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Social and Spatial Relationships Driving Landowner Attitudes Towards Aquatic Conservation

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SOCIAL AND SPATIAL RELATIONSHIPS DRIVING LANDOWNER ATTITUDES
TOWARDS AQUATIC CONSERVATION

A Thesis
Presented to
the Graduate School of
Clemson University

In Partial Fulfillment
of the Requirements for the Degree
Master of Science
Forest Resources

by
Samuel Norton Chambers
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Accepted by:
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ABSTRACT

Because of a gap between the science and practice of conservation planning, it has been suggested that there is a need for better understanding of the social systems within which conservation projects are embedded. Given that more than half of the land in the United States is privately owned and that private land covers the majority of the mapped endangered species habitat, understanding attitudes of private landowners towards biodiversity conservation may help to bridge the science-practice gap. Aquatic biodiversity is particularly imperiled throughout the world; in the United States headwater streams and small, isolated wetlands receive little protection through regulations and thus have become a focus of conservation planning efforts. To assess how landowners view such efforts we randomly selected 500 parcel holders in the Blue Ridge and Piedmont regions of South Carolina and mailed a 27-question survey to 409 that met criteria. We received completed surveys from 70 respondents and analyzed the results using mixed quantitative and qualitative methods.

Our study showed that aquatic areas and the associated wildlife are valued by and show influence on the decisions of landowners in the South Carolina Piedmont and Blue Ridge ecoregions. Willingness to conserve and the tendency not to, are not inverse as would be expected. Rather they are positively correlated. We found that greater familiarity with specific state-wide land trusts has the greatest influence on landowners' knowledge of land trusts and their practices in general. We also found that distance from protected area has a curvature in its relationship to the willingness to protect aquatic areas; meaning willingness increases and then decreases with distance. Qualitative coding

of text responses revealed a theme in landowners showing concern for threats of pollution from runoff and siltation. Perhaps most informative was the prevalence of apathy towards conservation. Disinterest in conservation through land trusts seemed prevalent throughout many of the respondents' answers, no matter their view of the importance of aquatic conservation. We conclude that any successful implementation of aquatic conservation initiatives must include focused outreach and education of landowners as to the benefits for society and landowners personally of landscape-scale cooperation with land trusts and other conservation mechanisms.

DEDICATION

This manuscript is dedicated to Gary Wein, Ph.D. of the Highlands-Cashiers Land Trust whose support and experience inspired and made this possible.

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CHAPTER 1

INTRODUCTION

There is a significant gap between the science meant for use in conservation planning and the practice of such in conservation planning (Bernstein and Mitchell 2005; Knight et al. 2005; Wallace et al. 2008). Biodiversity is inadequately protected in the network of public lands (Rodrigues et al. 2004). Conservation planning has arisen as a field to systematically assess where and when biodiversity protections should be extended (Trombulak et al. 2010). Much actual conservation practice is focused on privately-owned lands (Hilty and Merenlender 2003; Trombulak and Baldwin 2010). Landowners may consider biodiversity conservation if they receive an economic benefit, or if their value systems support biodiversity conservation (Ginn 2005). Because of this, Wallace et al. (2008) suggested a need for a better understanding of the value placed on social-ecological-economic systems involved in conservation to increase support for conservation planning on privately owned land.

Approximately 60% of the United States is privately owned; excluding Alaska the percentage rises to 71% (Hilty et al. 2003). A portion or the entire habitat for 85% of federally endangered species in the US is found on private land (U.S. General Accounting Office 1994; Rissman et al. 2007), leaving a mere 15% strictly on public lands. Unlike public land, the majority of private land in The U.S. is mesic and higher in productivity and biodiversity (Scott et al. 2001; Rissman et al. 2007). Even if an endangered or threatened species lies entirely or almost entirely on public lands, the private lands surrounding public lands are critical for maintaining biodiversity (Knight 1999; Groves et al. 2000; Rissman et al. 2007) by creating more contiguous areas with greater ecological benefits (Fahrig, 2001; Kareiva and Wennergren, 1995; Andren, 1994; Groves et al., 2002; Strager and Rosenberger 2006). The pressure to

subdivide and develop private land has depleted and damaged water resources, habitat, and biodiversity (McKinney 2002; Hansen et al. 2005; Wallace et al. 2008). Land trusts seek to compensate and solve these problems by protecting lands by full ownership or by conservation easements. Land trusts are nonprofit organizations that directly protect land by direct ownership or by conservation easements (Brewer 2003). A conservation easement is a voluntary agreement between a land trust or similar organization or a government agency and private landowners in which the organization acquires interest (obtains development rights) in the property in order to restrict land use, usually permanently, to prevent the loss of land (Gustanski and Squires 2000; Lippmann 2004; Sullivan et al. 2005; Rissman et al. 2007; Janota and Broussard 2008), hopefully by furthering the landowner's goals (Pannell 2006). Most land trusts' main objectives are to protect threatened or endangered species, more mesic sites in wetlands and river corridors, and existing protected areas (Rissman et al. 2007; Merenlender et al. 2004).

Large or contiguous areas generally have greater ecological benefits than small, more isolated areas (Fahrig, 2001; Kareiva and Wennergren, 1995; Andren, 1994; Groves et al., 2002; Strager and Rosenberger 2006). Open lands also have social benefits and are highly valued by adjacent communities (e.g., in the urban fringe) because of increased development and population growth and the need for open space for recreation (Ryan et al. 2004). Little attention has been given to these human values or the impacts of damaged environments (Baldwin et al. 2011). Pressure to subdivide and develop land creates a strain on water resources, wildlife habitat and biodiversity and limits land for public parks and recreation areas (McKinney 2002; Ryan et al. 2004; Hansen et al. 2005; Wallace et al. 2008). Such loss of habitat is a primary driver of the decline in biodiversity (Wilcove et al. 2000; WWF 2004; Pimm et al. 2006; Fishburn et al. 2009). Conservation efforts need to expand significantly to prevent further loss (Rosenzweig

2003; Fishburn et al. 2009). Land trusts not only seek to improve or retain habitat quality in urbanizing areas but also in working landscapes, such as those dominated by agriculture, forestry, or other intensive land uses (Brewer or some other broad reference). Land trusts typically view these “working” landscapes as important buffers for existing nature reserves, public or private (Rissman et al. 2007). Protecting parcels adjacent to existing protected lands is important to decrease fragmentation (Strager and Rosenberger 2007). These “working” landscapes have active resource use that may include farming, timber management, hunting, or fishing. These private lands have potential to provide connectivity between and buffer public lands (Wright 1998; Rissman et al. 2007).

Farmland owners’ attitudes were shown, in a study in Connecticut, to relatively agree with the statement that conservation easements were a good way to protect farmland generally; closer inspection revealed that landowners were not as willing to work with land trusts (Ryan et al. 2004) suggesting a poor public image or understanding of land trusts. This is not an atypical result for studies of landowner attitudes towards conservation. Studies of landowners with riparian habitat show higher support for the values and goals of buffer systems and lower support for the practice of the conservation methods (Hairston-Strang and Adams 1997; Schrader 1994; Dutcher et al. 2004). Despite positive views of conservation objectives, there have been documented negative responses from the public to active uses such as timber harvesting (Fairfax et al. 2005; Rissman et al. 2007). Most land trusts aim to protect threatened or endangered species, existing nature preserves, aquatic areas such as wetlands and river corridors, and/or open spaces (Rissman et al. 2007; Merenlender et al. 2004). This suggests a need for research on the compatibility of the uses on these “working” landscapes and conservation (Rissman et al. 2007).

Land trusts protect these working landscapes through conservation easements rather than full ownership.

The benefits of a legally recognized conservation easement are shown in Section 170(h) of the Internal Revenue Code. Benefits include public outdoor recreation or education, protection of relatively natural habitat, preservation of open space for either public scenic enjoyment or pursuant to local government conservation policy, and preservation of historic land or structures (Wallace et al. 2008; Rissman et al. 2007). Conservation easements are increasingly relied on to ensure protection (Fairfax et al. 2005) despite protecting along a gradient from intensive land use to highly restricted on all or most uses (Rissman et al. 2007). There is a lack of and a need for increased understanding of the protection status and extent of conservation easements (Rissman et al. 2007).

Merenlender et al. (2004) suggested a need for further study of the poorly understood, complex conservation situations that have occurred in the use of conservation easements. Easements have become more likely to restrict subdivision but also more likely to allow individual residences; which is likely due to shifting demographics to a segment more interested in investment than charitable donations (McLaughlin 2002; Small 2003; Rissman et al. 2007). National Woodland Owner Survey data in Alabama, Georgia, and South Carolina showed that 50.78% of people agreed that land investment was a very important reason for owning woodland; 58.18% agreed that passing land ownership to heirs was very important (Majumdar 2008).

A study in Georgia found that 38 out of 56 (68%) of the sampled easements permitted residences and 7 (12.5%) allowed subdivision (Crehan et al. 2005; (Rissman et al. 2007).

Criticism of conservation easements has been primarily focused on an excess of commercial and

residential development associated with the easements (Stephens and Ottaway 2003; Rissman et al. 2007). Guidelines of the Land trust Alliance (LTA) (<http://www.landtrustalliance.org>), an organization that represents and sets standards for 1,700 land trusts in the United States, do not actually address the variety and intensity of uses allowed on conservation easements (Rissman et al. 2007).

Incentives for conservation easements are available through law but are not guaranteed in the future. Private landowners may receive payments or a drop in property taxes in return for conservation easements (Byers and Ponte 2005; Rissman et al. 2007). Presumably federal and state tax incentives contributed to the growth in use of conservation easements among land trusts (Di Leva 2002; Fishburn et al. 2009). In 2005, a congressional report recommended the removal of the federal income tax incentives for conservation easements on land with owners' residences (Joint Committee on Taxation 2005; Rissman et al. 2007). Merenlender et al. (2004) suggested the need for long-term multidisciplinary research to quantify the cost and benefits of incentive based conservation and to what extent conservation easements mitigated threats to biodiversity (Merenlender et al. 2004).

Other negative issues with easements include lack of monitoring and resource extraction limits. Conservation easements range from having zero to extensive ecological monitoring (Block et al. 2004; Rissman et al. 2007). Landowners and therefore land trusts may also not own water or mineral rights, leaving a lack of protection against resource extraction by third parties (King 2004; Rissman et al. 2007). There is also the issue of education. There is a high importance in providing information to landowners to increase awareness, identify solutions for conservation, and provide incentives (Osterman 1988; Schrader 1995).

Economics limitations are not only a constraint on landowners but also the efficacy of land trust practices (Strager and Rosenberger 2007; Merenlender et al. 2004). Merenlender (2004) identified environmental, economic, and political/cultural variables that may affect land-trust activities and accomplishments. Included in the political/cultural variables are land-use history and current land uses; and prevailing views about private land, conservation, and environmentalism. They found that there was a need for further study of the relationships between landowner goals and socioeconomic demographics; property characteristics; easement terminology; and the characteristics of the land trusts (Merenlender et al. 2004). They also mentioned a need for multidisciplinary research effort to quantify the benefits and costs of incentive-based private land conservation; and the landowners who donate or sell easements (Merenlender et al. 2004). This would include landowners' understanding of tax breaks and associated costs and benefits, their desires or resistance to conservation in general, and their educational/philosophical reasons behind these views and levels of understanding. Despite this, research in increasing use of conservation easements by land trusts has still not focused on and has revealed little about the actual ecological and sociological outcomes of conservation easements (Merenlender et al. 2004; Yuan-Farrell et al. 2005).

There is a need for understanding what is behind a landowner's willingness to use the land conservation mechanisms, including easements, provided by a land trust. Research in significant life experience suggests that outdoor experiences foster pro-environmental outcomes (Cachelin et al. 2009). This shows a connection between personal experience and attitude towards conservation, implying that landowners' choices may also be influenced by their experiences on the land. Education and strong environmental ethic improve the chances that a landowner would use the option of conservation easements (LeVert 2009). Significant life

experience research suggests that outdoor experiences can result in pro-environmental attitudes and outcomes (Cachelin et al. 2009). The local knowledge of a landscape may significantly affect decisions regarding conservation (Strager and Rosenberger 2006; 2007). Landowners who know their properties and understand its potential benefits are likely to provide more detailed descriptions of benefit for the baseline and easement documentation (Wallace et al. 2008); making land trust efforts take less time, therefore easier and more affordable. There may be benefits that landowners do not recognize such as groundwater recharge, floodplain protection, community separation, connectivity, or buffering of public lands (Wallace et al. 2008).

Land trusts also need to know a particular landowner's likelihood to sell. This is often involved in a decision on whether or not to acquire a conservation easement (Strager and Rosenberger 2006). A study in Macon County, North Carolina showed that the public's willingness to pay for a conservation easement could reduce forestland conversion by 14-46% (Cho et al. 2005). In New Hampshire and Massachusetts a landowner's willingness to sell a conservation easement was shown to be influenced by the variables of offer, education, environment, recreation, whether land pays for itself, management/use, cooperation, whether they were a resident or absentee owner, and the state (LeVert 2009). Recreational land use, in general, has also been connected to interest in wildlife habitat and restoration (Morton et al. 2010). Absentee owners were shown to be much more likely to use conservation easements but also wished for land to 'pay its way.' It was suggested that the "culture" of an area also may influence the willingness to use conservation easements as an option (LeVert 2009). This theory may apply to other areas on a number of scales. The Clean Water Act of 1972 (33 U.S.C. 1344) prompted multiple federal agencies to regulate and give incentives for conserving aquatic areas, especially wetlands (Davenport et al. 2010). Wetlands have been historically perceived as

“wastelands” by the public (Kaplowitz and Kerr 2003; Davenport et al. 2010). By contrast, services provided by wetlands include nutrient cycling, flood mitigation, water filtration, erosion control, aesthetics, outdoor recreation, and carbon storage (Millennium Ecosystem Assessment 2005; Euliss et al. 2006; Davenport et al. 2010). It has been shown that restoring wetlands requires an interdisciplinary approach (Wagner et al. 2008; Davenport et al. 2010). Even so, there is a lack of understanding of the human dimensions of wetlands management (Johnson and Pflugh 2008; Davenport et al. 2010). For example, effective wetland conservation requires cooperation of funders, governments, and landowners (Gawlik 2006; Barham 2001; Michaelidou et al. 2002; Gesit and Galatowitch 1999; Johnson and Pflugh 2008; Davenport et al. 2010). Such cooperative management requires the involvement of local people (Layzer 2008; Sabtier et al. 2005; Wondolleck and Yaffee 2000; Davenport et al. 2010) that may know little about wetlands and what exactly they are (Johnson and Pflugh 2008; Davenport et al. 2010). Still, for many surveyed in southern Illinois the uniqueness of a wetland was a source of personal pride and community identity (Davenport et al. 2010). Riparian landowners are typically more accepting of conservation but still lack access to reliable information regarding conservation (Johnson 1996; Dutcher et al. 2004). If they know of wetlands and have positive views it is usually associated with wildlife habitat and protection (Johnson and Pflugh 2008; Kaplowitz and Kerr; Davenport et al. 2010). The perception of the significance of wetland functions are mixed though (Johnson and Pflugh 2008; Davenport et al. 2010). A survey in Nova Scotia showed respondents valued wetlands for providing green space and rural atmosphere to urban development along with allowing recreation and increasing property values (Manuel 2003; Davenport et al. 2010).

A study of attitudes towards river restoration in the UK found similar values not including ecological benefits (Tunstall et al. 2000; Davenport et al. 2010). In Florida, residents

showed a preference in paying for the restoration of the Everglades ecosystem when projects were characterized by wildlife and water levels (Milton and Scrogin 2006; Davenport et al. 2010). Michigan residents' willingness to accept wetland restoration depended on factors involving improvement in habitat quality. Although, support for specific restoration projects or actions is lower than support for restoring wetlands in general (Johnson and Pflugh 2008; Davenport et al. 2010). A study on community commitment to wetland restoration (Davenport et al. 2010) found that to continue the restoration of wetlands local cultural benefits and the supply of water quality should both be emphasized. In order to protect wetlands, social scientists have pointed out the need for understanding such residents' current connections to and views of wetlands (Davenport et al. 2010). This understanding could help develop educational programs to express the ecological and social benefits of wetlands (Gesit and Galatowtsch 1999; Davenport et al. 2010).

A study of rural greenway planning in Kansas found that recognition of community values, opinions and perceptions is important to planning land management strategies (Schrader 1995). The study found that protecting wildlife habitat was viewed as the most important function of streams and corridors; this conflicted with the well known issue of non-point source pollution (Schrader 1995). Results also showed that although economics is not necessarily the main driving force behind attitudes to stream conservation, perceptions of the importance of water quality, wildlife habitat, and aesthetics are significantly related to source of income and parcel size (Schrader 1995). Conserving stream corridors and greenways significantly decreases non-point source pollution (Lowrance et al. 1985; Peterjohn and Corell 1989; Welsch 1991; Stuart and Greis 1991; Schrader 1995). Landowners who consider stream conservation as

important also show more willingness to participate in planning conservation programs (Schrader 1994; Schrader 1995).

Owners of riparian forests also value owning the land for watershed protective purposes more than non-riparian owners (Janota and Broussard 2008). These landowners show an acknowledgement of the influence their actions have on the overall watershed and the responsibilities associated with this (Janota and Broussard 2008). These kinds of perceptions and their influence on attitudes towards conservation and stewardship could be an important consideration for conservation planning such as greenway development (Schrader 1995). There are setbacks, in federal spending for instance, that have made it increasingly difficult to conserve aquatic areas such as stream corridors (Foti and Jacobs 1989; Schrader 1995).

It has been shown that landowners having strong property rights views can reduce exchange of information with other landowners. Landowners may be skeptical of government involvement in conservation due to fear of sanctions and enforcement but typically trust other landowners and land management professionals, especially foresters (Habron 2002; Habron 2004; Dutcher et al. 2004; Davenport et al. 2010). Landowners in central Pennsylvania were shown to be suspicious of scientists, academics, government officials, and anyone involved in 'urban environmental politics', all of whom were seen as outsiders (Dutcher et al. 2004). Habron (2004) and Coughenour (2003) identified a need for a non-threatening actor-network/forum for landowners to learn from each other regarding conservation options. Landowners seeking such information have a higher likelihood to adopt conservation practices (Rogers 1983; Nowak 1987; Kraft et al. 1996; Habron 2004).

An interesting observation from Habron (2004) was that landowners who desired more information about the survey given to landowners were more likely to adopt practices protecting

riparian areas (Habron 2004). The research also showed that nearly half (49.8%) of those surveyed agreed that erosion of streambanks needed to be addressed (Habron 2004). Some subgroups such as riparian and absentee forest landowners in southern Indiana were shown to be more supportive of conservation oriented policies (Janota and Broussard 2008). Demographic characteristics such as age, education level, income range, and political ideology showed no influence on a landowner's perceptions of policy (Janota and Broussard 2008). The strongest influencing factor in support for forest conserving policy was the landowner's motivation of ownership being investment (Janota and Broussard 2008)

Categories of external variables that may affect land-trust activities and accomplishments are environment, economic and political/cultural. Environmental variables include biodiversity and habitat types. Economic variables include land value and taxes. Political/cultural variables include population density, land-use history, current land uses, availability of public and private funding organizations, and prevailing views about private land, conservation, and environmentalism (Merenlender et al. 2004). The Land Trust Alliance identified watersheds, river corridors, and wetlands were the top three types of land that land trusts were involved in conserving. Wetlands being the number one typed protected (Land Trust Alliance 2000; Merenlender et al. 2004). Most local land trusts actually work exclusively in areas such as a watershed or county (Albers et al. 2008).

A study of a land trust operating in the Cacapon River Watershed in West Virginia found that nearly as much time and effort is required to protect small parcels as that of larger parcels, although this does not count the costs of monitoring (Strager and Rosenberger 2007). This suggested a need for a successful management strategy. Strager and Rosenberger (2007) identified four primary questions to evaluate successful implementation of conservation

planning. The purpose was to determine whether high-priority areas identify locations with multifunctional characteristics and represent conservation objectives, how successful these areas aggregated to parcels for conservation easements, where chosen parcels fit a land trust's budget, and how large of a budget is required to protect large, contiguous, high priority areas. In order to conserve many of these 'target' parcels, a land trust may have to work in partnership with other land trusts or conservation groups, rely on funding from the landowners, or somehow relax or adjust their budget (Strager and Rosenberger 2007). For efficient use of land trust funds it may be necessary to identify whether valuation procedures, institutional behavior, landowner characteristics, and land uses may be hindering participation in easement programs.

Study Goals and Objectives

This study was designed to address for the need for more research on private landowner attitudes towards conservation, in order to increase communication and cooperation among researchers, local institutions like land trusts, and private landowners. Dutcher et al. 2004, Ryan et al. (2004), and Merenlender et al. (2004) all suggested a need for further study of the attitudes towards, especially to investigate patterns of and reasons for resistance to, voluntary conservation.

The goal of this study was to identify the social and spatial qualities that affected private individual or family landowners' attitudes broadly toward conservation through land trusts and particularly toward conservation of aquatic areas. In this study we refer to aquatic areas as including wetlands, streams, rivers, lakes, and ponds. The attitudes we aimed to identify included landowner willingness to conserve land through land trusts, tendency to not conserve through land trust, familiarity with land trusts, and willingness to protect aquatic areas. We designed a survey to quantify and categorize social variables identifying the values and attitudes of the

landowners. The survey consisted of a series of numerically valued questions and open-ended questions. The study took place in the southern Appalachian region of the southeastern United States including landowners in the Blue Ridge and Piedmont ecoregions. This area has a complex history of land uses and socioeconomics, including rapid transitions to and from intensive agriculture, agricultural overuse and erosion, the rise and fall of a textile industry, forestry, extensive river impoundments and federal and state ownership presence (Richter et al. 2000; Scott 2005). The southeastern United States has extensive riparian systems especially stream networks and associated wetlands, and is a global center for aquatic biodiversity (Harding et al. 1998).

CHAPTER 2

RESEARCH DESIGN AND METHODS

Methodology

Our study area consisted of the Blue Ridge and Piedmont ecoregions in Oconee, Pickens, Greenville, Spartanburg, and Anderson counties of South Carolina (Figure 2.1). We designed a survey to quantify and categorize social variables identifying the values and attitudes of the landowners. The survey consisted of a series of twenty seven numerically valued and open-ended questions on seven pages. It was estimated that it would take no more than fifteen minutes to finish. The quantitative values were analyzed using multiple least squares regression to compare them with other values from the survey plus a series of spatial values. The open ended questions were analyzed using qualitative research methodology, involving a systematic method of coding using common words and similarities (Saldana 2009). Five hundred parcels were randomly selected from all 67,688 privately-owned parcels that intersected aquatic areas such as streams,

rivers, lakes, ponds, and wetlands. Ninety one parcels were removed because they were owned by businesses or associations rather than individuals or families, leaving a total of 409 surveys sent out. Reminders were sent out a week after the survey. Seventy landowners (17%) returned answered surveys. Of the returned surveys, eight (11%) were from landowners in Oconee County, ten (14%) from Pickens County, twenty one (30%) from Greenville County, twenty six (37%) from Spartanburg County, and four (6%) from Anderson County. Twenty surveys were returned to sender by the postal service.

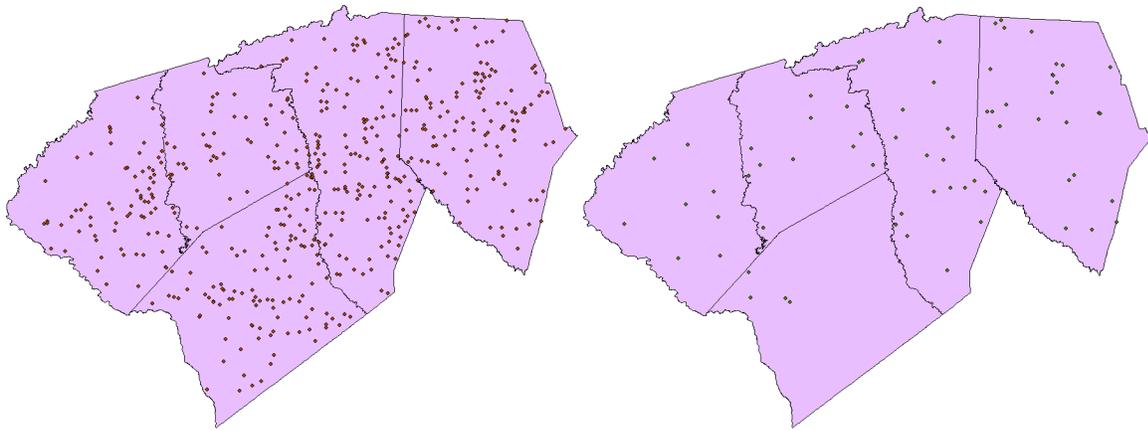


Figure 2.1 Left: Centroids of all parcels chosen randomly, Right: Centroids of all parcels with returned surveys

	Count	Minimum	Maximum	Mean	Standard Deviation
All privately owned parcels	67688	0.00011	1754.04004	6.125432	17.117893
Randomly selected parcels	500	0.008498	98.141296	6.409821	13.045111
Returned survey parcels	70	0.103314	87.056396	5.766406	12.063691

Table 2.1 Parcel Size (Ha) for all private parcels, sampled private parcels, and returned surveys

The quantitative questions were separated by topic (attitude towards land trusts and conservation easements; attitudes towards aquatic area conservation; knowledge of land trusts and conservation easements). The answers were given numeric values to coincide with the respondents' level of agreement with the statement. Each question category was given the total sum of their respective values.

The objective of the quantitative analysis was to determine whether any spatial variables or land owner characteristics were related to the answers to questions WPA, KLT, TN, and WC where WPA is the score rating the landowners' willingness to protect aquatic areas, KLT is the landowner's confidence in their knowledge of land trusts and land trust practices, TN is the landowners' tendency to choose non-conservation options, and WC is their level of agreement in using practices to protect land through land trusts. The spatial variables were species richness, amphibian richness, distance from wetland, distance from protected areas, distance from urban areas, distance from the city of Greenville, and parcel size. Species richness and amphibian richness were predicted values from raster data available through the South Carolina Department of Natural Resources. Distance from areas and points were measured using the Euclidean distance tool in ArcMap 10. Parcel size was recorded in parcel layers provided by county tax offices. The questions used in calculating each score were not used as variables in the regression analysis of that score. This was the case for WPA, KLT, TN, and WC. All remaining questions plus demographic characteristics were used in regression analysis.

Statements for which a landowner answers Strongly Agree, Agree, Disagree, or Strongly disagree with or is Undecided.
*It is important to protect aquatic areas (creeks, ponds, wetland, etc.) in the Piedmont and Blue Ridge of South Carolina.
*I highly value the aquatic areas on my property.
*I highly value the wildlife that depend on these aquatic areas.
**I am knowledgeable of the functions and purpose of Land Trusts.
**I am knowledgeable of the functions and purpose of Conservation Easements.
**I am knowledgeable of the functions and purpose of Reserved Life Estates.
***Regarding the property I will probably sell as is to non-family member.
***Regarding the property I will probably sell as is to family member
***Regarding the property I will probably develop and sell.
***Regarding the property I will probably leave in will or give to heir(s).
****Regarding the property I will probably leave to land trust by reserved life estate.
****Regarding the property I will probably protect with conservation easement.
****Regarding the property I will probably sell or donate to land trusts.
Statements for which a landowner answers Yes or No
Do you know of local non-profit organizations that conserve natural areas?
Do you know of statewide non-profit organizations that conserve natural areas?
Do you know of national non-profit organizations that conserve natural areas?
Is your property, particularly the portion containing aquatic areas, already protected by or in the process of being protected by a conservation easement?
Demographic Characteristics
Annual Income
Level of Education

Table 2.2 Quantitative statements (*Used to calculate WPA; **Used to calculate KLT; *Used to calculate TN; ****Used to calculate WC)**

The analysis proceeded in several steps. The first step was to analyze a series of simple regression models of the form

$$Y = \beta_0 + \beta_i * X_i + \epsilon$$

letting WPA, KLT, TN, and WC be the response (or Y) variables, and the each of the spatial variables and land owner characteristics be the predictor (or X) variables. For each response variable, a single predictor was chosen with the best fit. The criterion for X with the best fit was the X that produced the smallest p-value for the hypothesis test $H_0: \beta_i = 0$.

The second step was to determine if adding any additional X's would improve the fit. The residuals from the model with the best fit X were plotted against additional possible X's, providing visual evidence (like that in Figure 2.2) of the possible improvement to the model by

adding an additional X. In other words, we used plots for visual evidence that adding an additional X would improve fit.

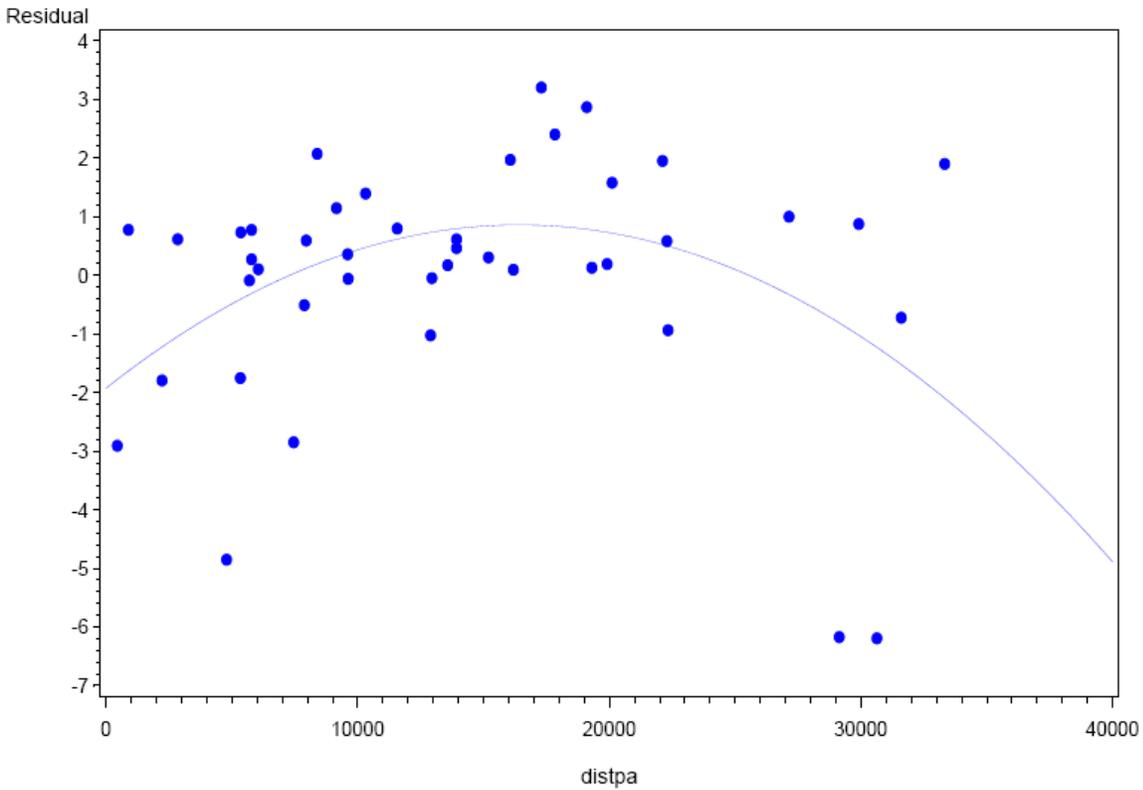


Figure 2.2 Residuals for WPA plotted against distance from protected areas

Note that additional X's could be interactions or multiples of X's like powers of the best fit X

(such as X^2) allowing for a curvilinear relationship among the X and Y, and in later steps,

products of X's in the model (such as $X_1 * X_2$) allowing for an interactive relationship among the

X's and Y. In addition to the plots, there was also a series of regression models of the form

$$Y = \beta_0 + \beta_1 * X_1 + \beta_i * X_i + \epsilon$$

Answers from a series of open-ended questions (Table 2.2) in the surveys were analyzed using coding method to simplify and categorize landowner attitudes. To do this, we identified keywords and phrases and compared commonalities with these from landowner to landowner.

These common words and phrases were coded with a series of numbers. We then identified patterns in these series to consolidate into a series of six themes.

Subjects of Qualitative Questions
What purpose do the property and aquatic areas serve to the landowners?
What about aquatic areas do landowners find important to protect?
How do they wish to alter the aquatic areas on their property?
How are the landowners using and how will they use the aquatic areas in the future?
Do neighbors views affect property and aquatic areas use?
How do landowners value their property and aquatic areas?
What affects landowners' decisions regarding land trusts?
What do landowners know and wish they knew about land trusts and conservation easements?

Table 2.3 Qualitative Subjects

The qualitative answers were analyzed using a coding method (Saldana 2009) to simplify and categorize landowner attitudes towards and views of land trusts and aquatic areas. Keywords and statements were selected from all open ended answers. Common words or similar phrases (describing locations, connections, land history, emotions, opinions etc.) were then identified for each individual question. These were labeled with a series of numbers for each question. This gave each respondent a series of numbers describing their answers. These series were matched with similar series to identify patterns in answers. These series were given general descriptions that were reviewed and then further consolidated into themes.

We conducted four least significant difference (LSD) t-tests to identify which themes were significantly different in regards to landowners' WC, TN, WPA, and KLT values. Each of these values was tested separately. Each theme was tested against all other themes individually.

Quantitative Results

The willingness to conserve (WC) was found to be influenced by the variables Q16, Species Richness, Q21.1, and Q7. The resulting regression equation accounted for 48% of the observed variance in Willingness to Conserve. The equation was as follows:

$$WC = -9.2031 + 2.7229(Q16) + 0.09595(\text{Richness}) + 0.476(Q21.1) - 0.01638(Q7)(\text{Richness})$$

For each additional species in an area, a landowners' willingness to conserve increased by 0.096 points.

Willingness to Conserve (R-Square = 0.4793)		Intercept	Q16	Richness	Q21.1	Q7*Richness
	Parameter Estimate	-9.20310	2.72290	0.09595	0.47600	-0.01638
	Standard Error	2.79875	0.49898	0.02305	0.23054	0.00444
	P-value	0.0022	<.0001	0.0002	0.0460	0.0007

Table 2.4 Quantitative research statistics for WC

The variable Q16 is the level of agreement a landowner gave for the statement “I highly value the wildlife that depend on these aquatic areas” referring to the streams, rivers, lakes, wetlands etc. on their parcel. With each increase from “Strongly Disagree” to “Strongly Agree”, a landowner’s willingness to conserve increased by a factor of 2.7 +/- 0.49.

The variable Q21.1 is the level of agreement a landowner gave for the statement that they will “Sell as is to non-family member”. With each increase in from “Strongly Disagree” to “Strongly Agree”, a landowner’s willingness to conserve increased by a factor of 0.48.

The variable Q7 is the level of agreement given for the statement “It is important to protect aquatic areas in the Piedmont and Blue Ridge of SC”. A combination of Species Richness and Q7 actually slightly reduces WC.

The Landowners’ tendency to use non-conservation options (TN) was found to be influenced by the variable Parcel Size in Hectares (Ha). The resulting regression equation accounted for 19% of the observed variance in TN. The equation was as follows:

$$TN = 10.57 - 0.116(\text{Ha})$$

For each hectare in parcel size, the tendency to use non-conservation options decreases by a factor of 0.116 points.

Tendency to not Conserve (R-Square =0.1864)		Intercept	Ha
	Parameter Estimate	10.57242	-0.11675
	Standard Error	0.47921	0.04453
	p-value	<.0001	0.0136

Table 2.5 Quantitative research statistics for TN

Landowners’ knowledge of Land trusts (KLT) was found to be influenced by the variable YN23. The variable YN23 is the point 1 for yes and 0 for no to the question “Do you know of statewide non-profit organizations that conserve natural areas?” The resulting regression equation accounted for 24% of the observed variance in KLT. The equation was as follows:

$$KLT = 8.7 + 3.2(YN23)$$

If a landowner answered that they knew of such areas, their score rating knowledge of Land Trusts and Land Trust Practices, increased by 3.2 points.

Knowledge of Land Trusts (R-Square =0.2413)		Intercept	YN23
	Parameter Estimate	8.70171	3.21945
	Standard Error	0.62194	0.78705
	p-value	<.0001	0.0001

Table 2.6 Quantitative research statistics for KLT

Landowners' willingness to protect aquatic areas (WPA) was found to be influenced by the variables Q215 and Distance from government-owned protected areas (DPA) which was measured in meters. The resulting regression equation accounted for ~30% of the observed variance in WPA. The equation was as follows:

$$\text{WPA} = 12.9 + 0.78(\text{Q21.5}) - 3.5\text{E-}9(\text{DPA}^2)$$

The variable Q21.5 is the level of agreement they gave for the statement that they will “Leave to Land trust in reserved life estate”. With each increase in from “Strongly Disagree” to “Strongly Agree”, a landowner’s willingness to conserve increased by a factor of 0.78.

Willingness to Protect Aquatic Areas (R-Square = 0.4793)		Intercept	Q21.5	DPA ²
	Parameter Estimate	12.9466	0.78023	-3.54011E-9
	Standard Error	0.87199	0.34113	1.055591E-9
	p-value	<.0001	0.0276	0.0018

Table 2.7 Quantitative research statistics for WPA

Qualitative Results

Six themes were identified using coding to profile landowner responses. Theme 1 represented disinterest in conservation and land use in general. For example these landowners did not use or plan to use or alter aquatic areas on their property outside the use of lakes recreation by some. If they showed a slight interest in protecting aquatic areas, it was in a general sense, only mentioning words like “lakes” or “rivers.” They had little knowledge of and no desire for knowledge of land trusts. Twenty one respondents were qualified as theme 1, and their locations did not cluster around any part of the study area (Figure 2.2). The average parcel size in theme 1 was 7.96 hectares (ha) with a standard deviation of 18.31 ha. Parcels ranged in size from 0.2 to 87.06 ha. Theme 1 parcels had a random spatial dispersion.

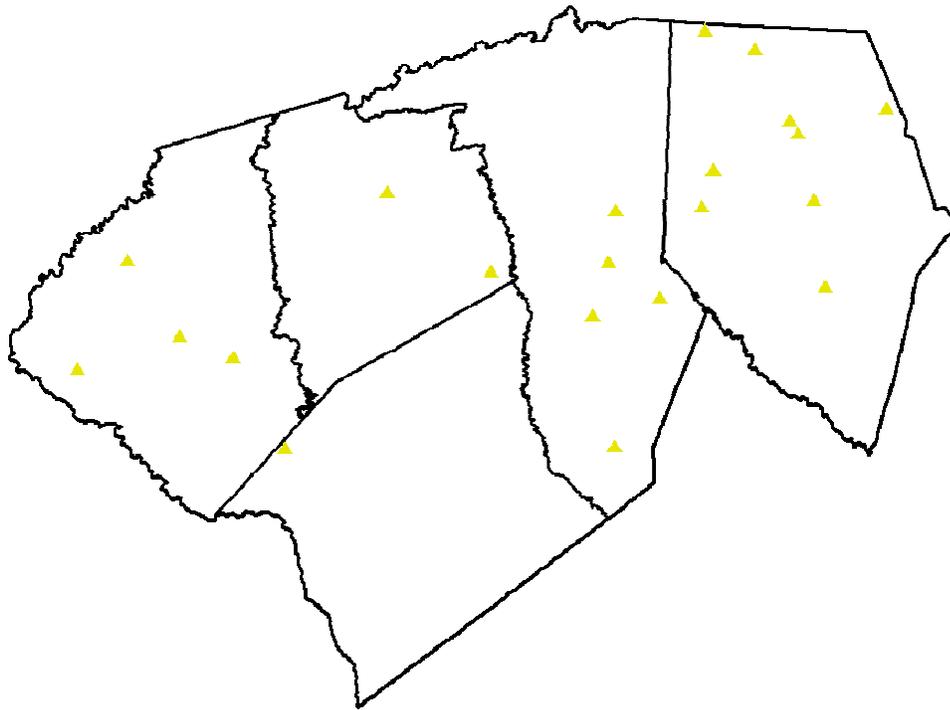


Figure 2.3 Landowners qualifying as theme 1

Theme 2 (N = 18) showed an interest in government and local community policies to protect aquatic areas. Like theme 1, they showed no interest in using land trusts for conservation. The greatest interest was in protecting aquatic areas especially as water resources. They placed most importance on water quality. Most mentioned the importance of preventing point-source and non-point source pollution. The words “runoff,” “siltation,” and “erosion” were mentioned frequently. Approximately 56% of theme 2 respondents were found in Spartanburg County (which returned 37% of the surveys) and 28% were found in neighboring Greenville County (which returned 30% of the surveys). The average parcel size in theme 2 was 6.96 ha with a standard deviation of 9.65 ha. Parcels ranged in size from 0.2 to 42.04 ha. Theme 2 parcels had a clustered spatial dispersion.

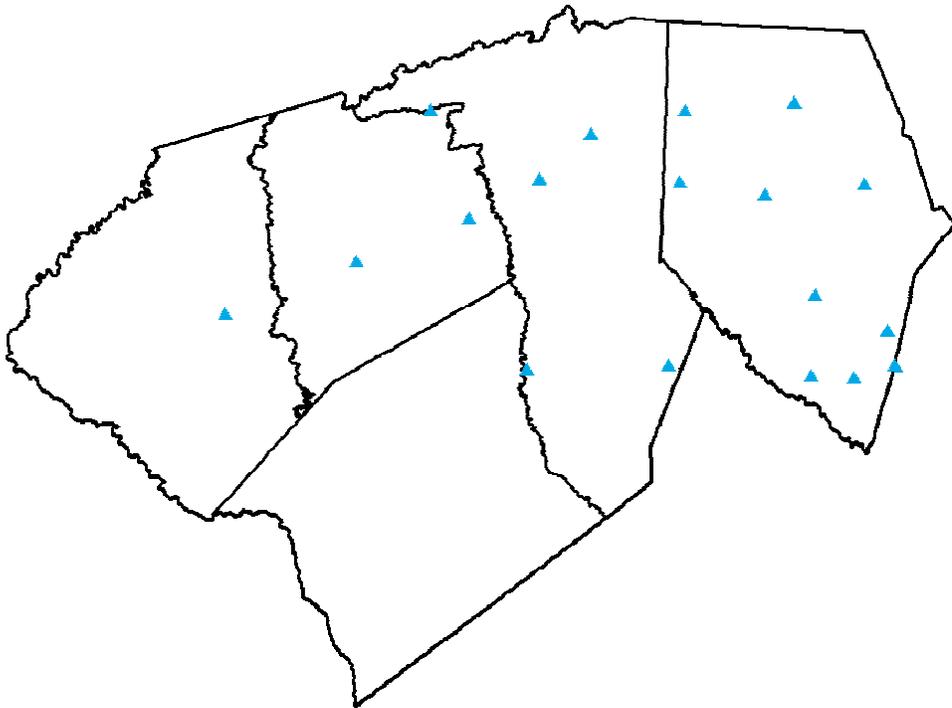


Figure 2.4 Landowners qualifying as theme 2

Landowners in theme 3 (N = 17) showed a deep connection to and knowledge of their land and how they used it. All parcels in theme 3 were used for direct resource extraction and multiple purposes such as agriculture, timber management, hunting and/or fishing, and family recreation activities. All respondents were ambivalent toward land trusts but highly valued the land for themselves and family members. Landowners expressed interest in the research and provided extensive answers. The average parcel size in theme 3 was 5.05 ha with a standard deviation of 7.78 ha. Parcels ranged in size from 0.32 to 30.53 ha. Theme 3 parcels had a random spatial dispersion.

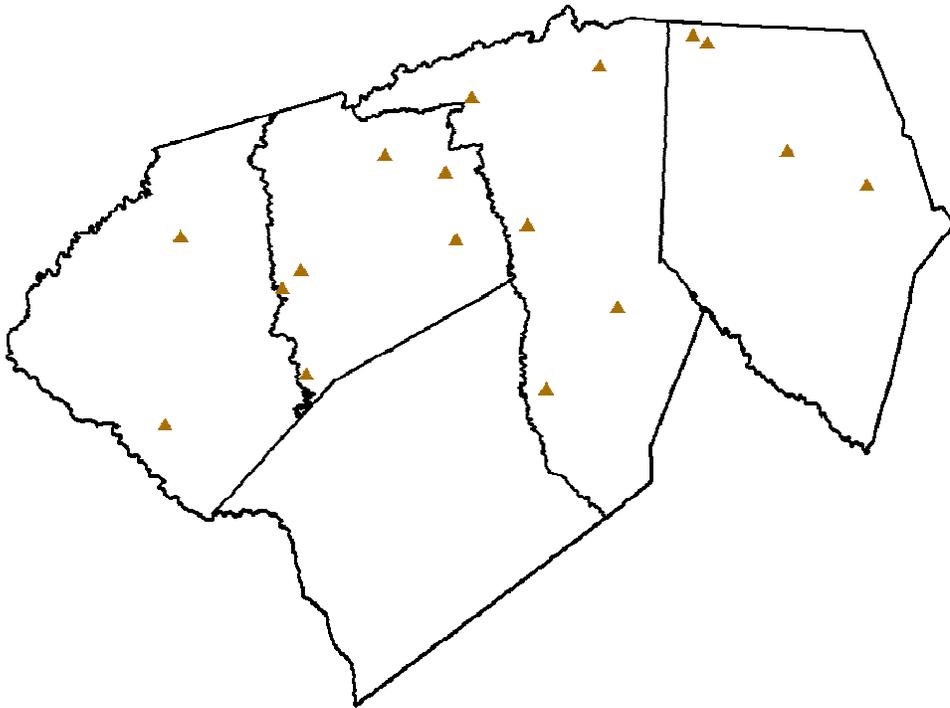


Figure 2.5 Landowners qualifying as theme 3

Theme 4 (N = 7) showed support of conservation with no distrust or rejection of land trusts although they may or may not have shown knowledge of or interest in knowing more about land trusts. They placed importance on regulating urban or residential development. Some identified more specific areas in need of conservation. Like theme 3 respondents, they expressed interest in research and provided extensive answers. Theme 4 respondents did show an interest in altering stream direction and shorelines - which may have been related to their ideas of land management and/or conservation. All respondents were found in or near urban areas. The average parcel size in theme 4 was 0.82 ha with a standard deviation of 0.88 ha. Parcels ranged in size from 0.1 to 2.65 ha. Theme 4 parcels did not have a clustered spatial dispersion.

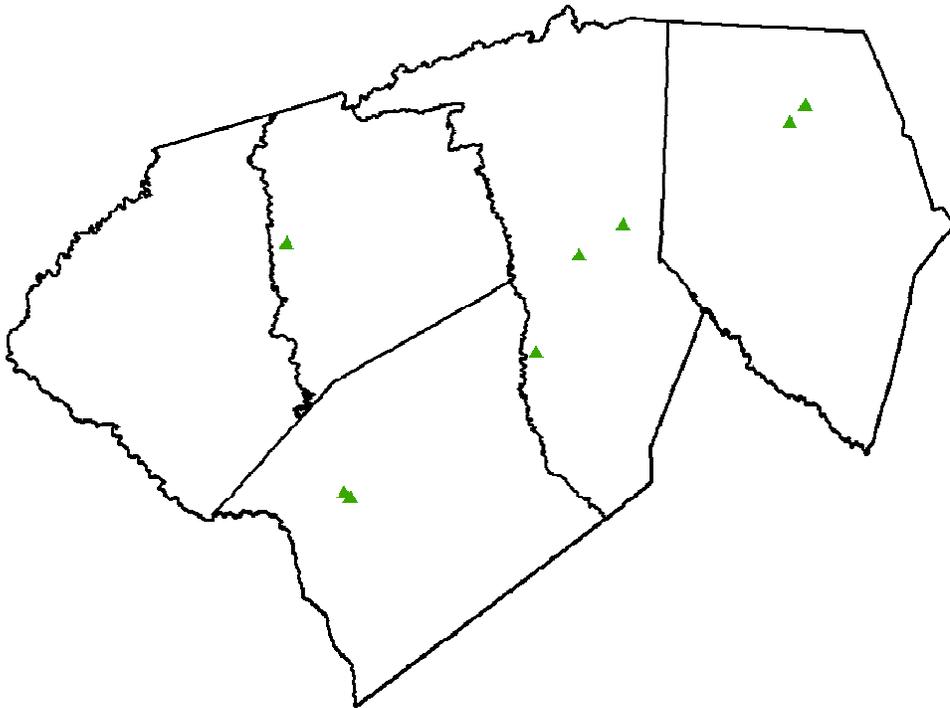


Figure 2.6 Landowners qualifying as theme 4

Theme 5 respondents (N = 4) expressed great interest in protecting property rights, seeing conservation by land trusts and conservation in general as violation of property rights. With this they made no distinction between land trusts and government. Distrust and contempt was expressed for both land trusts and government. One theme 5 respondent referred to conservation minded people as “enviro-wackos.” Another, when asked if they wished to know more about land trusts, said “Everyone trying to tell the property owners what they can do on their property - Bug Off.” Subjects also showed anger and questioned the ultimate purpose of the research. They were less extensive in their answers and skipped more than other responders. One made it impossible to identify spatial coordinates by removing the attached identification number despite assurance that name and specific parcel information would not be revealed in research. The average parcel size in theme 5 was 0.32 ha with a standard deviation of 0.11 ha. Parcels ranged in size from 0.19 to 0.46 ha. Theme 5 parcels had a random spatial dispersion.

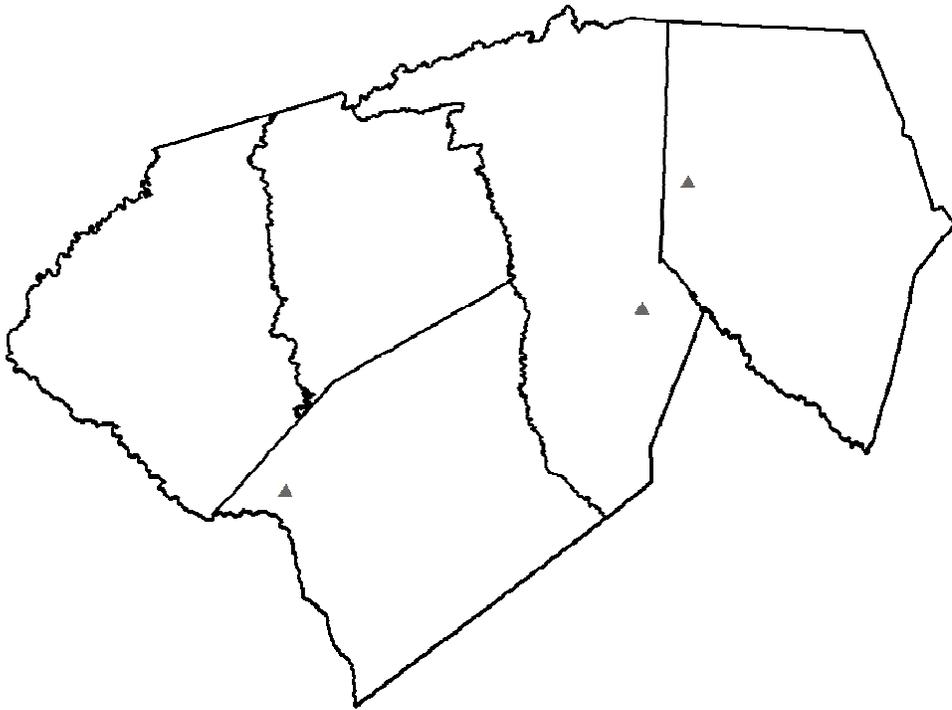


Figure 2.7 Landowners qualifying as theme 5

Theme 6 consisted of a single respondent, owning a 4.84 ha parcel, who expressed a fear of nature especially wildlife and streams. Despite this, the respondent expressed a value in the aesthetics of their natural surroundings. Safety, especially for children was a major issue

conflicting with interest in conserving land, especially aquatic areas.

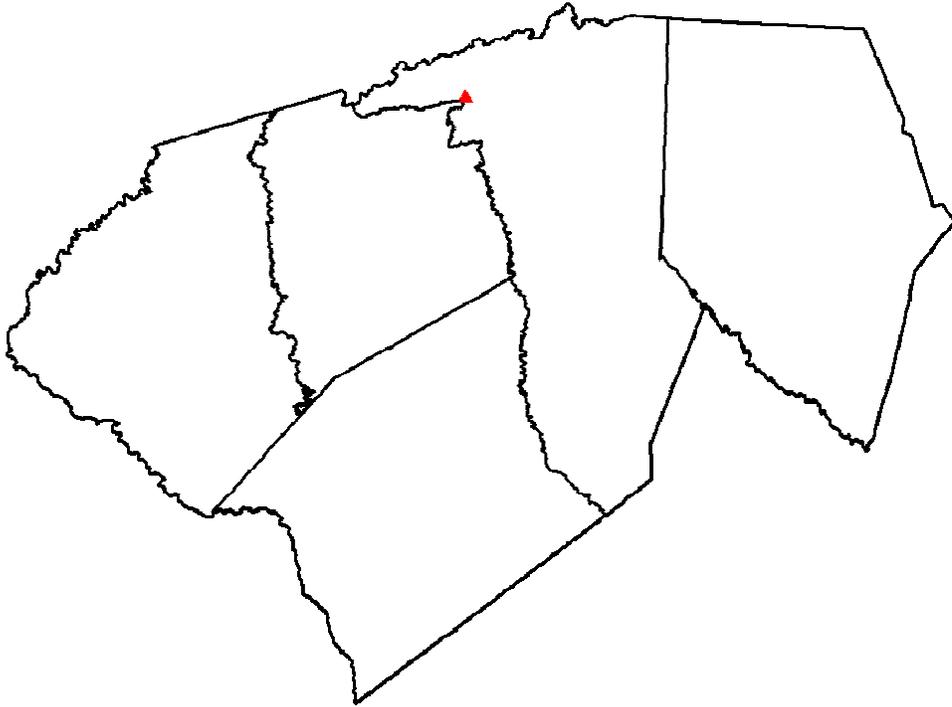


Figure 2.8 Landowner qualifying as theme 6

Qualitative-Quantitative Relations

LSD t-tests showed no significant differences for KLT or TN in any themes. There were no significant differences among themes 1-4 or between themes 5 and 6 for both WC and WPA. Therefore significant differences were shown between the group of themes 1-4 and the remaining two themes, 5 and 6, for both WC and WPA.

DISCUSSION

Quantitative Results

Our study identified a number of social and spatial qualities that appear to be related to private individual or family landowners' attitudes broadly toward conservation through land trusts and particularly toward conservation of aquatic areas. Social qualities included the level of value landowners' placed on aquatic area wildlife, likelihood they would sell property to a non-

family member, likelihood they would leave property to a land trust in a reserved life estate, and their knowledge of land trusts operating statewide. Spatial qualities included species richness, parcel size, and distance from public protected areas. Our research supports the suggestion by Hilty and Merlender (2003), Dutcher et al. (2004), Ryan et al. (2004), and Merlender et al. (2004) that more communication and cooperation between researchers, local institutions like land trusts, and private landowners are needed to ease concerns that private landowners have about voluntary conservation. Our research in particular points to a need for greater education and outreach to private landowners in the southern Appalachian and Piedmont ecoregions, about the need for and benefits of private lands conservation efforts for aquatic systems. This would include the functions of aquatic systems and the tax and personal benefits landowners obtain from voluntary conservation.

Our results for WC indicate that a landowner's willingness to use land trust methods to conserve their parcel increases with their valuing of wildlife that depend on aquatic areas, the animal species richness for the area in which their parcel occurs, and the likelihood they will sell the property to a non-family member. Their willingness to conserve decreased with a compound variable of the importance they place on protecting aquatic areas in the Piedmont and Blue Ridge of South Carolina and the animal species richness.

The coefficients for Q16 and Richness led us to conclude that persons who highly value wildlife in aquatic areas and own more land with greater species diversity are more likely to conserve. This may be good news for land trusts with objectives to protect biodiversity, especially as it relates to aquatic areas. These land trusts could expect a possible greater cooperation from owners of lands with high conservation value. We inferred from the coefficient for the variable Q21.1 that landowners who view their property as an investment may be more

willing to use the options of conservation through land trusts. This, perhaps, could be due to tax incentives for lands protected by conservation easements; it could also have to do with the option to sell or trade the property to a land trust. This is consistent with the theme in shifting demographics from interest in charity to investment, regarding conservation easements (McLaughlin 2002; Small 2003; Rissman et al. 2007; Janota and Broussard 2008). The results could give more reason for land trusts to support education on the importance of species richness and the relation between aquatic areas and biodiversity.

With our results for TN we inferred that a landowner's tendency to use non-conservation options seems to not be an inverse of their willingness to use conservation options. That is, even though a landowner may be willing to conserve their parcel, they may also be likely to choose an option that is non-conserving; or that a landowner is not less willing to conserve due to their tendency to choose non-conserving options.

The formula suggests that a landowner is less likely to take these non-conserving options when the parcel is larger. Land trusts typically aim to protect larger parcels not only for conservation objectives but because it takes nearly as much time and effort to protect a smaller parcel as one that is much larger (Strager and Rosenberger 2007). To be most productive, land trusts may already have an outreach to larger landowners. Results may also suggest that large landowners are already at least less likely to use these non-conservation options.

Tendency to use non-conservation options and willingness to conserve are not inversely related suggesting that they are in fact positively correlated. A landowner with a higher willingness or tendency to conserve could be just as likely to not conserve. This could be valuable information for land trusts to use in approaching owners of large parcels. There is evidence to conclude that land trusts should be proactive in talking to owners of larger parcels.

They may wish to focus more on benefits of conservation strategies and less on the pitfalls of non-conservation decisions.

Our results for KLT would suggest that if a landowner has at least some knowledge of at least one statewide-operating land trust, their general knowledge of the function of land trusts and their conservation methods is higher than that of those who do not know of such organizations. This would suggest that being familiar with a statewide land trust may have a greater influence on a landowner's knowledge of land trusts than knowing of national or regional land trusts. The problem is that there is no statewide operating land trust in South Carolina (http://findalandtrust.org/states/south%20carolina45/land_trusts#statewide), only local and nationwide land trusts. This suggests confusion as to where certain land trusts operate. Local land trusts may have been thought of as statewide while not actually being so. Such local land trusts include Community Open Land Trust, Naturaland Trust, and Upstate Forever. All of these operate regionally in South Carolina rather than statewide. They also work in larger areas than a specific town, watershed, or county. This may be responsible for confusion between the words "local" and "statewide".

The positive correlation between knowledge of land trusts and familiarity with statewide land trusts could possibly show that landowners typically understand a certain land trust as statewide even if that is not the case. Local/regional and nationwide operating land trusts may take this as an indication for a need for outreach explaining their objectives, express the importance of biodiversity, and to increase cooperation between their institution and private landowners (Hilty 2003). They could also cooperate more with statewide trusts in large projects. There is still the possibility that landowners are confused on which land trusts are actually

statewide and which are not. There is the possibility that landowners may have a lack of understanding between land trusts and federal government.

With our results for WPA we inferred that a landowner's willingness to protect aquatic areas is positively correlated with their willingness to leave their land to a Land Trust through a reserved life estate. The coefficient for distance from protected areas (DPA²) suggests a possible resistance to protecting aquatic areas near areas already protected by government ownership. It also shows a possible curvilinear relationship between their willingness to protect aquatic areas and distance from protected areas. If such were true, landowners near government protected areas would be less willing to protect aquatic areas but willingness would increase with distance from protected areas. At some point this effect may curve and willingness begins to decrease again. This may be due to other spatial or cultural factors that were not foreseen when analyzing the data. These distance relationships only make sense in our study area. The analysis did not include protected areas outside of the study area in other South Carolina counties or bordering states. Land trusts could possibly use this information by emphasizing reserved life estates as an option for those who own lands with aquatic areas to protect, especially those within a reasonable distance from government protected areas. A reserved life estate is when a landowner continues to live on or use a parcel until their death, leaving the parcel to a land trust and therefore gaining full estate tax benefits (Land Trust Alliance 2007). This could be valuable for establishing new or extending protected areas or habitat corridors that are within a certain distance from government protected areas. This relationship may also indicate a need for education on the value of clustered or contiguous habitat.

Qualitative Results

Nearly one third of all respondents were covered by theme 1, showing disinterest in conservation and land use outside of lake-related recreation. This theme shows a potential “swing-group” of landowners who have no strong opinion of conservation, in either a positive or negative light. This group of landowners may be open to education and outreach on the benefits of conservation of land aquatic areas.

Theme 2 respondents had shown interests in government policies to conserve aquatic areas. From theme 2, land trusts could infer that there may be a need for outreach involving education on the benefits of land trust parcels acting as buffers and greenways protecting water. This may be of value to trusts with at least part of their objectives involving greenspace in urban areas, highway corridors, and suburban development areas surrounding reservoirs. This theme may also be of value to land trusts working in cooperation with city planning committees for this same reason. Such land trusts and planning committees could try further research to explain the extent in numbers and details of attitudes in this theme. If there is not a recognizable resistance to government it may be useful to make contacts through other non-regulatory local organizations like the county cooperative extension offices (Huntsinger et al. 1997; Wallace et al. 2003).

Theme 3 represents a potential demographic that land trusts are not reaching. These landowners have “working landscapes”, the very sort that land trusts see important as buffers for existing nature reserves (Rissman et al. 2007). If this is an objective of area land trusts, outreach programs could take a proactive approach in contacting and familiarizing themselves with such landowners. Landowners involved in agriculture and forestry have long been the focus on outreach and education by extension programs at local universities and natural resource government agencies; land trusts could extend these efforts to include education about the

importance of biodiversity conservation. Habron's (2003) conclusion that landowners who desired more information about survey results were more likely to adopt riparian conservation practices may prove to be promising regarding this theme. This theme covering nearly a quarter of respondents suggests a large untapped source for conservation.

Theme 4, although expressing the greatest interest in conservation, may actually hold little land of value to land trusts, especially those trusts seeking large tracts. The interest in altering aquatic areas in this theme may also be a quagmire for trusts expecting to work with such. Although the landowners may show interest in conserving, they may also be persistent on their right to alter the course of streams or shape and vegetation of shorelines. Outreach could help reduce this conflict by educating landowners on the differences between aesthetic improvements and habitat improvements. The attitudes do suggest this theme does have potential for support of land trusts outside of direct land transactions. Such support could include financial donations or volunteer work. One respondent fitting this theme did in fact mention being involved in an outreach program for a local land trust.

Despite the expressed heavily emphasized rejection of conservation, the majority of landowners of theme 5 owned only small parcels (<0.5 ha) and were but a very small proportion of all respondents (6%). These extreme views reflecting concern for property rights and government/academic intrusion into their lives might actually prove to be minor barriers or a detriment to land trust objectives. They are also less of a threat if they are found in mostly urban areas as were these respondents. There is a possibility that more landowners of this attitude exist but did not return surveys for reasons such as distrust of government. This may require further sampling and potentially contacting non-respondents.

Theme 6 shows a conflict with a fear of nature outweighing a landowner's desire to conserve. This theme shows potential barriers to conservation, especially when a landowner ultimately decides whether or not to keep or sell the parcel. The one respondent was only 5.35 kilometers from a government protected area with a parcel size of 4.84 hectares. A parcel such as this could potentially provide connectivity or buffer public protected areas like that described by Rissman et al. (2007) and Wright (1998). If this is a common theme in landowners, land trusts or other organizations may wish to emphasize parental education in outreach programs. There is a risk of a type II error for themes, possibly meaning the proportions are wrong and themes such as 5 and 6 may be larger than respondent numbers show.

Kellert (2005) described nine types, in a typology of values in nature. All but one, symbolic, was represented in the open ended questions; Symbolic is the value of nature as a source of metaphorical and communicative thought. This may have not shown up because of questions not lending themselves well to such expression of values. Future researchers may wish to include topics that allow landowners to express symbolic values they may have. Theme 1 showed aspects of a utilitarian value in some points. This was especially true when the landowners talked of using aquatic areas for recreation which was one of the few uses emphasized in this theme. Theme 2 showed aspects of humanistic, naturalistic, and utilitarian values. Theme 3 had the widest array of values of all themes. It showed aspects of aesthetic, dominionistic, humanistic, moralistic, naturalistic, and utilitarian values. Theme 4 showed aspects of aesthetic, humanistic, naturalistic, and scientific values. Theme 5 showed only a slight aversion to the dominionistic value. Theme 6 showed aspects of two values, aesthetic and negativistic. This suggests that a certain set of values could possibly correlate with specific themes in landowner attitudes and may even help determine these attitudes. Future research in

landowner attitudes could use this typology, creating a system to identify values before coding themes.

Insignificant Variables

The spatial variables of amphibian species richness, distance from wetlands, distance from urban areas, distance from the city of Greenville showed no influence on WC, TN, WPA, or KLT. Only one respondent, mentioning the bullfrog, showed any knowledge of amphibians outside of general categories like “frog” and “salamander”. Only seven respondents mentioned wetlands either generically or specifically. All of these landowners qualified as themes 2, 3, or 4. Land trusts, other conservation organizations, schools, and county extension offices may use this as a suggestion to educate the public on the functions of wetlands and diversity of amphibians.

The fact that distance from urban areas in general and distance from the city of Greenville, SC showed no significance suggests that landowners near cities may have little difference in attitudes from those far from cities. If this is the case for the population of landowners, one could infer that it is possible education, outreach, and extension programs have had no difference in influence from urban to rural areas. Further research would be needed to measure the efficacy of such programs in the region.

Qualitative-Quantitative Relations

Themes 1, 2, 3 and 4 did not show any significant differences among them for WPA and WC. This indicates that themes 1-4 were fairly homogenous in their survey-based measures of willingness to conserve and WPA. There were significant differences between themes 1-4 and the remaining themes, 5 and 6. Themes 1-4 had higher mean scores than themes 5 and 6 for WC. This may suggest more willingness to conserve using land trusts and specifically conserve aquatic areas among themes 1-4. We could infer that it is possible that a single theme 6

landowner, who fears nature, although expressing support for conservation, is less willing to conserve their land but that inference is of course limited by the sample size. WPA, like WC, showed significant differences between the first four themes and the remaining themes, 5 and 6. Themes 1-4 had the highest mean values for WPA while 5 and 6 had the lowest. This suggests a commitment to protect aquatic areas landowners in themes 1-4. The lack of differences in TN and KLT suggests these values have little or no connection to the identified themes. It also means that landowners who associated land trusts with government (theme 5) thought they knew more about land trusts than their qualitative answers had shown.

CHAPTER 3

CONCLUSIONS

Results show that the willingness to conserve is influenced positively by the predicted species richness of the area in which the parcel occurs, the value landowners place on wildlife in aquatic areas, and the likelihood they will sell the land to a non-family member. It is negatively influenced by a compound variable of the level of importance in protecting aquatic areas and the species richness. The willingness to conserve and the tendency not to have a direct relationship. A landowners' tendency to make non-conservation decisions decreases with increasing parcel size. Supposed familiarity with state-wide operating land trusts increases a landowner's knowledge of land trusts and land trust practices. A landowner's willingness to protect aquatic areas is positively correlated with their willingness to leave their land to a Land Trust through a reserved life estate. The willingness to protect aquatic areas rises and then eventually decreases again in a curving relationship with distance from protected areas. Themes showed elements of apathy, interest, rejection, concern, and a sense of connection. Themes 1 and 3, with education, show potential for conservation lands. Themes 2 and 4 showed potential sources of support

outside of land transactions. Themes 5 and 6 show a possible minority resisting or fearing conservation through land trusts. In all instances, outreach and education on the details and benefits of conservation is a potential option for land trusts in the region.

Our research suggests that land trusts should expand education and outreach to encompass the subjects of biodiversity, aquatic ecology, and land planning and how these relate to landowners' objectives. Land trusts should also take distance from protected areas into account when planning where to focus their outreach and aquatic area conservation efforts, perhaps by using our formula for 'Willingness to Protect Aquatic Areas' in combination with spatial data for desired parcels, wildlife corridors, and/or property value.

The need for educating the public is probably not specific to the region but could in fact be an opportunity for land trusts in the greater landscapes including all private lands in South Carolina, the Blue Ridge Mountains and Piedmont, and in the US in general. The values landowners hold are probably not endemic to the area surveyed or the respondents; however since our area does have a long history of anti-government sentiment (dating back to the Civil War and Reconstruction eras) (Edgar 1998), some views we collected may have been extreme relative to national averages. Nonetheless, our results and conclusions could be valuable to land trusts outside of the surveyed area, especially bordering areas such as the remaining South Carolina Upper Piedmont, northern Georgia, and western North Carolina, all of which are encompassed by the same Upper Piedmont and Blue Ridge ecoregions (Ricketts et al. 1999) and have similar social and cultural histories. The willingness to conserve, tendency to do otherwise, knowledge of land trusts, and willingness to protect aquatic areas probably show similar patterns in these adjacent areas. The themes and landowners attitudes to conserving aquatic areas may also be of value to other conservation organizations, planning committees, and government

agencies. Likewise, the methods employed could be extended to sample other areas to test for geographic differences in responses at greater spatial extent.

Our research indicates what drives landowners' attitudes towards land trust conservation and the protection of aquatic areas in a region of the United States with rich aquatic resources and also a strong history of private property rights. In accordance with United States' historic veneration of property rights, the American southeast has one of the least-regulatory environmental-control systems in the world (Cashore and McDermott 2004; Mortimer 2008). A study in the neighboring state, North Carolina, found property rights and independence as important principles for landowners in the upper Piedmont (Daley et al. 2004).

Land trusts should take note: if people perceive land trust activities as impinging upon perceived or real property rights (keeping in mind our respondents with the strongest views held little property) rather than enabling landowners to retain ownership while providing ecological services for society, then land trusts in this and similar regions will likely fail. Overcoming such barriers of perception and understanding may become one of the most important conservation activities in the biologically rich southeastern United States. Studies such as ours may help to bridge these gaps between conservation science and practice. Such investigations bring together social and natural sciences in the hope of identifying interdisciplinary solutions to natural resource conservation problems. This should be incorporated with conservation planning like the already suggested parcel size and budget constraints (Davies et al. 2010). Future research should focus on a more detailed understanding of the reason the largest theme shows a lack of interest in conservation. Other topics should include more detail of landowners' knowledge of land trusts' methods for conservation and an explanation of why certain areas and themes have a lower

response in surveys – is this apathy towards research, towards conservation in general, aquatic areas, a combination of the above, or another as yet unexplained factor?

New land and water conservation projects should be based on the best available natural science: what organisms and ecosystems to protect, where, and when (under climate and land use change scenarios) (Moilanen et al 2009). They should also be based on the best available social science. Such research can help to operationalize a conservation plan hitherto confined to digital space. Moving conservation from maps and models, and published papers, to resilient landscapes in which people live and work depends upon such multidisciplinary efforts which in turn, depend upon knocking down traditional academic barriers to collaboration.

APPENDIX 1

SURVEY INFORMATION LETTER

Information Concerning Participation in a Research Study Clemson University

Landowner Attitudes to Voluntary Conservation of Wetlands and Aquatic Areas in the Upstate of South Carolina

Description of the research and your participation

You are invited to participate in a research study conducted by Samuel Chambers and Elizabeth D. Baldwin. The purpose of this research is to analyze landowner attitudes to the conservation of wetlands and aquatic areas in the Blue Ridge and Piedmont of South Carolina by non-government private conservation groups (e.g. land trusts). Your participation will involve the completion of a survey designed for landowners with wetlands or any aquatic areas on their property.

The amount of time required for your participation will be no more than 15 minutes.

Risks and discomforts

There are no known risks associated with this research.

Potential benefits

There are no known benefits to you that would result from your participation in this research. This research may help us to understand differences of attitudes towards conservation based on general location of land.

Protection of confidentiality

Information used will be publicly available land records and the surveys; both stripped of landowner identification. Your identity will not be revealed in any publication that might result from this study.

Voluntary participation

Your participation in this research study is voluntary. You may choose not to participate and you may withdraw your consent to participate at any time. You will not be penalized in any way should you decide not to participate or to withdraw from this study.

Contact information

If you have any questions or concerns about this study or if any problems arise, please contact Elizabeth D. Baldwin at Clemson University at 864.656.5357. If you have any questions or concerns about your rights as a research participant, please contact the Clemson University Office of Research Compliance at 864.656.6460 or toll free at 866.297.3071.

APPENDIX 2

SURVEY

Landowner Survey

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This survey has a mix of multiple choice and open questions. In a trial this survey has taken only 10-15 minutes to complete. It will be used to gain insight about landowners attitudes related to wetlands and or aquatic areas on their property. Your participation is appreciated. All answers are strictly confidential. Thank you.

← Please check this box if you are interested in the survey results for your area.

Please circle yes or no for the following two questions.

1) Do you reside on the property in question?

[YES] [NO]

2) Is any portion of this property leased out?

[YES] [NO]

3) Circle the letter beside the purpose(s) your property serve(s) to you and/or the leaser?

[a] Residential

[b] Agriculture

[c] Timber

[d] Outdoor Recreation

[e] Wildlife Viewing

[f] Hunting/Fishing

[g] Investment

[h] Development

[i] Tourism

[j]other, please specify _____

4) What is your annual income?

[a] Less than \$15,000

[b] \$15,000 – \$24,999

[c] \$25,000 – \$34,999

[d] \$35,000 – \$49,999

[e] \$50,000 – \$74,999

[f] \$75,000 - \$99,999

[g] \$100,000 - \$149,999

[h] \$150,000 or more

5) What is your highest level of education?

[a] Less than high school

- [b] High school diploma or GED
 - [c] Some college/No Degree
 - [d] Associates Degree
 - [e] Bachelor's Degree
 - [f] Master's Degree
 - [g] Doctorate
- 6) What is your age? _____

With the question below, please circle whether you Strongly Agree (SA), Agree (A), Disagree (D), Strongly Disagree (SD), or are Undecided (U).

7) It is important to protect aquatic areas (creeks, ponds, wetlands, etc.) in the Piedmont and Blue Ridge South Carolina.

[SA] [A] [D] [SD] [U]

8) If so, what about the aquatic areas in the Piedmont and Blue Ridge of South Carolina need protection?

9) Circle the letter beside the purpose(s) the aquatic areas (creeks, ponds, wetlands, etc.) and surrounding area on your land serve.

- [a] Wildlife habitat
- [b] Hunting/Fishing
- [c] Recreation
- [d] Aesthetics/Scenery
- [e] Agricultural/livestock runoff
- [f] Agriculture water source
- [g] Livestock water source
- [h] Flood Storage
- [i] No purpose
- [j] Problem

10) Would you wish to get rid of or alter the aquatic area and if so, why?

11) Describe your current and seasonal use(s) of the aquatic areas (creeks, ponds, wetlands, etc.) and property.

12) How do you plan to use the aquatic areas and your property in the future?

13) Do neighbors' views and opinions affect how you use the property and the aquatic areas?
How?

14) What wildlife are you aware of in or near the water on your property?

Fish _____

Birds _____

Amphibians (ex. frog, salamanders) _____

Reptiles (ex. turtles, snakes) _____

Mammals (ex. beavers, mice) _____

Please circle whether you Strongly Agree (SA), Agree (A), Disagree (D), Strongly Disagree (SD), or are Undecided (U).

15) I highly value the aquatic areas on my property.

[SA] [A] [D] [SD] [U]

16) I highly value the wildlife that depend on these aquatic areas.

[SA] [A] [D] [SD] [U]

17) How do the aquatic areas (creeks, ponds, wetlands, etc.) affect your personal value of your property and why?

18) Describe the uses and experiences that you and your family have had on the property, especially related to the water (creeks, ponds, wetlands, etc.) and surrounding area.

19) I am knowledgeable of the functions and purpose of...

- Land Trusts

[SA] [A] [D] [SD] [U]

- Conservation Easements

[SA] [A] [D] [SD] [U]

- Reserved Life Estates

[SA] [A] [D] [SD] [U]

20) Describe the uses and experiences that you and your family have had on the property, especially related to the water (creeks, ponds, wetlands, etc.) and the areas surrounding the water.

21) Regarding the property I will probably...

- Sell as is to non-family member

[SA] [A] [D] [SD] [U]

- Sell as is to family member

[SA] [A] [D] [SD] [U]

- Develop and sell

[SA] [A] [D] [SD] [U]

- Leave in will or give to heirs

[SA] [A] [D] [SD] [U]

- Leave to land trust by reserved life estate

[SA] [A] [D] [SD] [U]

- Protect with conservation easement

[SA] [A] [D] [SD] [U]

- Sale or donate to land trust

[SA] [A] [D] [SD] [U]

22) Do you know of local non-profit organizations that conserve natural areas?

[YES] [NO]

23) Do you know of statewide non-profit organizations that conserve natural areas?

[YES] [NO]

24) Do you know of national non-profit organizations that conserve natural areas?

[YES] [NO]

25) Is your property, particularly the portion containing aquatic areas, already protected by or in the process of being protected by a conservation easement?

[YES] [NO]

26) Are you likely to protect the property with a conservation easement?

[YES] [NO]

27) Are there any factor(s) that would change your choice in the previous question and why?

28) What do you know about Land Trusts and conservation easements? Is there anything you wish you knew about Land Trusts and conservation easements?

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