



Ecosystem Services, Markets, and Red Wolf Habitat: Results from a Farm Operator Survey

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January 2009



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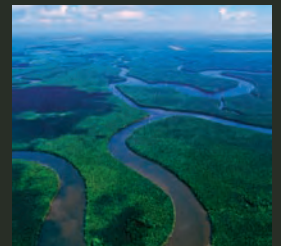
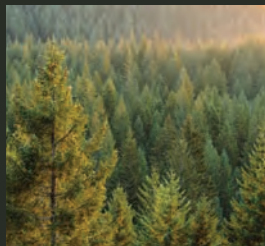


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NI R 09-01

ECOSYSTEM SERVICES SERIES



Ecosystem Services, Markets, and Red Wolf Habitat: Results from a Farm Operator Survey

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ACKNOWLEDGEMENTS

This report presents the findings of Phase 1 of a study titled “Ecosystem Services and Markets Associated with Red Wolf Habitat in North Carolina” funded by the Alex C. Walker Educational and Charitable Foundation, Defenders of Wildlife, and Duke University. The researchers would like to thank Frank Casey, Director of the Conservation Economics Program at Defenders of Wildlife, for his support and advice throughout the project. The researchers would also like to thank other members of the Defenders staff, including Timm Kroeger, Gina Schrader, and Anna McMurray for their comments and suggestions. A number of current and former students in the Nicholas School of the Environment contributed to the success of the survey effort. A five-member student group (Heather Hosterman, Benjamin Landis, Jean Lee, Brianna Menke, and Joshua Schneck) designed and implemented a pilot version of the farm operator survey in spring 2008 for Dr. Kramer’s Social Science Survey Methods course. Other students who provided help with the survey included Jennifer Wallis and Nicholas Hurwit. Zack Brown provided assistance with focus group administration, survey implementation, and econometric analysis. Several members of the Nicholas Institute, namely Leslie Kleczek, Stephanie Evans, Heather Hosterman, Etan Gumerman, and Paul Brantley, assisted in various ways to get the survey mailings out the door. Paul Brantley also provided editorial assistance with the report. Bud Fazio and several of his colleagues at the U.S. Fish and Wildlife Service generously provided their time to explain the USFWS Red Wolf Recovery Program and to give advice on our survey design and implementation. Thanks are also due to a number of individuals with the Farm Services Administration, Natural Resources Conservation Service, and Cooperative Extension Service for answering our questions and providing conservation program information. Several individuals provided insightful comments on early drafts of the survey, including Malcolm Gibbs, Rodney Woolard, and Rufus Croom. We are also indebted to Professors John Loomis and Ada Wossink for insightful comments on an earlier draft of this report. Any remaining shortcomings in our study design are our own. Lastly, the researchers extend their gratitude to the many residents of northeastern North Carolina who donated their time and effort to participate in the survey.

ABBREVIATIONS

CV	Contingent Valuation
NGO	Nongovernmental organization
NRCS	Natural Resources Conservation Service
PES	Payment for Ecosystem Services
RWRP	Red Wolf Recovery Program
USDA	U.S. Department of Agriculture
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
WTA	Willingness to accept

EXECUTIVE SUMMARY

Humans derive a number of benefits from healthy ecosystems, including water purification, flood control, wildlife habitat, and climate regulation. Much of the production of ecosystem services occurs on privately held farm and forest land. This study focuses on ecosystem service markets as a possible means to achieve biodiversity conservation goals on private lands. In particular, it addresses potential financial flows from ecosystem service benefits associated with conserved red wolf habitat in North Carolina. Extinct in the wild by 1980, red wolves were reintroduced by the federal government to the Alligator River National Wildlife Refuge in 1987 and now are found in five northeastern North Carolina counties.

This report is part of a larger project that examines economic values generated by red wolf conservation and explores ways to use market-based incentives to encourage greater conservation effort by private landowners. We report on a survey of 298 farm operators in the red wolf area about their attitudes toward current conservation programs and their interest in participating in future programs oriented toward the provision of ecosystem services. Using focus groups, expert consultations, and several pretesting methods, a mail survey was developed and implemented following Dillman's Tailored Design Method. We find that approximately one-half of farm operators in the study area have participated in conservation payment programs in the past and that they are generally satisfied with their participation experience. While there is a lack of familiarity with ecosystem services terminology, many are interested in participating in future payment-for-ecosystem-services (PES) programs, particularly if the programs emphasize wildlife conservation or water quality. Payment levels are found to be an important factor in decisions to enroll, but so are other program attributes, particularly contract length and program administration type. A PES that is specific to red wolf conservation is not widely supported. A targeted marketing and information campaign could be used to address a lack of familiarity with ecosystem services and markets and promote future sign-ups.

INTRODUCTION

Healthy ecosystems provide a variety of services critical for human and nonhuman life, including air and water purification, flood control, climate regulation, plant pollination, and production of food and fiber. As the impacts of humans on our planet grow, the challenges of maintaining healthy ecosystems continue to grow. As our natural ecosystems have become increasingly altered by human activities, there has been an emerging recognition that natural ecosystems make significant contributions to human well being (Heal 2000). These contributions from nature are increasingly referred to “ecosystem services.” Gretchen Daily defines ecosystem services as “the conditions and processes through which natural ecosystems, and the species that make them up, sustain and fulfill human life” (Daily 1997, p. 3).

Protection, restoration, and management of ecosystem services should be based in part on a better understanding of how humans benefit from ecosystems and how human behavior that affects ecosystems can be modified through markets and other economic incentives (Kramer 2008). Much of the production of ecosystem services occurs on privately held land, in particular, land used for agriculture and forestry (Wossink and Swinton 2007). This implies that efforts to sustain ecosystem services should include a focus on private land managers. This project explores ecosystem service markets as a means to achieve biodiversity conservation goals. More specifically, it deals with the ecosystem service benefits associated with conserved red wolf habitat in North Carolina. Through the Red Wolf Recovery Program (RWRP), the U.S. Fish and Wildlife Service (USFWS) manages the only wild red wolf (*Canis rufus*) population in the world. Extinct in the wild by 1980, red wolves were reintroduced by USFWS to the Alligator River National Wildlife Refuge in North Carolina beginning in 1987. The wild red wolf population is currently estimated at over 100 individuals in 18–22 packs spread across 1.7 million acres in five northeastern North Carolina counties—Hyde, Dare, Tyrrell, Beaufort, and Washington (USFWS 2006). Figure 1 shows the location of the RWRP area and the study area for our survey sample, which includes the five RWRP counties plus adjacent Bertie County used for comparison.

This report is part of a larger project that examines ecosystem services generated by red wolf conservation and explores ways to use market-based incentives to encourage greater conservation effort by private landowners. The first phase of the study was a survey of farm operators in the red wolf program area about their attitudes toward current conservation programs and their interest in participating in future programs oriented toward the provision of ecosystem services. The report describes the survey methods and the results of the survey. We conclude with some implications for the design of programs and markets for ecosystem services.

Figure 1. Map of Study Area



PREVIOUS RESEARCH

Although relatively little research has been conducted on farmers' interest in ecosystem service markets, research on agricultural conservation programs more generally has shed some light on characteristics of landowners that are correlated with program participation. Napier et al. (1995) found that the most likely participants in wetland restoration projects were part-time farmers who already had some wetlands on their lands, had larger farms than average, were less educated on average than other farmers, and placed a higher value on the watershed benefits that wetlands provide. This study, however, also found that many socioeconomic, farm structure, and public policy variables had an ambiguous effect on the likelihood of landowner participation. Other studies have found that the environmental aspects of wetland restoration, as opposed to economic factors, were the strongest motivation for landowners to participate (Chan et al. 1996; Lichtenberg and Zimmerman 1999). In a rather comprehensive study of the factors that motivate restoration and conservation behavior, Pease et al. (1997) found that environmental reasons were more important than financial reasons for the participating landowners. Lambert et al. (2007) examined characteristics of those farmers who were attracted to working-land conservation programs (as opposed to land retirement programs like CRP). They found that smaller farms were more likely to be interested in working-land conservation practices, particularly practices that are not management-intensive. They also found that the provision of expert advice increased the adoption of specialized conservation practices. Zbinden and Lee (2005) examined participation in Costa Rica's payment ecosystem services program that is designed to encourage reforestation, forest conservation, and sustainable forest management activities. They found that farm size, human capital, and information variables were significantly related to participation decisions. They found a disproportionately high representation of large farmers and forest landowners among program participants.

While previous studies have attempted to identify the characteristics of individuals that are correlated with participation in conservation programs, little research has been done on the importance of various program characteristics. Through a series of focus groups, Schnepf (1994) found that the landowners in his sample were concerned about permanent enrollment terms, and that long or permanent enrollment terms may discourage participation. A study of North Carolina farmers used choice-based conjoint analysis to examine farmers' preferences for different conservation program features (Eisen-Hecht 2005; Kramer, Huber, and Eisen-Hecht 2005). Preferences for these attributes were as expected, confirming that landowners prefer to maintain control of their land use options when enrolling in a conservation program. They thus preferred shorter and less restrictive contracts, and more options for harvesting timber and using the enrolled land for recreation. State administration of programs was also preferred over other options such as a federal agency or nongovernmental organization (NGO).

This study builds on the existing literature and attempts to fill gaps in the current knowledge base by uncovering factors that have an important influence on interest in ecosystem service markets. It looks at characteristics of both likely participants and desirable PES program features. It also assesses past experience with conservation programs and knowledge of ecosystem services and markets.

METHODS

Pilot Survey

One of the early steps of the study was a pilot survey designed and implemented by a five-member student group (Heather Hosterman, Benjamin Landis, Jean Lee, Brianna Menke, and Joshua Schneck) at Duke University. The pilot survey was conducted as a class project for Professor Randall Kramer's Social Science Surveys course in Spring 2008. To obtain background information and refine the survey instrument, the students conducted a focus group with staff of the U.S. Fish and Wildlife Service office in Manteo, North Carolina, on March 14, 2008. The final survey was administered by phone to Beaufort County farm operators in March and April. Beaufort County is one of the counties in the USFWS Red Wolf Recovery Program (RWRP). Phone calls to 204 contact numbers yielded 41 completed surveys. Approximately 80% of respondents had participated in conservation programs in the past, with no-till and nutrient management being the most frequent practice employed. About half of respondents indicated they would be willing to participate in a future payment-for-ecosystem-services (PES) program, while one-third were unsure. Many who were uncertain about participating expressed the need for more specific information about potential programs to make a decision. Lastly, when respondents were asked if they would be willing to participate in a conservation payment program associated with red wolves, 66% said "no," 20% said "yes," and 15% said "unsure." The pilot survey revealed the unfamiliarity of ecosystem services and the need for survey respondents to know more about the specific attributes of potential ecosystem service payment programs before answering questions about their potential participation. It also revealed the degree of concern that local landowners have about red wolf conservation. Finally, it showed the difficulty of reaching farm operators by telephone, especially during busy times of farm operations.

Survey Design and Pretesting

Based on results of the pilot study, researchers Kramer and Jenkins undertook the design of a more comprehensive survey to administer to a larger sample of individuals in the red wolf area. As part of this design work, a focus group was held on June 30, 2008 in Columbia, North Carolina (Tyrrell County). Six area landowners/farmers participated in the group; all were white males between the ages of 45 and 70. The focus group participants were recruited by telephone using names provided by area conservation agency personnel. Jenkins served as the focus group moderator.

Four of the participants currently farm, one recently retired from farming, and the other rents to farmers who share his values for promoting wildlife conservation. The main topics of discussion were the local farming experience, government agricultural agencies, local development, conservation payment programs, ecosystem services, and the red wolves. According to the participants, the principal factors driving conservation program participation were personal interests (usually in wildlife) and financial benefit; they were neutral on the question of who would administer a program (i.e., government agency, NGO, or private firm). Although participants were not familiar with the term "ecosystem services," several were familiar with the idea of carbon credits. Participants balked at estimating a payment level for a future PES program that they would be willing to accept because the provided scenario was too nonspecific, lacking concrete details about contract length, whether land would be retired or remain in

production, etc. Regarding red wolves, participants questioned if the species could sustain itself without ongoing intervention from USFWS, particularly given the issue of hybridization with coyotes. The participants were not sure if farmers should receive financial compensation to help red wolves and felt that more information was needed about the relationship between farming activities and red wolf habitat.

Weighing the evidence from the pilot survey and focus groups, we decided to switch from a phone to a mail survey format in order to obtain an adequate response rate from farm operators in the area. Considerable effort went into the design of a series of choice experiments (also known as choice-based conjoint analysis) that would allow the estimation of tradeoffs across contract length, program administrator, and payment level in a payment-for-ecosystem services (PES) program. We also designed a contingent valuation question to estimate willingness to accept payment for providing red wolf habitat on private land. We modified many of the pilot survey questions and added a number of new questions. We also decided to add one county, Bertie, that was adjacent to but outside of the Red Wolf program area. This was done to allow comparison of responses between those inside and outside of the RWRP area.

Once the new mail survey was developed, it was reviewed by several individuals, including those affiliated with Natural Resources Conservation Service (NRCS), U.S. Environmental Protection Agency, North Carolina State Cooperative Extension Service, and Defenders of Wildlife. These expert reviews enabled us to improve the wording of the questions to make them more comprehensible to survey participants. They also provided advice on how to maximize response rates. In July, we conducted a survey pretest through the mail. Fifty surveys were mailed out, and ten were returned. An additional pretest and in-person debriefing was conducted with one Albemarle Peninsula landowner. These pretest efforts enabled us to clarify a number of questions, modify a few answer formats, and improve the survey layout. The final version of the survey is found in the Appendix of this report.

Survey Implementation

After a last round of revisions to finalize the survey, it was printed for mailing to 950 individuals. Mailing lists for each county were obtained from the North Carolina Cooperative Extension Service county offices. The total number of active farmers in the six study area counties was rather small and consequently we employed a nonrandom sampling strategy by using all the contacts on the lists we received. Of the total, 560 were directed to farmers and landowners in the five Red Wolf Program counties and 390 to Bertie County, adjacent to the recovery program counties. Including Bertie County not only increased our sample size, but it also furnished a comparison county that allowed us to administer two treatments of the contingent valuation question. We followed the standard mail survey approach, known as the Tailored Design Method, which meant up to four mail contacts were made with each individual (Dillman 2007).

The first mailing of the survey went out on August 26 and 27, followed by a reminder postcard mailed September 4. A follow-up mailing was sent on September 22 to those who had not yet returned the survey. This mailing consisted of a new cover letter and another copy of the survey. The fourth and final mailing went out October 27. In a bid to maximize responses in the final mailing, we included a financial incentive in the form of a \$2 bill with every cover letter sent to those who had not yet responded. In total, there were 298 usable surveys returned. The adjusted response rate was 50.6% (see Table 1). There was a slightly better response from Red Wolf Program county recipients (51.5%) than from those in the

comparison county, Bertie (49.1%). A leading social survey researcher suggests that for mail surveys in general, response rates of at least 50% are adequate for data analysis (Babbie 1995). The distribution of returned surveys reasonably tracks the distribution of farms in the study area counties according to 2002 Agricultural Census data (see Table A6).

Table 1. Response rate to mail survey by county

	Beaufort	Dare	Hyde	Tyrrell	Washington	5 RWRP Counties	Bertie	Total
Sample	236	2	126	78	118	560	390	950
Usable surveys	80	1	36	37	41	196	102	298
Response rate*	52.7%	50.0%	48.6%	62.0%	44.4%	51.5%	49.1%	50.6%

* Calculated as (number returned / N in sample – [ineligible + unreachable]) x 100. (De Vaus 2000 p. 127)

RESULTS

Descriptive Statistics

In this section, we present descriptive statistics of key variables based on the surveys returned. (Additional tables and figures are found in the Appendix.) Summary information on key demographic variables is reported in Table 2 and is based on 293 surveys. Nearly all respondents (92%) are male and the mean age is 60. Most are long-term residents of the area and most have a private individual ownership structure for their farm. A little over one-third have off-farm employment. The most common income class that was selected by respondents was \$60,000–\$79,999.

Table 2. Demographics

	Gender	Age	Education	Yrs lived in resident county	Ownership structure	Working off-farm	Household Income
Question #	39	40	41	43	44	45	46
Stat	94% male	60 yrs (mean)	high school (mode)	51 yrs	78% private individual	36% of respondents	\$60–\$80K (mode)

Information about land management is summarized in Table 3. On average, the respondents’ families have been farming for 75 years in the area. More than nine in ten respondents own at least some of the land they are operating. There is a mix of tenure arrangements, with 42% leasing out at least some of their land and 53% renting land. The respondents express uncertainty about the involvement of the next generation of their family in farming.

Table 3. Land management

	Yrs personally farmed	Yrs family has farmed in area	Believe next generation will farm	Own land	Lease out land	Rent land
Question #	1	2	3	4	5	6
Stat	30 (mean)	75 (mean)	Yes 38% No 29% Don’t know 33%	92%	42%	53%

The respondents report that on average, they derive 46% of their income from land-based activities (Table 4). Not surprisingly, over 80% indicate that agriculture is the primary land use of their property. Corn, soybeans, and cotton are the highest-value crops produced by the respondents. The median number of

acres in crop production was 180. Statistics presented in Tables 2, 3, and 4 from our sample are quite similar to the population of farmers in the counties based on 2002 Agricultural Census data (see Table A7). For example, the percentage of farms with cropland was 84% in our sample, and ranged from 78% to 100% across the counties in the Census data. The sampled farmers were slightly older, but otherwise comparable to the 2002 Ag Census population statistics. These statistics also show that farmers in the comparison county Bertie are similar to farmers in the RWRP counties.

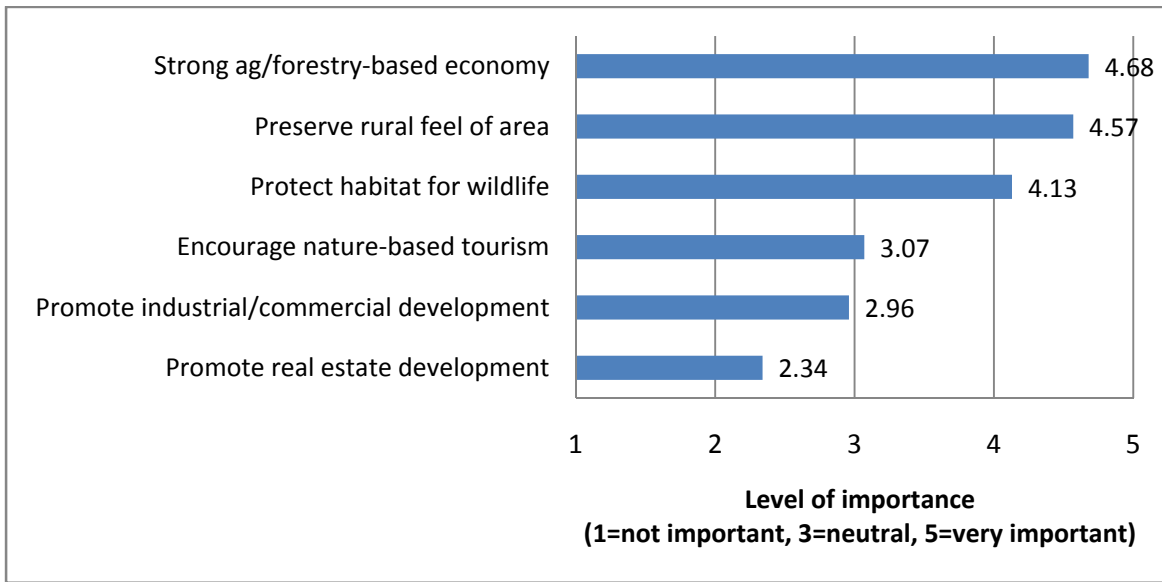
Table 4. Land management (continued)

	% HH income from land	Acres in crop production	Primary use of land	Highest-value commodities produced	% w/ acres in permanent easement
Question #	7	8	9	10	11
Stat	46% (mean)	777 (mean) 180 (median)	84% agriculture	Corn 35% Soybeans 16% Cotton 14%	7% (mean)

We also elicited respondents’ opinions on local development priorities (Figure 2). Respondents felt that the following were either important or very important priorities: a strong agriculture- and forestry-based economy, a preserved rural feel, and protection of wildlife. Respondents were relatively neutral about encouraging nature-based tourism and promoting industrial and commercial development in the area. They were disinclined to promote real estate development in the area.

A number of questions on the survey related to current and past participation in conservation programs. Results for selected questions on conservation programs are reported in Table 5. About one-half of the land operators said they had participated in conservation programs in the past and one-third indicated that they are current participants. When asked about their levels of satisfaction with different conservation programs, respondents rated the North Carolina Cost Share Program the highest (3.95 on a 5-point scale) (Table A3 in the Appendix). They rated no-till as their favorite conservation practice, followed by wildlife food plots and nutrient management (Table A4).

Figure 2. Local development priorities (Q20)



Question 30 asked: If there were a conservation program that offered you a payment for improving the quantity and/or quality of ecosystem services your land provides, would you consider participating in such a program?

There was a positive reaction to such a program with 63% saying “yes,” and only 7% saying “no.” Clearly there is a lot of uncertainty about this new type of program as indicated by the 30% who responded “don’t know.” When asked about the relative importance of attributes of future conservation programs, payment level was scored most highly (4.33 on a 5-point scale), followed by contract length (4.14) and program administration type (3.81).

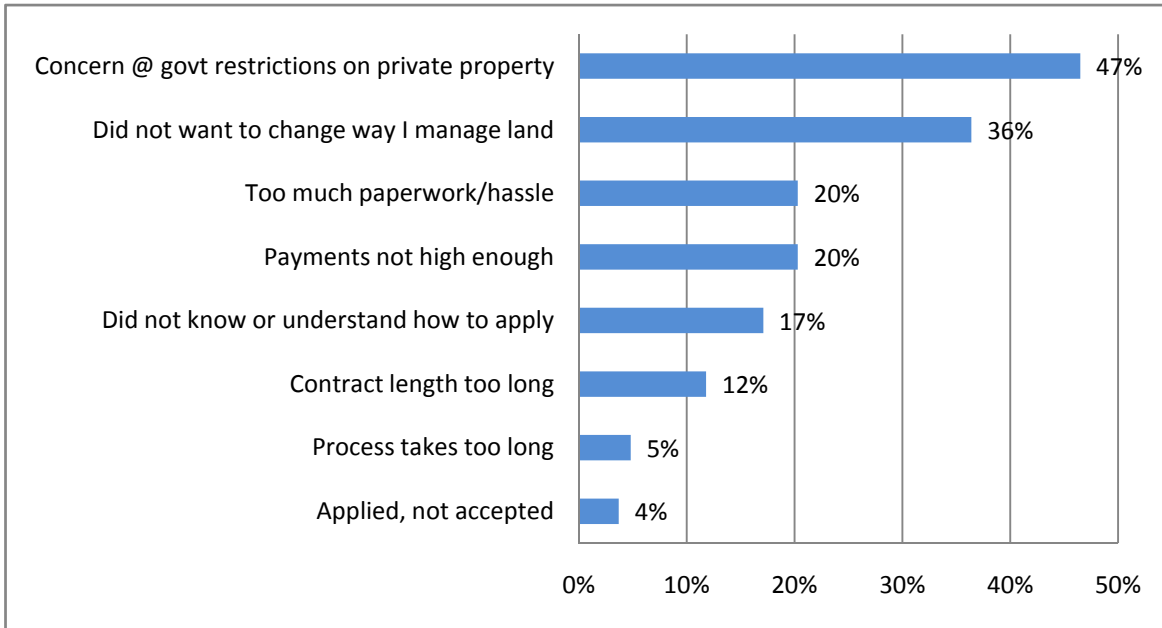
Table 5. Conservation program participation—past, current, and potential

Question #	<i>Past</i>	<i>Current</i>	Would consider participating in PES	Q33. Importance of program attributes (scale of 1 to 5)		
	participation in conservation program	participation in conservation program		Contract length	Program administration	Payment level
22	23	30	63% Yes 7% No 30% Don’t know	4.14 (mean)	3.81 (mean)	4.33 (mean)

We also asked nonparticipants about reasons for not participating in conservation payment programs currently or in the past (Figure 3). The most often mentioned reason for not participating was “concern about government restriction on private property,” cited by 47% of respondents. Other leading reasons for

not enrolling were “Did not want to change the way I manage my land” (36%), “too much paperwork/general hassle” (20%), and “payments not high enough” (20%).

Figure 3. Reasons respondents chose not to enroll in a conservation program (Q24)



For those respondents who had participated in conservation programs we asked what they like about the program (Figure 4). Approximately half of those who had been in a program liked the fact that the program “promotes wildlife” and “promotes soil conservation,” while 46% were pleased that conservation programs “provide another source of income” and leads to “less farm runoff.”

Figure 4. Aspects of conservation programs respondents liked (Q26)

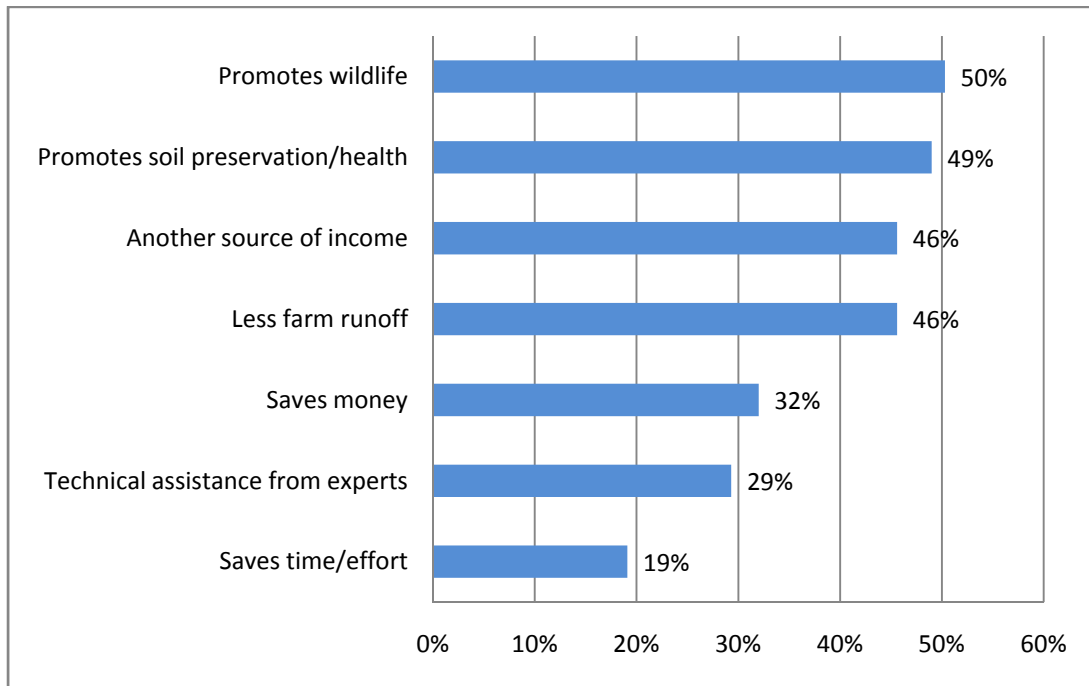
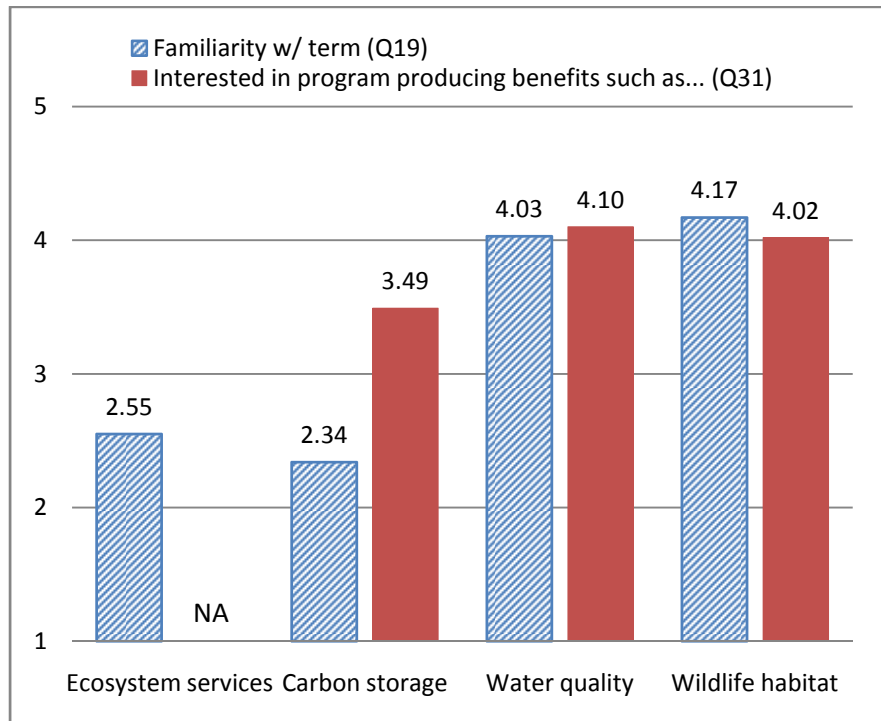


Figure 5 reports the responses to two of the key questions that were posed about ecosystem services. Question 19 asked respondents about their degree of familiarity with the term “ecosystem services” and several more conventional terms for specific ecosystem services (using a scale of 1 to 5, with 5 indicating “very familiar”). Respondents were much less familiar with the term “ecosystem services” (mean of 2.55) than they were with “water quality” (mean of 4.03) and “wildlife habitat” (mean of 4.17), both of which have been part of the farm conservation lexicon for decades. Respondents were also rather unfamiliar with “carbon storage” (mean of 2.34). This familiarity with individual services was related to their interest in programs that produce particular services. They would be most interested in ecosystem service programs for water quality (4.10) and wildlife habitat (4.02), followed by carbon storage (3.49).

Figure 5. Ecosystem services



Both an opinion question and a contingent valuation (CV) question were used to gauge farm operators' interest in enrolling in a PES for habitat protection. The wording of these questions is found in Box 1. Because some of our respondents were in Bertie County, which is outside of the Red Wolf Program area, a different version of the two questions was posed that substituted "wildlife" for "red wolf." This alternate form of the wording allowed us to test respondent sensitivity to wolf conservation given the controversy that surrounds the Red Wolf Recovery Program.

Box 1. Opinion question and contingent valuation question on a PES program for red wolf habitat*

35. Currently, organizations interested in ensuring the red wolf survives in the wild are considering how to enlist the help of landowners and managers. For example, these organizations recognize the important role that private landowners play in wildlife conservation and are considering the creation of voluntary programs in which landowners could receive payments to apply conservation practices that improve habitat for the red wolf population. What is your initial reaction to such a program?

(Please circle the number that most closely matches your response)

Strongly oppose		Neutral			Strongly favor	Don't know
1	2	3	4	5		X

36. Suppose there was a program that consisted of planting strips of natural cover (shrubs and grasses) along the edges of large crop fields. These strips would increase the amount of prey available to wolves as well as provide them corridors to travel to other areas with natural cover. The hypothetical program would be administered by the USDA, have a contract length of 10 years, and would involve a small percentage of your working land.

If this program paid you \$_____ per acre per year (for 10 years), would you be willing to participate in it?

- Yes [SKIP TO QUESTION 38]
- No
- Don't know

*NOTE: This version of these two questions was sent to Red Wolf Program county residents, whereas the alternate version sent to Bertie County residents was the same except that the terms “red wolf” and “wolves” were substituted by “wildlife” throughout.

The CV question elicited respondents’ willingness to participate in a program benefiting red wolves/wildlife given a specific payment level. This payment level was randomly varied across participants at \$60, \$120, \$185, and \$250. Each participant was offered one payment level.

The responses to opinion question 35 indicate that respondents were generally favorable about a PES for generic wildlife, but when the wording changed to “red wolf,” the overall view of the program was negative (Table 6) (mean of 4.0 vs. 2.01). This divergence of views is borne out in responses to the contingent valuation question as well. Only 13% of respondents said they would participate in a red wolf–related conservation program (across the different payment levels), while 45% of the Bertie County respondents said they would participate in a generic wildlife conservation payments program. The mean willingness-to-accept (WTA) to participate in such a program was \$202 in the Red Wolf Program

counties and \$36 in the comparison Bertie County.¹ This means that on average, it would require a much higher payment to attract farmers into a red wolf-oriented payments program than a more general wildlife program. These differences across counties are striking and are discussed in more detail later in this report.

A follow-up question showed that those who would choose not to enroll in the habitat conservation PES had two primary reasons: “concern about government restriction on private property” and “do not want to change the way I manage my land.” In addition, 50% of those in the RWRP counties cited “do not wish to help red wolf population” as a reason for not participating (Table 7A).

Table 6. Payment program for red wolf habitat conservation

	35. Reaction to potential program w/ payments for red wolf/wildlife habitat (scale of 1 to 5: 1 = strongly oppose; 5 = strongly favor)	36. Willing to participate in program that benefits red wolves/wildlife			Mean Willingness-to-Accept (WTA) to participate in program (using “Yes”/“No” responses)
	Mean	Yes	No	Don't know	
RWRP counties	2.01 (n = 165)	13.0%	56.8%	30.3%	\$201.89* (n = 126)
Bertie	4.00 (n = 85)	45.5%	9.1%	45.5%	\$35.99* (n = 43)

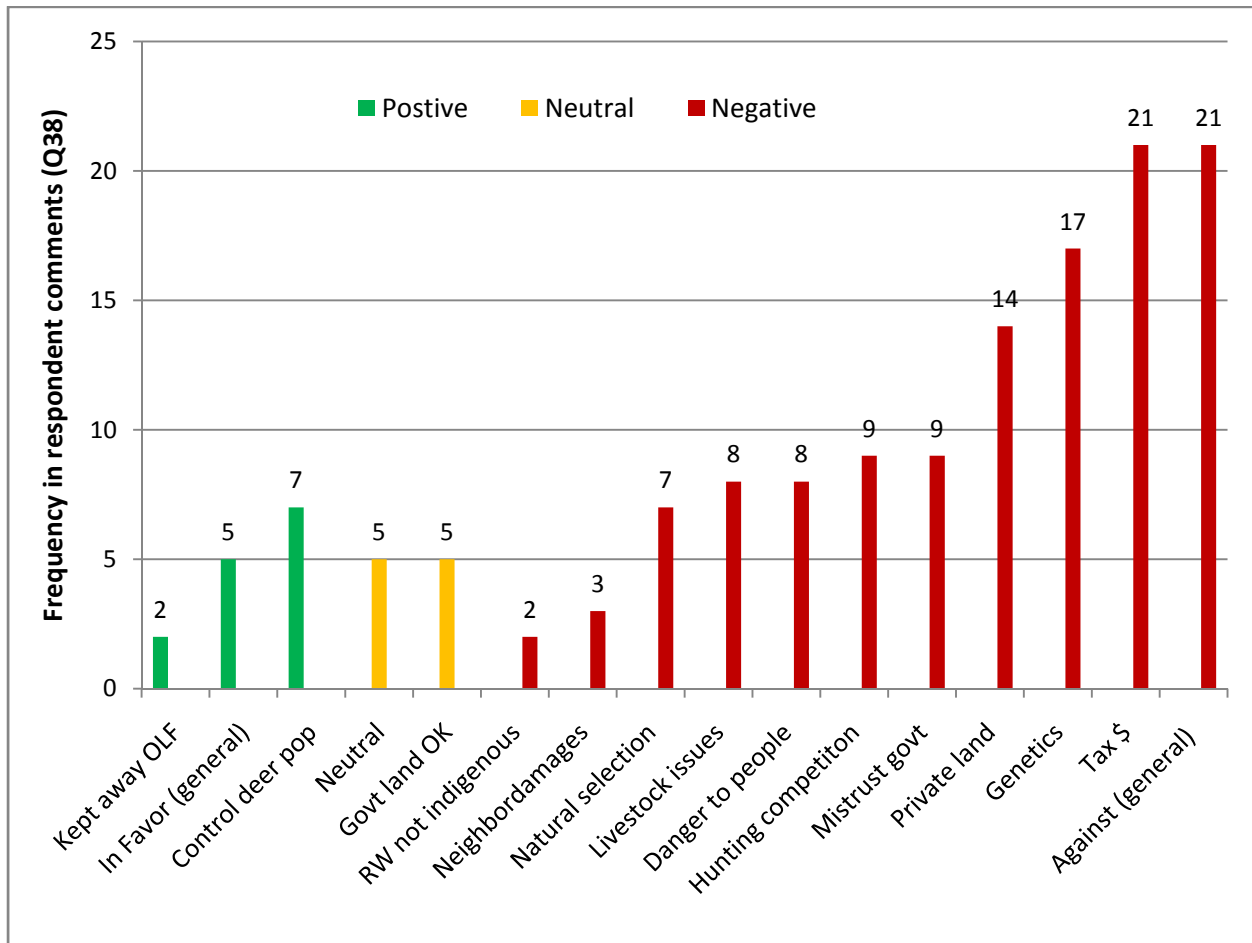
*t-test shows values to be statistically different with $p < 0.005$

Written Comments

Survey respondents in the RWRP counties were provided an opportunity to provide written comments “on the efforts to promote red wolves” (question 38). Comments were provided by nearly 52% of the respondents, some including more than one comment. The 143 handwritten comments were classified by the researchers into 16 categories as shown in Figure 6. The vast majority of the comments (119) were negative with the most frequently mentioned objections related to the use of tax money, the impact on private land, and genetic integrity of the red wolf population. Of the 24 neutral or positive comments, the most frequent comment related to the control of deer populations. Box 3 contains a brief selection of written responses to Question 38 given by survey respondents from RWRP counties.

¹ We appreciate the assistance of Zack Brown who calculated the WTA estimates using a Turnbull nonparametric estimator that was programmed in MATLAB.

Figure 6. Categorization of comments by respondents from red wolf counties



Box 2. Selected comments by survey respondents regarding red wolf conservation

“Because I had to replant 25+ acres of soybeans due to deer predation in 2008, I would welcome hungry wolves.”

“There’s sufficient land for red wolves and [it’s] unnecessary to burden landowners with the responsibility to provide land for the wolves.”

“The wolves that were introduced in 1987 are not true genetic red wolves. They create a danger to people, pets, livestock, and other wildlife. This program has cost taxpayers unreal money.”

“I am in favor of wildlife and natural resource conservation in general. The red wolf is a beautiful animal and I enjoy seeing them now and then when I happen to come across one just as I would any other wild animal. The problem I see is the cost and sustainability of this program because of the problem of breeding with coyotes ...”

“Program is completely worthless, bad for cattle, will shoot them.”

“Any red wolf program would need to be balanced relative to other wildlife.”

Econometric Models

In this section, we report results from two econometric models applied to two types of stated preference questions—contingent valuation (CV) and choice-based conjoint analysis. Both methods are widely used in the environmental economics literature to assign economic values to environmental goods. CV survey questions are used to ask individuals whether or not they would be willing to pay or willing to accept a specific dollar value for a change in an environmental good. A probit regression analysis of the yes/no responses to CV questions can identify socioeconomic and attitudinal variables that are correlated with those responses (Boyle 2003). In conjoint analysis questions, respondents are given alternative versions of a good described by several attributes and are then asked to select the most preferred option. A conditional logit model can be used to assess how the selection among alternatives is affected by the characteristics of the alternatives that vary across survey takers (Alberini et al. 2007). Model output reveals marginal tradeoffs in dollar terms between the good’s attributes. Both types of questions and analyses were applied in the current study.

Econometric Evaluation of the Contingent Valuation Responses

Additional analysis of the CV responses was accomplished through an econometric evaluation that is reported in Table 7. A probit regression model was used to regress respondents’ replies to the contingent valuation question against a series of explanatory variables to uncover factors that had a significant influence on their willingness to participate.

Several factors found to have a positive, statistically significant influence (at the 5% level) on respondents’ willingness to enroll in a PES program for habitat conservation were:

- the offered payment level
- current participation in one or more conservation programs
- support for wildlife protection as a development priority
- whether the respondent has off-farm employment
- education (at the 10% significance level)

These results lend support to the notion that respondents gave thoughtful answers to the contingent valuation question. For instance, it was logical to expect that respondents who were offered a higher payment level would be more likely to say they would enroll in a PES program. Similarly, those who were already participating in conservation programs were predisposed to participate in a PES, as were those who expressed a high opinion of the importance of wildlife protection as a priority for their area. Those with off-farm employment, and hence less dependent on farm income, were more likely to say they would participate in the program as would those with higher education levels.

Table 7. Probit analysis of potential enrollment in red wolf/generic wildlife PES program

Variable	Coefficient	z value	P > z
Would enroll in program (dependent)			
Ln (CV bids)	0.624**	2.220	0.027
RW county	-2.680***	-5.470	0.000
Currently enrolled in program	1.753***	4.450	0.000
Habitat, as development priority	1.633***	3.140	0.002
Acres, cropland	0.000	-1.230	0.220
Acres, natural forest	-0.004***	-3.270	0.001
Years farmed	0.018	1.310	0.191
Education	0.234*	1.800	0.072
Work off-farm	0.898**	2.450	0.014
Ln (income)	-0.133	-0.490	0.627
Constant	-3.336	-1.060	0.288
Number of Obs	142		
LR chi2(10)	100.74		
Log likelihood	-42.908		
Pseudo R2	0.540		

***Significant at 1% level; **Sig. at 5% level; *Sig. at 10% level

Two factors were shown to have a negative, statistically significant influence (at the 5% level) on respondents' interest in participating in a PES program:

- they reside in a Red Wolf Program county
- the percentage of natural forest on their property

Here we found further evidence that farm operators are less interested in a PES habitat program if red wolves are mentioned as the target species. We also found that those who have a greater proportion of natural forest on their property are less likely to say they would participate, perhaps because they feel they already have enough land devoted to habitat conservation.

Econometric Evaluation of the Conjoint Analysis Responses

Recall that the conjoint analysis questions asked respondents to compare alternative version of potential Farm Bill related PES programs (that are not tied specifically to wildlife conservation). To keep the choice questions as simple as possible for the mail survey format, we used only three attributes—contract length, program administration, and payment level—to characterize the hypothetical conservation programs. The descriptions and levels of those attributes are found in Table 8. Each respondent was asked to answer five choice questions; see Box 3 for an example of a choice question.

Table 8. PES program attribute descriptions and levels used in conjoint analysis

Attributes	Description	Levels
Contract length	Amount of time that land can be enrolled in conservation program	5, 15, 30 years
Program administration	Organization that would administer conservation program	Federal agency State agency Conservation organization Private company
Payment level	Rental payment per acre per year for enrolling land in program	\$40, \$75, \$140, \$225

Analysis of the conjoint data was conducted using a conditional logit model with fixed effects (Table 9). This model examined the influence that program attributes and their levels have on the respondents' selection between two hypothetical conservation programs (A or B) and the status quo (i.e., neither program). Additionally, it evaluates other factors that had a significant effect on respondents' choice of the status quo over a hypothetical program.

The "status quo" variable is a dummy variable indicating that a respondent selected "Neither" in the choice question. The lack of statistical significance for the "status quo" variable indicates that respondents were not more likely to choose the status quo over Program A or B. This finding demonstrates that respondents were relatively indifferent between the status quo and the hypothetical programs, neither strongly seeking nor avoiding change.

Payment level was the only variable that had a positive, statistically significant influence (at the 1% level) on respondents' program choices. As would be expected, the higher the payment level associated with a program, the more likely a respondent would be to select that program.

Several factors found to have a negative, statistically significant influence (at the 5% level) on respondents' selection of potential PES programs were:

- the contract length
- program administration by a conservation organization
- program administration by a private company (at the 10% level)

Respondents showed a preference for shorter contract lengths; as the contract length of a potential program increased, respondents were less inclined to select that program. This suggests that many respondents may be uncomfortable with the idea of entering into long-term program contracts. In this regression analysis, program administration by a state agency served as the baseline to which other institutions were compared. Respondents were statistically less likely to opt for programs administered by

a private company or a conservation organization than a state agency. This finding may reveal a distrust of or unfamiliarity with companies or conservation NGOs.

Box 3. An example of a choice question from the survey questionnaire

CHOICE 1

Program Features	Program A	Program B	Neither
Contract length	30 years	15 years	
Program administration	Conservation organization	State agency	
Payment level (per acre per year)	\$140	\$40	

I would choose . . .
(check only ONE)

To assess the influence of socioeconomic factors on respondents’ choice decisions, those variables were interacted with the status quo (SQ) variable because they cannot enter the model on their own since they do not change over choice occasions (Louviere et al. 2000). Variables that were shown to have a positive, statistically significant influence (at the 5% level) on respondents’ selection of the status quo were the age and household income of the survey respondent. Older respondents may be less willing to change the way they have managed their land, and more affluent ones may not feel the need to consider a change.

Education level and current participation in one or more conservation programs were the variables shown to have a negative, statistically significant influence (at the 1% level) on respondents’ choice of the status quo. More educated respondents were less likely to elect the status quo option, perhaps owing to a greater understanding or familiarity with the benefits of conservation programs. Not surprisingly, those currently enrolled in a conservation program were more inclined to choose the program options than the status quo. This may be due to their familiarity and satisfaction with programs they are enrolled in. This may also reflect the influence of a stronger conservation ethic that predisposes some individuals to consider enrollment in such programs.

Table 9 also contains the marginal values of program attributes, which are calculated by dividing the negative of the coefficient on each attribute by the coefficient on the price variable, in this case “payment level” (Alberini et al. 2007). For contract length, its marginal value indicates that respondents would need to be compensated \$7.41 per acre per year for each additional year that the contract entails. Given that state agency is the preferred option for program administration, the reported marginal values show that

respondents would require higher payment levels if a federal agency, private company, or conservation organization were to administer the hypothetical program. Conservation organization is the least preferred option, obliging additional compensation of \$31.55 per acre per year.

Table 9. Conditional logit model of responses to the choice questions

Variable	Coefficient	z value	P > z	Marginal value
Conjoint responses (dependent)				
Status quo (SQ)	-0.468	-0.77	0.444	
Contract length	-0.080***	-12.83	0.000	\$7.41
Federal agency	-0.108	-0.67	0.503	\$10.06 [^]
Conservation organization	-0.339**	-2.16	0.031	\$31.55
Private company	-0.262*	-1.65	0.100	\$24.44
Payment level	0.011***	13.00	0.000	
SQ * Age	0.019**	2.32	0.020	
SQ * Education	-0.259***	-3.87	0.000	
SQ * Currently enrolled in program	-1.281***	-6.36	0.000	
SQ * % income from land	0.0036	1.39	0.165	
SQ * Income (\$000)	.0021*	1.89	0.059	
Number of Obs	2664			
LR chi2(11)	468.060			
Log likelihood	-1174.701			
Pseudo R2	0.166			

*** Significant at 1% level; ** Sig. at 5% level; * Sig. at 10% level

[^] The effect of federal agency was not found to be statistically different from that of a state agency.

DISCUSSION

Our survey has shed light on knowledge and attitudes about ecosystem service markets and payment programs. While restricted in geographic scope to a particular region of North Carolina, the findings may help in the design of PES programs more generally. Some of the main survey findings follow:

(1) Area land operators are strongly interested in PES-type programs, especially those related to water quality and wildlife habitat.

Nearly two-thirds of respondents indicated that they were potentially interested in a PES program, which is higher than the percentage that has participated in conservation programs in the past. Farm operators were particularly interested in PES for water quality enhancement and wildlife habitat provision. Coupled with a generally favorable view of current conservation programs, this suggests fertile ground for developing markets and other payment systems for ecosystem services. However, nearly one-third said they did not know if they would participate. Furthermore, respondents were initially unfamiliar with the term “ecosystem services,” implying the need for an information and marketing campaign by those who wish to promote PES programs and markets. The agricultural media has featured stories on ecosystem services in recent years, and the new farm bill also mentions ecosystem services. However, there is still a lack of understanding of this term, at least among North Carolina farmers. The most influential sources of information for conservation decisions were agricultural extension newsletters and USDA bulletins (see Appendix Figure A4), so these could be effective venues for promoting PES approaches.

(2) Carbon storage is not a well-understood ecosystem service.

Some farm organizations are now promoting carbon offsets from farming as part of a future cap-and-trade climate policy. The National Farmers Union has contracts with 2,300 farmers and ranchers, half in North Dakota, to pay them to store carbon in soil (E&E Daily 2008). The payment levels are now quite modest as they are based on a voluntary market for carbon. However, the price of carbon is expected to rise under any future cap-and-trade climate policy. While carbon storage payments may be the most promising source of future PES funding, the survey revealed that carbon storage is the least well understood and least attractive ecosystem service for our respondents. This lack of familiarity with and interest in carbon offsets again underscores the need for information campaigns. Since the respondents also said that two of the most attractive aspects of current conservation programs are “soil preservation” and “another source of income,” a carbon storage PES could be promoted with a user-friendly carbon calculator similar the one developed by the Nicholas Institute for Environmental Policy Solutions for the USEPA (<http://ecoserver.env.duke.edu/rapcoev>). Using local soil data, estimates of potential soil carbon storage from moving farmland into conservation status or by changing production practices could be combined with current and projected future prices in the emerging carbon market to project likely carbon payments for individual farmers. This information could be provided over the Internet or in public forums as a marketing tool to promote PES.

(3) Payment levels are an important factor in decisions to enroll, but so are other program attributes, particularly contract length.

As expected, both regression models showed that interest in enrolling in future PES programs is influenced by the level of the offered conservation payment. Raising payment levels is one of the most effective levers available to program managers and private buyers of ecosystem services, especially when crop prices are high. However, there are additional factors driving farm operator enrollment decisions. For example, there is a tradeoff between payments and contract length. Farm operators would be willing to take less payment on average if the contract length for the PES program were shortened. They would also prefer a program managed by a state agency, perhaps reflecting their past experience with the North Carolina Cost-Share Program (which was their highest-rated existing program; see Table A3). Attracting enrollment in a PES operated by a federal agency, private company, or conservation organization would likely require increasing payments (in that order).

(4) Whether focused on wildlife, water quality, or carbon, information and marketing campaigns for PES programs will likely be more effective if they are targeted to farm operators with particular characteristics.

One of the best predictors of potential enrollment is current participation in conservation programs. Therefore, these individuals would be a priority target for outreach and marketing efforts related to future PES programs and markets. Although precise guidance for a targeted marketing approach requires further analysis, it appears that targeting farm operators who are younger, have higher education levels, and have off-farm income would be advantageous. Thus, survey results could be used to target future marketing efforts so that those who are most likely to enroll will be reached.

(5) A PES program that is specific to red wolves does not have widespread support.

Finally, there were large differences in the responses in Bertie County to a generic wildlife program and those in the RWRP counties to a red wolf conservation program. Some 44% of Bertie County respondents said they would participate in a wildlife conservation program, while only 13% of RWRP county respondents would participate in a red wolf conservation program. Furthermore, RWRP county residents would require nearly six times as much compensation per acre to enroll their land (\$202 vs. \$36). However, given the reservoir of support for wildlife habitat protection in general, a broader-based wildlife habitat program may be attractive to a significant portion of area farmers and foresters. Wildlife biologists have indicated that cover strips of natural vegetation around crop fields benefit many kinds of wildlife including wolves. Thus, those who wish to encourage red wolf habitat improvement through a PES may have an easier time marketing a more generic wildlife program that does not emphasize wolves as the target species.

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APPENDIX A: Additional Tables and Figures

Table A1. Hunting-related survey questions.

	You and family hunt on land	Others hunt on your land	% respondents earning \$ from hunting leases	Money from hunting leases
Question #	12	13	14	14
Stat	Yes 74% No 25% Don't know 2%	Yes 58% No 39% Don't know 3%	32.3%	Less than \$500 (mode)

Figure A1. Frequency of levels of annual hunting lease earnings (Q14)

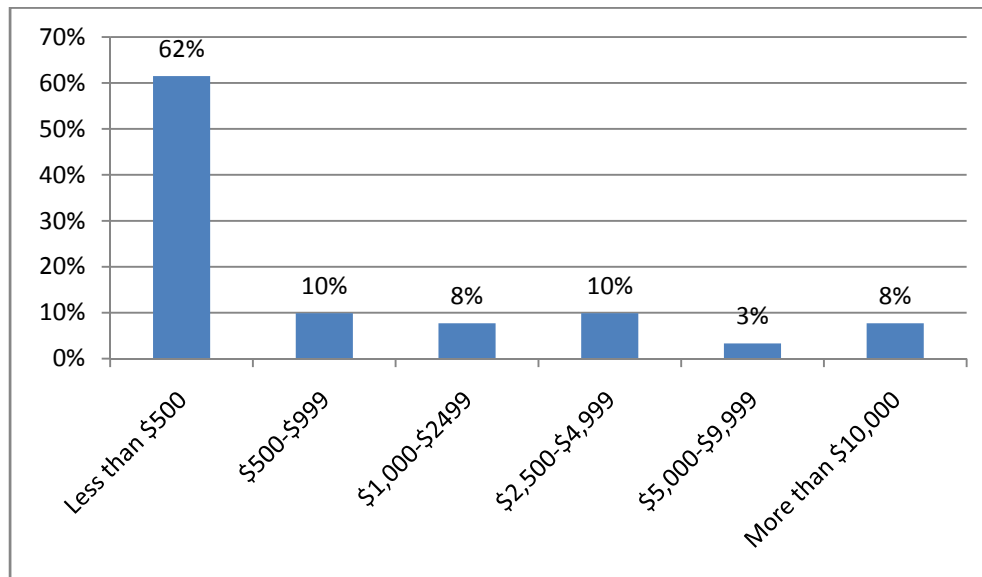


Table A2. Influence in making land conservation decisions (on scale of 1–5: 1 = no influence, 5 = complete influence)

	How much influence your renters have	How much influence you have as renter
Question #	15	16
Mean	2.28	3.21
N	115	152

Figure A2. Percentage of respondents whose property shares a border with the following land use types (Q17)

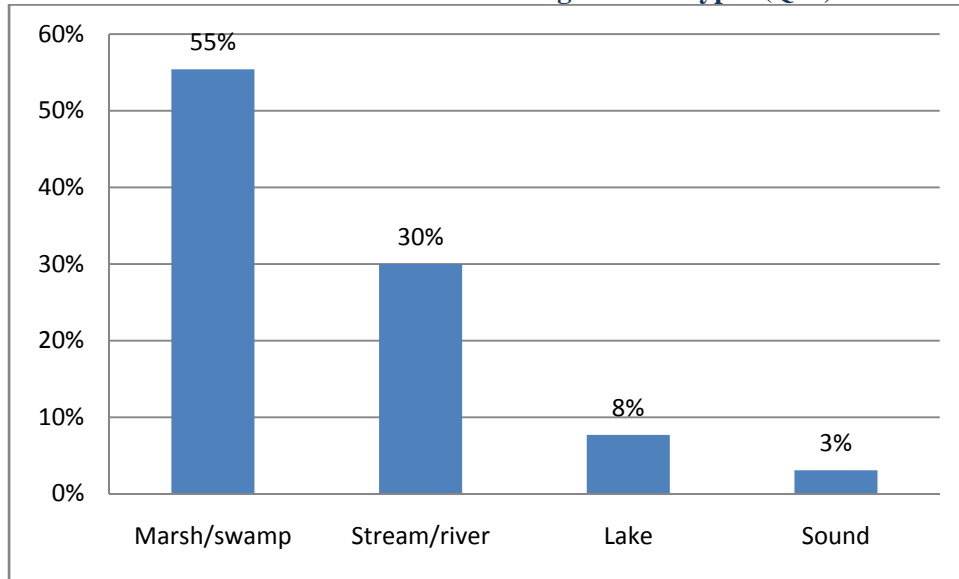


Figure A3. Percentage of respondents whose property shares a border with the following types of conservation lands (Q18)

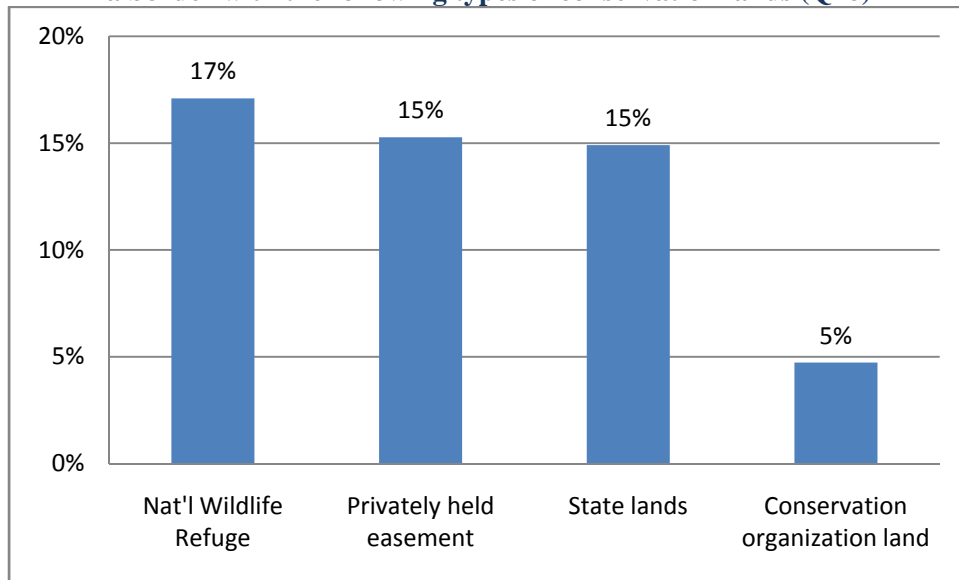


Table A3. Conservation programs in which respondents had participated and the average scores on scale of 1 to 5 of how satisfied they are/were with those program (Q25)

	CRP	WRP	CREP	EQIP	WHIP	NC Cost Share
N	75	23	40	55	25	76
Score	3.67	3.17	3.83	3.75	3.52	3.95

Table A4. Conservation practices applied by respondents and the average scores on scale of 1 to 5 of how satisfied they are/were with those practice (Q28)

	No-till	Nutrient management	Filter strips	Riparian buffers	Wildlife food plots	Waterfowl impoundments
N	146	119	63	33	83	56
Score	4.08	3.79	3.52	3.42	3.83	3.77

Figure A4. Where respondents obtain information on conservation programs (Q29; n = 291)

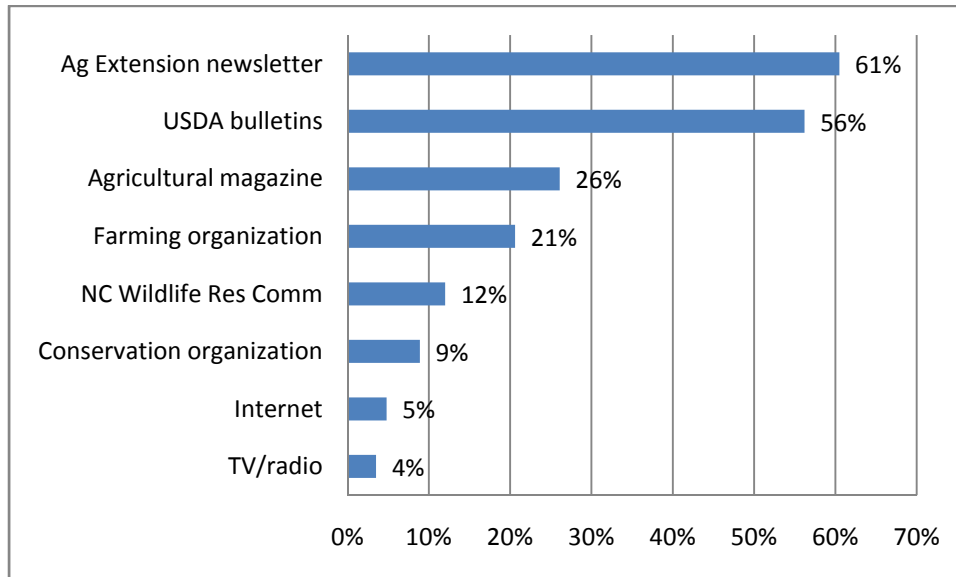


Table A5. Rates of response to conjoint questions (Q32)

	Chose Program A or B	Chose "Neither"	Total answered	Not answered	Total
N	817	403	1220	245	1465
Percentage of Total	55.8%	27.5%	83.3%	16.7%	100.0%

Table A6. Comparison of distribution of farms with that of returned surveys in study area counties

	Beaufort	Bertie	Dare	Hyde	Tyrrell	Washington	Total
Farms, 2002 Ag Census	350*	330	8	144	91	193	1116
Farms, Percentage of total	30.1%	28.4%	0.7%	12.4%	7.8%	16.6%	–
Returned surveys	109	155	1	52	44	48	410
Surveys, Percentage of total	26.6%	37.8%	0.2%	12.7%	10.7%	11.7%	–

*2002 Ag Census reports 395 farms in Beaufort County. Forty-five farm operators were contacted through the pilot survey and the pre-test and were thus ineligible for the main survey. For this reason, 395 was adjusted down to 350.

Figure A5. Frequency with which respondents consult the following people regarding land management decisions (Q34; n = 209–261)

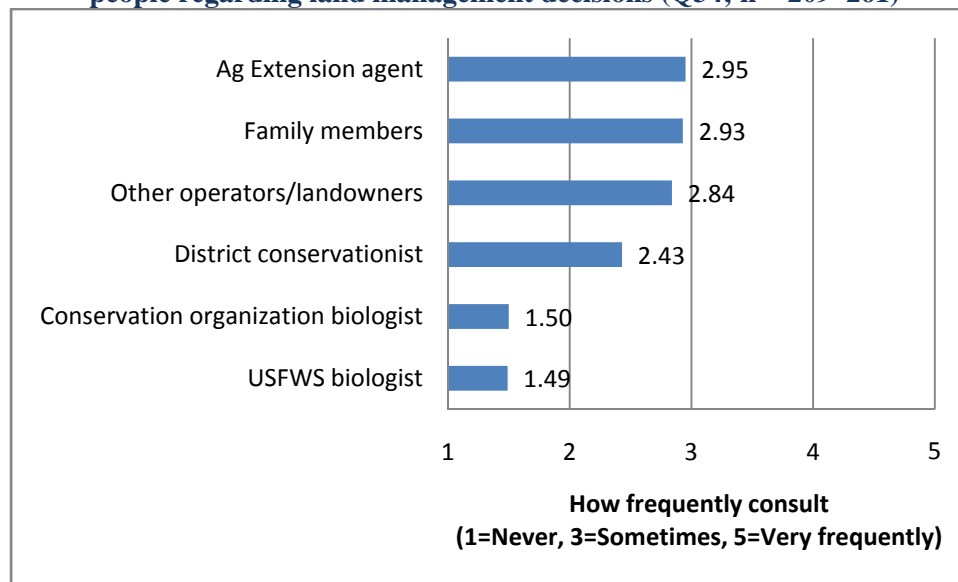


Table A7. Comparison of survey demographic and land management variables with similar 2002 Agricultural Census variables

2002 Ag Census Variable	Beaufort	Bertie	Dare	Hyde	Tyrrell	Washington	Survey Data	Survey Question
Percentage of farms with cropland	89%	78%	100%	84%	87%	82%	84%	Primary use of land–agriculture, Q9
Cropland, # of acres (mean)	436	362	619	756	883	635	788	Acres in crop production, Q8
Owned acres of total acres	88%	85%	NA	79%	78%	93%	92%	Own land, Q4
Rented acres of total acres	57%	58%	NA	63%	77%	55%	53%	Rent land, Q6
Farms with cropland that harvest corn	32%	36%	20%	33%	41%	37%	35%	Highest-value commodity–corn, Q10
Principle operators, male	93%	92%	NA	97%	98%	94%	94%	Gender, Q39
Principle operators, age (mean)	54.4	53.8	50.4	58.4	51	54.2	59	Age, Q40
Farms with family/individual ownership	82%	82%	75%	79%	80%	87%	78%	Ownership structure, Q44
Principle operators working off-farm	38%	40%	25%	24%	36%	31%	36%	Working off-farm, Q45
Net cash farm income of operation (mean)	\$41,395	\$43,673	NA	\$40,525	\$38,122	\$41,834	\$43,511	HH income from land*

*This variable was calculated by multiplying the mean percentage of income derived from the land (Q7) by mean household income (Q46)

Figure A6. Respondents from red wolf counties: Reasons given for not wanting to participate in program that would benefit red wolves (Q37; n = 161)

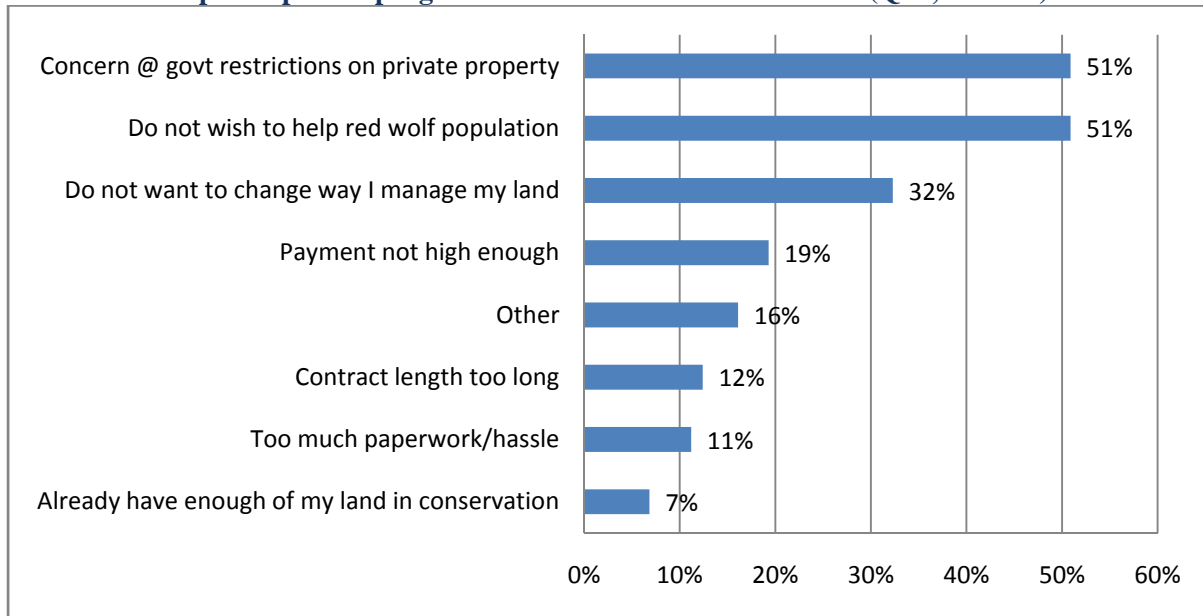


Figure A7. Bertie County respondents: Reasons given for not wanting to participate in program that would benefit wildlife (Q37; n = 48)

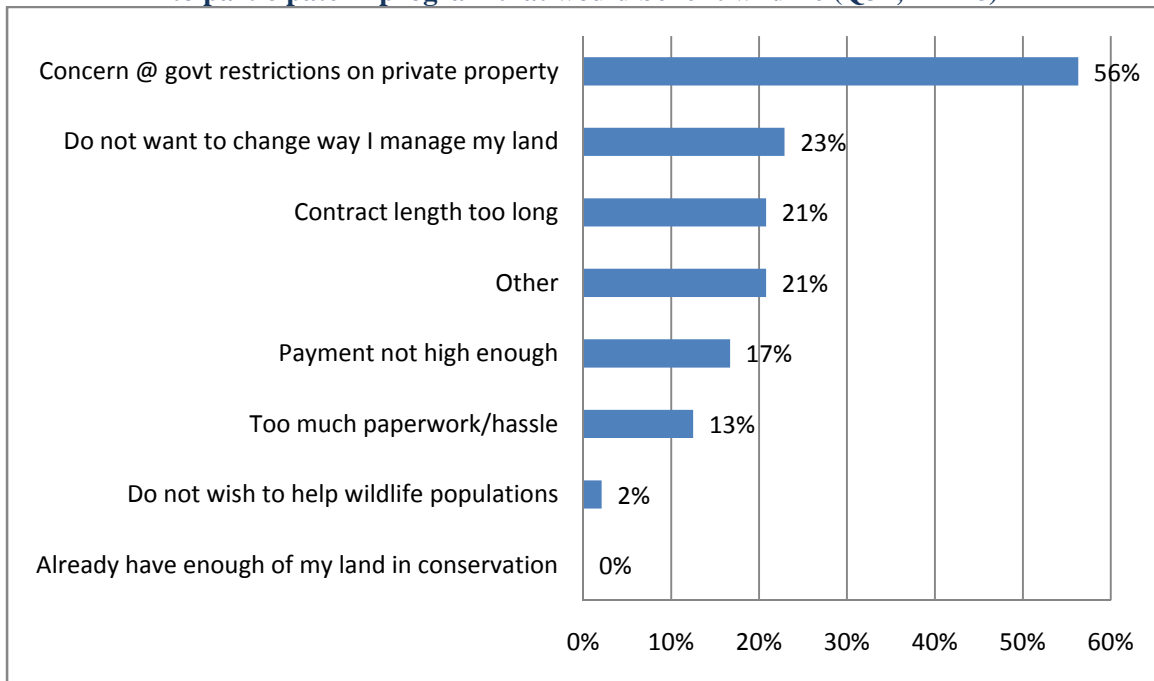


Figure A8. County-of-residence frequencies of survey respondents (Q42)

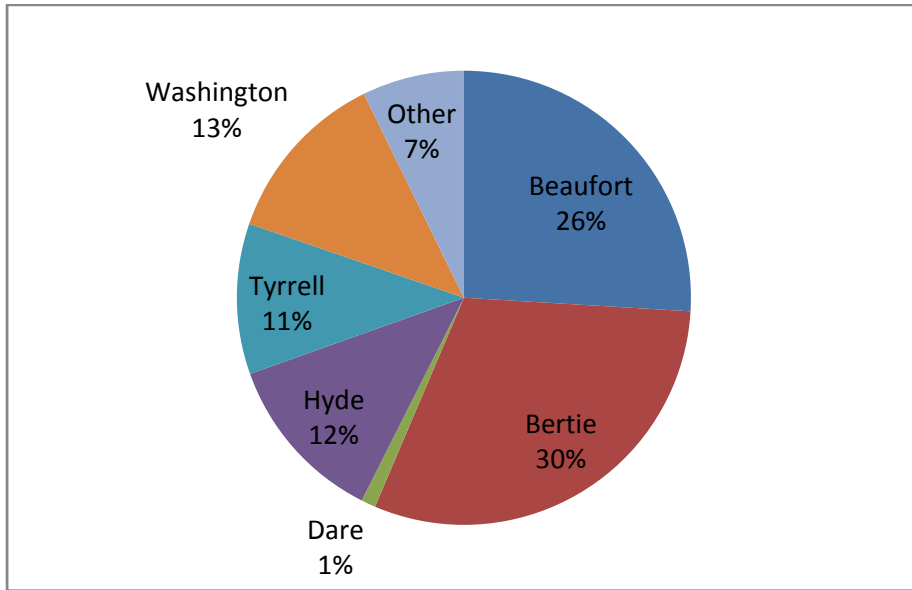


Figure A9. Education level frequencies of survey respondents (Q41)

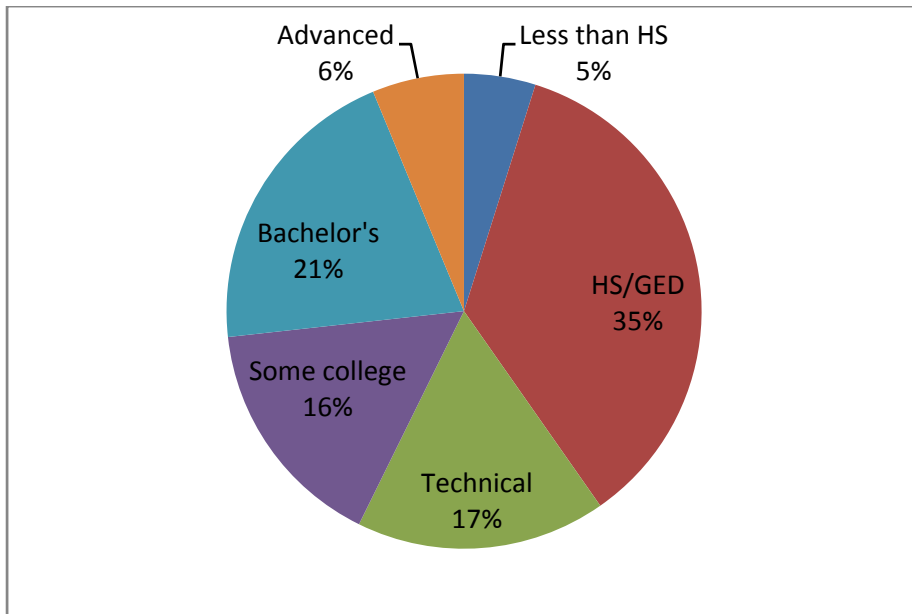
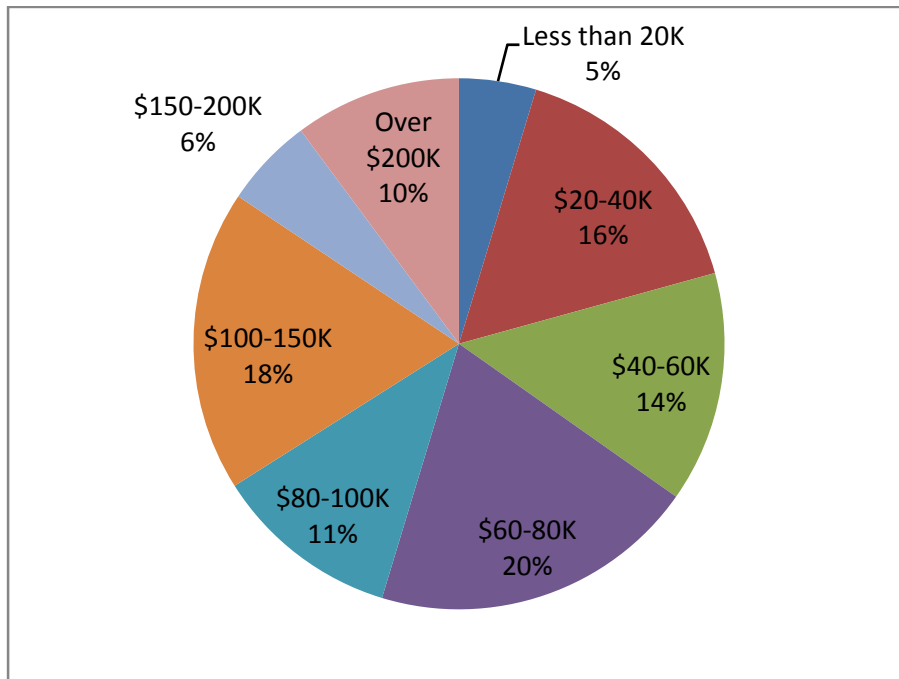


Figure A10. Household income frequencies of respondents (Q46)



See the online appendix at <http://www.duke.edu/~kramer/Frequencies.pdf> for a complete set of frequency distributions for survey responses.

APPENDIX B: Survey Instrument

Conservation Programs on Private Land: Eastern North Carolina Survey



Source: NRCS Photo Gallery

Duke University – 2008

**THIS SURVEY SHOULD ONLY BE FILLED OUT BY THE PERSON
TO WHOM IT WAS ADDRESSED.**

7. **What percentage of your annual household income comes from your owned/rented land?**

_____ % of income

8. **On your owned/rented land, how many acres do you currently have in the following uses?**

_____ Acres in crop production

_____ Acres in livestock production

_____ Acres in planted forest

_____ Acres in natural forest/forested swamp

_____ Acres in marsh/non-forested wetland

_____ Acres in other land use _____ (Please specify)

9. **What is the primary use of your owned/rented land? (Check ONE)**

_____ Agriculture

_____ Timber

_____ Recreation

_____ Other. Please specify _____

10. **Which commodity produced on your land (e.g., corn, broilers, timber) has the highest total cash value?**

11. **On your owned/rented land, how many acres do you currently have in the following conservation uses?**

_____ Acres in permanent conservation easement

_____ Acres in other conservation program (CRP, EQIP, etc.)

12. **Is your owned/rented land used for hunting by you and/or your family?**

_____ Yes _____ No _____ Don't know

13. **Is your owned/rented land used for hunting by people outside of your family?**

_____ Yes _____ No _____ Don't know

14. **If you lease out your land for hunting, approximately how much money do you earn each year from hunting leases? (Check ONE)**

- | | |
|--|---|
| <input type="checkbox"/> Less than \$500 | <input type="checkbox"/> \$2,500-\$4,999 |
| <input type="checkbox"/> \$500-\$999 | <input type="checkbox"/> \$5,000-\$9,999 |
| <input type="checkbox"/> \$1,000-\$2,499 | <input type="checkbox"/> More than \$10,000 |

15. **If you identify yourself as a landowner who leases out land, how much influence do your renters have on which land conservation programs you participate in? (Please circle one number that most closely matches your response)**

<i>No influence</i>		<i>Neutral</i>		<i>Complete influence</i>	<i>Don't know</i>	<i>Not applicable</i>
1	2	3	4	5	X	X

16. **If you identify yourself as a renter of land, how much influence or control do you have over whether land you rent can be placed into a conservation program? (Please circle one number that most closely matches your response)**

<i>No influence</i>		<i>Neutral</i>		<i>Complete influence</i>	<i>Don't know</i>	<i>Not applicable</i>
1	2	3	4	5	X	X

17. **Please indicate if your owned/rented land shares a border with: (Check all that apply)**

- marsh/swamp
- stream or river
- lake
- sound

18. **Please indicate if your owned/rented land shares a border with conservation lands such as: (Check all that apply)**

- State game land, state park, or state forest
- National Wildlife Refuge (U.S. Fish & Wildlife Service)
- Land managed by a conservation organization
- Privately held easement (e.g., WRP, CRP)
- Other. Please specify _____

19. We would like to find out what you know about the following terms. Please indicate your degree of familiarity by circling the number that most closely matches your response.

	<i>Not familiar</i>		<i>Somewhat familiar</i>		<i>Very familiar</i>	<i>Don't know</i>
Ecosystem services	1	2	3	4	5	X
Carbon storage	1	2	3	4	5	X
Water quality	1	2	3	4	5	X
Wildlife habitat	1	2	3	4	5	X

20. We would like to get your opinion on how you would like to see your county developed in the future. For each issue listed, please indicate how important this issue is to you personally by circling one number for each statement that most closely matches your response.

	<i>Not important</i>		<i>Neutral</i>		<i>Very important</i>	<i>Don't know</i>
Having a strong agriculture/forestry-based economy	1	2	3	4	5	X
Preserving the rural, countryside feel of the area	1	2	3	4	5	X
Promoting industrial or commercial development	1	2	3	4	5	X
Encouraging nature-based tourism	1	2	3	4	5	X
Protecting habitat for wildlife	1	2	3	4	5	X
Promoting real estate development	1	2	3	4	5	X

21. Are there any other local issues, not listed above, that are important to you?

Section 2: Conservation Programs

We would like to ask you about government conservation payment programs. These include U.S. Department of Agriculture (USDA) programs that provide financial and technical assistance to landowners and farmers who voluntarily conserve soil, water, wildlife habitat and other natural resources on their land. An example would be the Conservation Reserve Program (CRP), among others.

22. **Have you participated in a conservation payment, rental, or easement program in the past?**

Yes No Don't know

23. **Do you currently participate in a conservation payment, rental, or easement program?**

Yes No Don't know

24. **If you answered NO to question 22 and/or 23, what are the reasons you chose not to enroll in a conservation payment, rental, or easement program? (Check all that apply)**

- Too much paperwork/general hassle
- Applied, but not accepted into program
- Application/enrollment process takes too long
- Payments not high enough
- Contract length was too long
- Concern about government restriction on private property
- Did not know about or understand how to apply for program
- Did not want to change the way I manage my land
- Other. Please specify _____

[SKIP TO QUESTION 28]

25. **If you have participated in one of the following programs, please indicate your level of satisfaction with the program by circling one number next to the program name. (Please DO NOT circle a number if you have not participated in a given program)**

	<i>Very unsatisfied</i>		<i>Neutral</i>		<i>Very satisfied</i>	<i>Don't know</i>
Conservation Reserve Program (CRP)	1	2	3	4	5	X
Wetland Reserve Program (WRP)	1	2	3	4	5	X
Conservation Reserve Enhancement Program (CREP)	1	2	3	4	5	X
Environmental Quality Incentives Program (EQIP)	1	2	3	4	5	X
Wildlife Habitat Incentives Program (WHIP)	1	2	3	4	5	X
NC Agriculture Cost Share Program	1	2	3	4	5	X
Other program _____	1	2	3	4	5	X

26. **What aspects of the conservation program(s) do/did you like?** (Check all that apply)

- Saves money
- Less farm run-off
- Promotes wildlife
- Technical assistance from experts
- Saves time/effort
- Promotes soil preservation/health
- Another source of income
- Other. Please specify _____

27. **What aspects of the conservation program(s) do/did you NOT like?** (Check all that apply)

- Too much paperwork/general hassle
- Application/enrollment process takes too long
- Payments not high enough
- Contract length was too long
- Concern about government restriction on private property
- Other. Please specify _____

28. **If you have applied conservation practices to your land, please indicate your level of satisfaction with the practice by circling one number next to the practice name.**
(Please DO NOT circle a number if you have not used a given practice)

	<i>Very unsatisfied</i>		<i>Neutral</i>		<i>Very satisfied</i>	<i>Don't know</i>
No till or conservation tillage	1	2	3	4	5	X
Nutrient management	1	2	3	4	5	X
Filter strips	1	2	3	4	5	X
Riparian buffers	1	2	3	4	5	X
Wildlife food plots	1	2	3	4	5	X
Waterfowl impoundments	1	2	3	4	5	X
Other practice	1	2	3	4	5	X
Other practice	1	2	3	4	5	X
Other practice	1	2	3	4	5	X

29. **Whether you have enrolled in a program or not in the past, where did you get information about conservation payment programs?** (Please check all that apply)

- Agricultural magazine
- Television/radio
- USDA bulletins
- NC Wildlife Resource Commission
- Ag Extension newsletter
- Internet
- Farming organization
- Conservation organization (e.g., Ducks Unlimited)
- Other. Please specify _____

Section 3: Conservation Services

There is a growing awareness that forest and some farmland provide many environmental benefits to society, such as purifying air and water, renewing soils, providing habitat for wildlife, and helping to stabilize the climate. The term *ecosystem services* is used to refer to these benefits.

30. **If there were a conservation program that offered you a payment for improving the quantity and/or quality of ecosystem services your land provides, would you consider participating in such a program?** (Check ONE)

- Yes
- No
- Don't know

31. **Please indicate your level of agreement with the following statement:**
“I would be interested in enrolling in a conservation payment program that produces benefits such as...” (Circle one number that most closely matches your response)

	<i>Completely disagree</i>		<i>Neutral</i>		<i>Completely agree</i>	<i>Don't know</i>
... Carbon storage	1	2	3	4	5	X
... Water quality	1	2	3	4	5	X
... Wildlife habitat	1	2	3	4	5	X

The 2008 Farm Bill takes a first step towards encouraging landowner/operator participation in emerging markets for ecosystem services. Guidelines are being developed to inform new ways to provide payments for ecosystem services. These include programs that would be voluntary and would give landowners the opportunity to receive payments for applying conservation practices on their property. The potential programs are described by the following three features:

Contract Length – Programs offer landowners several different options for the length of time that land can be enrolled in them. Contract length options are 5, 15, and 30 years.

Program Administration – The organization administering the program enrolls the land, works with the landowners, and distributes the payments to participating landowners. Organization options are Federal agency (e.g., USDA, US Fish & Wildlife Service), State agency (e.g., NC Wildlife Resources Commission), Conservation organization (e.g., Ducks Unlimited), or a Private company.

Program Payment – Landowners receive a rental payment for enrolling land in a program. Payment level options are \$40, \$75, \$140, and \$225 per acre per year.

Directions: In each of the following hypothetical choices, we ask you to select your preferred option from the programs presented. Please assume that these programs would apply to your owned/rented land. In each case, also assume that the options in each table are the only ones available to you and do not consider programs shown in other tables. Given the description of each program, please decide which one you would choose by checking the line directly below it.

32.

CHOICE 1

Program Features	Program A	Program B	Neither
Contract length	30 years	15 years	
Program administration	Conservation organization	State agency	
Payment level (per acre per year)	\$140	\$40	

**I would choose...
(check only ONE)**

CHOICE 2

Program Features	Program A	Program B	Neither
Contract length	15 years	5 years	
Program administration	Federal agency	Conservation organization	
Payment level (per acre per year)	\$75	\$40	

**I would choose...
(check only ONE)**

CHOICE 3

Program Features	Program A	Program B	Neither
Contract length	15 years	5 years	
Program administration	Conservation organization	Federal agency	
Payment level (per acre per year)	\$40	\$75	

**I would choose...
(check only ONE)**

CHOICE 4

Program Features	Program A	Program B	Neither
Contract length	5 years	5 years	
Program administration	State agency	Federal agency	
Payment level (per acre per year)	\$140	\$40	

**I would choose...
(check only ONE)**

CHOICE 5

Program Features	Program A	Program B	Neither
Contract length	15 years	5 years	
Program administration	Federal agency	State agency	
Payment level (per acre per year)	\$225	\$140	

**I would choose...
(check only ONE)**

33. When you were making your choices between alternative conservation programs in the previous section, how important were each of the program features to your decisions? (Circle one number that most closely matches your response)

	<i>Not important</i>		<i>Neutral</i>		<i>Very important</i>	<i>Don't know</i>
	1	2	3	4	5	
Contract length	1	2	3	4	5	X
Program administration	1	2	3	4	5	X
Payment level (per acre per year)	1	2	3	4	5	X

34. How frequently do you consult with the following people about land management decisions such as enrolling in conservation programs?

	<i>Never</i>		<i>Sometimes</i>		<i>Very frequently</i>
	1	2	3	4	5
Agricultural extension agent	1	2	3	4	5
Other operators/landowners	1	2	3	4	5
U.S. Fish & Wildlife biologist	1	2	3	4	5
Family members	1	2	3	4	5
District conservationist	1	2	3	4	5
Conservation organization biologist	1	2	3	4	5
Other _____	1	2	3	4	5

In parts of the eastern United States, animals such as bear, deer, rabbit, quail, and wolves are part of the natural environment. Increasingly, the habitat for these animals is being reduced and fragmented by human activity on the land. The red wolf is a predator native to the eastern United States that became extinct in the wild by 1980. In 1987, red wolves were reintroduced into east-central North Carolina in an effort to restore wild populations.

35. Currently, organizations interested in ensuring the red wolf survives in the wild are considering how to enlist the help of landowners and managers. For example, these organizations recognize the important role that private landowners play in wildlife conservation and are considering the creation of voluntary programs in which landowners could receive payments to apply conservation practices that improve habitat for the red wolf population. What is your initial reaction to such a program? (Please circle the number that most closely matches your response)

<i>Strongly oppose</i>		<i>Neutral</i>		<i>Strongly favor</i>		<i>Don't know</i>
1	2	3	4	5		
1	2	3	4	5		X

36. **Suppose there was a program that consisted of planting strips of natural cover (shrubs and grasses) along the edges of large crop fields. These strips would increase the amount of prey available to wolves as well as provide them corridors to travel to other areas with natural cover. The hypothetical program would be administered by the USDA, have a contract length of 10 years, and would involve a small percentage of your working land.**

If this program paid you \$_____ per acre per year (for 10 years), would you be willing to participate in it?

_____ Yes [SKIP TO QUESTION 38]

_____ No

_____ Don't know

37. **If you responded NO or DON'T KNOW to the previous question, what are the reasons you would choose not to enroll in a conservation payment program like this?**
(Please check all that apply)

_____ Too much paperwork/general hassle

_____ Do not wish to help red wolf population

_____ Already have enough of my land in conservation uses

_____ Payment not high enough

_____ Contract length is too long

_____ Concern about government restriction on private property

_____ Do not want to change the way I manage my land

_____ Other. Please specify _____

38. **At this time, please feel free to say any opinion or comment you have on the efforts to promote red wolves. Remember, your response is completely anonymous.**

Section 4: Personal Background

39. **Are you:** ___ male ___ female

40. **How old are you?** ___ years old

41. **What is the highest level of education that you have achieved?** (Check ONE)

___	Less than high school diploma	___	Some college at a 4-year institution
___	High School diploma or GED	___	4-year college degree
___	Technical/vocational degree	___	Advanced degree beyond 4-year degree

42. **In what county is your primary residence?** _____ County

43. **How long have you lived in that County?** ___ years

44. **If you own land, what is the ownership structure of that land?** (Check ONE)

___ Private individual
___ Corporation
___ Partnership (e.g., LLC)
___ Other. Please specify _____

45. **Please indicate if you and/or your spouse work off-farm, even if only part-time.**

___ You ___ Spouse ___ Neither

46. **What is your approximate annual household income before taxes last year?** (Check ONE)

___	Less than \$20,000	___	\$80,000 to \$99,999
___	\$20,000 to \$39,999	___	\$100,000 to \$149,999
___	\$40,000 to \$59,999	___	\$150,000 to \$199,999
___	\$60,000 to \$79,999	___	Over \$200,000

Thank you very much!

Please fold the survey in half, place it in the postage-paid envelope provided, and drop it in the mail.

**Use the space below to write any comments you have
about this survey or our research.**

the Nicholas Institute

The Nicholas Institute for Environmental Policy Solutions at Duke University is a nonpartisan institute founded in 2005 to engage with decision makers in government, the private sector and the nonprofit community to develop innovative proposals that address critical environmental challenges. The Institute seeks to act as an "honest broker" in policy debates by fostering open, ongoing dialogue between stakeholders on all sides of the issues and by providing decision makers with timely and trustworthy policy-relevant analysis based on academic research. The Institute, working in conjunction with the Nicholas School of the Environment and Earth Sciences, leverages the broad expertise of Duke University as well as public and private partners nationwide.

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