to correct an incentive problem that leads to animal and plant extinction at the risk of negatively affecting human well being, it seemingly exacerbated the problem on private lands. Since the passage of the ESA in 1973, a lack of funding, problems with enforcement (Bean 1998), an over-

reliance on biologists to solve social conflict (Kellert 1994), a heavy-handed approach to implementation, and a bureaucratic structure that precludes organizational learning, flexibility, and adaptability (Clark 1997) has led to a policy that is effective at preventing extinction but ineffective at promoting recovery (Norris 2004). Private landowners have had little reason to engage in beneficial land management practices that would help endangered species (Bean 1998). In fact, because the ESA as initially written and implemented required landowners to fully bear the costs of recovery even though society benefits from increased biodiversity, it unintentionally created perverse incentives for landowners to manage their properties in ways that harm endangered species (e.g., Lueck and Michael 2003) and alienated land stewards who might otherwise take steps to protect endangered species on their own. An additional consequence is that information collection about species populations and conservation on private land occurs at suboptimal levels because, in most cases, private landowners can refuse to allow the federal government to access their land (Polasky and Doremus 1998).

Private lands are integral to endangered species recovery and the ESA has been ineffective in this regard. Consequently, the use of incentive programs as a means to promote endangered species recovery on private lands has increased greatly over the past two decades (e.g., Parkhurst and Shogren 2003; Land Trust Alliance 2005). Incentives work by using the carrot of monetary and nonmonetary rewards rather than the stick of land-use restrictions or prosecution for harming a listed species (Shogren 2005). The logic of the incentive is that because the benefits of endangered species protection accrue to the entire nation, the burden (i.e., cost) is shifted from the individual landowner to society through a government agency or private organization.

The logic behind the incentive program is sound but like many solutions to complex problems the devil is in the details. A number of types of incentive-based agreements exist such as conservation easements and cost-share programs (Parkhurst and Shogren 2003). These programs can offer either monetary incentives, non-monetary incentives, or both (Hadlock and Beckwith 2002). Adding to the complexity, landowners own their land for many reasons including investment, recreation, or

production; and, these landowners may have differing inclinations to accept different types or levels of incentives. Differing levels of incentives may be required to obtain cooperation from different landowners. To date, little focus has been on the design of programs as it relates to the incentive offered. Focusing on program design is important because incentives that do not reflect the preferences of landowners lead to suboptimal levels of conservation. My purpose was to understand the role of the structure of an incentive program in improving endangered species recovery on private lands while accounting for heterogeneity in landowners. Specifically, I used a choice model to examine the combinations of incentives needed to engender cooperation, the trade-offs landowners may be willing to make when choosing to participate, as well as the individual factors that may be related to cooperation.

Previous Research

A limited number of empirical investigations of the role of incentives in enhancing endangered species recovery on private lands exist but we are starting to understand factors that influence cooperation. I begin by describing a series of papers that focus on the endangered red-cockaded woodpecker (*Picoides borealis*) and the Safe Harbor incentive program. Safe Harbor was created by the federal government in 1999 to encourage landowners to voluntarily protect land for endangered species without fear of future prohibitions (Rappaport Clark and Dalton 1999). Landowners are provided with assurances that when the agreement ends they can use the property in any manner that doesn't reduce the endangered species' population below pre-agreement baseline conditions. Safe Harbor, however, provides no financial incentives to landowners. Zhang and Mehmood (2002) surveyed participants of the Safe Harbor program and found that landowners identified perceived risk (i.e., woodpecker nesting on nearby lands), an expectation for increased future timber sales, a desire to reduce risk and uncertainty, the ability to assist in woodpecker recovery, and the desire to be known as good stewards as important factors for enrolling. Landowners were neutral on the costs, time, and paperwork involved, and did not identify technical assistance as an important factor. Participants generally were satisfied with Safe Harbor but expressed preferences

for programs that provide financial incentives such as government payments, tax breaks, or cost sharing. At the same time, they preferred Safe Harbor over government land acquisition, land exchange programs or long-term conservation easements.

Using the same data, Mehmood and Zhang (2005) compared Safe Harbor participants with non-participating landowners and found that landowners owning more acres, having a higher perceived risk of woodpeckers nesting on their land, and who had consulted a forester were more likely to enroll. They conclude that larger landowners have the most to lose financially and are interested in securing their investment by reducing future uncertainty. Landowners who were less likely to enroll were those who expressed concerns about privacy and property rights. One caveat to these conclusions, however, is that their survey response rate from non-participants was extremely low (17%) and likely does not provide a representative sample.

Finally, Zhang and Flick (2001) examined the role of the Endangered Species Act and governmental financial incentive programs to influence the reforestation behavior of private landowners in and around red-cockaded woodpecker habitat. They found that while regulations lower a landowner's expectation for future returns on their land, government assistance increases expectations. Landowners are more likely to reforest quickly and invest more if governmental programs are available. In this case, cost sharing and technical assistance positively influenced reforestation.

Another research program focused on endangered species within the Oregon and Washington area. Kline et al. (2000), for example, examined the willingness of private forest landowners to adopt harvest restrictions to protect or enhance riparian habitat in return for federal income tax deduction. They found that many private forest landowners were motivated to operate their land for reasons other than timber production. Specifically, the more a private forest owner depends on the land for timber sales the less willing they are to participate. This finding was fairly consistent across income categories. Landowners who depend on their land for income require a higher economic incentive than landowners who operate their land either for recreational or mixed objectives. Although the paper was framed as benefiting coho salmon restoration,

it is unclear whether the researchers actually framed the purpose of the no-harvest buffer around riparian areas as a program for the benefit of endangered species or for the general ecosystem in the survey instrument.

Christian Langpap's research in this same geographic area specifically focuses on endangered species-related incentive programs. Langpap (2004) examined individual and land-use factors related to enrolling in an incentive program. He found that landowners who are younger, have acquired their property more recently, own more woodland, are interested in conservation and providing wildlife habitat on their forests, and belong to conservation organizations are more likely to participate in an incentive program. Additionally, it seems that the proportion of woodland was more important than actual acres given that the overall acres a landowner owned was negatively related to enrollment. He also found that fear of land restrictions on their property due to the ESA was not an important factor in decision making.

Langpap (2006) then considered the effects of program structure on participation by examining the effects of assurances, cost sharing, incentive payments, and technical assistance on the probability that private landowners would engage in increasing levels of effort to manage their land for endangered species. Cost sharing provided a weak incentive while assurances provided the strongest incentive. Combining financial incentives with assurances, however, markedly increased a landowner's potential effort to manage their land for endangered species. Technical assistance did not provide any substantive incentive. Finally, in this study, demographic variables, property size, and residence were not related to participation or effort.

Despite the dearth of empirical research on incentive programs related to endangered species protection, we are starting to get a picture of their potential use in improving endangered species recovery efforts. I continue this line of investigation by considering landowner and land-use characteristics simultaneously with program structures in order to improve our understanding of factors that affect private landowner cooperation in endangered species recovery. I specifically look at four structural factors landowners may consider when deciding to participate including financial incentives,

receiving technical assistance with land management activities, contract length, and their obligation to the endangered species after the contract is complete. In addition, I incorporate landowner characteristics to further explain participation.

METHODS

To examine the role of program structure on participation in an incentive program, I used a stated preference choice model. Choice models are behavioral models that recognize that complex decisions are based on several factors considered simultaneously. Unlike contingent valuation, the choice model does not focus exclusively on estimating willingness to pay. Instead, it asks respondents to identify the tradeoffs they are willing to make between different factors within the choice task (Boyer and Polasky 2004). The key here is to obtain useful information on the relative ranking of value as it relates to a particular policy. In this way, it can provide decision makers with a predictive understanding how individuals are likely to react to policies which could lead to better allocation of resources, increased cost-effectiveness, and ultimately improved recovery of endangered species.

Stated preference choice models assume that individuals behave in ways that maximize their utility, their relative satisfaction for a particular alternative. It assumes that the part-worth utilities, the proportion of utility that can be attributed to a specific attribute (Hensher et al. 2005, p. 703), are integrated cognitively by the respondent and that the alternative with the highest overall utility is chosen. For example, when presented with two different incentive program contracts, the choice modeling technique assumes that a private landowner will choose the one that makes him or her happiest overall. While the landowner considers all personally-relevant factors during the decision-making process a researcher cannot account for all of these factors involved. Consequently, choice models are probabilistic, decomposing the utility (U_j) of enrolling in a particular incentive program into what a researcher can observe (V_j) for a set of program attributes (A) and into other unobserved factors (ε_j). This random utility model is formally represented as:

$$U_j = V_j(A) + \varepsilon_j$$

The choice model presented landowners with a series of six pairs of hypothetical performance contracts in which the landowner would "restore and maintain endangered species habitat on a portion of [their] land by clearing Ashe juniper (i.e., cedar), conducting a prescribed/controlled burn, and setting aside some mature oak-juniper woodlands on steep slopes and in canyons." Performance contracts are legal instruments in which the landowner receives the full benefits once the criteria of the program are fully completed. Landowners in central Texas prefer this type of policy instrument (Olenick et al. 2005). Landowners examined each set of contracts individually and selected their preference for contract A, contract B, or for neither contract. This choice serves as the dependent variable in this analysis. Specifically, I examined whether landowners choose a contract or no contract and then simultaneously estimated the effects of the program structure and other covariates to understand the choices.

I examined four program factors landowners may consider when deciding to participate including financial incentives, technical assistance, contract length, and their obligation to the endangered species on the contract term expires. These items and their levels were determined based on previous research as well as two focus groups. One focus group consisted of persons involved in creating and administrating incentive programs. The second focus group consisted of landowners within the research area.

The financial incentives consisted of two different attributes. First, most programs provide some level of cost sharing so that the landowner does not bear the full costs of active land management. The cost share amount was defined as the percentage of land management costs paid for by the program. It was based on an average management cost of $260 per acre determined for similar programs implemented in the area (J. Richard Conner, personal communication) and was represented in the choice model by levels of 25%, 50%, 75% and 100%. Some programs also provide an incentive payment that serves to offset the opportunity cost of dedicating the land to endangered species protection rather than other uses. The annual payment was defined as the yearly incentive payment received by the landowner for each acre enrolled. The

payment levels were based on similar programs in the area and ranged from no incentive payment ($0) to $45 per acre in $15 increments.

Despite the lack of fear regarding land regulation due to the Endangered Species Act (Langpap 2004), Langpap (2006) found that assurances against future regulation combined with financial incentives increased the probability that a landowner would put a high level of effort into conservation. I defined this attribute as the level of obligation a landowner has to the target endangered species after the contract expires in order to have assurances against future regulation of their land. The first level was characterized as full obligation. It represents the Endangered Species Act's status quo which mandates that landowners with endangered species must avoid harming those species until, at minimum, they are recovered and delisted. The second level represents the U.S. Fish and Wildlife Service's Safe Harbor program which requires that landowners provide only for an initial baseline level of endangered species in perpetuity and are not obligated to maintain higher-than-baseline levels of endangered species that result from beneficial land management. The final level was defined as no further obligation to the species once the contract expires.

Most programs provide some level of technical assistance to ensure that program objectives are met and to facilitate implementation. As discussed above, technical assistance may not be an important factor for landowners. Because it is provided by many programs, including the proof-of-concept recovery credit system project implemented at Fort Hood, I included it here. Four levels of assistance included: no technical assistance, assistance only with the management plan, assistance with the management plan as well as consultation on implementation, and assistance with the management plan as well as full implementation of the plan executed by the program.

Previous research on landowner preferences in central Texas indicates that landowners prefer short-term contracts over long-term ones (Olenick et al. 2005). While I was initially interested in exploring the potential for longer-term contracts, the final levels of contract length used here were based on the results of the landowner focus group and include 5, 10, 15, and 20 years. Finally, because these programs are

hypothetical in nature, I could include varying levels of expected outcomes for enrolling in the program. Species increase was defined as the expected increase in the target endangered species population in the county as a result of improving habitat and was delineated by both descriptive and numerical terms: no increase (0%), minor increase (about 5%), moderate increase (about 10%), and major increase (about 15%). Land improvement was defined as the average overall increase in grazing capacity, water conservation, and wildlife habitat for the entire property as a result of participating in the program. It was defined in a similar manner: no change (0%), minor improvement (10%), moderate improvement (20%), and major improvement (30%). For both of these expected outcomes, the levels were determined by experts in the field.

Incorporating Landowner Characteristics

I incorporated two background items to explain choice behavior in landowners. The importance landowners ascribed to protecting endangered species in Texas was measured on a four-point scale from "not important at all" to "very important." To facilitate modeling, this variable was converted to a dummy variable for landowners who ranked importance as moderately or very important.

Many studies operationalize a landowner's dependence on their land for income using a fairly objective measure of the percent of annual household income derived from activities on their property. I found that this item suffered from a relatively high item-nonresponse rate (12%). The measure, based on perceived dependence, involved three items measured on a 7-point scale from *strongly disagree* to *strongly agree*. The three items, "My place is an important source of income," "My place is a business," and "My place is a way to financially provide for my family," (Cronbach's alpha = 0.89) were used to create four categories of dependence from low to high.

Sampling

The population of interest in this study was private landowners around the Fort Hood military installation who had potential habitat for the black-capped vireo and the golden-cheeked warbler. To maintain consistency with previous research (i.e., Wilkins 2004), this study sampled from the population of landowners in three watersheds within

all or part of six counties including: Bell, Bosque, Coryell, Hamilton, Lampasas, and McLennan County in central Texas.

I constructed a sampling frame using landowner information obtained from each of the six county tax appraisal districts. For each county, I used GIS to overlay a golden-cheeked warbler habitat model created by Jones (2006) and selected landowners with a moderate to high probability of having golden-cheeked warbler habitat. I further restricted the sampling frame to landowners with at least 10 hectares (25 acres) because it is sizeable enough to accommodate a breeding pair (e.g., Anders and Dearborn 2004) and it is of interest given the current demographic trend in Texas land ownership toward smaller-sized properties (Wilkins, Brown et al. 2003). Finally, landowner information was submitted to a consumer information company and available phone numbers were obtained. This resulted in a sampling frame of 542 landowners.

Data Collection

Sampling was stratified by county only to facilitate data collection and the results were treated as a random sample. Because endangered species issues are not salient for most landowners (e.g., Brook et al. 2003; Raymond and Olive 2008), the research protocol involved four steps. First, I sent a letter to the landowner's mailing address advising them that I would be calling regarding a project on wildlife conservation. For landowners who agreed to participate, a face-to-face structured interview was conducted focusing on land-use and landowner characteristics. At the end of the 15-minute interview, a self-administered questionnaire containing the programmatic items along with a thank-you gift of a small watercolor print of a local landscape was left with the participant. To ensure a suitable response rate for the self-administered questionnaire I used a rolling reminder procedure based on the Dillman (2000) mail survey technique. One week after each round of interviews, I sent a thank you/reminder postcard followed 3 weeks and 7 weeks later by a reminder letter and replacement questionnaire.

I administered the choice model to landowners in the self-administered questionnaire. Because there were 7 attributes with 3 or 4 levels each, over 12,000 combinations attributes and their levels were possible. Generally, respondents can

handle only a small number of choice set comparisons (Louviere et al. 2000). I used a fractional factorial experimental design with blocking that resulted in 8 versions of the questionnaire with each landowner answering 6 choice sets.

Data Analysis

Although the random utility model discussed above provides a conceptual framework for analyzing choice behavior, a statistical model is needed to estimate the probability that an individual will select a particular program from a set of alternatives as well as to estimate the parameter weights for the individual program attributes. As discussed above, the random utility model is formally represented as $U_j = V_j(A) + \varepsilon_j$. The probability that an individual chooses alternative *j* is the probability that the utility of *j* is greater than the utility of all other alternatives in the choice set, *C*:

$$\text{Prob}\{\text{Alternative j chosen}\} = U_j > U_i \text{ where } \varepsilon_j \neq \varepsilon_i, \forall i \in C)$$

Now, substituting the observed and random terms for the utilities U_j and U_i

$$\text{Prob}\{\text{Alternative j chosen}\} = (V_j + \varepsilon_j > V_i + \varepsilon_i)$$

and rearranging the terms yields the cumulative probability that the error difference is less than the observed quantity:

$$\text{Prob}\{\text{Alternative j chosen}\} = (\varepsilon_i - \varepsilon_j < V_j - V_i)$$

To summarize with an example, the probability of choosing Performance Contract A over Performance Contract B is the probability that, when I look at the unobserved factors of Contract B compared to Contract A, $\varepsilon_B - \varepsilon_A$, the person continues to choose Contract A as long as the unobserved factors for Contract B do not dominate by at least the amount that Contract A dominates on the observed factors ($V_A - V_B$).

The well-known multinomial logit models choices as a function of the attributes of alternatives presented to the landowner (McFadden 1974). In this model, the conditional probability of selecting alternative *i* over all other alternatives (*j*) is

$$\text{Prob(i)} = \frac{\exp(\mu\beta_k X_i)}{\sum_{j \in C} \exp(\mu\beta_k X_j)}$$

Where μ is a scale parameter (which is set to a value of one in this research), C is the choice set, and X is a vector of attributes that enter the equation at various levels based on the experimental design (Bennett and Blamey 2001).

The multinomial logit relies solely on the program attributes to explain choice behavior and ignores relationship between individual-specific characteristics and choice. Thus, this model assumes that all individuals have identical preferences but, empirically, this almost never the case (Louviere et al. 2008). To account for heterogeneity, I employed a latent-class choice model to predict enrollment in a hypothetical incentive program to protect endangered species on private lands. The latent-class choice model accounts for heterogeneous preferences by assuming that a finite number of classes exist in a population and that these classes are characterized by relatively homogenous preferences (Birol et al. 2006). The model further assumes that the researcher does not know the class membership of particular individuals; thus, the researcher can only determine the probability that any individual belongs to a specific class. Once classes are established, the researcher can then use the multinomial logit form to estimate characteristics of an individual that help to explain the probability that an individual belongs to a certain class (see Boxall and Adamowicz 2002p; Morey et al. 2006, for details on latent choice models).

The appropriate number of classes typically is identified by the data using either the Akaike information criterion (AIC) or Bayesian information criterion (BIC). Due to the smaller sample size, I used a corrected version of the AIC, labeled as AIC_C, which provides stronger protection against overfitting (see Simonoff 2003, pp. 45-46). As Swait (1994) notes, researcher judgment and model interpretability are also key factors in model selection. For each class, the latent-choice model estimates a separate set of parameter estimates. For this data set, I set the level of confidence at $\alpha = 0.10$. I used effects coding for ordinal attributes (i.e., technical assistance and obligation) and linear coding for all other attributes. I also tested for quadratic effects and interactions.

The predicted values of the multinomial logit models for each class are the part-worth utilities, which serve as relative weights for the levels of each attribute. These

part-worth utilities can be transformed into predicted probabilities which, expressed as percentages, serve as calculations of relative support for different policy options. Thus, a decision support system (DSS) can be created in which the market share or support for one contract over the other can be forecast. I provide two examples to illustrate how the DSS can identify potential tradeoffs landowners are willing to make based on financial incentives (cost share and compensation) as well as obligation and contract length. I then examine a number of scenarios to understand changes in support for contracts.

RESULTS

I obtained an interview cooperation rate of 45% for landowner interviews (American Association for Public Opinion Research 2006). Of the 245 self-administered questionnaires left with participants, 214 were returned for a self-administered survey response rate of 87%. Three individuals were removed during the data analysis because of excessive influence on the model (as measured by standardized residuals and Cook's D values). Considering missing data, 172 landowners were available for this analysis.

A large proportion of the sample (34%) refused to choose a contract for any of the six choice profiles. This type of nonresponse is considered a protest, where respondents rejected the premise or some other aspect of the choice task. I removed these protest respondents from the sample leaving 113 landowners in the final analysis. All information criterion indicators suggested that latent classes improved the model over the traditional multinomial logit. Both the AIC_C and the BIC suggested a two-class solution as optimal. I found this model to fit the data well ($\rho^2 = 0.4072$) and it was easily interpreted.

Table 6 contains the parameter estimates for the two-class model. Table 6a contains the choice model parameters or the utility functions and Table 6b contains the class membership model parameters. The class membership model represents the effects of a landowner's opinion toward help endangered species in central Texas as well as their perceived dependence on their land for income on the probability of membership in one of the two classes. Both effects are statistically significant and separate landowners

into one group that is more dependent on their land for income and less concerned with protecting endangered species than the average landowner (Class 1, 62% of respondents) and another group that is less dependent on their land and more concerned with protecting endangered species than the average landowner (Class 2, 38% of respondents).

Table 6. Parameter estimates for a.) the choice model and b.) the class membership model.

		Class 1		Class 2	
	Model	**Parameter**	**z-value**	**Parameter**	**z-value**
a.	Choice Model				
	Intercept	-0.9796	-9.3996	0.7936	5.0738
	Cost Share	0.2389	4.5653	0.2437	4.9445
	Incentive Payment	0.1538	2.7686	0.1389	2.6991
	Technical Assistance				
	None	-0.2709	-1.2107	-0.7139	-3.2166
	Plan Only	-0.3583	-1.5505	0.0442	0.226
	Plan & Consult	0.4267	2.2321	0.2669	1.3651
	Plan & Implement	0.2026	0.9794	0.4028	2.0018
	Contract Length	-0.3536	-6.1319	-0.1876	-3.6828
	Contract Lengthq*	0.5354	4.012	0.0652	0.5943
	Obligation				
	Full	-1.6681	-5.3269	-0.2818	-1.5907
	Baseline	-0.1176	-0.5981	0.0207	0.1373
	None	1.7857	8.3103	0.2611	1.4383
	Species Increase	-0.0135	-0.2567	0.1199	2.5454
	Land Improvement	0.0645	1.2012	0.1609	3.235
b.	Membership Model				
	Importance	-0.6872	-2.2383	0.6872	2.2383
	Dependence	0.0295	1.7028	-0.0295	-1.7028

*Quadratic coding used

The parameter estimates for the choice model are presented in Table 6a. The statistically significant negative intercept for Class 1 shows that holding all attributes constant, members of this group prefer to not choose a contract. In contrast, with everything else held constant, Class 2 prefers to choose a contract over no contract. Based on Vermunt and Magidson's (2005) Wald I statistic, all attributes were

statistically significant in both classes indicating that they influenced the landowners' choice of alternatives. However, the Wald II statistics indicated that not all attributes differed significantly between the two classes. Specifically, the parameters for cost share, incentive payment, technical assistance and expected land improvement did not differ, indicating relatively homogeneous preferences for the overall sample on these attributes. Both groups preferred increased levels of these attributes. The segments differed significantly on contract length, obligation to the endangered species, and the expected effect of enrolling on the species improvement.

The part-worth utilities in Figure 5 represent the relative preferences of landowners and facilitate interpretation. Landowners in Class 1 were more likely to opt out and not choose a contract. They had increasing preferences for cost share and incentive payments. They expressed a preference for cost share levels around 75% or greater, indicating they much prefer the compensation program to pay for land management costs. Similarly, they preferred incentive payments toward the higher end of the range. The level of technical assistance did not factor strongly in their decision making as only one level of this attribute was statistically significant. Landowners in Class 1 preferred the program to assist with the management plan and consult on implementation. Landowners strongly preferred a 5-year contract and had a loss in preference for longer contracts. This relationship was quadratic indicating that the loss occurs at a decreasing rate as the contract length increases. This group had a strong disutility for a full obligation to endangered species and a strong preference for no further obligation once the contract expires. Neither species increase nor land improvement factored into landowner decision making in this group.

Holding everything constant, landowners in Class 2 were more likely to choose a contract over no contract. Their preferences for cost share and incentive payment were extremely similar to landowners in Class 1. This group had a strong negative reaction to no technical assistance and preferred a program that assists with the management plan and also implements the land management measures. They also indicated greater preference for shorter-term contracts and indicated some preference for 10-year

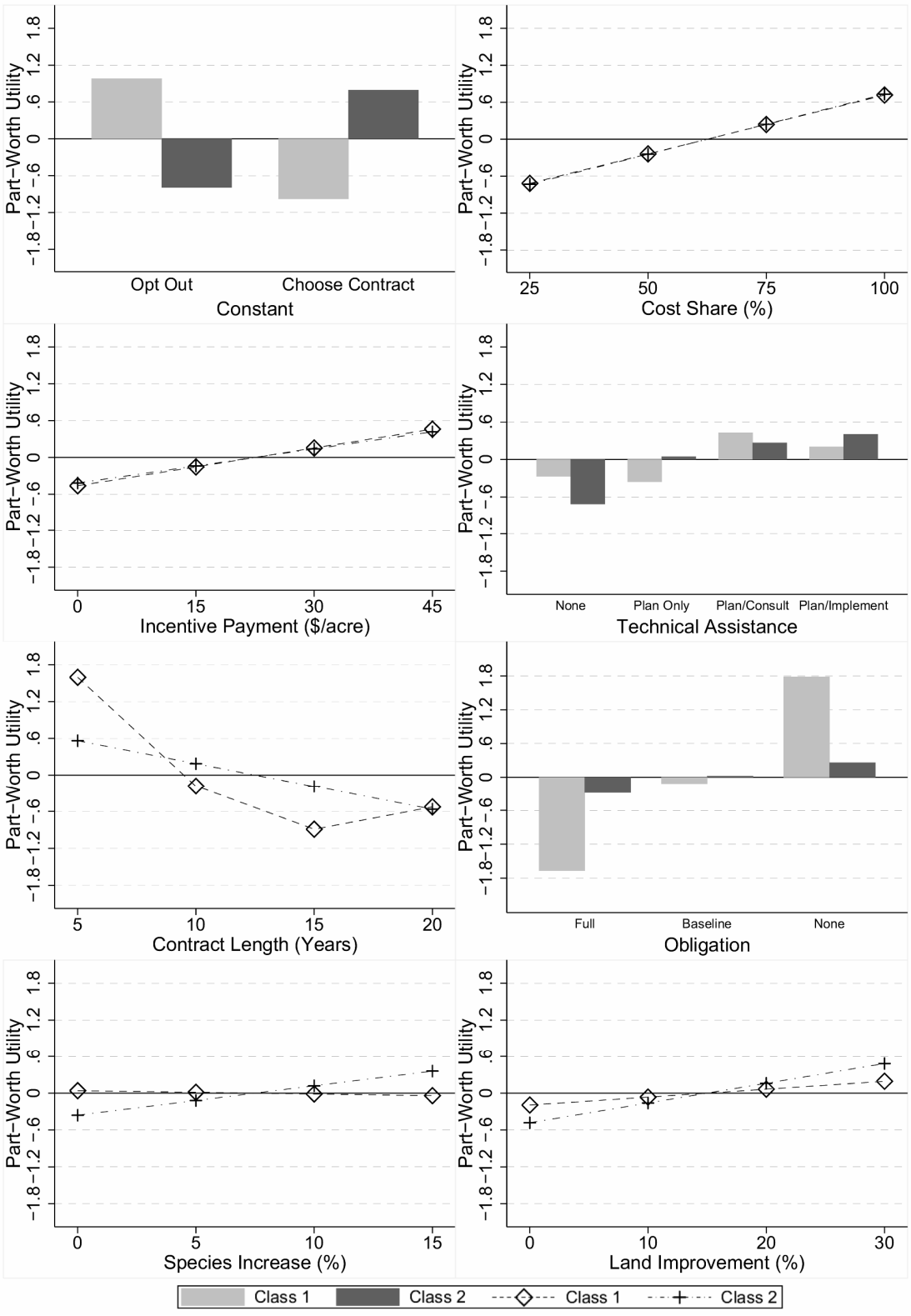

Figure 5. Part-worth utilities for each choice model attribute.

contracts. Landowners in Class 2 did not indicate any significant preference for obligation to the species. The lack of statistical significance indicates that obligation probably did not factor into their decision making process. Unlike landowners in Class 1, this group showed increasing preference for improving the numbers of species as well as their land as a result of enrolling. Specifically, landowners preferred that the program makes moderate and major improvements.

To understand landowner support for different performance contracts I used the decision support system to examine the market share for a number of scenarios. Figure 6 shows the percent of landowners who prefer a particular contract over no contract. The structure of the first contract is similar to the recovery credit system (RCS) performance contract. While the number of years can vary, current trends for landowner enrollment are toward 20 year contracts (N. Wilkins personal communication). There is no incentive payment with the RCS and the program pays for all land management costs except the prescribed burn. Given, however, that the cost share level is well over 75%, I use 100% as the base for this program. The RCS also conducts the brush clearing and prescribed burn for the landowner. It guarantees that landowners have no obligation to the endangered species after the contract expires because Texas state law forbids disclosure of this information to other agencies or individuals (Texas Parks & Wildlife Code 12.0251). While the expectation attributes are purely hypothetical, I chose to be conservative and set the baseline for species and land improvement as minor. Species increase was set to be greater than "none" because I should be able to expect some improvement given the "net benefit" requirement of the RCS program. Additionally, I know from previous work that the land management techniques employed for the black-capped vireo benefit the landowner by restoring and enhancing their rangeland (Olenick et al. 2005).

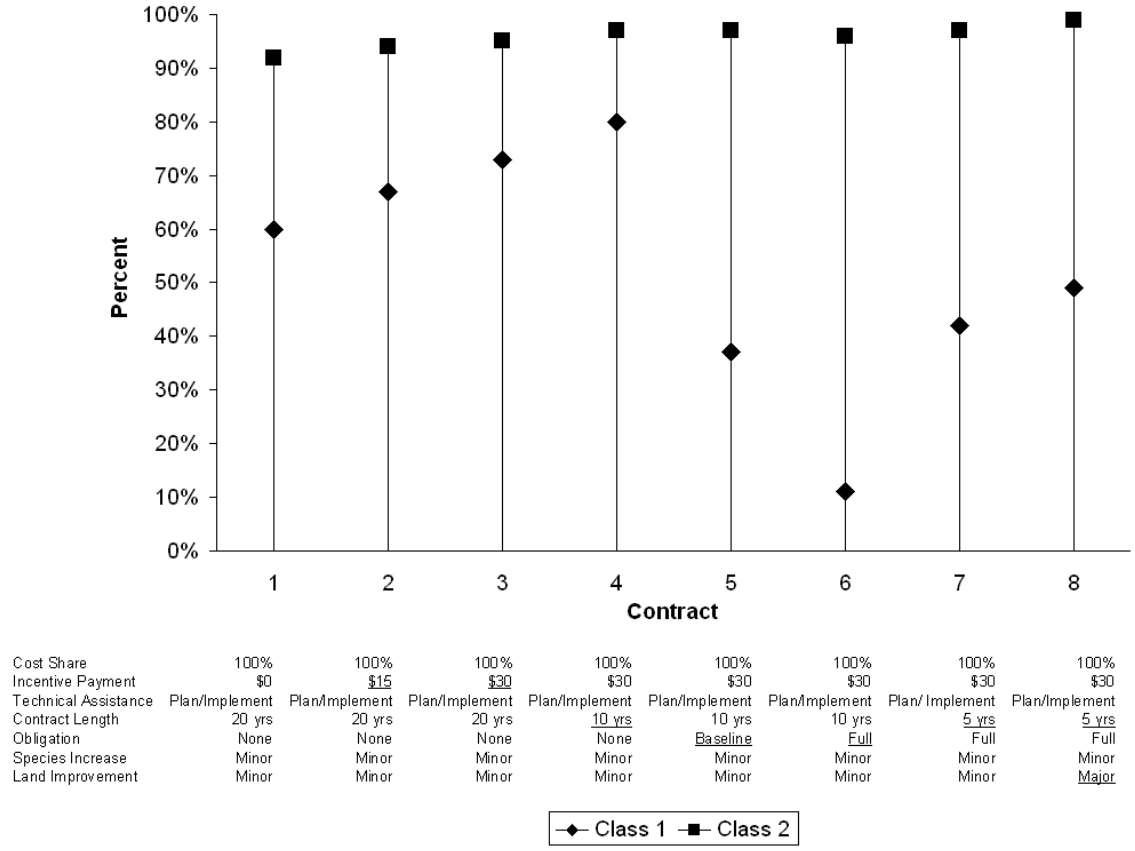

Figure 6. Market share for contracts with varying attribute levels. The underlined text below the x-axis highlights which attribute's level was changed. Contract 1 represents the RCS contract.

The landowners in Class 2 showed strong initial support for the RCS contract (92%) over no contract (Figure 5). Landowners in this group were adverse to 20-year contracts but this seemed to be traded off for high cost share levels, technical assistance that includes help with implementation, and some benefit to both the species and their land. As the contract is modified Class 2's support for the contract does not vary much. This can be explained by the nonlinear logit model. If an alternative is extremely good to begin with (i.e., support is close to 100%) then changes to the program do not change support by much (Train 2003). The most change in support as attribute levels are varied occurs when initial support is close to 50%.

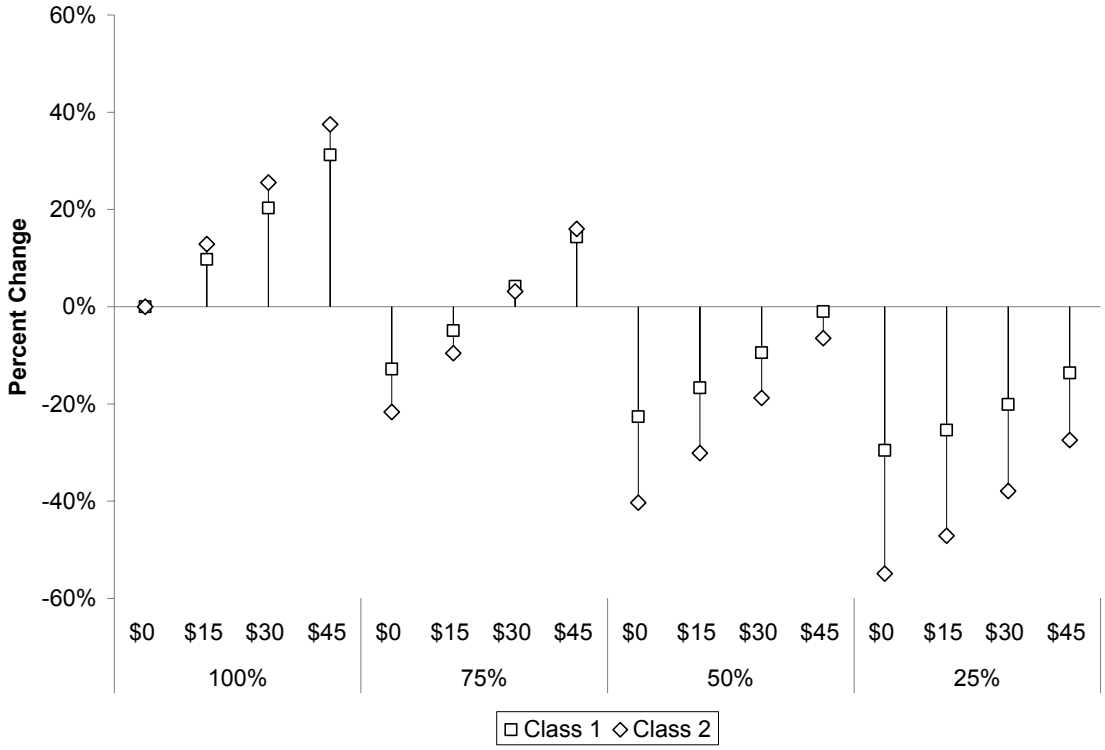

Figure 7. Percent change in support for performance contracts with varying levels of incentive payment per acre and cost share. The percent change is relative to the RCS contract which represents 100% cost share and a $0 per acre incentive payment.

Class 1 shows much more sensitivity to changes in program structure. As the incentive payment increases in Figure 6 (Contracts 2 and 3) and as the contract length is decreased (Contract 4), support increases by 20%. For this group, increased obligation to the target species drastically reduced support for the performance contract. For example, in Contract 3 where the contract length is 20 years and there is no obligation, support for the contract is 73%. When the contract length is 5 years and there is a full obligation to the species (Contract 7), support decreases by almost one third to 42%. This comparison demonstrates that landowners in this group are more sensitive to obligation than to contract length.

The decision support system can also be used to compare preferences for two competing contracts and to identify potential tradeoffs landowners are willing to make. For example, Figure 7 shows landowner preferences for different levels of financial

incentives while controlling for other attributes. Here, the annual incentive payment per acre is nested within the four levels of cost share. The RCS program is set as the base scenario and normalized to zero (as shown by the $0 per acre, 100% cost share level in the figure) and all other combinations of financial incentives can be viewed as the percent change in support compared to the RCS. All levels of support greater than or equal to zero (i.e., the RCS) indicate a combination of financial incentive attributes that can either substitute for or are preferred over the RCS performance contract while holding all other attributes constant. Landowners in both Class 1 and 2 preferred to receive 100% cost share as in the RCS but also an additional incentive payment. Landowners in both classes also were willing to accept a 75% cost share with either a $30 per acre or $45 per acre incentive payment. Finally, members of Class 1 but not Class 2 were almost equally happy with the RCS contract or a 50% cost share and $45 per acre, holding other attributes constant.

In a second example, I compare tradeoffs landowners may be willing to make with regard to their obligation to the endangered species and the contract length (Figure 8). In this case, the RCS performance contract is a 20-year term with no obligation to the species once it expires. Landowners in Class 1 showed a strong preference for no obligation. Five and 10-year contracts with no obligation were preferred over the RCS contract. This group also was willing to accept a baseline level of obligation but only for a 5-year contract term. Landowners in Class 2 were much more willing to support alternative contracts because their preference for shorter-term contracts was stronger than their preference levels of obligation. Specifically, Class 2 landowners preferred any shorter-term contract with no obligation to the current RCS contract. Holding other attributes constant, they also preferred any 5 or 10-year term with any level of obligation over the RCS contract.

Finally, I compare the best and worst contract for each class as well as a feasible contract (Table 7). The best contracts for each group indicate that almost all landowners who did not register a protest vote would choose the performance contract over the option of no contract. The worst contracts show that all landowners in Class 1 would opt

out and choose no contract over this contract. In contrast, almost one quarter (24%) of landowners in Class 2 would still select this contract over no contract.

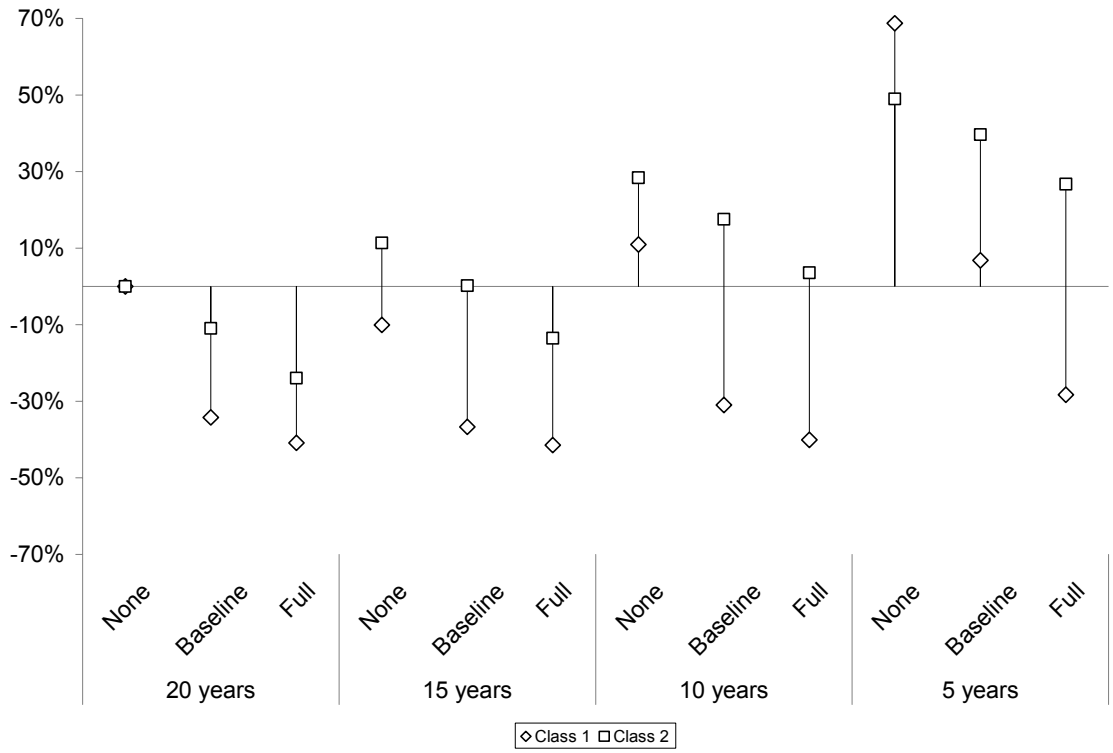

Figure 8. Percent change in support for performance contracts with varying levels of obligation and contract length. The percent change is relative to the RCS contract which represents no obligation and a 20-year contract term.

The feasible contract approximates a performance contract similar to the Environmental Quality Incentives Program (Knight) in which a landowner in central Texas might enroll (J. Richard Conner, personal communication). The EQIP program does not focus on wildlife but can significantly restore and enhance a landowner's rangeland and thus wildlife habitat. To approximate this, I chose no obligation to the target species and also removed the expectation of species improvement. I do recognize that the choice model overall was framed as a program to enhance and maintain endangered species habitat. The point here is to examine a program structure for endangered species habitat management that is similar to EQIP. Overall, there was a

high level of support for this contract despite the modest financial incentives. This helps to further see the large influence of contract length and obligation in the choice model.

DISCUSSION

Conservation programs that compensate private landowners for land management practices that benefit imperiled species are effective only insofar as landowners cooperate. To date, the role of program structure in encouraging participation has not been discussed in the literature. Previous research focuses almost exclusively on the relationship between landowner and land-use characteristics and participation in a given program (Kraft et al. 1996; Nagubadi et al. 1996; Kline et al. 2000; Langpap 2004; Mehmood and Zhang 2005; Zhang and Flick 2001; Zhang and Mehmood 2002). Langpap (2006) is the first work I am aware of that actually examines the underlying structure of the conservation program and my work adds to this line of research. Using a latent choice approach I illustrate the principle that there is no such thing as an average landowner. This data essentially identified three distinct segments. One group of landowners was the protest respondents (33% of the sample). While I didn't measure the reason for their nonresponse, one explanation could be a general disinterest in government assistance. Landowners tend to be highly independent (Peterson and Horton 1995) and may not be interested in government compensation programs in general (e.g., Kraft et al. 1996).

Table 7. Relative change in support for hypothetical performance contracts for each landowner segment when compared to the choice of 'No Contract.' Underlined items indicate different attribute levels between classes.

Attribute	Best-Case Contract		Worst-Case Contract		Feasible Contract	
	Class 1	Class 2	Class 1	Class 2	Class 1	Class 2
Cost Share	100% of $260/acre = $260/acre	100% of $260/acre = $260/acre	25% of $260/acre = $65/acre	25% of $260/acre = $65/acre	50% of $260/acre = $130/acre	50% of $260/acre = $130/acre
Incentive Payment	$45 per acre	$45 per acre	$0 per acre	$0 per acre	$0 per acre	$0 per acre
Technical Assistance	Plan & Consult	Plan & Implement	Plan Only	None	Plan & Consult	Plan & Consult
Contract Length	5 years	5 years	15 years	20 years	5 years	5 years
Obligation	None	None	Full	Full	None	None
Species Increase	None	Major Increase (about 15%)	Major Increase (about %15)	None	None	None
Land Improvement	Major Improvement (20%)	Major Improvement (20%)	None	None	Moderate Improvement (20%)	Moderate Improvement (20%)
Market share of choosing a contract over no contract	98%	100%	0%	24%	88%	92%

A second group did participate in the choice task but was more likely to opt out rather than choose a contract (41% of the sample). This group was highly sensitive to the obligation attribute indicating that their preferences were driven by endangered species concerns. Thus, in addition to an overall disinterest in conservation programs, those programs targeted toward endangered species may face yet another hurdle for a significant proportion of landowners. The third group was predisposed to choose a contract (26% of the sample). Even in the worst-case scenario, almost one quarter of the landowners in this group were still willing to cooperate. Obligation to the endangered species was less of an issue than cost share and contract length. Overall, almost three quarters of the landowners in the sample were either not willing to consider a conservation program or were more likely to opt out. Given the differences in landowners, interpreting average-based results may mislead decision makers. For example, if I had assumed landowners have identical preferences, program designers likely would be left wondering why enrollment was lower than expected.

As discussed in Chapter II, socio-demographic information by itself generally is not useful in predicting specific behavior (see also Langpap 2006). I did find some evidence that perceived dependence on land for income might be useful as a proxy for landowner characteristics because perceived dependence provides insight into how a landowner thinks about or operates the land. In Chapter II, I found that landowners with higher incomes, more education, who operate their land for the enjoyment of doing so, are less rooted to the community where their land is located, and who are less likely to identify themselves as a rancher were less dependent on their land for income. For this data, dependence on land for income was useful in discriminating between members of each latent class and adds support for this construct. Additionally, decreased dependence was related to increased importance for protecting endangered species similar to Brook et al. (2003). This lends support for the work of Kline et al. (2000) who found that landowner participation in programs was related to their land-use motivations.

The results show that landowners concentrated more on the program structure and less on the expected outcomes of participation. This should serve as an alert to

agencies who design conservation programs. While landowners may have expectations, these potential outcomes are diminished by the parameters of the program itself. Thus, landowners' preferences for program fit seem to be more important than expected program outcomes indicate that designers cannot simply create a program who high potential for land benefits and expect landowners to enroll.

Identifying heterogeneity in landowner preferences also has implications for the design of conservation programs. Programs designed with the average landowner in mind, or that use a broad-brush approach likely are not achieving optimal levels of conservation on private lands. I argue that programs can find efficiencies as well as increase efficacy by considering that landowners vary in their orientation to their land, to compensation programs in general, and to endangered species. The voluntary nature of conservation programs makes them more like consumer goods. Landowners can examine various programs based on their objectives, the program structure, and the expected outcomes of enrolling. Then, they can choose one that best fits them. Thus, it is in the best interest of the conservation field to identify landowner segments and design products with these groups in mind. For example, this research may suggest that a graduated program in which the contract length and the level of incentive payment are inversely graded to the percent of a landowner's income derived from activities on their land may be a flexible approach to appeal to a wider array of landowners.

I can reexamine Langpap's (2006) findings considering this heterogeneity. His finding that landowners concerns about restrictions on timber harvesting and land development did not influence their participation in a conservation program is supported by this data (i.e., landowners in Class 2; also see Chapter II). I also found a large proportion of landowners for whom obligations are a concern. It is important to note, however, that the attribute was framed differently between studies and this could affect responses (Kahneman et al. 1991). Lanpap framed the issue as receiving assurances while I framed it as an obligation to the species in order to receive assurances. While Langpap (2006) found that cost share provided the weakest incentive to landowners, I found cost-share levels to be at least as important compensation, especially for

landowners in Class 2. A reasonable explanation for this may be that landowners who are less dependent on their land devote less time to operating their land and are more open to receiving assistance. Additionally, prioritizing cost share over compensation may indicate that program choice is more about improving the land or helping the species than receiving compensation for opportunity costs for this group. These ideas are supported by the fact that landowners in Class 2 thought protecting endangered species in central Texas was more important than landowners in Class 1; landowners in Class 2 were more likely to choose a program that helped the target species; and, landowners in Class 2 preferred programs that improved their own land.

Finally, a limitation is worth noting is that this method assumes landowners make choices based on the principle of utility maximization. This assumption is part of mainstream economics and policy analysis approaches and does not hold under experimental conditions. Newer approaches that incorporate ideas of bounded rationality, framing, and that use deliberative processes to improve the link between preferences and behavior increasingly have been incorporated into research (Venkatachalam 2008). Even with these improving methods, the rational choice approach can be useful in predicting behavior. This is especially true regarding behaviors that are purely voluntary, like choices on what to do with your private property. Research incorporating both stated and revealed preferences has demonstrated the predictive validity of this approach (e.g., Adamowicz et al. 1997; Earnhart 2001; Haener et al. 2001).

CONCLUSION

In central Texas, there is no average landowner; they are not a single homogeneous group. Based on their responses to the hypothetical performance contracts, the latent choice model identified two groups that responded differently to program structures. These groups can be delineated by their opinion on endangered species protection and their perceived dependence on their land for income. Landowners who were more dependent on their land and afforded less importance to endangered species protection were less likely to consider compensation programs related to

endangered species, and were more sensitive to the structure of a compensation program. Less dependent landowners who gave more importance to endangered species protection were more willing to enroll in a compensation program and their support for different performance contract was less sensitive to program structure.

This paper illustrates how a stated preference choice model can help decision makers design incentive programs for landowners by providing information about the acceptability of program structure. The prospects for gaining landowner cooperation in endangered species recovery around Fort Hood are not entirely encouraging. This research emphasizes identifying tradeoffs and allows for the development of a forecasting model, the decision support system that provides a means of estimating potential support for varying configurations of performance contracts. By considering the different types of landowners, program designers can increase prospects for landowner cooperation, enhance participation and thus improve the efficacy of endangered species recovery on working lands in central Texas.

CHAPTER V
CONCLUSIONS

Although the predominant human-related cause of the current loss of biodiversity is land conversion, the conservation field increasingly recognizes the opportunity to engage working lands in conservation efforts. As previously discussed, major ecosystems of the U.S. are not adequately represented in our parks and protected areas and most imperiled wildlife species use or rely on habitat provided by private landowners. Michael Rosenzweig (2003), for example, illustrates the limitations of preservation and restoration strategies and calls for what he labels a "reconciliation ecology" approach that works in concert with these two dominant strategies to conserve species from within human-dominated landscapes. Furthermore, while land converted into working lands is condemned as the problem, empirical evidence supports a general shift from a bias in the conservation field that favors a traditional research emphasis on pristine ecosystems (Tscharntke et al. 2005) to one that recognizes the potential to improve conservation from within the working landscape.

The idea that working lands should be incorporated into efforts to protect and sustain biodiversity is not new. The Endangered Species Act passed in 1973 recognizes the problem of land conversion in its purpose statement (16 U.S.C. 1531 §2(a)(1)): "Various species of fish, wildlife, and plants in the United States have been rendered extinct as a consequence of economic growth and *development* untempered by adequate concern and conservation" (emphasis added). It mandates prevention of extinction above all other social goals (Mann and Plummer 1995; Yaffee 1982) and this, along with a historically heavy-handed approach to implementation, led to a dilemma in which landowners perceive it in their best interest not to manage their land to benefit endangered species (see Lueck and Michael 2003). Because private landowners have the right to refuse government access to their land the ESA has found its success in dealing with endangered species on federal lands (Norris 2004).

What is new, or at least newer, is the recognition that regulation and enforcement is not an effective strategy for protecting endangered species on private lands.

Compensation programs recognize the perverse incentive structure and the need to rearrange incentives in a way that offset costs or enhance benefits to the cooperating landowner. Given this increasing recognition, improving conservation on private working lands will be successful inasmuch as landowners want to voluntarily cooperate with conservation goals. My research investigated the potential for landowners in central Texas to participate in a compensation program to protect two endangered bird species. I examined their willingness to enroll in cost-sharing performance contracts by assessing landowner characteristics including behavioral, attitudinal, and normative factors as well as preferences for program-related attributes.

CONTRIBUTION TO THE LITERATURE

While a number of studies have been conducted on conservation-related compensation programs (see Chapter I), they mostly have focused on landowner and land-related characteristics associated with actual or hypothetical enrollment. Myriad factors have been identified as being systematically related to enrollment including age, education, membership in conservation or forestry organization, political attitudes, attitudes toward endangered species, interaction with or trust in agencies and their personnel, property rights orientations, motivation for land use, perceived risk of regulation, years of ownership, acres owned, on-site residence, owning vs. leasing land, income derived from land, among others (Kline et al. 2000; Kraft et al. 1996; Langpap 2004; Mehmood and Zhang 2005; Nagubadi et al. 1996; Zhang and Flick 2001; Zhang and Mehmood 2002). The inferences that can be drawn from these studies, however, are limited. In some studies age is important and in others it is not. Interacting with an agency or forester may positively (e.g., Kraft et al. 1996) or negatively (e.g., Nagubadi et al. 1996) influence participation. Some research indicates that fear of government control is a constraint to enrollment (e.g., Smith et al. 2007) while others claim it is not a factor at all (e.g. Langpap 2004).

The mixed outcomes do little to paint a clearer picture of landowners who do or do not enroll in conservation programs. This is not surprising. Back in 1980, Icek Ajzen and Martin Fishbein proffered a theory of behavior that relegated these types of

characteristics as theoretically unimportant. That is, these items are at best indirectly related to behavior. For example, education does not directly affect enrollment in a conservation program. It may affect salient beliefs about the outcomes of participating in a program which could then affect attitude toward enrolling and ultimately influence behavior. Items that are more closely related to behavior (e.g., past behavior, attitude toward a behavior, etc.) are much better at predicting actual behavior. In this example, as one moves from education, an external variable, to beliefs, to attitude, predictive ability increases. Thus, "there is no necessary relation between any external variable and a given behavior" (Ajzen and Fishbein 1980, p.85). When relationships between so-called external variables (e.g., education) and behavior are detected, it is generally a sample-specific finding and does not necessarily hold in other settings, other contexts or other time periods.

My research illustrates this idea well. In Chapter II, external variables were not related to intention to enroll in the performance contract. As I added expected outcomes of enrolling, past behavior, and other behavioral intentions, the ability of the model to predict intention improved. In Chapter III I applied Ajzen and Fishbein's (1980) theory of reasoned action and found that it predicted intention quite well. One could expect to use the same model in a different location, at a different time and prediction would still be high. This is because the theory of reasoned action is delimited in such a way that, like other useful theories, transcends time and space.

Because constructs that are more closely related to behavior are better at predicting behavior, I incorporated past behavior and ancillary behavioral intentions. These worked well and also helped to identify landowners who may or may not enroll in a more robust way than expected if I had relied on external variables. This same approach could be taken into other settings and used to further understand behavioral intentions toward a multi-attribute item. Overall, work in this area needs to apply behavioral theory not just to predict behavior but to explain it. Continued attention to landowner and land characteristics will never provide the level of insight needed to understand participation across contexts and optimize conservation on working lands.

The literature on conservation programs also generally fails to account for the idea that participation can be influenced by the structure of the program (but see Langpap 2006, for an exception). Most empirical studies focus solely on the relationship between landowner characteristics and participation in a given program. In Chapter IV I address this dearth of research by examining preferences for the structure of a conservation program. My work goes beyond that of Langpap (2006) because I account for the heterogeneous preferences of landowners. Using a latent class approach, I identified specific attributes (e.g., obligation to the endangered species) on which landowner segments differ while at the same time providing some insight into the characteristic differences between the groups.

PRACTICAL IMPLICATIONS FOR CONSERVATION PROGRAMS

Because conservation programs are voluntary, they rely on landowners knowing about the program, identifying the benefits of enrolling, and then making the decision to enroll. In this way, they are like a consumer good. Landowners can use organizations such the Texas Land Trust Council (http://www.texaslandtrustcouncil.org) to essentially shop for a conservation program that meets their needs and desires. Tools such as conservation easements, where landowners directly negotiate the terms of the easement, likely are popular because of their flexibility and ability to be customized. For conservation programs that will be created and bound to an underlying structure, it makes sense to segment the market in order to create a product that has a broad appeal. Considering the heterogeneous preferences of landowners during the design phase can result in conservation programs that have wider appeal and that are therefore more effective in engaging working land in conservation efforts.

Lessons

The first lesson this research provides is that, although it is popular to do so, using landowner characteristics is an inefficient means of segmenting landowners. Characteristics such as land size, age, education, absentee landowner, years property owned, etc. may be related to general attitudes toward endangered species or conservation programs but have little ability to predict participation in a specific

program. This is not a new finding but bears repeating because many studies still use this approach to try to understand and predict behavior.

The second lesson is that while theoretical frameworks such as reasoned action are well-suited to predict behavior under certain circumstances, they are not entirely useful to program managers. It is not surprising to find that landowners with positive beliefs and attitudes toward enrolling in a program are more likely to express an intention to enroll. For program managers, it is finding those landowners that is the key to enhancing endangered species recovery efforts. I found that behavioral predictors can improve understanding of who are these landowners with positive attitudes. For example, landowners who recently have cleared brush on their land tend to have more positive attitudes along with landowners who are interested in conservation programs that focus on clearing brush.

The third lesson is that conservation programs must strongly consider the heterogeneous preferences of landowners when designing programs. While all landowners prefer strong financial incentives they do not only focus on the money. They consider other payoffs such as future obligations and potential outcomes. The reason I make a normative statement here is that conservation programs focusing on endangered species provide a social good, biodiversity. Incorporating the differing needs of landowners is a way to improve participation and thus enhance recovery efforts in a more cost-effective manner.

Values

A currently popular technique in human dimensions work is to measure held values and examine their relationship to attitudes and behavior. Dunlap et al. (2000) use the new ecological paradigm (NEP) to understand people's so-called primitive beliefs about the environment. Fulton et al. (1996) use the cognitive hierarchy to create a scale to measure the value orientations of people toward wildlife along a protection-use and appreciation orientation. Paul Stern and his colleagues focus on three types of values to explain the phenomenon of environmentalism including self-interest, humanistic altruism, and biospheric altruism (e.g., Dietz et al. 2005). This research is fairly

consistent in identifying people who are more concerned about the environment and more likely to engage in pro-environmental behaviors. For example, Dunlap et al.'s NEP scale is positively correlated with perceived seriousness of environmental problems, pro-environmental policies, and self-reported pro-environmental behaviors. Stern's work with his colleagues consistently finds that the biospheric altruism, which measures concern for species or ecosystems beyond the benefit they provide to humans, is most strongly related to a pro-environment orientation.

I did not measure environmental values in this research because values are very broad beliefs and do not perform well in predicting behavior (see Hrubes et al. 2001 for an example). However, the results of my research indirectly identify the utilitarian values of landowners in central Texas. In Chapter II, I found that the expected outcome of land improvement was important to landowners while helping endangered species was marginally important in the beliefs-only model (see Table 3, Model 1). In the second analysis, land management techniques that fit with landowner needs helped to predict intentions to enroll. In the third analysis, dependence on land was a discriminating factor in understanding preferences for program structure. In this case, expected land improvement was only an important factor for one subgroup. However, this does not necessarily mean that land improvement was not important. It may simply mean that land improvement played less of a role in the choice process when other program features were considered jointly. If I were to explore the held values of landowners, I would hypothesize that Group 2 in the third study would exhibit higher appreciation values (Fulton et al. 2000) and stronger biocentric altruism values (Dietz et al. 2005) than the landowners in Group 1 who were more dependent on their land. An indirect lesson here for conservation programs might be to focus on the direct benefits of conservation programs that coincide with a landowner's land management goals. However, a values-basis reasoning for landowner preferences warrants direct study.

FUTURE RESEARCH

My dissertation offers a number of ideas for further investigation of the same data as well as for future research. First, I will heed some of my own advice and

incorporate the theory of reasoned action with preferences for program structure to obtain a clearer picture of why some landowners refused to engage in the choice task and to better explain the reasons behind the preferences of those who did engage in the task. That is, while the choice model can only account for those who participated in the choice task, I can apply the theory of reasoned action to explain differences between choosers and non-choosers and then to understand the preferences of choosers. As discussed by Bernath and Roschewitz (2008), incorporating psychological factors into economic models can increase the explained variance.

As I discuss in Chapter IV, there is no such thing as an average landowner. This same idea of preference heterogeneity can be used to segment landowner to obtain an improved picture of intention to enroll in a conservation program using the theory of reasoned action.

This research has also led to me to ask further questions about landowners. First, I'm interested the stewardship construct. In the literature and in my work (see page 26 and 29) landowners strongly self-identify as stewards. Paradoxically, landowners do not manage their land for imperiled species or many other nongame species. Thus, differing worldviews seem to exist on what exactly stewardship entails. Landowners may limit the stewardship idea to healthy rangeland as it applies to their intended uses for it (e.g., cultivation, livestock, recreation, etc.). I think some exploratory research using a technique like cultural domain analysis to compare worldviews of landowners and program designers is warranted here.

Exploring the potentially different worldviews between landowners and those designing conservation programs for biodiversity can help bridge the gap and improve participation in conservation programs. Additionally, improved approaches to understanding the link between preferences and choice behavior are needed. In this study, a fairly large proportion of landowners did not participate in the choice task. I have come to believe that a better general understanding of landowner willingness to participate in a conservation program needs to be investigated more closely. For example, Smith et al. (2007) surveyed landowners at a agricultural producers

conferences in Kansas and found that 97% of those interviewed were familiar with the USDA Conservation Reserve Program but that only 45% had participated. Additionally, 81% were familiar with the USDA Environmental Quality Incentives Program and just under 31% had participated. Because this data was collected at a meeting of producers (and does not include producers that do not participate), I suspect that these numbers represent upper bounds of participation. Fundamental underlying issues including the endowment effect and status-quo bias can provide further insight on how to design, implement, and recruit landowners so that conservation behavior occurs at higher levels. The status-quo bias postulates that individuals have a strong tendency to remain at the status quo because the disadvantages of changing loom larger than the potential advantages (Kahneman et al. 1991). The endowment effect is a phenomenon where an individual demands more to give up an object than he or she would be willing to pay for the object.

I also appreciate new approaches to measuring preferences that assume that people do not a priori have well-formed attitudes or preferences. Alternative approaches, for example, that use the social process of valuation (i.e., participatory and deliberative processes) have been increasingly used (Spash et al. 2005; Lynam et al. 2007). This hybrid economic and political approach is intriguing and represents the next generation of valuation approaches.

Finally, one staid critique of incentive programs is that they reward behavior that landowners should be doing anyway (Raymond 2006; Raymond and Olive 2008). I previously argued that compensation programs related to endangered species are simply correcting an incentive problem that existed and was exacerbated by the historical implementation of the Endangered Species Act. Thus, they are not rewards but simply fixes to correct a perverse incentive structure. This criticism, however, raises an important issue. As research on the influence extrinsic incentives on behavior shows, rewards change the fundamental motivation for engaging in a target behavior (e.g., Kohn 1993; Pierce et al. 2003). Individuals who act solely for the reward (i.e., an extrinsic motivation) have a much higher probability of not continuing the behavior once the

incentive is removed. Those who engage in a behavior because of an intrinsic motivation are much more likely to continue that behavior with or without rewards. Although I argue that incentive programs for endangered species protection are not rewards, landowners engaging in them may view them as such and enroll because of an extrinsic motivation to obtain the "reward." It is my opinion that the ultimate goal of the conservation program should be to create an internal norm of conservation behavior on an intergenerational scale. Society should help with the costs because of the positive externalities. Thus, I would like to engage in theory development that synthesizes what we know about collective action and cooperation from experimental social psychology and case studies as it applies to conservation on private lands. The research question of interest to me is how programs can be designed and implemented in a manner that appeals to and reinforces the intrinsic motivation of landowners. This research can be applied to endangered species, biodiversity, as well as ecosystem services.

CONCLUSION

I found that landowner interest in compensation programs appears to be moderate at best (Chapters II and IV). For those who are willing to consider programs involving endangered species, dovetailing the land management requirements for the species with direct benefits to the landowner is important (Chapters II and III) but perhaps not as important as ensuring that the program provides adequate financial incentives, consideration of the term of the program, and a level of certainty regarding the landowner's future obligation to the target species (Chapter IV). Finally, landowners are not a single homogenous group. Segmenting landowners using socio-demographic variables for the purpose of program design and recruitment will not result in optimal levels of conservation.

Although flawed in many respects (Goble et al. 2006; Mann and Plummer 1995; Norris 2004; Yaffee 1982), the Endangered Species Act of 1973 is the primary policy tool for protecting biodiversity in the United States. One major lesson derived from its implementation over the past 30 years is that direct regulation is not the only nor the optimal way to protect endangered species on private lands because it imposes an undue

cost on the affected landowner. The role of the conservation program is to rearrange the incentives so that society bears the cost for something for which it obtains the benefits. This recognition has resulted in tools that are much more flexible and that rely on cooperation more so than coercion. At its core, however, the issue is a social dilemma and improving endangered species protection on private lands requires an interdisciplinary effort from social psychologists, economists, and political scientists improving our understanding of conditions under which collective action occurs.

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