INTERNET ACCESS, PRACTICE ADOPTION, AND CONSERVATION PROGRAM

PARTICIPATION IN THREE ALABAMA WATERSHEDS

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INTERNET ACCESS, PRACTICE ADOPTION, AND CONSERVATION PROGRAM PARTICIPATION IN THREE ALABAMA WATERSHEDS

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INTERNET ACCESS, PRACTICE ADOPTION, AND CONSERVATION PROGRAM

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Meredith Leigh Tallant, the daughter of Pam and Wade Tallant, was born on June 19, 1979 in Cumming Georgia. After graduating from North Forsyth High School in Coal Mountain, Georgia in 1998, she entered Piedmont College in Demorest, Georgia. Meredith graduated in 2002 with a Bachelor of Science degree in Sociology. After employment in private industry for fourteen months, she entered Auburn University for graduate school in the fall of 2004 to earn a masters degree in Rural Sociology.

THESIS ABSTRACT

INTERNET ACCESS, PRACTICE ADOPTION, AND CONSERVATION PROGRAM PARTICIPATION IN THREE ALABAMA WATERSHEDS

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The Internet is changing many things about our society; the way we communicate, do business, and obtain information. While the Internet provides a multitude of services for most of America, questions remain about its usefulness to the American farmer in need of conservation based information and resources. Some researchers feel that the Internet has the ability to form a powerful link between farmers, researchers, and other relevant agencies or groups, but past studies show that farmers are reluctant to adopt.

This study focuses on the affects of farm operator Internet use on conservation practice adoption and Natural Resource Conservation Service (NRCS) program

participation in three Alabama watersheds. Particular attention will be given to indicators of Internet use and its role in shaping conservation adoption.

The study examines the overall usefulness of the Internet in creating a natural resource management context that could dramatically change the way information is created and disseminated in the agricultural community.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

I. INTRODUCTION

Protecting soil and water resources is a societal concern of growing importance. Conservation programs like those offered by the Natural Resources Conservation Service (NRCS) have been around since 1935, but with current changes in the world trade regime and a growing concern for the environment these programs may become more important to farmers. While future cuts in traditional farm payment programs are likely, conservation programs could represent the future of income support for many farmers, redirecting their focus away from production agriculture and toward conservation. New farm programs such as the Conservation Security Program, require certain levels of conservation already implement conservation practices. Many of the new NRCS programs require certain levels of conservation measures already be implemented on the farm in order to qualify. Implementation requires information. Thus, this study focuses on the Internet as a means for farmers in the U.S. to discover, select, and engage in conservation activities and programs.

The Internet has provided a new medium for communication and accessing information that's limits are not fully known. Web pages and email provide a mechanism for information discovery, exchange, and clarification with capabilities that are still not fully known. The Internet allows people to collaborate and exchange information without being bound by geographic location. Seen as a collection of communities or networks, the Internet has experienced much success in the ability to meet needs for affiliation and problem solving for many different groups (Leiner et al. 2003). The Internet is a tool that can be used by people with similar interests or concerns, providing a ‘space’ for communication and the transfer of knowledge. The potential for frequent interaction and access to information seems promising for farmers looking for ways to implement or adjust their conservation practices and/or programs.

Agricultural Sources of Environmental Degradation

Environmental degradation as a result of agriculture is still a significant problem for much of the United States. The Environmental Protection Agency (EPA) (2004) reported that

> “agricultural nonpoint source pollution is the leading remaining source of water quality impacts to surveyed rivers and lakes, the third largest source of impairments to surveyed estuaries, and also a major contributor to ground water contamination and wetlands degradation” (EPA 2004: 1).

The Economic Research Service (ERS) reports that agriculture is responsible for the pollution of 57 percent of river miles, and 30 percent of lake acres (excluding the Great Lakes). Given that 2 out of 3 Americans (18 million people) live within 10 miles of a polluted water source, concern is warranted (ERS 2000).

Some agricultural activities that can cause nonpoint source pollution include: confined animal facilities, grazing, tillage, pesticide spraying, irrigation, fertilization, planting, and harvesting (EPA 2004: 1). Sediments, nutrients, pathogens, pesticides, and salts are just some of the pollutants that result from agricultural practices (EPA 2004: 1).

The United States Geological Survey studied agricultural land in watersheds with poor water quality and found that 71 percent of cropland in the United States is located in watersheds with concentrations of at least one of four common surface water contaminants: nitrate, phosphorus, fecal coliform bacteria, and suspended sediment (ERS 2000). These byproducts of agricultural production can affect the quality of water in the surrounding watershed.

Sedimentation, as a result of soil erosion is the leading cause of pollution in rivers and streams (ERS 2000). Sediment is dangerous to the health of water systems in many ways and can be caused by such agricultural techniques as tillage, cultivation, or leaving the soil without a vegetative cover. Some problems due to soil erosion range from clogged roadside ditches to destruction of aquatic wildlife habitats. Sediments also collect in streambeds and fill wetlands—leading to an increase in the probability and severity of flooding (ERS 2000).

Nutrients applied to cropland also pose a threat to water quality. The two most common nutrients applied are nitrogen and phosphorus; and when applied in excess they can enter surface waters by way of runoff (ERS 2000). These nutrients can also leach into ground water, leading to nonpoint source pollution of groundwater, and in turn other water bodies. These two nutrients create problems with surface water quality because they promote the growth of algae and plants, which in turn leads to problems including clogged pipelines and fish kills (ERS 2000).

Pesticides in the form of insecticides, herbicides, and fungicides, also present a formidable threat for water quality. ERS reported that over 500 million pounds of pesticides were applied annually on farmland (ERS 2001). Pesticides leaching into the soil and ground water pose a threat to drinking water supplies as well as overall watershed health.

Pathogens resulting from agricultural operations present yet another threat to water supplies. ERS points to pathogens as the leading cause of impairment to estuaries and the second leading cause in rivers (ERS 2001). Animal feeding operations and the waste that results from them can pose a threat to human health as well. Proper animal management practices and water treatment can help to reduce the risk of pathogens to human health (EPA 2004).

It is clear that nearly everyone, whether directly involved with agriculture or not, can be affected by the impact of farming on the land and on water supplies. Reducing agricultural pollution is a central responsibility for public agencies like the Natural Resource Conservation Service (NRCS). Programs like the Conservation Security Program (CSP) and the Environmental Quality Incentives Program (EQIP) offer incentives to farmers who are working to reduce adverse environmental impacts from their operations, making such programs valuable not only to the farmer, but to society as well.

Current Conservation Programs

The Natural Resources Conservation Service (NRCS) offers a variety of voluntary conservation programs. These programs provide technical and financial assistance to eligible farmers who implement structural and management practices on eligible agricultural land. These NRCS programs reward the stewardship of farmers who have already implemented conservation practices on their operations. For example, the Environmental Quality Incentives Program (EQIP) promotes stewardship through technical support and payments (NRCS 2003). While this thesis does not give the full scope of all NRCS conservation programs (there are over 50), it does show the commitment that NRCS has to helping farmers "reduce soil erosion, enhance water supplies, improve water quality, increase wildlife habitat, and reduce damages caused by floods and other natural disasters"(NRCS 2003: 2).

Voluntary conservation programs like those offered through NRCS could become more important to farmers as the traditional structure of agricultural income support changes. The president of the National Farmers Union, Dave Fredrickson noted that the United States has made a major agreement with other countries to try to cut agricultural supports by 20 percent in the next round of trade talks of the World Trade Organization (WTO) (Pore 2004). Future support for farmers is likely to be through conservation payments or green box payments (Pore 2004). In the language of the WTO, green box payments are those that have minimal or no effect on production or trade, such as payments for research, domestic food aid, environmental conservation and rural development schemes (Alizadeh and Nomikos 2005: 16). While future cuts in traditional farm payment programs are likely, programs like the Conservation Security Program (CSP) and the Environmental Quality Incentives Program (EQIP) may represent the future of farm income support, redirecting the focus of assistance away from production and toward conservation. These development will likely make conservation a central focus for farmers in need of income stability.

Adoption of Conservation Practices

Past research on innovation adoption focused primarily on technologies and practices that insured farmers' higher profits, centering the motivation to adopt on profitability (Roger 1971, Nowak 1982). Pample and van Es (1977) found that farmers who adopt commercial practices may not be the same farmers adopting environmental practices. In the short run conservation practices may cost the farmer, while only benefiting society. Conservation practices often promote long-term farm viability, but may fail to meet farm income needs in the short-term. The economic strains related to conservation adoption make diffusion much more challenging. While most farmers care about the betterment of society, survival of their farm as a business is also a major concern.

While all of the NRCS conservation programs discussed in this study are voluntary, it is important to note the differences in adoption rates between commercial and conservation innovations. Both Napier (2001) and Pampel and van Es (1977) argue that voluntary programs rely on commercial incentives in order to gain compliance with regulations and innovation adoption. They maintain that there is little evidence that the same mechanisms that motivate the adoption of commercial innovations will work for conservation innovations.

Information or lack thereof has been found to effect the adoption of sustainable agriculture. Researchers Gamon, Harrold, and Creswell (1994) point out that the cause of limited adoption of sustainable agriculture is due to the lack of clear information provided to all farmers. "Although science has accumulated a great base of knowledge of potential benefit to alternative agriculture, research and extension have not focused on integrating this knowledge into practical solutions to farmers' problems" (Gamon, Harrold, and Creswell 1994, 38). Farmers' knowledge and technologies are often undervalued by researchers who prefer scientifically developed knowledge and technologies (Nowak and Korsching 1998). Conversely, farmers often attach low credibility to research findings that may lack practical relevance. Establishing a strong link between researchers (theory) and farmers (reality) is a complicated, but crucial step in increasing conservation adoption. “All the good intentions of science and technology are meaningless until the farmer actually uses the practices” (Nowak and Korsching 1998: 159). Printed information is still the most preferred method for information transfer for farmers (Riesenberg and Gor 1989). Farm magazines have been found to be the very useful to farmers in previous studies. (Tucker and Napier 2002)

Agribusiness provides one stream of information to farmers in the form of advertising, product dealers, and commercial sales people. Iowa farmers have reported chemical dealers as their top source of information (Gamon et al. 1994: 41). Extension is also a popular source for information, but often geographic placement and the local office play a role in its use (Risenberg and Gor 1989). In addition, public institutions remain an important check and corroborator of the claims of private firms. Nonetheless, much could be learned from agribusiness information diffusion strategies that could assist with the adoption of conservation practices by farmers. The on-farm visits, printed information styles, and the wealth of accessible information are all agribusiness strategies that could be used to motivate conservation practice adoption and NRCS program participation.

Traditional Agricultural Communication

Agricultural extension is in a period of crisis in relation to its role in providing farmers with information on the latest innovations, including conservation practices (Vanclay and Lawrence 1994). The realization that the extension office is no longer a major information provider for the American farmer is not a new phenomena. The question remains, if farmers are not getting information from extension, then who are they getting it from?

The field extension service (however it may be perceived in the agricultural service world) is still a very helpful place to gain a better understanding of how information was and should now be disseminated among the agricultural community. The key instrument used in extension for inducing change is written and oral communication. Extension agents educate farmers about new practices and strategies through face to face or telephone information as well as printed pamphlets. The efficacy of education alone as a conservation adoption motivator is not agreed upon by all researchers. Taylor and Miller (1978) view education as the key to conservation adoption. Other researchers such as Pampel and van Es (1977), Napier and Forster (1982), and Lovejoy and Parent (1981) do not support education as a top predictor of conservation adoption motivator and point to other variables such as operational size and total gross value of sales that induce adoption.

Agricultural Information Systems

The use of communication to bring about behavioral (or practice) change is dependent on the extent to which meaning or common definitions are shared between the intervening party (conservation agency) and target clients (Röling 1988: 41). This leaves a lot of room for error and misunderstanding.

The Agricultural Information System (AIS) is one construct used to understand the transfer of information and the process of innovation diffusion. Röling (1988: 33) cites Nagel (1980) as the first to use AIS as an analytic tool. Röling (1988: 33) defines agricultural information as "a system in which agricultural information is generated, transformed, transferred, consolidated, received and fed back in such a manner that these processes function synergistically to underpin knowledge utilization by agricultural producers.” The institutions generating, transforming, transferring and receiving information are emphasized as well as the information flows and linkage mechanisms between them (Röling 1988: 33). It is these information and linkage mechanisms on which this study is focused.

Röling’s work calls for a greater understanding of the ways in which people use information sources, process information, and utilize knowledge (Röling 1988: 34). By focusing on agricultural producers’ understanding and use of the Internet as an information system, this study may clarify what kind of information is needed in light of trends in Internet use by farmers and their decisions to use conservation technologies.

In a case study report entitled, *Benefits of Collaborative Learning for Environmental Management,* Allen and his coauthors point to the “potential role of the Internet in supporting and disseminating experience gained through ongoing adaptive management processes” (Allen, Bosch, Kilvington, Oliver, Gilbert 2001: 1). In studying the control of bovine tuberculosis (TB) vectors Allen et al. (2001: 2) illustrate how collaborative learning approaches can be used (along with more traditional linear forms of information transfer) to support improved environmental decision making. They used an Integrated Systems for Knowledge model to address the bovine TB problem in the South Island of New Zealand. The goal was to create an approach that is based on “learning by doing,” thus creating stronger linkages between science, policy making, and resource management (Allen et al. 2001: 1).

Information flows about environmental management issues are often fragmented and complex. While conservation practices are considered innovations (Nowak and Korsching 1979) they are diffused and adopted in distinctive ways. Linear, more traditional modes of extension information systems, such as the technology transfer and diffusion models, tend to portray the advance of commercial innovations, but fall short when it comes to conservation innovations (Korsching, Stofferahn, Nowak, and Wagener 1983). Early extension innovation diffusion projects focused primarily on commercial innovations in order to help operations become more viable with little attention given to conservation initiatives. Many environmental innovations tend to cost the farmer in the short term and benefit the farmer and society in the longer term, while commercial innovations are intended to increase the farmer's profits (Allen et al. 2001). Making conservation more economically feasible, with income support payment programs like those offered by NRCS could help combat the economical strains felt by farmers adopting conservation practices.

The Internet is a fast-changing medium, but it cannot realize its potential for conservation decision making unless farmers have efficient access to web-based resources and they actively use these tools to seek information.

The Problem

The United States has entered into international agreements to reduce its funding for agricultural support programs by at least 20 percent and there is a general growing worldwide concern about the health of the environment (Pore 2004). While future cuts in traditional farm payment programs are likely, conservation based programs like those offered by NRCS may represent the future of income support for many farmers in need of support payments, redirecting the focus away from production agriculture and toward environmental stewardship. Conservation policies rely on the voluntary participation of the farmer in order to succeed (Long 2003). Not enough is known about the role access to information and the Internet play in influencing farmers to adopt conservation measures or participate in conservation based programs. The purpose of this study is to examine socioeconomic and individual characteristics that along with education and communication help facilitate the adoption of conservation practices and participation in NRCS programs. Specifically, this study clarifies the role Internet access and use has on the adoption of conservation practices and participation in conservation programs.

Under NRCS programs, a farmer who has already implemented conservation practices may have an advantaged in comparison to those who have not yet begun to implement conservation practices on their farming operation. A major step in the implementation of conservation practices is getting information to farmers in a way that will induce them to adopt. There are numerous methods used to communicate information about new practices to farmers, which commonly include printed media in the form of magazines and news letters. While these methods have shown some success, the Internet offers new possibilities for accelerating access to and use of agricultural information systems by farmers.

Recent trends suggest that the Internet might now be able to provide useful communication strategies for programs and practices (Howell and Habron 2004). In fact, the Internet is changing many things about our society; they way we communicate, do business, gain information and more. While Internet use seems to be a good way to facilitate communication for most of America, some questions remain about its usefulness to the American farmer in need of conservation information. Some researchers feel that the Internet has the ability to form a powerful link between farmers, researchers, and other relevant agencies or groups (Allen et al. 2001: 7). The Internet could provide ready communication and information to the American farmer, but it has not gained much support from farmers themselves. Studies have shown that farmers do not currently prefer the use of the Internet in obtaining agricultural information (Howell and Habron 2004).

Little is known about the effects of Internet access and use on a farmer's inclination towards conservation practice adoption and/or NRCS program participation. While previous research is useful in understanding certain indicator variables for Internet use and conservation adoption and program participation, few studies have addressed the mediating role of Internet use on conservation adoption and conservation program participation by agricultural producers. It is not clear whether Internet information actually accelerates the rate and level of conservation adoption or whether these resources simply represent a communication path that parallels traditional communication through peers, meetings, and printed materials.

Purpose of Study

The purpose of this study is to understand how Alabama farmers use the Internet to adopt conservation practices and participate in NRCS programs. Some of the same variables related to conservation adoption and program participation also might be positively related to Internet use. By identifying barriers to Internet use, possible barriers to conservation practices and program participation may be discovered. This study also examines the overall usefulness of the Internet in creating a context for natural resource management that could markedly change the way information is created and disseminated in the agricultural community. Thus, Internet access and use is expected to facilitate conservation adoption and program participation.

Objectives

The theoretical objective of this study is to determine how the Internet acts as a path or a knowledge system for conservation adoption (Röling 1988). The research treats variables that have been previously shown to be related to conservation adoption, by endeavoring to clarify how Internet access and use mediates participation in conservation programs and adoption of practices. The specific objectives are:

1. To conceptualize the mediating role of Internet access and use in NRCS program participation and core conservation practice adoption;

2. To determine if Internet use is positively related to the adoption of core conservation practices and NRCS program participation; and

3. To suggest Internet and non-Internet based paths for increasing NRCS program participation and core conservation practice adoption.

The empirical objective of this study is to measure Alabama farmers' access to the Internet, the amount of conservation implemented on their operation, and the number of NRCS programs they are participating in. The analysis treats age, education, income level, operation size, core conservation practice adoption, and NRCS program participation.

The goal of this research is to identify patterns of association among Internet use, core conservation practice adoption, and NRCS program participation. Learning more about the possible relationship between these variables may help facilitate use of the Internet as a way to motivate and inform farmers about conservation adoption. The next chapter develops a conceptual model of conservation adoption and articulates hypotheses between key variables.

II. CONCEPTUAL FRAMEWORK

This chapter reviews past research on conservation adoption, Internet use, and identifies central variables found to influence adoption. Although there is a wealth of past research, many conflicting findings and interpretations exist.

Internet and Education

"The Internet is emerging as a new system for managing complex information that allows people to create, annotate, link together and share information from a variety of media including text, graphics, images, audio and video" (Allen et al. 2001: 6). The potential for such a "hyper-media" based system to promote learning, problem solving, and possible conservation adoption is great. Allen and others point out that farmers will become authors and presenters, thus leading to a deeper understanding of conservation implantation techniques and strategies. (Allen et al. 2001: 6). The concept of the Internet acting as a "decision-tree" is used to show the Internet as a mechanism that could guide people through a problem solving exercise.

Internet use can also enhance peer-to-peer learning (Brant 2002). Along with more traditional modes of information dissemination, the Internet offers a place to inform farmers about the benefits of conservation practices. For example, Brant suggested that list-serves, interactive websites and similar means could provide a "space" for producers to gain information (Brant 2002: 7). This strategy seems to suggest that the Internet is a good place for farmers who are already conservationists, but could help to inform non-adopters about possible benefits to be gained from conservation practices and programs as well. Search engines provide immediate access to a wide, and sometimes bewildering array of technical sources on conservation topics. Some farmers might be deterred by the abundance of information available via the Internet. A key question then is how to motivate farmers to seize pertinent information from websites, search by definition is a motivated act.

Brant points out that the major advantage of the Internet is that all users can have access to the same information (Brant 2002: 7). The Internet provides a space where researchers and farmers in need of information could easily dialogue, thereby increasing adoption of conservation methods. Farmers could relay information or questions to researchers and all could learn from each other's inquiries. The real time speed of communication via the Internet allows for better communication and learning, particularly in terms of conservation solutions to site-specific problems.

Nowak (1983, 1987, and 1992) claims that a lack of information dissemination is the central factor inhibiting conservation adoption. By examining relationships between Internet use, core conservation practice adoption, and program participation it may be possible to clarify and focus Nowak's assessment. These results could point to more effective methods for supporting farmers seeking information about conservation technologies and potential programs. With the possibility that conservation payments will be the income support system of the future and the need for a more sustainable and environmentally safe agriculture, understanding what variables point to core conservation practice adoption and NRCS program participation for Alabama farmers is crucial.

Past Studies on the Prototypical "Innovative" Farmer

Sociological factors are also significant in the decision to adopt conservation practices. Everett Rogers (Rogers and Shoemaker 1971) was one of the first to associate personal characteristics of farmers with the timing of their adoption of an innovation (Clearfield 1986). Clearfield (1986) profiled the prototypical farmer who is most likely to adopt conservation practices. He reviewed previous studies to find that "adopters of conservation practices are likely to be well-educated, full-time farmers, with a high level of organizational participation" (Clearfield 1986: 6). However, Napier (2001) consistently found that

> "factors such as access to information, farming experience, technical assistance, partial economic subsidies, farm size, personal characteristics of the primary farm operator, debt-to-asset ratio, farm income, participation in government conservation programs, and a host of other variables examined in the studies were not useful for predicting extent of use of conservation production systems" (Napier 2001: 286).

Previous studies on the adoption of conservation are restricted in their ability to explain the adoption process. Their findings and ability to be generalized are limited. Many contradictory findings make it hard to make conclusions about what variables affect conservation adoption.

Conceptual Model and Hypotheses

Dependent Variable: Adoption of Core Conservation Practices

The definition for adoption used in this study reflects Roling's (1988) concept of voluntary change. Grounded in the field of extension practice and practice adoption, Roling points to communication as the main instrument used for inducing change, and this limits the ability to induce voluntary change or adoption (Roling 1988). In order to induce adoption, communication must induce a farm operator to adopt a practice or program. This can be difficult because a communication strategy that induces one farmer to adopt may not work for another. Thus, the communication strategy must be fluid and able to accommodate a variety of different audiences.

This study focuses on adoption patterns among four sets of conservation practices: rotational grazing, conservation tillage, soil testing, and integrated pest management (IPM).

Rotational grazing refers to the regular movement of livestock to fresh paddocks or pastures to provide for pasture recovery, improve livestock health and production, and to protect water quality. (National Sustainable Agriculture Information Service 2004)

Conservation tillage refers to retaining all or a significant portion (30 percent or more) of the previous crop's residue on the soil surface after harvesting of the cash crop to reduce soil erosion and conserve soil moisture. Tillage practices include no-till, para-till, strip-till, mulch-till and ridge-till. (Conservation Information Technology Center 2002)

Soil Testing provides basic information on the nutrient state or condition of the soil. It is an important management tool for developing an efficient soil fertility program, while monitoring for potential water and soil management problems (Herrera 2000). Soil testing is also used to determine animal waste application rates and sustaining profitable forage production. (Conservation Information Technology Center 2002)

Integrated pest management (IPM) is the use of comprehensive information on the life cycles of pests (such as diseases, insects and weeds) and their interaction with the environment, along with available pest control methods, to manage pest damage by the most economical means, and with the least possible hazard to people, property and environment. (Conservation Information Technology Center 2002)

Dependent Variable: NRCS Program Participation

Participation in NRCS programs involves a variety of organized efforts to promote voluntary conservation adoption. Many of these organized efforts involve communication through local NRCS offices. There are seven NRCS conservation programs treated in this study; all of which help with the "reduction of soil erosion, enhance water supplies, improve water quality, increase wildlife habitat, and reduce damages caused by floods and other natural disasters" (NRCS 2003: 1). The seven main NRCS programs are summarized in Table 1.

Table 1. NRCS Programs

Environmental Quality Incentives Program (EQIP)	Voluntary program that offers education, assistance, and funding to producers in order to promote production and environmental quality as compatible goals. Cost share assistance is provided for up to 75% (90% for limited resource operators) of the costs of structural conservation practices. Incentive payment help encourage farmers to implement land management practices. Contracts can be as short as one year (after implementation of all practices), or as long as 10 years. (NRCS: 2004)
Wetlands Reserve Program (WRP)	Voluntary program that provides technical and financial assistance to landowners to address wetland, wildlife habitat, soil, water, and related natural resource issues. At least 70% of all lands in the program will be returned back to their natural condition. The three program participation options include: Ten year restoration cost-share agreements, 30 year conservation easements, and permanent easements (NRCS: 2004).
Farm and Ranch Lands Protection Program (FRPP)	Voluntary program that provides matching funds to State, Tribal, or local governments and non-governmental organizations with existing farm and ranch land protection programs to purchase conservation easements from producers with highly erodible land. The program compensates farmers for limiting future development of their land by buying the development rights and allowing the farmer ownership. The easements restrict non-farm development, allowing the land to remain in agriculture. (NRCS: 2004).
Grasslands Reserve Program (GRP)	Voluntary program that helps producers restore and protect grassland, including rangeland, pastureland, shrubland while maintaining the areas as grazing lands. The program supports working grazing operations susceptible to conversion to crop land, development and other activities that threaten grassland. Offers for enrollment must contain at least 40 acres of contiguous land with no limit to the amount. Enrollment options include: 30 year permanent easements, or 10, 15, or 20 year rental agreements. During the agreement or easement the operator is prohibited from planting crops and must follow a grasslands conservation plan. (NRCS: 2006)
Conservation of Private Grazing Land (CPGL)	Voluntary program that provides technical assistance (i.e. information, data, guidance, and other support provided by NRCS staff) for operators of private grazing lands in addressing natural resource concerns. The program does not provide financial or cost-share assistance. NRCS staff provides operators with a better understanding of the ecological issues on their farms as well as a plan for meeting natural resource and management goals. (NRCS: 2003)
Wildlife Habitat Incentives Program (WHIP)	Voluntary program that provides financial and technical assistance in order to improve and protect wildlife habitat on private and Tribal lands. Cost-share assistance is provided for the protection and development of upland, wetland, riparian, and aquatic habitat areas. There is no limit on the amount of land that can be put in the program, or the amount of payments. Agreements run from 10 to 15 years depending on the practices implemented. Fifteen year agreements can be made if participants wish to implement habitat development practices. (NRCS: 2004).
Conservation Reserve Program (CRP)	Voluntary program that provides annual rental payments and cost-share assistance to help operators establish long-term, resource conserving covers on eligible farm land. Technical assistance is provided in order to address soil, water, and related natural resource concerns. Contracts for CRP run from 10 to 15 years. (NRCS: 2004)

Independent Variables: Farmer and Farm Characteristics

For this study, several socioeconomic characteristics have been identified as factors that may influence a farmer's decision to adopt core conservation practices and/or participate in NRCS programs. Along with the socioeconomic factors, Internet access is treated as a factor shaping conservation adoption and program participation. These variables have been grouped into Farmer Characteristics, Farm Characteristics, and Internet Paths. Farmer Characteristics include factors such as education, age, and race. Farm Characteristics are operation size and total gross value of sales. Internet Paths refer to the presence and type of Internet connection.

Farmer Characteristics

Education

Education has been regularly employed in identifying innovative farmers and as a factor in promoting conservation adoption. Extension's key instruments for inducing change are communication and education. However, supplying information or education may not be sufficient to motivate conservation adoption.

Researchers (Carlson et al. 1981, Ervin and Ervin 1982; Pampel and van Es 1977) have found a positive relationship between education and conservation practice adoption (Clearfield 1986). Years of formal schooling has also been found to be positively related to recognition of erosion problems, knowledge of government projects, and positive attitudes about these projects (Ervin and Ervin 1982; Taylor and Miller 1978). Napier (2001) did not find evidence that education is positively related to conservation adoption, but did find that more educated farmers were more likely to adopt precision farming techniques (Napier 2001).

Hypothesis 1A. Education is positively related to core conservation practice adoption.

Hypothesis 1B. Education is positively related to NRCS program participation.

Age

Age is often used to explain conservation adoption with fairly consistent results. In a study of Iowa farmers, Korshing, Stoferahn, Nowak, and Wagener (1983) found the average age of adopters was 49.9 years and the average age of non-adopters was 55.1 years. It would seen that fives years can make a big difference when it comes to conservation adoption.

Other studies (see Hoover and Wiitala, 1980; Lasley and Nolan, 1981) have found that older farmers were more likely to adopt conservation practices (Clearfield 1986). Nowak and Korshing (1985) found that while younger farmers were more likely to adopt conservation practices, older farmers where more likely to adopt structural improvements with conservation consequences (Clearfield 1986). Bromley (1980) suggested that older farmers often have shorter planning horizons, so they may be less concerned with long-term negative affects of resource depletion.

Ervin and Ervin (1982) showed that farm experience is negatively related to education. This indicates that the more experience a farmer has on his or her farm, the less education he or she will probably have, making it less likely they will implement conservation measures on their operation. Carlson and Dillman (1983) found a negative relationship between age and adoption of erosion control practices.

Hypothesis 2A. Age is negatively related to core conservation practice adoption.

Hypothesis 2B. Age is negatively related to NRCS program participation.

Male and Female

The discussion of gender is complicated when it comes to American farmers. There is not a lot of past research pertaining to male verses female conservation adoption rates. While there is a great deal of literature about women from other parts of the world and their conservation adoption, American women farmers are not represented in the literature. A study by Feldstein and Poats (1989) dealing with African women farmers, found that women's access to resources and effective technologies is often constrained by gender barriers or blindness (Feldstein and Poats: 1989). Adoption is not based on gender, but on the resources and access to support available to each farmer which may be more restricted for female operators. Traditional patterns of informal relations may tend to exclude or bypass women farmers.

Hypothesis 3A. Female farmers have lower levels of core conservation adoption.

Hypothesis 3B. Female farmers have lower levels of NRCS program participation.

Hypothesis 4A. Male farmers have higher levels of core conservation adoption.

Hypothesis 4B. Male farmers have higher levels of NRCS program participation.

African American

Molnar et al. (2001) investigated the adoption of four sets of conservation practices (conservation tillage (CT), crop nutrient management (CNM), integrated weed and pest management (IPM), and conservation buffers (CB)) by small and limited resource farmers in Alabama, Georgia and Mississippi. African American farmers adopted fewer conservation practices, many citing a lack of information on how to implement conservation practices. The study also found that African American farmers in all study states were in lower income categories (Molnar et al. 2001).

Several studies compare the conservation program participation of minority and white landowners. Many of these studies report disparities in program participation by racial and ethnic groups (Gan 2005). Demise (1989) found that African American farmers in five Southern states were less likely to participate in conservation programs than whites. Lack of participation was due to less awareness about programs and a lower economic standing than many white farmers (Demise 1989).

Hypothesis 5A. African Americans farmers have lower levels of core conservation practice adoption.

Hypothesis 5B. African American farmers have lower levels of NRCS program participation.

Farm Characteristics

Operation Size

Much of the past research has found a link between size of operation and income level. Most studies show that the larger the farm, the more income it produces, and the greater the amount of conservation practices adopted (Clearfield 1986). Larger farm businesses are more financially able to take advantage of new technologies (Napier 2001). Carlson and Dillman (1983) found that both farm size and income have moderate positive relationships with erosion control adoption.

Studies on farm size in relation to conservation practice use show a significant positive relationship (Nowak and Korshing 1981; Abd-Ella et al. 1981,Carlson et al. 1981; Coughenour, Kothari 1962; Ervin and Ervin 1982; Pampel and van Es 1977).

Hypothesis 6A. Operation size is positively related to core conservation practice adoption.

Hypothesis 6B. Operation size is positively related to NRCS program participation.

Total Gross Value of Sales

Annual sales of farm products can be a central indication of farm size depending on the crop. It is important to note that vegetables are a very high value crop, so a small vegetable farm could have very high sales. Many farmers would like to practice conservation techniques on their farm, but simply cannot afford it. Napier and Forster (1982) found that farmers are concerned about the long-term growth of their farming operations, but they were also very much committed to short-term economic gain. While economic factors play a major role in a farmer's decision to adopt conservation practices, cost considerations may not be the only factors (Napier and Forster 1982, Korshing, Stofferahn, Nowak, and Wagener 1983). It takes more than an interest in the long term environmental benefits of conservation practice adoption to induce a farmer to commit to a program of conservation practices and structures. Bell, Mayerfield, and Exner (2001) found that a sample of Iowa respondents spoke positively toward sustainable and organic agriculture, but were concerned with its profitability (Bell et al. 2001). Farmers with larger operations may have more idle resources to devote to conservation.

Hypothesis 7A. Total gross value of sales is positively related to core conservation practice adoption.

Hypothesis 7B. Total gross value of sales is positively related to NRCS program participation.

Internet Characteristics

Internet Access

Past studies show that the Internet is not a preferred form of information for most farmers. Howell and Habron (2004) found that most farmers preferred communication strategies that employed written methods such as newsletters, printed bulletins, and fact sheets. The least preferred form of agricultural communications were computer and Internet methods that included software such as e-mail, and World Wide Web pages (Howell and Habron 2004: 4).

Korshing and Hoban (1990) use what Dillman (1985) termed the information age to explain Iowa farmers' eventual preferred use of farm magazines. As mass media (magazines) became more pervasive, its' role in society become more accepted even by farmers (Korshing and Hoban 1990). The same could be applied to the Internet as a form of communication that is gaining acceptance as a way to gain and exchange information. Röling (1988: 23) noted that

> "where extension is in close contact with a sophisticated agricultural community, the need to listen and understand, to pre-test new ideas with local people before promoting them, and to use knowledge which has been developed by farmers themselves, is obvious and commonly practiced, facilitated by homophily between all the actors and the resources available to them."

It may be possible to relate these assertions to the fact that most farmers report the use of familiar information sources such as farm bulletins and magazines instead of the Internet.

While farmers in general may be slow in embracing the Internet as an information source, a great deal of the rest of America is not. Since the mid-1990s, when the Internet accelerated as a mass medium, social scientists have been interested in the distribution of Internet access and its potential to make information more attainable at a lower cost to all (DiMaggio and Harrgittai 2001: 2).

The Internet has not proved to be the equal opportunity information provider that many thought it would. Access to high speed lines that facilitate web browsing is often limited in rural areas (Howell: 2004). DiMaggio and Harrgittai cite Hoffman and Novak (1998, 1999), Benton (1998), and Strover (1999) to conclude that certain kinds of people are more likely to use the Internet than others. They found that for the most part, those with higher levels of access to the Internet were: whites, men, and residents of urban areas. Internet users had a greater access to education, income and many of the other resources that help people get ahead (DiMaggio and Harrgittai 2001).

Hall, Dunkelberger, Ferreira, Prevatt, and Martin (2003) examined the importance of personal computers and Internet use in the Alabama farming community. Hall et al. (2003) found that age and education play a major role in the adoption of Internet and computer use (Hall et al. 2003). All three variables (age, education, and Internet use) might also affect a farmer's likelihood to adopt conservation technologies. Young farmers with high education levels might be more likely to use the Internet and more open to adopt conservation innovations.

More farmers are embracing new information management technologies, such as on-line information services, advanced decision support software, and the Internet (Napier 2001). It is important to point out that much of this technology is associated with precision farming, an arguably profit maximizing conservation technology. Napier (2001) notes that farms have to position themselves in order to effectively use new technologies. Farmers are constantly exploring new technologies and approaches, so that they can adopt these changes quickly and increase the performance of their farm operation. Napier (2001) views this 'high tech' approach as the best way to ensure that information is progressively and thoroughly evaluated so that farmers are able to obtain the maximum benefit from new developments. The Internet can facilitate information sharing as well as motivation to improve performance (Napier 2001). Thus, Internet access is argued to provide autonomous assessment of conservation possibilities.

Hypothesis 8A. No Internet access is negatively related to core conservation practice adoption.

Hypothesis 8B. No Internet access is negatively related to NRCS program participation.

Hypothesis 9A. Internet access is positively related to core conservation practice adoption.

Hypothesis 9B. Internet access is positively related to NRCS program participation.

The next chapter outlines the procedures used to measure the dependent and independent variables. It also describes the tests that will be used to examine the hypotheses developed in this chapter.

III. RESEARCH METHODS

Sample and Data Collection

The data for this study were collected during the period from November 2004 to March 2005. The research project was funded by the United States Department of Agriculture- Agriculture Research Service (USDA-ARS) and conducted by the Department of Agricultural Economics and Rural Sociology of Auburn University.

Sample

The sampling frame for this study is the USDA-NASS list of agricultural producers in Alabama. This list is continually updated by obtaining current information from a variety of local and state sources. Crop acreages, livestock and poultry inventories, economic data, and various operator characteristics are maintained for each farm operator on the list. Every effort is made to maintain and keep the list as up-to-date as possible. However, any list frame of farm operators will always be incomplete because of constant changes in population due to retirements, farm sales, farm consolidations, entry of new farm operators, changes in operating arrangements, etc. Consequently, there is an undetermined, yet minimal, amount of incompleteness in the list frame used for this study.

The sampling design for the survey was structured to obtain 300 responses from each of three regions in Alabama, the Wheeler Lake watershed, the Upper Alabama watershed, and the combined area of the Upper Choctawhatchee \Pea watersheds. A map of the surveyed watershed is shown in Figure 1. Each of these watersheds was identified as potential candidates for early entry into the Conservation Security Program. Because the boundaries of the watersheds do not correspond with the boundaries of the counties within the watershed, random samples of farm operators were drawn using zip codes used by the United States Postal Service with the condition that 10 percent of the region defined by each zip code is within the watersheds being examined. All farmers were used in the Upper Alabama and Choctawhatchee/Pea watersheds due to the small number of farmers. Thus, the actual area being sampled were larger than the watershed being examined. This larger sampling area was not problematic, given many of the watersheds bordering those being examined were similar in the amount of conservation and types of farming being done. Samples were drawn from the 2004 Census of Agriculture, which identifies all persons who have more than $1,000 in sales of agricultural products. To help ensure that all the farm operators sampled were involved in production agriculture, only farm operators with greater than $10,000 in sales were chosen.

Sample sizes and number of completed questionnaires are shown in Table 2. Producers were contacted by mail using a self-administered survey instrument. A second request questionnaire was used to increase the mail response for both the Upper Alabama watershed (Lowndes), and the Choctawhatchee Pea (Coffee). To further boost response, a telephone contact was initiated in the Choctawhatchee Pea (Coffee) watershed. Trained telephone interviewers from NASS Alabama State Statistical Office conducted the follow-up. The 1054 respondents represent a 17.7 percent completion rate. The analysis contrasts farmer perceptions of conservation issues and practices in the three watersheds.

Figure 1. Three Alabama Watersheds.

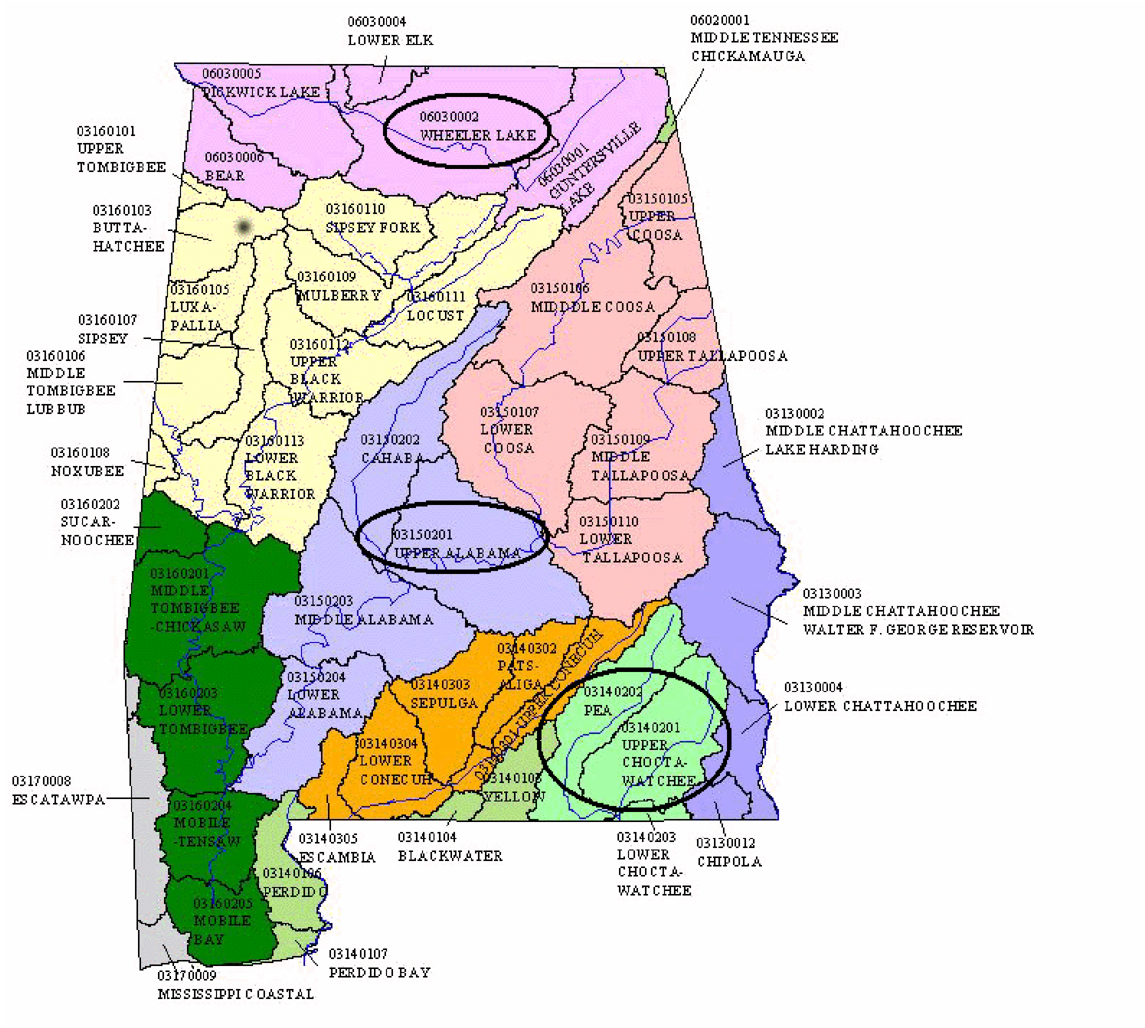


Table 2. Population Sample of Alabama Farms, 2000

Watershed (Main County)	Farm operators			
	Population	**Sample**	**Respondents**	**Response rate**
Wheeler Lake (Madison)	5,786	2,735	316	11.5%
Upper Alabama (Lowndes)	2,150	1,241	412	33.1%
Choctawhatchee -Pea (Coffee)	2,994	1,959	326	16.6%
Total	10,930	5,935	1054	17.7%

The response rate signals caution in the representativeness of the data. Comparisons between the sample and population data suggest that respondents tend to be more educated, wealthier, and somewhat younger than the actual population of operators. The sample frame employed in the study is the best available listing of farm operators in these states, but access rules to the list and the study's resource limitations constrained full implementation of the Dillman (2001) procedures for repeated contact with nonrespondents.

Measures

Dependent Variables

NRCS Program Participation Index

Table 1 summarizes the seven NRCS programs that make up the NRCS program participation index. The conservation programs provided by the USDA Natural Resource Conservation Service (NRCS) include: Environmental Quality Incentive (EQIP), Wetlands Reserve Program (WRP), Farm and Ranch Lands Protection Program (FRPP), Grasslands Reserve Program (GRP), Conservation of Private Grazing Land (CPGL), Wildlife Habitat Incentives Programs (WHIP), and Conservation Reserve Program (CRP). This was a multiple response question and the responses were coded 1 = yes, and 0 = no and then treated as a count. In order to qualify for these programs farmers must be currently taking conservation measures on their farm, or be willing to implement conservation efforts on their farm. Some NRCS programs take agricultural land out of production. The measure counts the number of "yes" responses.

Core Conservation Practices

Four core conservation practices were used to evaluate the adoption of conservation practices. The practices included rotational grazing, conservation tillage, soil testing, and integrated pest management (IPM).

Rotational Grazing

Rotational grazing refers to the regular movement of livestock to fresh paddocks or pastures to provide for pasture recovery, improve livestock health and production, and to protect water quality (NRCS). Respondents were asked the amount of rotational grazing done on their operation with the options of: two, three, four or five, and more than six pastures or paddocks on their operation. Response were coded as follows; I do not raise livestock was treated as missing, 1 = none (use only one pasture for livestock), 2 = two paddocks or pastures, 3 = three paddocks or pasture, 4 = four or five paddocks or pasture, and 5 = more than six paddocks or pastures. This item is ordinal and was treated as a measure of the degree of adoption of the conservation practice among producers with livestock.

Conservation Tillage

Conservation tillage refers to leaving all or a significant portion (30 percent or more) of the previous crop's residue on the soil surface after harvesting to reduce soil erosion and conserve soil moisture (NRCS). Tillage practices include no-till, para-till, strip-till, mulch-till, and ridge-till. Respondents were asked to identify the amount of row crop acreage (excluding hay) that is planted using conservation tillage with the options of: less than one fourth, about half, around three fourths, or most or all. Responses were coded as 1 = I do not grow row crops (treated as missing), 2 = none, 3 = less than ¼, 4 =

about ½, 5 = around ¾, and 6 = most or all. This item is ordinal and was treated as a measure of adoption of the conservation practice among farmers who grow crops.

Soil Testing

Soil testing is one of the most basic forms of crop nutrient management which enhances the ability of a farmer to manage the amount, source, timing, and method for applying nutrients to a growing crop to ensure adequate nutrition for crop production and to reduce water and soil pollution (NRCS). Respondents were asked to identify how often they have their soils tested. Responses were coded 1 through 5: 1 = never, 2 = 4 years or more between testing, 3 = 3 years, 4 = 2 years, and 5 = every year. This item is ordinal and was treated as a measure of adoption of the conservation practice.

Integrated Pest Management (IPM)

IPM is the use of comprehensive information of the life cycles of pests (such as diseases, insects and weeds) and their interaction with the environment, along with available pest control methods, to manage pest damage by the most economical means, and with the least possible hazard to people, property, and the environment (NRCS). Respondents were asked to mark all of the following practices that applied to them: trap crops, scout crops for pests, resistant crop varieties, manage beneficial insects, mechanical controls (hooded sprayers), tillage, and spray advisories for diseases. Farmers without row crops were coded as missing. This was a multiple response question and responses were coded 1 = yes and 0 = no. The measure counts the number of “yes” responses, the extent of IPM practice adoption.

Independent Variables

The independent variables describe the characteristics of farmers and their farms. The farmer characteristics include: education, age, and Internet accessibility. The farm characteristics include: farm sales level and operation size. Internet characteristics refer to the farmer's Internet accessibility.

Farmer Characteristics

Education

The variable, education, referred to the amount of formal schooling received by the farmer. The information was obtained as a response to the question, "What is the highest level of formal education you (the operator) completed? Responses were measured in degrees attempted and/or achieved. Codes 1 to 6 were assigned: 1 = some high school, 2 = high school or GED equivalency, 3 = trade school, 4 = some college, 5 = college graduate, and 6 = postgraduate.

Age

The measure of age was obtained as a response to the question: "How old were you on your last birthday?" The age reported by the respondent was recorded.

African American

The measure of race/ethnic status was obtained by asking the respondents what their race/ethnic status was. Codes 1 through 6 were assigned to the following responses: 1 = Black or African American, 2 = American Indian, 3 = Hispanic American, 4 = White, 5 = Asian or Pacific Islander, and 6 = other. The measure contrasts African Americans with others by coding African American = 1, and 2 through 6 = 0.

Female

The measure for the variable female was obtained by asking the respondents to select either male or female. The responses were coded 1 = male, and 2 = female. The variable was recoded, making female= 1, and male = 0.

Male

The measure for gender was obtained by asking the respondents to select either male or female. The responses were coded: 1 = male, and 2 = female. The variable was recoded, making male = 1 and female = 0.

Farm Characteristics

Operation Size

The operation size referred to the total amount of land operated by the farmer, including land rented from others and to others. Respondents were asked to give an acre amount for the amount of land in their operation that they own, rent from others (including land used rent free), and land that is rented to others. The amount of land they own and rent from others were combined in a count to determine the size of the operation in acres for the respondent' operation size. Thus the acres owned plus acres rented from others, minus acres rented out is equal to the total acres operated on-farm.

Total Gross Value of Sales

The total gross value of sales referred to the farm revenue including agricultural payments gained through farming, including sales of all crops, livestock, poultry and miscellaneous agricultural products (including the landlord's share) and government agricultural payments. Respondents were asked to select the category that represents the total gross value of sales from their operation last year (2004). Codes 1 through 9 were assigned: 1 = less than \$1,000, 2 = \$1,000 to \$2,499, 3 = \$2,500 to \$4, 999, 4 = \$5,000 to \$9,999, 5 = \$10,000 to \$24, 999, 6 = \$25,000 to \$49,999, 7 = \$50,000 to \$99,999, 8 = \$100,000 to \$249,999, and 9 = \$250,000 and over.

Internet Path

The variable Internet accessibility referred to the kind of Internet access available in the farmer's home or office. The information was obtained as a response to the question: "What kind of Internet access do you have available in your home or office?". Respondents were asked to mark all that apply out of the following choices: No Internet Access, Dial-up, DSL or ADSL, Cable, and Satellite. Responses were coded 1 = yes and 0 = no for each type of access.

Descriptive Statistics

Table 3 shows the descriptive statistics for the dependent and independent variables in the study. The dependent variables measure various aspects of conservation adoption.

Table 3. Descriptive Statistics for Study Variables in Three Alabama Watersheds, 2005

	Mean	Standard Deviation	Range	N
Farmer Characteristics:				
Education	3.64	1.54	1-6	1054
Age	59.49	12.14	25-90	1054
African American	0.05	0.22	0-1	1054
Male	0.94	0.24	0-1	1054
Farm Characteristics:				
Total Gross Value of Sales	5.1	1.99	1-9	1054
Operation Size:				
Acres in Row Crops	78.07	348.34	0-6000	1054
Acres in Hay	42.64	76.09	0-100	1054
Acres in Pasture/Paddock	110.11	192.96	0-2500	1054
Operation Size Index	370.29	584.26	0-5998	1054
Internet Path:				
None	0.38	0.49	0-1	1054
Dial-up	0.41	0.49	0-1	1054
DSL/ADSL	0.08	0.27	0-1	1054
Cable	0.09	0.28	0-1	1054
Satellite	0.03	0.16	0-1	1054
Conservation Practices:				
Grass Waterways	0.3	0.46	0-1	1054
Controlled Drainage	0.24	0.43	0-1	1054
Permanent Vegetation Cover	0.44	0.50	0-1	1054
Precision Agriculture	0.03	0.16	0-1	1054
Legumes in Rotation on Pasture	0.14	0.35	0-1	1054
Wildlife Habitat	0.24	0.43	0-1	1054
Filter or Buffer Strips	0.14	0.35	0-1	1054
Rotational Grazing	3.68	1.39	1-5	850*
Conservation Tillage	3.88	1.59	2-6	244*
Cover Crops	4.06	1.81	2-7	244*
Soil Testing	3.06	1.38	1-5	1054*
Integrated Pest Management Practices (IPM):				
Trap Crops	0.01	0.12	0-1	434
Scout Crops for Pests	0.15	0.36	0-1	434
Resistant Crop Varieties	0.11	0.31	0-1	434
Manage Beneficial Insects	0.08	0.27	0-1	434
Mechanical Controls (hooded sprayers, e.g.)	0.05	0.22	0-1	434
Tillage	0.07	0.26	0-1	434
Spray Advisories for Diseases	0.05	0.22	0-1	434
IPM Index	1.27	1.56	0-6	434

*The differing N scores for rotational grazing, conservation tillage, cover crops, and soil testing are related to whether the practice pertains to row cropping or livestock production. Rotational grazing only pertains to livestock farmers, conservation tillage and cover crops pertain only to row crops farmers, with soil testing including both livestock and row crops producers

Analysis

To analyze the data, the SPSS statistical computer program was utilized. Hypotheses were tested by using the Pearson's r correlation with a two tailed significance test. Multiple regression analysis was then used to assess the independent and aggregate effects of the independent variables on conservation adoption and program participation.

IV. RESULTS

This chapter describes the conservation activities and programs used by farmers in three Alabama watersheds. The analysis relates farmer attributes, farm characteristics, and Internet use, to conservation adoption, and program participation. This chapter tests the hypotheses stated in Chapter II.

Dependent Variables

Rotational Grazing

Nineteen percent of the respondents reported that they did not raise livestock on their operation. Twenty eight percent reported using only one pasture or paddock for their livestock. Twenty percent reported using two paddocks or pastures as well as twenty percent reported using four or five. Only 12 percent of the farmers reported using more than six pastures or paddocks for their livestock. There was a great deal of variation pertaining to the adoption of rotational grazing.

Conservation Tillage

There was much variation in the responses for conservation tillage adoption. Twenty eight percent of the respondents reported using no conservation tillage and 28 percent also reported using conservation tillage on most or all of their operation. Twenty percent reported using the practice on less than ¼ and only 10 percent reported using it on around 3/4ths of their operation. Conservation tillage adoption is widespread, as 72 percent of the respondents reported some level of adoption on most or all of their operation.

Figure 2. Rotational Grazing Adoption, Alabama Farmers, 2005.

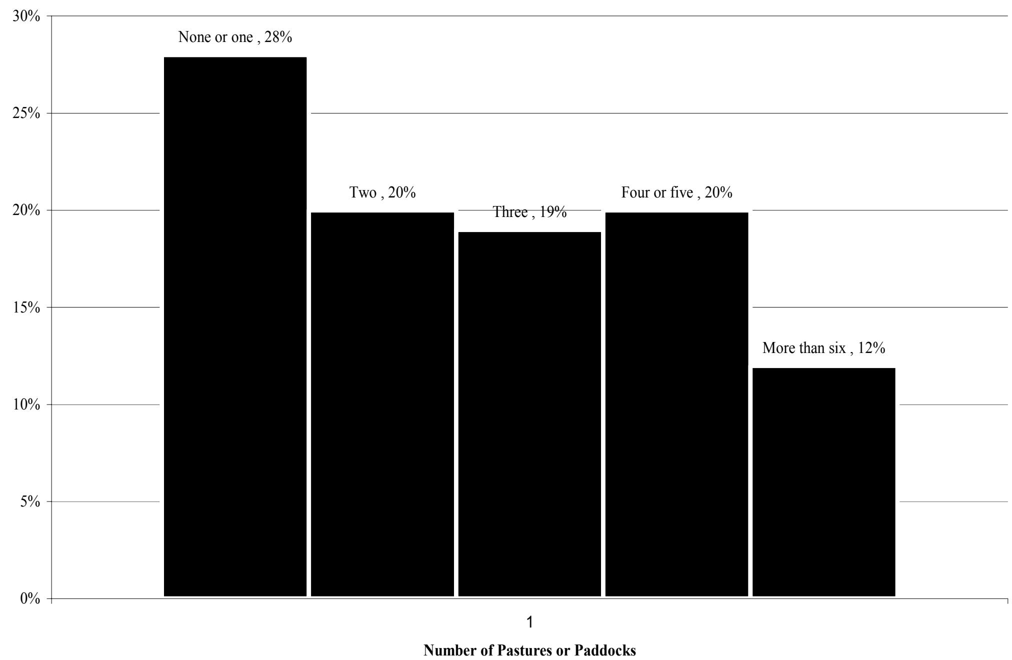
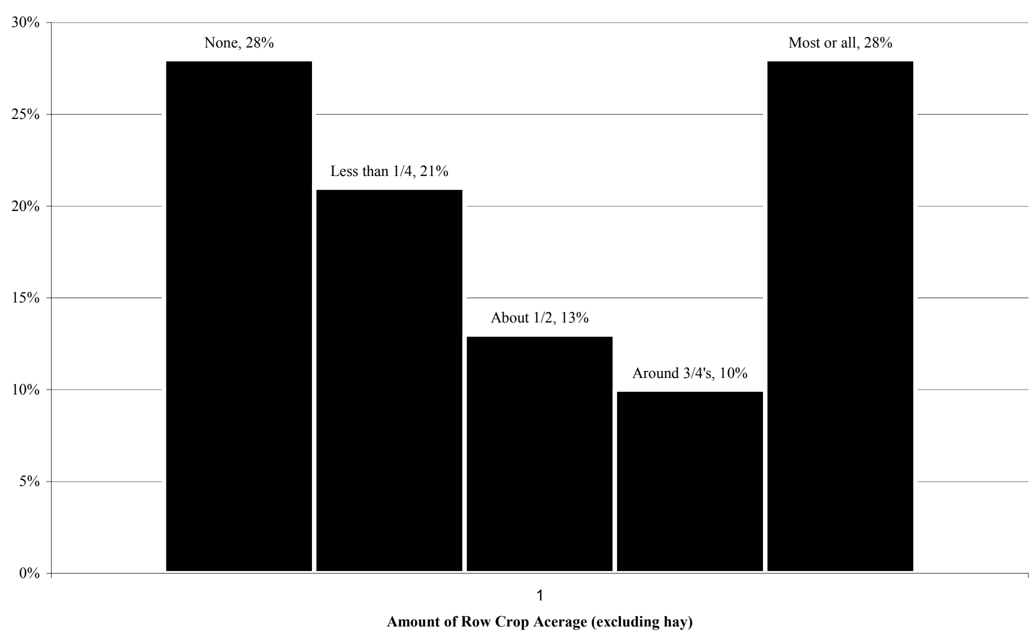


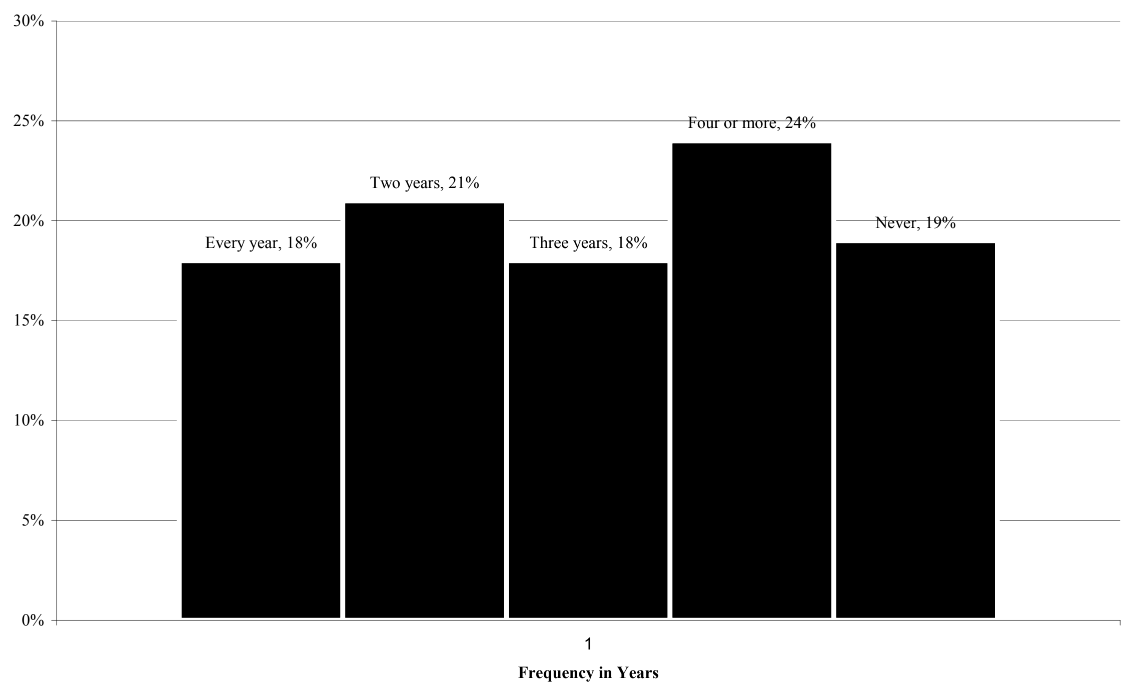
Figure 3. Conservation Tillage Adoption, Alabama Farmers, 2005.



Soil Testing

Eighteen percent reported soil testing their operation every year and 21 percent tested every two years. Eighteen percent of the respondents reported soil testing every three years, which is the minimum requirement for NRCS program participation. Nineteen percent reported never testing and 24 percent tested every four years or more. Farmers in Alabama are not soil testing with great frequency.

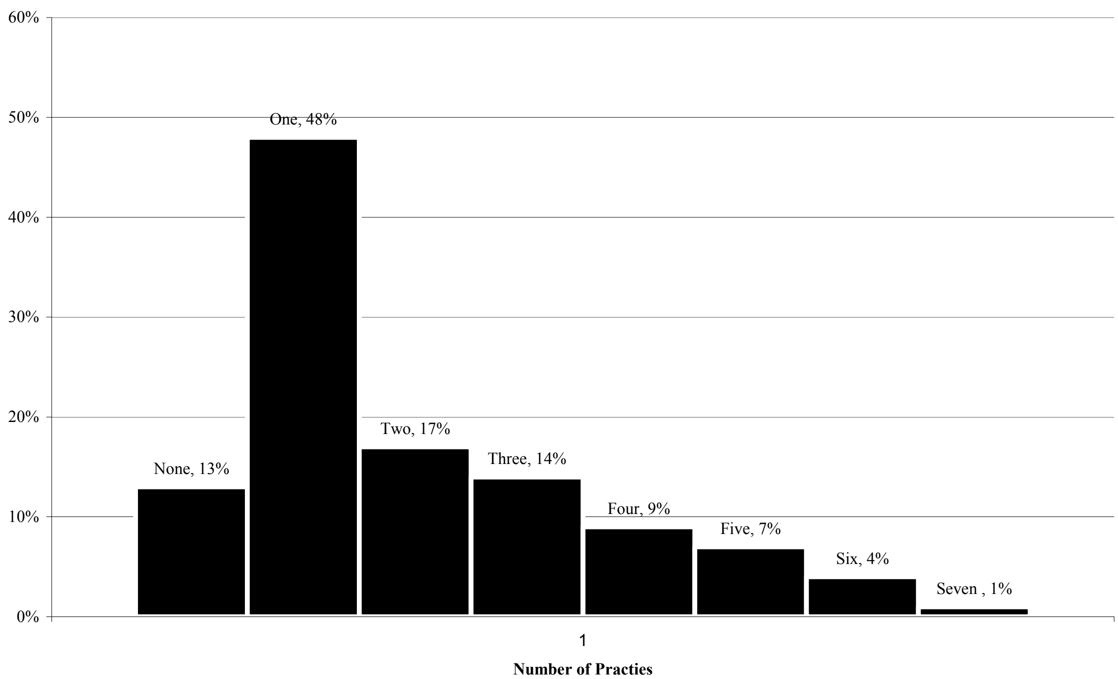
Figure 4. Soil Testing Adoption, Alabama Farmers, 2005.



Integrated Pest Management (IPM)

Forty eight percent of the row crop farmers surveyed reported using no form of IPM on their operation. Seventeen percent reported the use of one IPM practice, 14 percent reported using two practices, and nine percent reported using three of the practices. A very low percentage rate of farmers reported using any more than four IPM practices. IPM has a relatively low adoption rate among Alabama farmers.

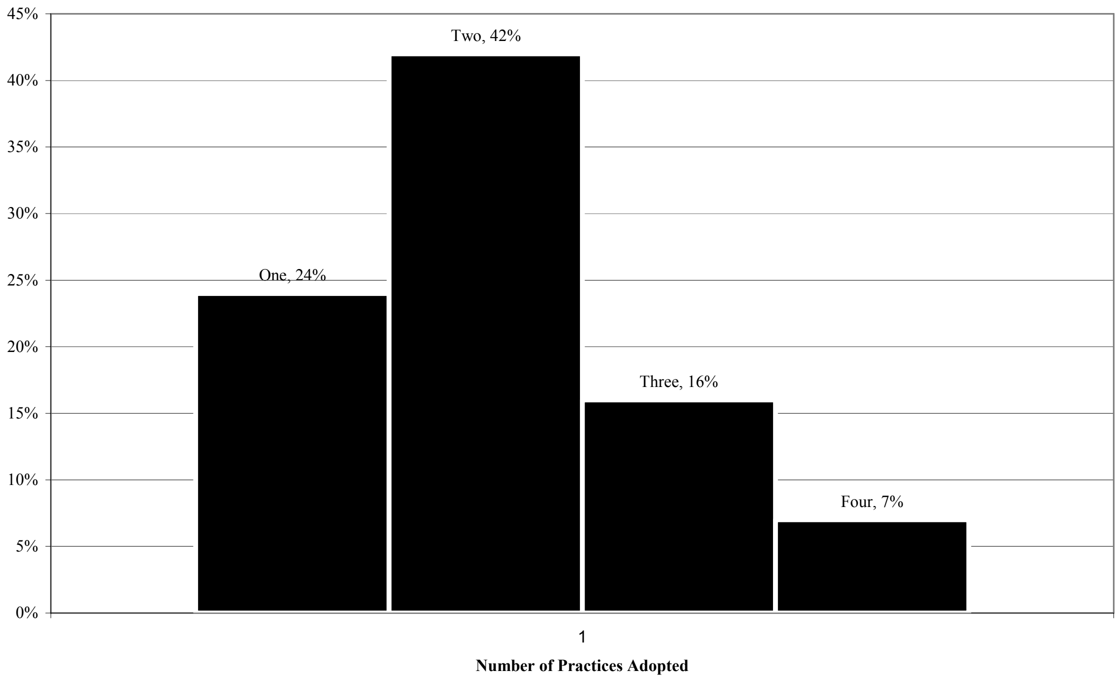
Figure 5. Integrated Pest Management (IPM), Alabama Farmers, 2005.



Overall

Soil testing proved to be the most popular conservation method adopted. Forty two percent of the respondents reported using two of the core conservation practices. Twenty four percent adopted one practice, and 16 percent reported the use of three practices. Only seven percent of the farmers surveyed reported using all four of the core conservation practices. Figure 6 summarizes the adoption of core conservation practices.

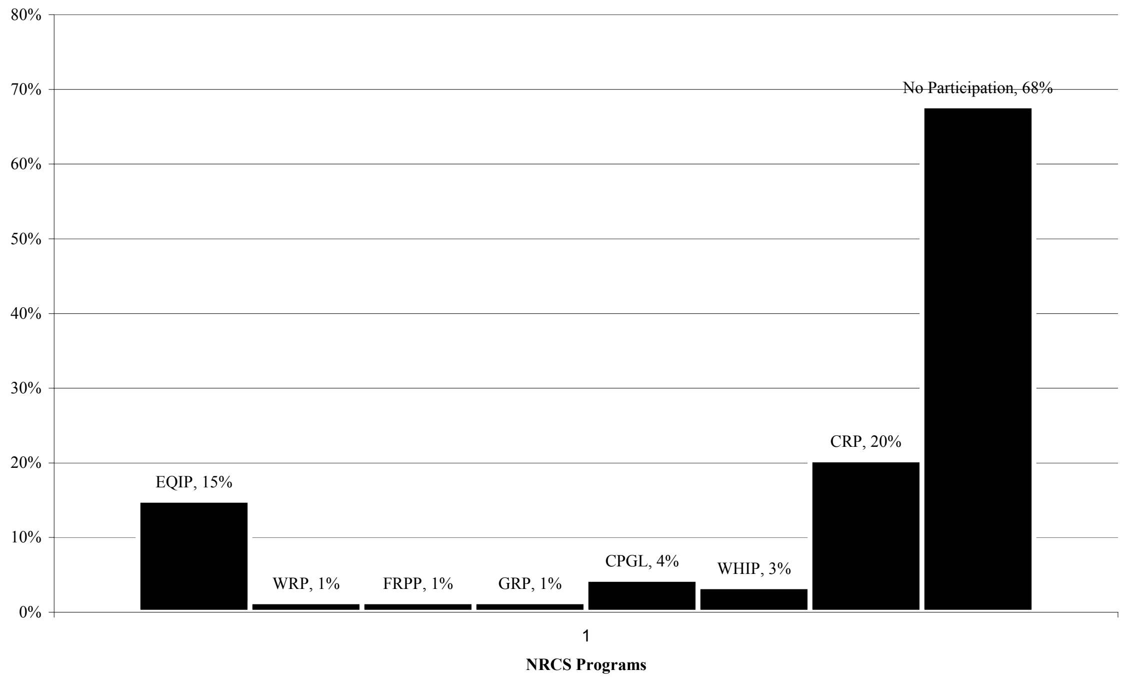
Figure 6. Core Conservation Practice Adoption, Alabama Farmers, 2005.



Program Participation

Twenty eight percent of the Alabama farmers surveyed reported no participation in NRCS programs, but 30 percent reported that they participated in at least one. Fewer (21 percent) reported participation in more than one NRCS program. The CRP was the most popular program with 20 percent of the respondents reporting participation and 15 percent of the respondents' reported participating in EQIP. This could be related to the somewhat specific nature of some of the programs. CRP requires no prior conservation in order to qualify, only a willingness to retire land from agricultural production and plant it into trees or pasture. EQIP requires a willingness to adopt conservation practices with no minimum standards. Figure 7 summarizes NRCS program participation.

Figure 7. NRCS Program Participation, Alabama Farmers, 2005.



Independent Variables

Education

The range for education is 1-6 with a mode score of 2, and a mean score of 3.64, showing that a large portion of respondents finished high school and attended some college.

Age, Gender and Ethnicity

The mean for age is 59.5 years with 57 as the mode. The minimum age reported was 25 and the maximum 90 with a moderate standard deviation of 12. Most of the farmers surveyed were white and male (94 percent). Five percent of the farmers surveyed were African American.

Operation Size

The acres operated measure reveals a great deal of variation among Alabama farmers with a standard deviation of 584 acres. The smallest farm reported 2 acres and the largest 6,000 acres. The mean operation size was 370 acres.

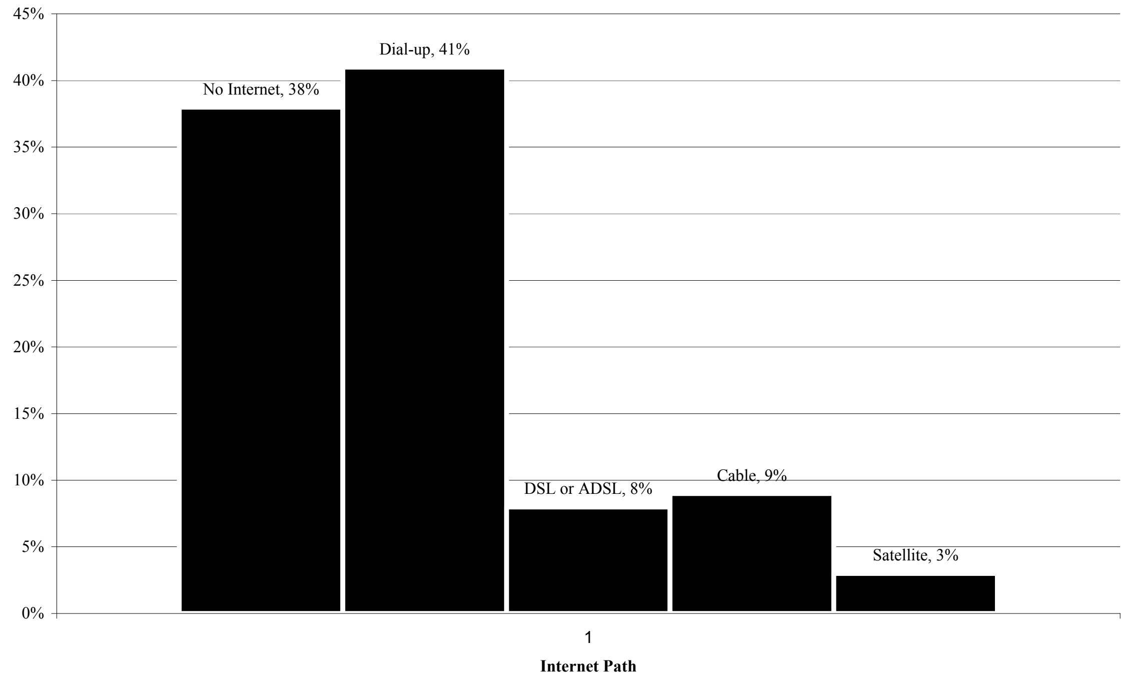
Total Gross Value of Sales

The total gross value of sales has a range of 1-9 with a mean score of 5.1. This implies that the average total gross value of sales for the farmers surveyed is between $10,000 and $24,999. Total gross value of sales had a standard deviation of 1.99.

Internet Access

Thirty eight percent of the respondents reported having no Internet access in their home or office. Forty one percent reported that they had dial-up access in their home or office. The majority of farmers surveyed had no Internet access or slow access provided through dial-up. Figure 8 helps to further explain the Internet access of the farmers surveyed for this study.

Figure 8. Alabama Farmer Internet Access, 2005.



Hypothesis Testing

Dependent Variables

Table 4 summarizes the correlations found between the four conservation practices (item-to-total correlations). For this study, rotational grazing had very little effect on adoption of the other practices with the exception of soil testing. It is important to note that conservation tillage and IPM practices are used primarily in cropping operations, so the correlation between rotational grazing and soil testing could be related to the fact that both practices may be adopted by livestock producers. The significant correlation between conservation tillage and IPM could be explained by the prominent use of these practices by crop producers. Soil testing had a significant positive relationship with all three conservation practices and this could be connected to the fact that both crop and livestock producers may implement soil testing on their operation.

Thus the significance of soil testing is connected to its ability to be adopted by a larger sample of producers.

Table 4. Pearson Correlations between Core Conservation Practices Alabama Farmers, 2005.

Variable	Rotational Grazing	Conservation Tillage	Soil Testing	IPM Index
Rotational Grazing	1			
Conservation Tillage	0.05	1		
Soil Testing	0.20**	0.20**	1	
IPM	0.08	0.35**	-0.40**	1

**Correlation is significant at the 0.01 level (2-tailed).
*Correlation is significant at the 0.05 level (2-tailed).

Table 5 summarizes correlations between the seven individual NRCS programs and the NRCS program participation index variable (Item-to-total correlations). For this study, each of the NRCS programs were positively correlated ($p < .01$) with the NRCS program participation index. The Environmental Quality Incentives Program (EQIP) has a correlation of ($r = .58$, $p < .01$), the Wetlands Reserve Program (WRP) ($r = .37$, $p < .01$), the Farm and Ranch Lands Protection Program (FRPP) ($r = .36$, $p < .01$), the Grasslands Reserve Program (GRP) ($r = .35$ $p < .01$), the Conservation of Private Grazing Land (CPGL) ($r = .42$, $p < .01$), the Wildlife Habitat Incentives Program (WHIP) ($r = .51$, $p < .01$), and the Conservation Reserve Program (CRP) ($r = .67$, $p < .01$).

Table 5. Pearson Correlation between NRCS Program Participation Variables, Alabama Farmers, 2005.

Variable	NRCS Program Participation Index	Environmental Quality Incentives Program (EQIP)	Wetlands Reserve Program (WRP)	Farm & Ranch Lands Protection Program (FRPP)	Grasslands Reserve Program (GRP)	Conservation of Private Grazing Land (CPGL)	Wildlife Habitat Incentives Program (WHIP)
NRCS Program Participation Index	1						
Environmental Quality Incentives Index	0.58**	1					
Wetlands Reserve Program Index	0.37**	0.08**	1				
Farm & Ranch Lands Protection Program	0.36**	0.025	0.19**	1			
Grasslands Reserve Program	0.35**	0.04	0.19**	0.19**	1		
Conservation of Private Grazing Land	0.42**	0.02	0.09**	0.29**	0.13**	1	
Wildlife Habitat Incentives Program	0.51**	0.08*	0.20**	0.20**	0.15**	0.19**	1
Conservation Reserve Program	0.67**	0.14**	0.10**	0.039	0.098**	0.04	0.20**

**Correlation is significant at the 0.01 level (2-tailed).

*Correlation is significant at the 0.05 level (2-tailed).

Independent Variables

Table 6 summarizes the correlations found between the dependent variables and the independent variables. Results from Table 6 are used to examine the study hypotheses presented in the previous chapter.

Table 6. Pearson Correlations between Adoption of Core Conservation Practices, the NRCS Program Participation Index and Independent Variables, Alabama Farmers, 2005.

Variable	Rotational Grazing	Conservation Tillage	Soil Testing	IPM Index	Composite NRCS Program Participation Index
Farmer Characteristics					
Education	0.14**	0.03	0.09**	0.14**	0.05
Age	-0.05	-0.02	-0.19**	-0.22**	0.03
Female	0.03	-0.07	-0.09**	-0.09	-0.03
Male	0.17*	0.19**	0.09**	0.09*	0.20**
African American	-0.18**	-0.23**	-0.15**	-0.14**	-0.04
Farm Characteristics					
Operation Size Index	0.14**	0.24**	0.25**	0.37**	0.30**
Total Gross Value of Sales	0.17**	0.26**	0.37**	0.47**	0.20**
Internet Accessibility					
None	-0.08*	-0.12	0.13**	-0.13**	-0.02
Dial Up	0.03	0.16*	-0.07*	0.09*	-0.02
DSL/ADSL	0.02	-0.08	0.02	-0.01	-0.03
Cable	-0.01	-0.05	-0.05	0.04	0.03
Satellite	0.07*	-0.09	-0.04	-0.01	0.01

**Correlation is significant at the .01 level (1-tailed)
*Correlation is significant at the .05 level (1-tailed)

Hypothesis 1A. Education is positively related to adoption of core conservation practices. There is significant positive relationship between education and rotational grazing ($r = .14$, $p < .01$), soil testing ($r = .09$, $p < .01$) and IPM practice adoption ($r = .14$, $p < .01$). There is no significant relationship between education and conservation tillage. While education does not significantly affect the adoption of conservation tillage, it is positively related to rotational grazing, soil testing, and IPM practice adoption. Therefore, hypothesis 1A is accepted for rotational grazing, soil testing and IPM practice adoption.

Hypothesis 1B. Education is positively related to NRCS program participation. There is no significant relationship between education and the NRCS program participation index. Hypothesis 1B is rejected.

Hypothesis 2A. Age is negatively related to adoption of core conservation practices. Age was negatively related to soil testing ($r = -.19, p < .01$), and IPM practice adoption ($r = -.22, p < .01$). Both rotational grazing and conservation tillage are not significantly related to age. Hypothesis 2A is accepted for soil testing and IPM practice adoption.

Hypothesis 2B. Age is negatively related to NRCS program participation. No significant relationship exists between age and the NRCS program index, therefore hypothesis 2B is rejected. However some correlations with specific programs can be noted. There is a significant positive relationship between age and FRPP ($r = .08, p < .05$), CPGL ($r = .10, p < .01$) and CRP ($r = .10, p < .01$). A significant negative relationship exists between age and EQIP ($r = -.16, p < .01$). Age seemed to be positively related to conservation programs that take land out of production (FRPP, CPGL, and CRP), but negatively related to those that require implementation of conservation practices (EQIP). Age is not related to overall NRCS program participation.

Hypothesis 3A. Female farmers have lower levels of core conservation practice adoption. The only significant correlation between female farmers and conservation practice adoption exists with soil testing ($r = -.09, p < .01$). The relationship is negative, therefore hypothesis 3A is accepted for soil testing and rejected for the other three conservation practices. It is important to note that 94 percent of the respondents were male, thus lower levels of female conservation adoption could be due to a lack of sufficient representation.

Hypothesis 3B. Female farmers have lower levels of NRCS program participation. No significant correlations were found between female farmers and the NRCS program participation index. Being a woman had no significant effect on NRCS program participation, thus hypothesis 3B is rejected. These findings could be related to the low number of female respondents.

Hypothesis 4A. Male farmers have high levels of core conservation practice adoption. Male farmers conduct more soil testing ($r = .09$, $p < .01$) and score higher on the IPM practice index ($r = .07$, $p < .05$). Hypothesis 4A is accepted for soil testing and IPM practice adoption. High levels of male conservation adoption could be related to the high number of male respondents.

Hypothesis 4B. Male farmers have higher levels of NRCS program participation. A significant correlation ($r = .20$, $p < .01$) exists between male farmers and NRCS program participation. Hypothesis 4B is accepted. Ninety four percent of the respondents in this study were male, so the positive relationships between male farmers and NRCS program participation could be related to a lack of female representation within these findings.

Hypothesis 5A. African American farmers have lower levels of adoption of the core conservation practices. The African American farmer variable showed significantly negative correlations with rotational grazing ($r = -.18$, $p < .01$), conservation tillage ($r = -.23$, $p < .01$), soil testing ($r = -.15$, $p < .05$), and IPM practice adoption ($r = -.14$, $p < .01$).

Hypothesis 5A is accepted. African American farmers are not implementing conservation practices at the same levels as other groups.

Hypothesis 5B. African American farmers have lower levels of NRCS program participation. There are no significant correlations found between African American farmers and participation the NRCS program participation index. Therefore, hypothesis 5B is rejected for NRCS program participation. Race was not related to participation in NRCS programs.

Hypothesis 6A. Operation size is positively related to adoption of core conservation practices. A significant positive relationship exists between operation size and all four of the core conservation practices. Operation size has a high positive correlation with rotational grazing ($r = .14$, $p < .01$), conservation tillage ($r = .24$, $p < .01$), soil testing ($r = .25$, $p < .01$), and IPM practice adoption ($r = .37$, $p < .01$). Hypothesis 6A is accepted. Farmers with large operations have higher levels of conservation practice adoption.

Hypothesis 6B. Operation size is positively related to NRCS program participation. Operation size is significantly related to the NRCS program participation index ($r = .30$, $p < .01$). Therefore, hypothesis 6B is accepted for NRCS program participation. This demonstrates that farmers with a larger operation size are more likely to participate in NRCS programs. Larger farms have more land and more types of land, making program participation more likely.

Hypothesis 7A. Total gross value of sales is positively related to adoption of core conservation practices. Much like operational size, total gross value of sales is significantly related to all of the core conservation practices. Total gross value of sales is positively related to rotational grazing ($r = .17$, $p < .01$), conservation tillage ($r = .26$, $p < .01$), soil testing ($r = .37$, $p < .01$), and IPM practice adoption ($r = .47$, $p < .01$). Hypothesis 7A is accepted. Farmers with high total gross value of sales have higher levels of core conservation adoption.

Hypothesis 7B. Total gross value of sales is positively related to NRCS program participation. A significantly positive correlation exists with the NRCS program participation index ($r = .20$, $p < .01$). Therefore, hypothesis 7B is accepted. Larger farms participate in more NRCS conservation programs.

Hypothesis 8A. No Internet access is negatively related to adoption of core conservation practices. No Internet access had a significant negative correlation with IPM practice adoption ($r = -.13$, $p < .01$), soil testing ($r = -.13$, $p < .01$), conservation tillage ($r = -.12$, $p < .05$) and rotational grazing ($r = -.08$, $p < .01$). Hypothesis 8A is accepted, farmers with no Internet access adopt conservation practices with lower frequency.

With respect to specific types of Internet access, a significant relationship exists between dial up and conservation tillage ($r = .16$, $p < .05$), and soil testing ($r = .07$, $p < .05$). No significant correlations were found between DSL/ADSL and Cable in relation to adoption of core conservation practices. A weak positive relationship was found between satellite access and rotational grazing adoption ($r = .07$, $p < .05$). These finding could be due to limited Internet access available in rural areas and the rural nature of farms. These correlations do little to show that Internet access has a systematic effect on adoption of core conservation practices. The negative correlations found between no Internet access and dial up access in relation to adoption of core conservation practices show that few farmers had Internet access faster than dial up.

Hypothesis 8B. No Internet access is negatively related to NRCS program participation. Internet access was not associated with the NRCS program participation index, thus hypothesis 8B is rejected.

Hypothesis 9A. Internet access is positively related to adoption of core conservation practices. Dial up access proved to have the most positive correlations with conservation practice adoption. This could be due to the fact that 41 percent of the Alabama farmers surveyed reported dial up access. Dial up access is positively related to conservation tillage ($r = 16$, $p < .01$), soil testing ($r = .07$, $p < .05$), and IPM adoption ($r = .09$, $p < .05$). Significant relationships were also found between cable Internet access and soil testing ($r = .05$, $p < .05$), and satellite access and rotational grazing adoption ($r = .07$, $p < .05$). Overall, Internet access is not significantly related to adoption of conservation practices and hypothesis 9A is rejected.

Hypothesis 9B. Internet access is positively related to NRCS program participation. No significant relationship was found between Internet access and the NRCS program participation index. Hypothesis 9B is rejected. Internet access has no significant positive effect on NRCS program participation.

Multivariate Linear Regression

Table 7[1] gives a summary of the multivariate linear regression results for the four core conservation practices and the NRCS program participation index on farm characteristics, and Internet path variables. The regression showed patterns that sustain

[1] A PLUM ordinal regression showed findings largely consistent with those found in the OLS linear regression. Of the 60 coefficients in the OLS linear regression table 57 were consistent in magnitude and significance with the PLUM. Three variables were significant in the OLS, but not the PLUM. The African American variable had a significantly negative effect on conservation tillage in the OLS regression but not in the PLUM regression. Operation size had a significantly positive effect on both soil testing and IPM adoption in the OLS regression, but was not found to be significant in the PLUM regression. No significant sign reversals were observed.

some of the stated hypotheses. Regression results showed that rotational grazing was the only conservation practice significantly influenced by education (beta = .11, $p < .05$). Hypothesis 1A is accepted for rotational grazing only. Age had a significantly negative relationship with soil testing (beta = -.11, $p < .01$). Hypothesis 2A is supported for soil testing only. Hypothesis 3A, 3B, 4A, 4B were rejected; gender did not effect conservation practice adoption or NRCS program participation. A significantly negative correlation was found between African American farmers and rotational grazing (beta = -.14, $p < .01$), and conservation tillage (beta = -.19, $p < .05$). Hypothesis 5A is accepted for only rotational grazing and conservation tillage.

Operation size had a significantly positive effect on soil testing (beta = .10, $p < .05$), IPM practice adoption (beta = .15, $p < .05$), and the NRCS program participation index (beta = .25, $p < .01$). Hypothesis 6A is accepted for soil testing and IPM practice adoption. Operation size was found to be significantly positively related to NRCS program participation and hypothesis 6B is accepted.

Soil testing (beta = .28, $p < .01$) and IPM practice adoption (beta = .35, $p < .01$) were both found to be positively related to total gross value of sales. Therefore, hypothesis 7A is accepted for soil testing and IPM practice adoption. Findings show a positive correlation between total gross value of sales and NRCS program participation (beta = .11, $p < .05$), as well. Thus, hypothesis 7B is accepted, indicating high levels of total gross value of sales help to induce NRCS program participation.

Regression results showed that Internet access had no effect on adoption of the core conservation practices or NRCS program participation. Hypotheses 8A and 8B were both rejected. A lack of Internet access (or no Internet access) did not negatively effect adoption of the four core conservation practices or NRCS program participation. Hypotheses 9A and 9B were both rejected. Internet access (dial-up, DSL/ADSL, Cable, or Satellite) had no effect on conservation adoption or NRCS program participation.

Overall operation size and total gross value of sales seemed to affect the dependent variables the most. Farm characteristics like the size of the operation and the total gross value of sales play a big role in whether a farmer adopts conservation practices or participates in NRCS programs. The significant correlations with soil testing, IPM practice adoption, and the NRCS program participation index could point to a possible trend. Farmers who adopt soil testing and IPM practices are more likely to participate in NRCS programs.

Table 7. Linear Regression of the Four Core Conservation Practices and the NRCS Program Participation Index on Farm Characteristics, and Internet Path Variables, Alabama Farmers, 2005.

Variable	Rotational Grazing	Conservation Tillage	Soil Testing	IPM	NRCS Program Participation Index
	Beta (Standard Error)	Beta (Standard Error)	Beta (Standard Error)	Beta (Standard Error)	Beta (Standard Error)
Farmer Characteristics:					
Education	.11* (.03)	-.01 (.07)	.05 (.03)	.09 (.05)	.04 (.02)
Age	-.01 (.00)	.07 (.10)	'-.11** (.00)	-.12 (.01)	.07 (.00)
Female	.04 (.21)	-.04 (.53)	-.05 (.16)	-.10 (.29)	-.01 (.10)
Male	-.04 (.21)	.04 (.53)	.05 (.16)	.10 (.29)	.01 (.10)
African American	'-.14** (.20)	-19* (.39)	-.07 (.18)	-.02 (.27)	.00 (.11)
Farm Characteristics:					
Operation Size	.06 (.00)	.15 (.00)	.10* (.00)	.15* (.00)	.25** (.00)
Total Gross Value of Sales	.10 (.03)	.09 (.06)	.28** (.02)	.35** (.04)	.11* (.01)
Internet Path:					
No Internet Access	-.11 (.20)	-.17 (.41)	-.13 (.17)	-.02 (.28)	-.08 (.10)
Dial-up	-.11 (.19)	-.02 (.39)	-.10 (.16)	-.01 (.27)	-.09 (.10)
DSL/ADSL	-.06 (.23)	-.13 (.49)	-.09 (.19)	-.03 (.31)	-.06 (.11)
Cable	-.08 (.23)	-.12 (.45)	-.02 (.19)	-.00 (.33)	-.02 (.11)
Satellite	.04 (.32)	-.11 (.57)	-.00 (.26)	-.05 (.44)	-.03 (.15)
	R^2 = .08 F = 6.24*	R^2 = .15 F = 3.62*	R^2 = .18 F = 20.12*	R^2 = .27 F = 13.83*	R^2 = .10 F = 11.03*

* p < .05

** p < .01

Summary

This chapter explains the hypothesized relationship between core conservation practice adoption and NRCS program participation and the independent variables of farmer and farm characteristics. The results found many significant relationships between the variables.

The Pearson correlation findings showed education to be positively related to rotational grazing, soil testing, and the IPM index. The linear regression found fewer correlations, with rotational grazing being the only conservation practice with a significant positive relationship with education. When all of the independent variables are considered education does not have a great deal of significance on all four of the core conservation practices. A significant positive correlation was found between education and rotational grazing in both the Pearson correlation and the linear regression. Therefore hypothesis 1A is accepted for rotational grazing only.

Findings for the Pearson correlation showed age to be negatively related to soil testing and IPM practice adoption. Older farmers are less likely to soil test and implement IPM practices on their operation. Regression results only supported the significant negative correlation between age and soil testing. Therefore, hypothesis 2A is accepted for soil testing only.

The Pearson correlation found a significant negative correlation between female farmers and soil testing and the linear regression found no significant relationships. Therefore hypothesis 3A is rejected, female farmers do not have lower rates of conservation adoption. The Pearson correlation found significant positive correlations between male farmers and all four of the core conservation practices. However, the regression found no significant correlations between male farmers and adoption of the core conservation practices. When all of the independent variables are taken into consideration gender does not affect adoption of the core conservation practices.

Significant negative correlations were found between African American farmers and adoption of all four of the core conservation practices. The linear regression found African American farmers to be negatively related to rotational grazing and conservation tillage. Hypothesis 5A is accepted for rotational grazing and conservation tillage only.

Operation size was positively correlated with all four of the core conservation practices. Regression results found significant effects of operation size and soil testing on IPM practice adoption. The regression shows that when all of the independent variables were considered operation size did not have a significant relationship with the adoption of rotational grazing and conservation tillage. Hypothesis 6A is accepted for soil testing and IPM practice adoption only.

Much like operation size, the Pearson correlations showed a significant positive association between total gross value of sales and all four of the core conservation practices. Regression results found significant relationships between total gross value of sales, soil testing and adoption of IPM practices. Hypothesis 7A is accepted for soil testing and IPM practice adoption only.

The Pearson correlations showed a significantly positive association between no Internet access and soil testing. This could be explained by the high number (80 percent) of farmers reporting some frequency of soil testing on their operation. IPM practice adoption and rotational grazing were found to be negatively correlated with no Internet access. Pearson results revealed positive correlations between dial up access and conservation tillage and IPM practice adoption. A negative correlation exists between dial up and soil testing. The Pearson correlation found no significant relationships between any of the four core conservation practices and DSL/ADSL or Cable Internet access.

A positive correlation exists between adoption of rotational grazing and satellite Internet access. Linear regression results showed no significant effects for the Internet access paths. Internet access does not play a role in a farmer's decision to adopt conservation practices when all of the other independent variables are considered. Hypotheses 8A and 9A are rejected. Internet access, or a lack there of, has no effect on a farmer's decision to adopt conservation practices.

Pearson correlation findings showed no significant correlations with education, age, female or male farmers, and African American farmers. Regression results support these findings, revealing no significant correlations. Hypotheses 1B, 2B, 3B, 4B, and 5B are rejected. Education levels, age, gender, and race do not significantly affect a farmer's participation in NRCS programs when all of the independent variables are considered.

Operation size and total gross value of sales were found to be significantly related to NRCS program participation in both the Pearson correlation and the linear regression. Hypothesis 6B is accepted; operation size significantly affects a farmer's participation in NRCS programs. Farmers with larger operations have higher levels of participation in NRCS programs. Hypothesis 7B is accepted, total gross value of sales has a significant positive affect on a farmer's NRCS program participation. Farmers with higher levels of sales participate in more NRCS programs.

No significant correlations were found between any of the forms of Internet access (none, dial up, DSL/ADSL, Cable, or Satellite) and NRCS program participation in either the Pearson correlation or the linear regression. Hypothesis 8B is rejected; a lack of Internet access has no effect on a farmer's NRCS program participation. Hypothesis 9A is rejected; Internet access has no affect on a farmer's NRCS program participation.

V. CONCLUSIONS

This chapter presents theoretical implications, implications for research, and suggestions for technical assistance and support.

Implications

Theoretical Implications

This study found that the variables indicating which farmers are more likely to implement conservation practices and participate in conservation programs have not changed much in relation to past studies; and the Internet is still relatively underutilized among Alabama farmers. An area for growth in information transfer and collective learning, such as the Internet has not yet reached it's potential for the Alabama farmer. However, the capabilities of the Internet to inform and motivate farmers in the area of conservation should not be ignored.

Total gross value of sales and operation size were the only two variables to be significantly related to both core conservation practices adoption and NRCS program participation. These findings provide evidence that cost and wealth considerations shape conservation practice adoption and NRCS program participation. In order to be approved for many NRCS programs a farmer must implement a number of conservation practices and this requires information and resources. Many times acquiring this information and support requires money. Smaller and/or limited resources farmers are often times left in the gap between conservation funding and the ability to implement the practices needed to gain acceptance and funding. Much could be learned from NRCS small farm initiatives in states like Mississippi.

Many farmers with large operations rent upwards of 50 to 80 percent of their fields. Implementing conservation practices on land that you do not own can be a challenging process. Farmers renting fields may not want to invest in improving land(s) they do not own. These farmers may not be the ones enrolling in NRCS programs such as the CRP, but their landlord could be.

Race still presents a barrier to conservation adoption and NRCS program participation. This could be related to the significant positive correlation that exists between total gross value of sales, operation size and adoption. African American farmers tend to fall into the limited resource farmer category most often in the state of Alabama (Molnar, Bitto, Brant 2001). These findings point to a correlation between limited resources and African American farmers. Further investigation is needed in order to fully understand the barriers faced by African American farmers.

In order to understand the potential benefits of the Internet for conservation and program participation a closer look at the diffusion process in needed. Crucial elements in the diffusion process include: the innovation, which is communicated through certain channels, over time, among the members of a social system. Rogers and Burdge (1972) emphasize the importance of communication through out the process of diffusion and it is an important element of social change. The time factor is a central aspect of the diffusion process.

> "The time dimension is involved in the innovation-decision process by which an individual passes from first knowledge of the innovation through its adoption or

rejection; in the innovativeness of the individual, that is the relative earliness/lateness with which an individual adopts an innovation when compared with other members of his social system; and in the innovation's rate of adoption in the social system, usually measured as the number of members of the system that adopt in a given period" (Rogers and Burdge 1972: 355).

The time from the moment of first knowledge to the decision to adopt or reject could be substantially reduced. Waiting for information or traveling to the NRCS office in order to complete paper work would be a thing of the past. Information from farmers who have already gone through the adoption process could make decisions much easier. While some programs can be applied for online, previous studies show that issues with Internet access types may cause problems (Molnar, Tallant, Bergtold 2006). Farmers complained that dial up access was not sufficient for the application process and that downloading applications took too long or just would not work (Molnar et al. 2006).

Time also relates to the low rates of Internet use among Alabama farmers. Past studies (DiMaggio and Hargittai 2001) have shown that delays in providing high-speed Internet access to rural areas, not to mention the higher costs discourage use. While many farmers reported no Internet access in their households, this might not last much longer. In the not so distant future, broad band could be much more available in rural areas, making it the possible future for information transfer in many of these locations. The Internet is and will continue to diffuse into rural areas, providing farmers with a new method for communication, collaboration, and community learning.

Time is also related to the findings of Rolling (1993) who found that a shift towards a more sustainable agriculture in not a question of availability of these techniques because it requires a slow learning process and a change in the farmer's mentality. While the concepts of diffusion may help to explain strategies for the diffusion of a more sustainable agriculture, finding a method of information transfer that works for a large variety of groups is not so easy. The possibility of finding a method that works for all American farmers seems unlikely.

Implications for Research

A great deal of research has been done on classifying the 'innovative farmer' and often times the results are similar. Overall, there has been a lack of attention to the position of small, limited resource and minority farmers. More research is needed to find methods of getting information and resources to these groups of farmers. Research that works closely with these farmers in order to gain a better understanding about the process of practice implementation and program participation could aid in understanding methods that might better serve these groups. Finding ways to support small, limited resource and minority farmers in search of information on conservation techniques and programs could facilitate a much needed diversification of the 'innovative farmer'.

Low rates of high grade Internet access (ADSL/DSL, cable, and satellite) were found among the Alabama farmers and this could point to a "digital divide" (DiMaggio and Hargittai 2001). Rural areas need Internet access in order for many farmers to be able to consider the Internet as a possible information source. Also, rural Internet service prices need to be made more economical, so more people may be able to take advantage of the service. Subsidies programs provided through the government or as part of another programs could help with making rural Internet access better and more economical. A program modeled after the Rural Electrification Act of 1936, which provided federal funding for the installation of electrical distribution systems in rural areas could work for Internet access.

More research is needed in order to understand the Internet access available to Alabama farmers and rural populations. Understanding more about the barriers to this technology might help in understanding barriers to agricultural technology adoption.

Conventional American farmers that are women are under represented in much of the research. It seems that past studies focused on women involved in the sustainable agriculture field, but not those in the more conventional/commercial areas. Of course women who are already involved in some sort of sustainable program would be more likely to adopt conservation practices, but what about those who are not? What factors are holding these female farmers from conservation practice adoption and program participation? More information is needed to understand the adoption possibilities and barriers of these conventional farm women.

Additional research in the field of current Internet farmer communities could lead to a greater understanding of how farmers are using the Internet. While the Internet did not prove to be widely used by Alabama farmers, this may not hold true for all American farmers. It is important to note that the average age of farmers surveyed for this study was around 60 years old, and age was found to be a barrier to conservation technology adoption. This may also be true of the Internet. A study focusing on younger farmers and their methods of gaining conservation practice and NRCS program information might help better understand the possibilities for Internet use in the agricultural community. The field of agricultural Internet information systems is very new and little is understood about it and its impacts on the agricultural community.

Research geared towards preferred information transfer systems is needed. A better understanding of the types of information that Alabama farmers prefer and respond to could help in the transfer of conservation information. Past studies show that farmers prefer printed media, but what about the farmers of today. What sort of information transfer mediums are they most comfortable with? If a farmer is not comfortable with the information he or she is provided they might not use it

Suggestions for Technical Assistance and Support

Many of the practical implications found in this study mirror those found in past studies related to conservation practice adoption and program participation. Agencies like NRCS need to actively recruit groups that have historically low participation levels in the past and gear conservation based income support programs to their needs. More outreach and information should be directed toward smaller and limited resource farmers. NRCS needs to do more in the way of supporting and guiding farmers through the process of implementing conservation practices required for and by NRCS conservation programs.

More farmers need to learn how to make the Internet 'work' for them. Training in this area could facilitate more use and higher more effective rates of practice adoption and program participation. Learning how to access and capitalize on massive amounts of technical and business advice could be very helpful for farmers in need of information and support. An online community of farmers committed to understanding how to make conservation and green payment programs work for them could be a good start for many.

Alabama farmers are very diverse in relation to operation size. The data shows that the standard deviation for acreage is 545, making it harder to classify what type of farmer we are working with. Larger farmers are more likely to adopt conservation practices and participate in programs in relation to smaller farmers. Different communication strategies are needed for such a diverse group. More needs to be learned about how to motivate adoption and participation in relation to operation size. Operation size may also be related to the type of crop and/or livestock produced, making this an area for further research.

A further investigation on Internet access available to farmers is needed to better understand how to stimulate farmer usage, as well as a comprehensive study on Internet access and price rates available to farmers living within the study area. In order to facilitate Alabama farmer's move into the 'Internet Age" more must be learned about their current situation.

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