PERCEPTIONS AND UTILIZATION OF RIPARIAN FOREST BUFFERS BY FARMING INTEREST LOCATED IN THE BIG SUNFLOWER WATERSHED

By

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The field of Landscape Architecture can further develop a niche for the design of sustainable productive landscapes. This study attempts to understand a major stakeholders' perceptions and use of riparian buffers and other conservation practices for water quality in an agricultural watershed of Mississippi. A survey was distributed to agricultural producers in the Big Sunflower Watershed of the MS Delta. The survey informs the interested parties of producers' perceptions and uses of riparian forested buffers, perceptions and uses of conservation practices that restore water quality, perceptions of their environment, perceptions of surface water quality, enrollment of governmental incentive programs, and utilization of digital technology. Analysis of this data could lead to a better understanding of the knowledge and attitudes farmers have of the riparian systems and watershed processes at work within the region and factors that influence the farmers' decisions of implementing conservation plans.

Key words: regional planning, conservation planning, conservation practices, sustainable agriculture, riparian forested buffers, incentive programs, water quality, farmer adoption, watershed stewardship

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

1.1 Background

The Mississippi alluvial floodplain, locally known as the Delta (Figure 1.1, Region 7), is 1 of 7 physiographic regions of Mississippi and has been a major contributor to the Mississippi and United States economies through the production of textiles and food products from the moment agriculturists found the fertile soils that were deposited by the floods of the Mississippi River. The Yazoo Mississippi Delta Joint Water Management District (YMD) stated in their 2006 Water Management Plan for the Mississippi alluvial floodplain that, "The Delta is the economic center for agriculture in Mississippi, producing 99% of the rice, 96% of the catfish, 79% of the soybeans, 72% of the cotton, and 69% of the corn grown in the State." The Delta suffers from a decline in water levels of the Mississippi River Alluvial Aquifer due to excessive pumping for irrigation of crops. This decline has resulted in a low base flow in many streams and rivers of the Delta (NRCS, 1998). This low base flow in the streams and rivers does not allow sufficient water to dilute permitted point sources of effluent and non-point sources (NPS) of pollutants; therefore, the resulting water quality could be detrimental towards wildlife and human safety and welfare (NRCS, 1998).

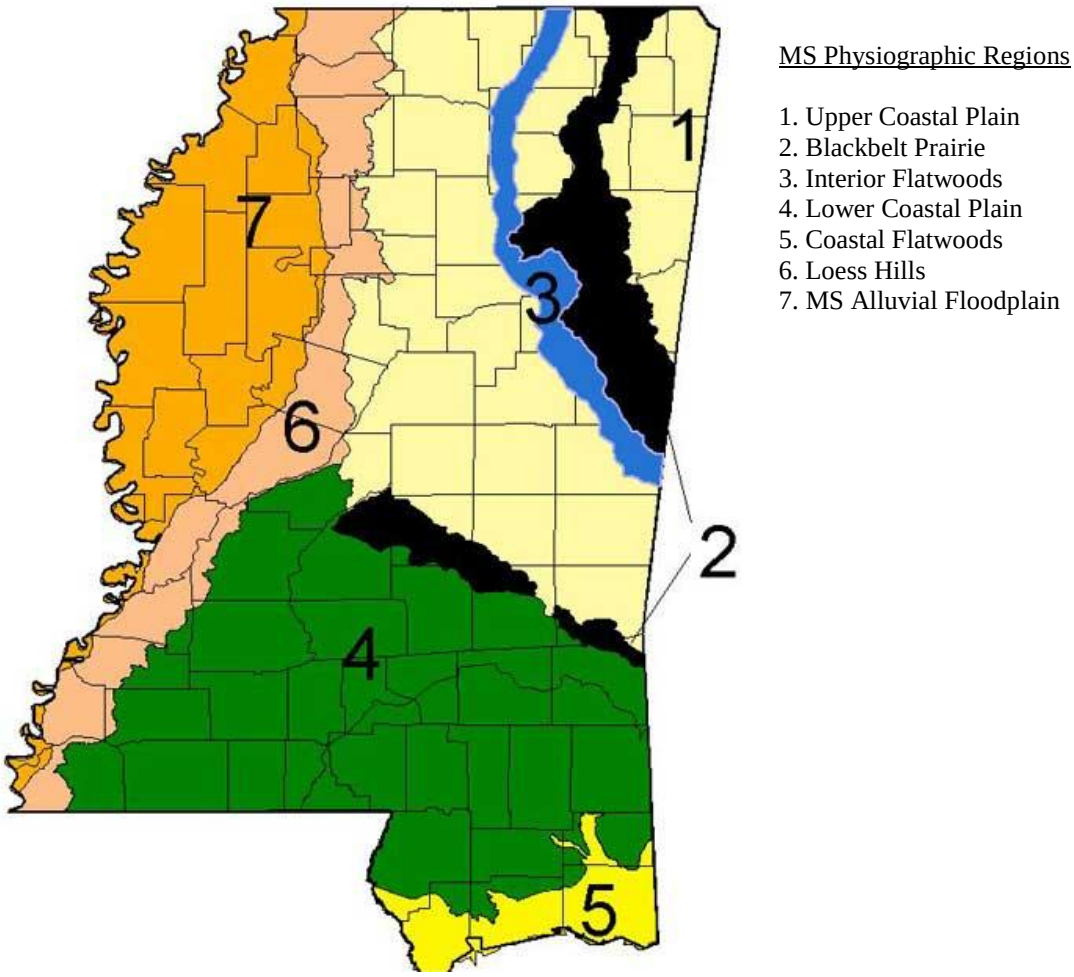

Figure 1.1 Mississippi Physiographic Regions (Brzuszek, 2010)

The Big Sunflower watershed (BSW) is located in the middle of the Delta and encompasses seven counties. This watershed drains the majority of the Delta via the Big Sunflower River and its tributaries (Bogue Phalia, Quiver River, and Hushpeckena River) (YMD, 2006). The MS Department of Environmental Quality (MDEQ) finds that cropland is the major land use of the BSW (Figure 1.2) (MDEQ, 2002). The Big Sunflower River was listed as the #1 most endangered river in the U.S. by American Rivers, a non-profit organization (American Rivers Annual Report, 2003). Although the

endangered status is mainly due to projects planned by the Army Corps of Engineers, agriculture is still believed to have the most impact via NPS pollution on the habitat quality of rivers and streams (Ryan et al., 2003). In 1990, the EPA estimated that 60% of all NPS pollutant loading on assessed surface waters is from agricultural land (EPA, 1990; Osmond et al., 1990). According to Osmond et al. (1990), sediment, nutrients, pathogens, and pesticides are the main agricultural pollutants. Soil erosion and sedimentation contribute to water quality impairments (Ryan et al., 2003; Yaun et al., 2002). An understanding of soil conservation behavior and water quality perceptions will aide in the development of techniques that will enable farmers to look beyond their own boundaries and protect the entire watershed (Clearfield and Osgood, 1986; Duff et al., 1990).

The research process on the extensive amount and depth of literature related to watershed management of agricultural dominated lands is a difficult endeavor. Research on the stakeholder's perceptions and decisions of conservation can be traced to the beginning of man's domestication of plants and animals and the beginning of agricultural settlements. This literature review attempts to synthesize the information from a broad spectrum to understand a specific stakeholder's attitudes and utilization of conservation practices that immediately impact the stakeholder's watershed.

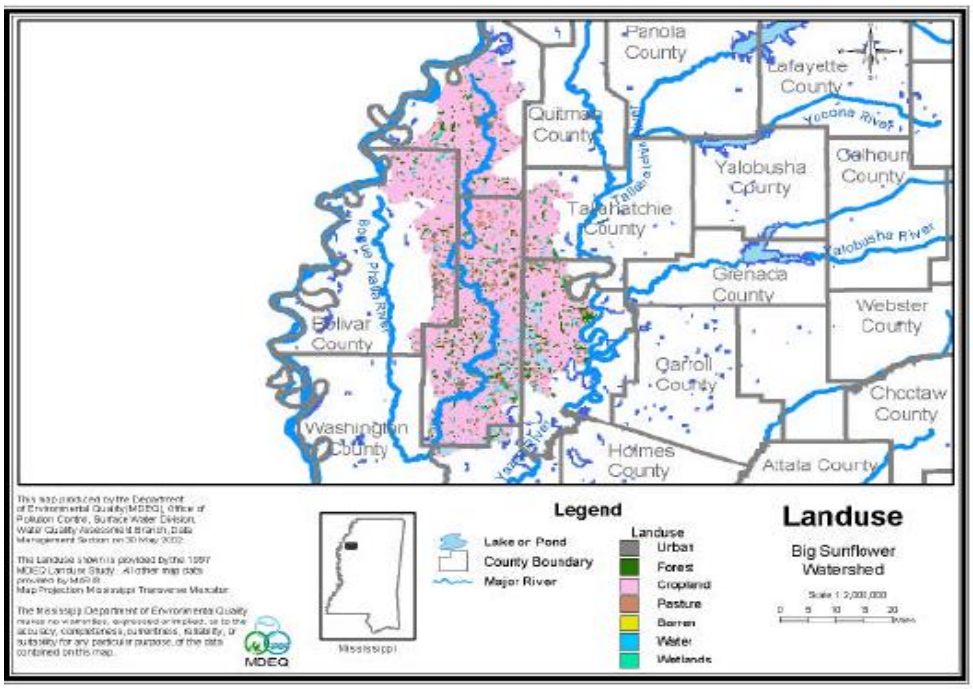

Figure 1.2 Landuse of the Big Sunflower Watershed (MDEQ, 2002)

1.2 Review of Literature

The (BSW), as discussed in the background section of this chapter, is dominated by agriculture. The productive landscape is the predominant land use which results in impaired water quality in this area. This study will focus a "stakeholder approach" (Burroughs, 1999) on the producers of the BSW of the MS Delta. When stakeholders are involved in the decision-making process the community is empowered to make the correct changes in environmental restoration and management (Burroughs, 1999; Chanse, 2011; Gregory and Wellman, 2001; Jones, 1999; Leach, 2002; Lubell, 2004; Rhoads et al., 1999). The management decisions of the farmers at work in the watershed directly impact the surface water quality of the region. Rhoads et al. (1999) state that, "watershed management, although dependent on science and engineering, is first and foremost a social process." By understanding the perceptions and needs of Delta farmers regarding

watershed processes, we will be able to develop tools that will help to minimize environmental impacts for this agricultural rich land.

1.2.1 Conservation Planning

Coughenour, in his paper "Social Ecology and Agriculture" (1984) attempted to include environmental factors in agriculture innovation adoption research and stated that, "The general perspective is that agriculture is a process by which the farmer as the instrument of society engages in transactions with the environment to extract the means of sustenance." The agriculture industry sustains human life and through the production of a dependent food supply, is responsible for permanent settlements and the culture of the human spirit. In order to sustain the exponentially expanding population and the growth of culture, we must move towards a sustainable agriculture industry, towards an industry that looks upon our natural resources as finite, and helps develop means of sustaining water, topsoil, and oil so that future generations will have the means of sustaining human life, physically and culturally. In Towards a More Sustainable Agriculture, Raymond Poincelot (1986) stated erosion is the main cause of low water quality in agriculture dominated regions. Ian McHarg (1992), a landscape architect and ecological designer, proposed ways of developing a more sustainable human culture, the title of his definitive work says it all: Design with Nature. The members of society that produce our sustenance must be given the tools, the incentives, the knowledge, and the abilities to design and manage their farm systems within the greater ecosystem and eco-region. Researchers have historically placed a division between the farmer and the environment, working from an assumption that places a farmer as a natural resource user

that must maximize output for profit. One must not forget that farmers are connected to the land more intimately than most professions, and researchers have found that farmers will adopt practices that are environmentally sound for a variety of reasons outside of profit-maximization (Nassauer, 2002; Petrzelka, 1996). On the other hand, a farmer's attitude towards sustainable agriculture may be different from the actualization of sustainable agriculture on their fields (Petrzelka, 1996). A long-term regional goal of this study, moving the producers and farm managers of the BSW toward a sustainable agriculture industry, will begin with an ethnographic study of farmers' and producers' connections to ecosystems and the productive landscape.

Conservation planning for agricultural land is a natural extension of the profession of Landscape Architecture, providing an opportunity to develop plans that conserve and protect natural resources in agriculture dominated regions. The implementation of conservation plans will utilize the most effective practices to mitigate impairments of agricultural watersheds. An area that is under immediate scrutiny is the surface water quality of the Delta.

Conservation practices are utilized to reduce sediment, pollutant, and nutrient loss from agricultural watersheds (Logan, 1990; Yuan et al., 2002). A set of recommended conservation practices that control NPS pollution from agricultural lands are known as Best Management Practices (BMPs) (Cox, 1979; Hoban and Wimberley, 1992). In order to protect future generations, farmers and landowners must adopt conservation practices. Benefits of conservation reach well beyond the farm's profit margin through wildlife habitat, aquifer recharge, on-site nutrient cycling, and other land and water quality benefits. The farmer must not be put in a situation where "he or she must choose

between protecting the soil resource or maximizing output to survive economically" (Clearfield and Osgood, 1986). Yet it is up to the farmer to voluntarily adopt conservation strategies that protect the water and soil resources. According to Kim et al. (2005), many farmers perceive BMPs to increase costs and provide no financial benefits for the farm. On the contrary, Amacher and Feather (1997), Benham et al. (2005), Johengen et al. (1989), and Logan (1990) find that BMPs reduce operation and production costs, improve long-term soil productivity, and protect or enhance water quality. Conservation practices that restore water quality and wildlife habitat have been organized into three groups: buffer type practices (riparian forested buffers (RFBs), filter or buffer strips, field borders, prescribed forestry, prescribed grazing, strip cropping); field and crop residue practices (conservation tillage, cover cropping); and water control and conveyance practices (grassed waterways, water and sediment control basin, structures for water control). One conservation practice that can have a positive effect on water quality is riparian buffers along streams, rivers, lakes, and other surface waters (Klapproth and Johnson, 2000; Maille, 2001).

Riparian buffers are a specific conservation practice that is proven to mitigate the effects of sedimentation and pollutants in surface runoff (Klapproth and Johnson, 2000; Maille, 2001; Skelton et al., 2005; Fawecett, 2007). Riparian forested buffers (RFBs) are areas immediately adjacent to surface waters (lakes, rivers, and streams) that use woody and herbaceous plant material to filter, hold, and slowly release surface runoff that is the main carrying agent of pollutants and sediment. RFBs are designed and implemented in the riparian zone directly adjacent to the surface water and may reach into the upland zone (Belt et al., 1992). RFBs have the potential to slow runoff, remove sediment,

absorb nutrients, and immobilize heavy metals and pesticides (Klapproth and Johnson, 2001; Lowrance et al., 1997; Lowrance and Sheridan, 2005; Lynch et al., 2002; Palone and Todd, 1997; Schultz et al., 2004; and Skelton, 2005). When properly maintained, buffers can remove almost 100% of sediment from runoff. Removing sediment and pollutants are only part of the benefits of RFBs, buffers also provide production opportunities through agroforestry, foraging and shelter for a diverse amount of wildlife (including game species for eco-tourism opportunities) and contribute to the health of aquatic species through shading and cooling streams, providing foraging and shelter, and increasing dissolved oxygen (Lovell and Sullivan, 2006). Habitat fragmentation through agriculture and encroaching human development is increasingly becoming detrimental to wildlife diversity and ecosystem health. Buffers can become green corridors that provide safe movement between fragmented natural areas (Lovell and Sullivan, 2006). These findings have caused watershed organizations and other environmental agencies to prioritize the adoption and installation of RFBs.

The Landscape Architecture profession can design and develop conservation plans that utilize RFBs and other conservation practices to inform the producer of the benefits and costs of the practice. Nassauer, a professor of Landscape Architecture in the School of Natural Resources and Environment at the University of Michigan, attempts to connect cultural needs and ecological functions. Landscape Architecture will design "beautiful" landscapes that provide "ecological health, agricultural productivity, and quality of life" (Nassauer, 2002). Through the use of technology, conservation plans can be designed and implemented with less expense and more accuracy than ever before. Geographic Information System (GIS) technology is a digital modeling program that can

provide information on watersheds, sedimentation, and BMP implementation at a low cost to the farm operator. Spatial modeling can aid in the process of selecting the most effective conservation practices for a landscape (Yaun et al., 2002). Stakeholders, consultants, agencies, and NGO's can use technology that helps them make informed decisions associated with the productive landscape. A farmer or farm consultant will be able to digitally model the farm ecosystem and place it in the larger watershed. In much the same way that each farm operation is different, the needs to reverse impairments for each watershed and region will differ. Landscape architects can inform the agricultural landscape within a local or regional scale, and move the agriculture industry towards sustainability.

1.2.2 Theoretical Models Explaining the Adoption of Conservation Practices

Historically, research has been uni-dimensional and based on an economic-centered model (Seitz and Swanson, 1980; Clearfield and Osgood, 1986; Pampel and van Es, 1977; Stonehouse, 1995), adoption-diffusion model (Jones, 1967; Rogers, 1983; Korsching et al., 1983; Heffernan, 1984; Napier et al, 1984; Nowak, 1987), or the macrostructural model (Bromley, 1982; Lovejoy and Napier, 1986; Repetto, 1986). Duff et al. (1990) notes that most of the research has been narrowly focused on a sociological or economic perspective. Stonehouse (1996) suggested that a "more comprehensive, multidisciplinary approach be used in recognition of the deep complexity of issues involved in and factors affecting soil conservation behavior" (Ervin and Ervin, 1982; Swanson et al., 1986; Blaikie and Brookfield, 1987; Norris and Batie, 1987; Lockeretz, 1990; Duff et al, 1992). Research outside of the narrow sociological and economic

models varies from an entire new paradigm to including aesthetics and intrinsic motivations in operation decisions (Naussauer, 1995; Ryan et al., 2003).

According to Duff et al. (1990) the conventional models are divided into a "four-tiered typology: the traditional adoption-diffusion model; the traditional economic constraint/decision-making model; a revised adoption-diffusion model; and the macrostructural model." The four different models will help the readers to organize the numerous varied approaches researchers have used in understanding farmer adoption of management practices.

The traditional adoption-diffusion model is defined by the five stages of the "innovation/decision process: knowledge, persuasion, decision, implementation, and confirmation" (Rogers, 1983; Rogers and Shoemaker, 1971). The process of adoption or rejection of an innovation is carried through the five stages; this process is motivated by the characteristics of the operator, the actual and perceived characteristics of the practice, and the exposure to information or opinions of the practice. Although this model was originally designed to model the adoption and use of mass innovations, the adoption-diffusion theory has been applied to conservation practices. The model assumes that adoption of conservation practices can be attributed to the access and quality of information; therefore, adoption rates of conservation practices can be increased by the flow of information to willing or potential adopters. Under the adoption-diffusion model, farmers are believed to reject a conservation practice because there is a lack of knowledge and assistance (Nowak, 1987; Duff et al., 1990). The farmers' knowledge of incentive programs and conservation practices in the BSW may be influenced by the information sources or contact with outreach and education.

The economic constraint model of the adoption-diffusion process assumes that farmers' decisions are based on profit maximization (Duff et al., 1990). Pampel and van Es (1977); Nowak (1983); van Es (1983); and Heffernan (1984) led the research towards a newly revised adoption-diffusion model because environmental innovations are affected differently from the commercial innovations on which the traditional model was based. The revised model has included a variety of factors that were not included in the traditional model such as perceptions of land degradation on the farm and within the community, and the ability to adapt the practice (Green and Heffernan, 1987; Ervin and Ervin, 1982; Nowak, 1983). The revised economic model does not take into account aesthetics, intrinsic motivations, and outside sources into the factors that affect the adoption of conservation practices. Nassauer (1997) challenges us to "look beyond rational economics to aesthetic experience to understand why people maintain particular landscape patterns."

The macrostructural model is an alternative perspective to the other theoretical models by concerned with the slow adoption of conservation practices and environmental impairments as they are connected to the arrangement of agriculture as an institution (Duff et al., 1990). Duff et al. (1990) argues that it is the "broad political, economic, and institutional factors" that are more important in understanding adoption of conservation practices. The macrostructural model assumes the influence of the entire community and society into the decision of why farmers adopt conservation practices. The macrostructural model will be useful in this study because the farmers' decision to adopt conservation practices is not based purely on institutional factors, economic considerations, or social influences. This study will attempt to use the macrostructural

model, combined with the stakeholder approach, to understand the perceptions and use of riparian forest buffers by farmer interest in the BSW.

1.2.3 Factors Affecting the Adoption of Conservation Practices by Farmers

According to Hoban in *Farm Operators' Attitudes about Water Quality and the RCWP* (1992), farmers' greatest influence of implementing BMPs was the cost of the practice. Historically, the research has been based on economic analysis, in which individual behavior is evaluated based on motivations for profit-maximization. The economic-centered research has disregarded similar or alternate goals of motivation research (Duff et al., 1990). A major assumption of economic analysis models viewed the farmer as a "profit-maximizer" (Duff et al., 1990). Batie (1986) described that conservation is perceived as another input involved in the farm operation. In order to promote adoption of conservation on agricultural land, the U.S. government has provided numerous financial incentives and programs to landowners who adopt RFBs and other conservation practices (Skelton et al., 2005). Many farmers may believe that the benefits and costs of designing, installing, and maintaining RFBs are not equal, that the benefits are largely societal, while the farmer is forced to pay the majority of the costs. On the contrary, cost-sharing and incentive payments to help the landowner are available because the societal benefits of RFBs are so numerous (Skelton et al., 2005). There are many conservation programs through federal and state agencies in which producers may enroll their farms (Smith et al., 2007).

Current federal programs that are in place to address water quality, quantity, wetlands, wildlife, and reforestation of agricultural lands are the Environmental Quality

Improvement Program (EQIP), the Wetland Reserve Program (WRP), the Wildlife Habitat Incentives Program (WHIP), the Conservation Reserve Program (CRP). Agricultural producers may voluntarily adopt conservation practices and are provided financial assistance for the planning and implementation of conservation practices under EQIP, which was added to the 1996 farm bill to increase farmers' adoption of BMP's (Kim et al., 2005; NRCS, 2011). Financial and technical support for the protection, restoration, and enhancement of wetlands on private farmland is offered under the WRP (NRCS, 2011). The WRP is discussed further in the next chapter about generating revenue in addition to the financial support offered by the NRCS. The WHIP is another financial and technical assistance programs for the restoration of upland wildlife habitat, wetland wildlife habitat, threatened and endangered species habitat, habitat for species of special concern, declining native habitats (longleaf pine for example) (NRCS, unknown date). In the 2008 farm bill, technical assistance for the CRP responsibilities was delegated to the Farm Service Agency (FSA) and the Natural Resource Conservation Service (NRCS)(Coppess, 2009). The relationship between the farmer and the FSA and the NRCS may indicate factors that influence the adoption of conservation programs.

The MS Delta is an area that is historically known for its eco-tourism opportunities; therefore, the Wetland Reserve Program (WRP), the Wildlife Habitat Incentives Program (WHIP), and the Conservation Reserve Program (CRP) are opportunities for landowners to produce wildlife for hunting and fishing leases. This would put marginally-productive land into an environmental program that could increase profits. Lannie Philley, a farm manager for Delta Land and Farm Management Co., helped manage 150,000 acres in six states and said that farmers can generate prices of

$80-$100 per acre for hunting leases versus $20 per acre for soybeans by enrolling land in the WRP (Conservation Technology Information Center, 2006). Delta farmers may or may not be aware of the numerous programs that are available for their property. Understanding why the farmers of the Delta are enrolled or not enrolled in programs will inform this study of the success and limitations of these cost-sharing opportunities and what impact these incentives have on farmers' decision to adopt conservation practices. Lovell and Sullivan (2006) find that buffers have not been widely adopted by farmers because the benefits and costs are not evenly distributed. Even with the numerous federal programs, farmers may perceive the cost of establishing and maintaining riparian buffers too high.

Past and recent research shows that there are other factors that influence a farmer's decision to adopt conservation practices besides just costs. Ryan et al. (2003) finds that intrinsic motivations, such as land stewardship, for implementing conservation practices were stronger than economic incentives. Farmers, by definition, are intrinsically motivated to sustain their natural resources from their direct connection to the land. Adoption of conservation practices was also increased when the practice helps the farm appear well-managed (Nassauer, 1995; Ryan et al., 2003). The aesthetic potential of conservation practices is researched heavily in the field of Landscape Architecture and Planning by J.I. Nassauer. Nassauer (1989, 2002) states "that some management decisions that are made on the farm are not for economic reasons, but purely for aesthetics." Some conservation practices, particularly ones that make the farm appear well managed and within the "cultural norms" tend to be readily adopted by producers (Nassauer, 1995).

Many different researchers have categorized the variables that affect adoption of conservation practices. Stonehouse (1996) used an "integrated, comprehensive approach" in classifying factors that affect adoption and broadly classified the different variables into technical, social, economics, and institutional. Stonehouse's factors (1996) are as listed:

- Technical:
  - Natural Resource Endowments:
    - Soil
    - Type
    - Climate
  - Conservation Needs:
    - Function of Resource Endowments
    - Past Land Uses
  - Conservation Practice Characteristics:
    - Adaptability
    - Maintenance
- Social:
  - Personal Characteristics
    - Age
    - Education
    - Awareness and Perception of the Extent of Degradation Problems
    - Risk Orientation
    - Attitudes Towards Conservation Needs
    - Stewardship
    - Farming Orientation
    - Farm Management Skills and Abilities
  - Outside Pressures
    - Availability of Technical and Performance Information about Conservation Practices
    - Types of Information
    - Sources of Information
- Economics:
  - Profitability
  - Ability to Take Financial Risks
- Institution:
  - Government Policies and Programs
  - Education and Extension for Assisting Farmers
  - Macrostructural Characteristics of the Agricultural Industry

Clearfield and Osgood (1986) used an Expanded Model for Adoption of Conservation Practices to represent their research findings. They categorized the model into "four major sets of explanatory variables":

- Social-Psychological:
  - Characteristics of Farmers
    - Age
    - Years Farming
    - Education
    - Off-farm Employment
    - Social Participation
  - Attitude Variables
    - Stewardship
    - Risk Orientation
    - Non-economic Orientation towards Farming
    - Attitudes towards Government Involvement
- Farm Structural:
  - Farm Operation Size
  - Net Income/ Farm Sales/Debt Levels
  - Tenure
  - Farm Specialization/Diversification
- Ecological:
  - Actual Soil Erosion Conditions
  - Perceptions of Soil Erosion Conditions
- Institutional:
  - Institutional Contacts

1.2.3.1 Personal Characteristics

Clearfield and Osgood (1986) and Duff et al. (1990) stated that more research needs to be conducted in the areas of farmer's age and years farming. The past research has been contradictory or lacked finding significance between age and years farming and the adoption of conservation practices. According to Clearfield and Osgood (1986), Hoover and Wiitala (1980) along with Lasley and Nolan (1981), older farmers are more likely to be SCS cooperators and adopters of no-tillage techniques. "Culver and

Seecharan (1986) concluded that younger farmers were more likely to perceive that soil erosion was a problem, that conservation measures are profitable, and that the risk associated with adopting new practices is therefore justified" (Duff et al., 1990). Bultena and Hoiberg (1983) in *Factors Affecting Farmers' Adoption of Conservation Tillage*, found that younger farmers were more likely to adopt conservation tillage. Yet, Carlson and Dillman (1986) and Carlson et al. (1981) could find no relationship between age and adoption of conservation practices. Years farming can also have a significant relationship with the use of conservation practices (Clearfield and Osgood, 1986). Christensen and Norris (1983) discovered that farmers with more experience were more likely to keep traditional practices and not likely to adopt BMP's while Pampel and van Es (1977) stated that years farming is related to adoption positively.

Past research indicated that education is positively related to the adoption of conservation practices and the perceptions of environmental degradation, but the extent of the problem may not be perceived. Bultena and Hoiberg, 1983; Carlson et al., 1981; Ervin and Ervin, 1982; Fuglie and Kascack, 2001; Pampel and van Es, 1977 have found established relationships between education and the use of conservation practices. Carlson and Dillman (1986) found that early adopters of no-till were better educated than non-adopters. Clearfield and Osgood (1986) also stated that education is positively related to the perception of soil erosion problems, but Green and Heffernan (1987) found education to be negatively related to the perceived extent of the problem. Perception of water quality impairments may also be positively associated with education, but the extent of the problem may not be perceived. If the perception of an impairment or erosion problem is there, it doesn't necessarily mean the producer will implement

conservation practices. Behavior is not represented by attitude; attitude is only "a predisposition to act" (Clearfield and Osgood, 1986). Although a farmer may have a perception of a problem, he/she may not have the resources, financial backing, or information to resolve it.

According to Ervin and Ervin (1982) off-farm employment is negatively related to both the use and the decision to adopt conservation practices. The type of non-farm job may also affect conservation decisions. Part-time farmers that are professionals in another industry might be more likely to adopt because of education levels and disposable income (Clearfield and Osgood, 1986). And lastly, social participation has had a positive relationship with the use of conservation practices in the past research (Korsching et. al., 1983). Social participation is defined as membership in local organizations. Lovejoy and Parent (1981) found that farmers that are local opinion leaders are more likely to adopt conservation practices. Local opinion leaders may promote adoption of conservation practices by showing other farmers the benefits and costs of adopting.

1.2.3.2 Attitude Variables

Clearfield and Osgood (1986) dealt with attitudes as a separate variable in their research, but stated that they are related to individual level variables and farm structural variables; they examined four attitude variables in their research: stewardship, risk orientation, non-economic orientation toward farming, and attitudes toward government involvement. The past research on attitudes is inconclusive and contradictory when relating attitudes to the adoption of conservation practices. Stewardship is positively

associated with the use of conservation practices (Clearfield and Osgood, 1986; Ervin and Ervin, 1982), but Carlson et al. (1985) determined that economic returns are far more influential in the adoption of conservation practices than stewardship. Eighteen years later, Ryan et al. (2003) found that intrinsic motivations, such as land stewardship for conservation, were stronger than economic considerations. Risk orientation is the likelihood that one will take chances (Clearfield and Osgood, 1986). Ervin and Ervin (1982) related risk orientation positively to the use of conservation practices. Economic orientation is also positively related to the use of conservation practices (Clearfield and Osgood, 1986). Government involvement and farmers' attitudes are widely varied; farmers generally do not support legal pollution controls and other governmental intervention that seems regulatory, but "most farmers feel the government is responsible for funding conservation" (Clearfield and Osgood, 1986). This contradictory attitude of not wanting government intervention, but expecting the government to fund conservation may stem from farmers having to pay the majority of costs for conservation while the benefits are largely societal.

1.2.3.3 Farm Structural Variables

Farm structural variables related to the adoption of conservation practices include farm operation size, net income/farm sales debt levels, tenure characteristics, and family involvement (Clearfield and Osgood, 1986; Duff et al., 1990; Soule et al., 2000). Past research on farm size and the use of conservation practices indicate that the larger the farm size and the more income produced, the more likely the use of conservation practices will occur (Abd-Ella et al., 1981; Carlson et al., 1981; Ervin and Ervin, 1982;

Fuglie and Kascak, 2001; Gill, 2001; Pampel and van Es, 1977; Steil, 2005). Fuglie and Kascak (2001) in their study of adoption of three different conservation practices (conservation tillage, integrated pest management, and soil fertilizer testing) found that the farm size had a positive effect on all three practices. Norris and Batie (1987) found a significant positive relationship between total acreage cropped and conservation tillage acreage.

The farm's income level is an economic factor that has been discussed in the majority of research concerning farmers' adoption of conservation practices. Income has been overwhelmingly positive in the relationship with adopting conservation practices. Valentin et al. (2004) tests the relationship between farm profitability and the use of BMPs and finds that producers' may be reluctant to adopt practices that they are uncertain of the impact on profitability. Valentin et al. (2004) found that nutrient BMPs (soil testing, site-specific management, split application, incorporation, and reduced application rate) were associated positively with farm profits, while pesticide BMPs (early-spring application, incorporation, crop rotation, reduce application rate) were negatively associated with farm profits and soil conservation BMPs (reduced tillage, planting in contour with terraces, and tillage in contour with terraces) were profit neutral. Hoban and Wimbereley (1992) found that the greatest influence for farmers to adopt BMPs was the cost of the practice. Although the early research was focused on the view of the farmer as a "profit-maximizer", the view has broadened in recent research to account for other variables that effect adoption (ecological factors, stewardship attitudes, and perceptions of land degradation for example).

The past research has found that rented land management decisions will be different from owner-operator decisions (Ervin, 1985; Soule et al., 2000). Duff et al., in Understanding Conservation Behaviour (1990), found that rented land does not employ soil conservation practices (Duff et al., 1990). Soule et al. (2000) used a logit adoption model to find that "cash renters are less likely than owner operators to use conservation tillage, but share renters are not;" also, they found that owner operators are more likely than cash and share renters to adopt practices that provide long-term benefits. Crop residue conservation practices that provide short term benefits are more likely to be adopted by renters (Soule et al., 2000). A comparative study of conservation and conventional tillage that calculated net returns per acre of corn production in ten Corn Belt states found that conservation tillage ranged from $168 to $251 and conventional tillage ranged from $127 to $246 (Day et al., 1998). Yet, Skelton (2005) found that non-producers who rented land near a site that could adopt a RFB were more likely to adopt. Although buffer type conservation practices are long term investments of soil and water conservation, the benefits are very important to renters and owner-operators of farmland.

Clearfield and Osgood (1986) related family participation to ownership; the research finds that the family farm business adopts significantly more conservation practices. Abd-Ella et al. (1981) argue that when the farmer's family is active in the operation the use of conservation practices is much higher. The family size, married couples' decision making, and families involved in gathering farm-related information also have a positive relationship in the use of conservation practices (Abd-Ella et al., 1981; Pampel and van Es, 1977).

1.2.3.4 Ecological Factors

Clearfield and Osgood (1986) defined ecological factors as the farmers' perception of soil erosion and actual soil erosion on the farm and Gill (2001), Rahelizatovo (2002), and Ryan et al. (2003) related landscape characteristics and proximity to water bodies to ecological factors. The research on ecological factors as it effects adoption of conservation practices is vast and ongoing. The farm's place in the greater ecological setting and the farmer's awareness of the ecological impacts of the farm all influence the farmer's adoption of conservation practices. Past research has found a connection between farmers' perceptions of the environmental degradation and adoption of conservation practices (Ryan et al., 2003). Two factors that have not been studied extensively are the presence of wildlife and the practice of hunting and fishing as it relates to the adoption of conservation practices. As stated earlier, in some cases, land that is enrolled in the WRP, the WHIP or the CRP nets a return two to three times the amount generated by row crops (CTIC, 2006). The importance of wildlife on the farm or the practice of hunting and fishing may influence farmers' adoption decisions and may influence the farmers' decision to enroll marginal farmland into incentive and cost-shared programs that will generate income through eco-tourism opportunities.

1.2.3.5 Institutional Factors

Institutional factors affecting the adoption of conservation practices are the most influential according to Clearfield and Osgood (1986). Ervin and Ervin (1983) found that the higher number of institutional contacts, the more likely farmers were to use conservation practices. Clearfield and Osgood (1986) associate cost-sharing programs,

incentive programs, and conservation subsidies with institutional contacts and find that they have a significant relationship to conservation practice utilization. Although Clearfield and Osgood (1986) associated institutional factors with profit and econometric models, the literature reviewed shows that institutional contacts can be organizations the farmer is a member, other farmers, extension agencies, government agencies, and other information sources.

1.2.3.6 Summary and Conclusions of Factors Affecting Adoption

Clearfield and Osgood (1986) identify the four major social-psychological factors that affect farmers' adoption of conservation practices. Recent research has expanded the Clearfield and Osgood "Expanded Model of Adoption of Conservation Practices", including intrinsic motivations, employment characteristics, tenure characteristics, landscape characteristics, and farm perceptions. Perceptions of the farm operation may influence decisions greatly; for example, part-time farmers may perceive their farm as a residential and natural setting and not a profit-maximizing business as full-time farmers may perceive. This perception of the farm as a natural setting may influence the farmer to make conservation-minded decisions. Also, the appearance of the farm to others influences the management decisions on the farm (Nassauer, 1989). As stated earlier, Nassauer (1989) found that farmers are more likely to adopt practices that make their farm appear well managed and tidy.

This review of the literature associated with the factors that affect adoption of conservation practices informed the development of the researcher's survey of the

agricultural stakeholders of the BSW. According to the past literature, the researcher divided the variables into four categories:

- Personal:
  - Gender
  - Ethnic Background
  - Marital Status
  - Age
  - Farming experience
  - Education
  - Information sources
- Farm Operation Characteristics:
  - Size of farm
  - Tenure characteristics
  - Family involvement
- Economic:
  - Incentive Programs
  - Farm Sales
  - Supplemental income

- Ecological:
  - Proximity to surface waters,
  - Perceptions of water quality
  - Use of Hunting and Fishing Resources
  - Importance of Wildlife

This organization of the variables that affect adoption of conservation practices helped dictate the structure of the survey questionnaire and the results and cross tabulations that were discussed.

1.2.4 Digital Technology in the Farming Operation

Digital software and hardware adoption in farming operations is a major concern to conservation planners and environmental agencies focused on environmental degradation due to agroecosystems (Hoag et. al., 2000). This study will attempt to

understand the BSW producers' use of digital technology in the farm operation for the implementation of planning technologies.

Computer technology may be used in the farm operation for record-keeping, financial analysis, and decision making. The number and variety of programs to aid in the farm operation decision making is vast and complex. James and Estes (1996) stated fifteen years ago, that there were thousands of programs offered for free or for a small fee that could aid in the decision making of the farm operation. Hoag et. al. (2000) and Putler and Zilberman (1988) found that farmers were more likely to use computers for recordkeeping and financial analysis than a DSS (decision support system). Hoag et. al. (2000) also found in his study of Great Plain producers use of computers, that three-quarters of the producers used software for recordkeeping and taxes, just over half of the producers used computers for production records and financial planning, and one-quarter of producers used software for decision aids, marketing, weather information, or for internet access. Hoag et. al. (2000) also found that only 25% of farmers that owned computers indicated that they would use a computer for production decision aids, but the study did find that producers indicated a strong preference to use computers to address government programs and regulations.

Research on the factors that affect the adoption and use of computers in the farm operation is as vast and complex as the factors that influence conservation practice adoption. Past research has found that education, farm size, and ownership are related positively to the adoption of computers, whereas age and experience are related negatively to the adoption of computers (Amponsah, 1995; Putler and Zilberman, 1988). Internet is treated as a separate variable when associated with computer and software

adoption. The majority of past research that associates the use of internet in the farm operation finds that a small percentage of farmers buy inputs online (Briggeman, 2008). Briggeman (2008) also finds that age is related to internet use negatively, and education and farm size are positively related to internet use; also, this research of Australian farmers' use of the internet found no significant relationship between the miles from a town (rurality) and the use of internet.

The number of programs and research of programs that aid in the decision making of the farm operation to reduce environmental degradation is staggering. GIS (Geographic Information System) is a special set of software and data that is applied to large scale planning, to manage large scale geographic places, analyze spatial relationships, and model spatial processes. Murdock (2007) states that, "GIS is a map-making system that uses spatial and non-spatial data to create extremely accurate and georeferenced maps, which are highly interactive." Water quality issues in agricultural land has caused government agencies, environmental agencies, NGO's (non-governmental organizations), and universities to increase research and development of DSS's for the mitigation of environmental degradation on farmland, an example of these DSS's are as follows: Wilkerson et. al. (2010) attempt to further the advances of spatial and hydrologic models that quantify BMPs' impact on water quality; Baker et. al. (2001) developed several GIS models that predict spatial patterns of subsurface and riparian hydrology to explain and predict patterns of nutrient export within a riparian hydrologic setting; Osmond et. al. (1997) developed WATERSHEDSS (WATER, Soil, and Hydro-Environmental Decision Support System), to aid watershed and land managers to define

water quality impairments and aid in selecting appropriate conservation practices for non-point source pollution.

This study will question the farmers of the BSW about the types of applications used in the farm operation. Applications and software questioned were divided into three separate categories: internet; business technologies (Microsoft Office Suite, Adobe); and decision support technologies (GPS, ArcGIS, ArcView, Basins/HSPF, AutoCad) (Putler and Zilberman, 1988). Although computer adoption is not the focus of this study, the researcher hopes to gain knowledge of the types of computer applications, if any at all, used in the farming operations of the BSW. In addition to computer use in the farm operation, this study will ask the study sample of their willingness to be trained in new technologies, training needs of each application, and perception of technology needs. These additional questions may help inform the interested parties of farmers' needs and willingness to adopt new technologies.

1.3 Objectives of Study

As seen in the literature review, the question "what are farmers' perceptions and use of RFBs in the BSW" is not a simple inquiry. This study will attempt to answer this question starting from a broad scope. By understanding the factors that affect the adoption of buffer type conservation practices, crop residue conservation practices, and water control conservation practices, the researcher hopes to identify trends that support or contradict the existing research. This study will attempt to test the major research question that personal characteristics, farm operation characteristics, economic characteristics, and ecological characteristics influence the adoption of RFBs.

In order to test the main research question completely, four main objectives emerged from the research. The first objective is to test the hypothesis that personal, farm operation, economic, and ecological characteristics influence the adoption of buffer type conservation practices, field and crop residue conservation practices, and water control and conveyance conservation practices within the BSW. This broad scope will help the reader understand which conservation practices are widely adopted within the BSW and which conservation practices are not widely adopted within the BSW and to identify the factors that influence adoption.

The second objective is to test the hypothesis that BSW farmers' perceptions of their environment influence the adoption of conservation practices. This objective will attempt to understand and identify the environmental factors that influence farmer adoption of conservation practices within the BSW. Proximity to surface waters, perceptions of water pollution, wildlife importance, and use of natural resources through hunting and fishing are environmental factors that may influence the adoption of conservation practices.

The third objective is to test the hypothesis that the frequency of enrollment of incentive programs that utilize conservation practices is influenced by recommendations from government agencies. If costs are the main barrier to the adoption of conservation practices, incentive programs provide technical and financial assistance to farmers in order to promote the adoption of conservation practices and watershed stewardship.

The fourth and final objective is to test the hypothesis that farmers of the BSW use digital technology in the farm operation. This hypothesis will illustrate the types of digital technology farmers use in their operations and will inform the reader of the types

of technology farmers are willing to utilize in the farm operation. The farmers will be asked about their use of internet, business applications, and planning applications. The information provided by this hypothesis will further inform researchers of the kind of applications farmers may be willing to use in the farm operation and ultimately inform the development of a decision support system (DSS) in the farm operation that will aid the farmers in making conservation and environmental management decisions.

This grassroots, stakeholder study has three long-term regional goals. The first regional goal is that the field of Landscape Architecture and Planning, utilized in agricultural watersheds, will move agriculture operations towards a sustainable agricultural industry. Poincelot (1986) finds that erosion is the largest contributor to impaired water quality of agricultural dominated watersheds. In order to move towards a sustainable agricultural industry, conservation practices that focus on mitigation of water quality impairments through the slowing of runoff; the filtering of sediment, nutrients, and toxins from runoff; and protecting and promoting wildlife habitat must be adopted by agricultural producers.

The second regional goal is to inform further research and the development of a DSS for farmers and farm consultants. The field of Landscape Architecture and Planning has developed digital tools and DSS for the design of sustainable communities, mainly in urbanized watersheds. The applications of these tools to regional planning and rural, agricultural communities in agriculture dominated watersheds can promote the adoption of conservation practices through conservation plans under regional planning guidelines.

The final and third long-term regional goal is to develop and promote participatory watershed stewardship in the BSW. The involvement of the community and

the major stakeholders of the watershed will implicate the natural resource users into protecting and conserving their natural resources. Water quality impaired by soil erosion in agricultural watersheds (Poincelot, 1986) must be mitigated by the major stakeholders and community members of the watershed. Chanse (2011) found that the composition of stakeholders involved in watershed stewardship became increasingly diverse as did the stewardship activities of Contra Costa County as volunteer organizations, technical organizations, and governmental agencies became increasingly involved in watershed stewardship of Contra Costa County. This study, by involving the community that utilizes the natural resources and therefore impacts the natural resources into watershed stewardship will help promote the involvement of other stakeholders of the region and other non-profit, technical, and governmental agencies into a increasingly complex approach and scale of environmental mitigation of impaired water quality (Chanse, 2011).

As the literature review demonstrates, a stakeholder or grassroots approach was developed. The stakeholder community that directly affects water quality of the BSW, in this case, agriculture producers and managers, was the focus of this study. Landscape Architecture is an industry that has focused on DSS's, LID (Low Impact Development) strategies, and environmental degradation mitigation through design and planning. The myriad of disciplines and the complex dimensions that have a hand in developing watershed stewardship is an overwhelming task to organize. Using spatial modeling technology, sociology statistical analysis, ecology, and design; Landscape Architecture and Planning has the multidisciplinary approach to design, develop, and implement plans that cross political and geographic boundaries. This multidisciplinary approach to

watershed stewardship is able to utilize participatory focus and community involvement to ensure the stewardship is empowered by the community that is directly affected by environmental impairments.

CHAPTER II

METHODOLOGY

2.1 Introduction

In this study, we will attempt to understand farmers' perceptions of conservation practices for water quality, governmental incentive programs, their environment, and their current digital technology use in this agricultural-dominant area of Mississippi. A self-administered questionnaire (SAQ) was developed and distributed to agricultural stakeholders in the Big Sunflower watershed (BSW). Descriptive statistical analysis will determine the factors that influence MS Delta producers to adopt or not adopt RFBs and other conservation practices for surface water quality and will provide valuable data on the stakeholders' perceptions and attitudes of incentive programs and their environment that can be used for future studies.

2.2 Survey Population

Purposeful sampling is the strategy of selecting the sample population deliberately because of particular settings, persons, or events (Patton, 1990; Maxwell, 1996). In this case, the researchers want to understand the perceptions and uses of RFBs by the largest stakeholder, the agricultural producers and managers in the Big Sunflower watershed. This sampling will involve the community that has the most impact on the chosen

watershed. Chanse (2011) shows in her case study of Contra Costa County that community involvement in watershed stewardship evolved in the Contra Costa County exponentially in terms of scale, approach, and diversity of stakeholders involved. Beginning with one major stakeholder of this region, this study will help the researcher to understand watershed stewardship from an agricultural landscape to "participatory landscapes," landscapes that are created and cared for by stakeholders (Chanse, 2011). Agriculture is the main land use of the watershed and is believed to have the most impact on the habitat quality of rivers and streams (Ryan et al., 2003). The farmers of the BSW were chosen as the study population because they have the most impact to the water quality of the surface waters through non-point source (NPS) pollution and have the opportunity to mitigate the impairments through conservation practices and stewardship. Through meetings and focus groups with the Farm Service Agency (FSA), United States Department of Agriculture (USDA) National Resources Conservation Service (NRCS), Yazoo MS Delta Joint Management District (YMD), Ducks Unlimited, Friends of the Sunflower River, farmers, and consultants a list was compiled of 1,046 farmers in the BSW.

2.3 Perception and Utilization Assessment Survey Design

Our study utilized a combination of open, closed, and 5-point Likert – scale response/questionnaire format to question stakeholders in the BSW. SAQs in a mail survey are the most cost efficient and easiest implementation to understand the characteristics of a large study population (Dillman, 1991). The questionnaire focused on producers' perceptions and use of RFBs; factors that affect the adoption of eleven

conservation practices having to do with water quality; perceptions of their environment; perceptions of surface water quality; access to information sources for conservation practices; use of digital technology in the farm operation; and demographic information. The survey is information intensive and required a design, development, and implementation strategy to overcome a population that historically has received low response rates (Pennings et al., 2002).

Farmers tend to be low respondents to mailed questionnaires (Balakrishnan et al., 1992; Buse, 1973; Pennings et al., 2002). Nyaupane and Gillespie (2011) focused their study on Louisiana crawfish producers and recorded an adjusted response rate of 15% from almost 800 surveys. Similarly to Nyaupane and Gillespie (2011), our study is focused on a particular group of farmers; the researcher took this into account, with other variables that may decrease response rates, and developed the survey. According to the literature, the length of this questionnaire and the time period of distribution were other factors that would negatively impact the response rate (Dillman, 1991; Pennings et al., 2002). First, the questionnaire was consolidated to the most important questions through consultation with ten BSW farmers, NRCS personnel, the FSA, YMD, Delta Farm Press personnel, Ducks Unlimited (DU) personnel, and a focus meeting with the Friends of the Sunflower River and executive director of YMD, Dean Pennington. The survey was divided into four groups of questions:

1) Demographic Information
2) Conservation Practices
3) Incentive Programs

4) Technology Use

The survey was also developed using the recommendations and guidelines of Dillman's Total Design Method (TDM) for mail surveys (1991). According to Dillman (1991), following his TDM for mail surveys will increase the response rate considerably; his design recommendations include the order of questions, ease of reading, making the pages seem smaller and easier to complete, and a graphically designed booklet; the use of four mailings: (1) cover letter and questionnaire, (2) reminder postcard , (3) replacement questionnaire with cover letter stating the questionnaire has not been received, and (4) a second replacement questionnaire; and the design of the envelopes to not look like advertising mail and addresses that are printed on the envelopes, not labels. These design recommendations were followed according to Dillman's TDM, yet the survey remained lengthy with 11 pages and 39 questions. Although utilizing the design recommendations of the TDM will positively affect the response rate, Pennings et al. (2002) states that the period of distribution is a significant factor when surveying farmers. Because of the timescale of the study, the survey distribution for this study was pushed from the January and February window recommended by Pennings et al. (2002) to a later window of distribution during May and June. To increase the low response that is historically associated with this population and that may be caused from the focused population, the length of the questionnaire, and the window of distribution, several incentives were offered to the respondents. First, the respondents were told in the cover letter that the study will be of great help to the researchers at Mississippi State University, the farmers of the MS Delta, the communities of the MS Delta, and the wildlife and environment of the MS Delta. Raymond de Young (1986) finds that intrinsic motivations (attitudes,

perceptions, and beliefs) of why people conserve resources may have more of an impact than extrinsic motivations (costs, time, labor), the self-satisfaction of helping the University, the farm, the community, and the environment was the most important incentive that was focused on the study population. Second, we have made available our findings to the study population. Each individual within the study frame was given contact information to the Landscape Architecture department at Mississippi State University. Lastly, the researcher offered a cash incentive through a lottery giveaway of $100 to a randomly selected respondent, according to Balakrishnan et al. (1992) and Pennings et al. (2002) this is a significant method to increase responses to low response populations.

CHAPTER III

RESULTS & DISCUSSION

3.1 Introduction

The variables identified in this study were demographics, perceptions of RFBs, adoption of conservation practices, perceptions of the environment, enrollment of incentive programs, and use of digital technologies. The trends that were identified help explain the Big Sunflower watershed (BSW) farmers':

- Factors affecting the adoption of conservation practices associated with mitigating impaired water quality
- Perceptions of RFB's
- Perceptions of their environment
- Frequency of enrollment in governmental incentive programs
- Utilization of digital technologies

The following descriptive figures and cross tabulations of the results were identified to be the most important to the study, a complete list of the descriptive figures and cross tabulations can be found in the appendices. This chapter briefly discussed the response rate, the frequency of response, factors that affect adoption, and a description of adoption indicated by the respondents. The descriptive results, cross tabulated results, and discussion of the data generated from this survey were organized in parallel with the survey questionnaire. For the ease of the reader, the results and discussion will be organized under the groups: Demographics, Conservation Practices, Incentive Programs, and Technology.

3.2 Response Rate

The "purposeful sampling" (Patton, 1990; Maxwell, 1996) survey population was distilled to 1,046 farmers in the Big Sunflower Watershed (BSW). Of the 1,046 surveys that were mailed, 12 were returned because of change of address, no longer farming, or deaths. 178 total respondents mailed surveys back to the researchers at the Landscape Architecture Department. 8 surveys from the 178 respondents were deemed undecipherable. The total response rate was 17% (178/1046), after adjusting for the returned surveys and the intelligible responses, the final adjusted response rate for this project was 16.4% (170/1034). This response rate was considered low according to the rates that Dillman's Total Design Method (TDM) offers (Dillman, 1991). However, Nyaupane and Gillespie (2011), in a their study on the adoption of Best Management Practices (BMPs) by crawfish farmers in Louisiana, received a response rate of 15% and Ryan et al. (2003), in their study of farmer's motivations for adopting conservation practices along riparian zones, received a response rate of 20%. The researchers and other professionals involved with this study were generally pleased with the farming interest response of such an involved survey distributed during the growing season.

3.2.2 Frequency of Responses

The frequency of responses was correlated with the mail-outs of the postcard, the first replacement questionnaire, and the 2nd replacement questionnaire (Figure 3.1). The sending of the reminder postcard and the replacement questionnaires increased the total response considerably. The researchers and professionals involved in this study

unanimously agreed that the utilization of the TDM increased the response of such a historically low response population (Balakrishnan et al., 1992; Buse, 1973; Pennings et al., 2002) to the current rate of 16.4%.

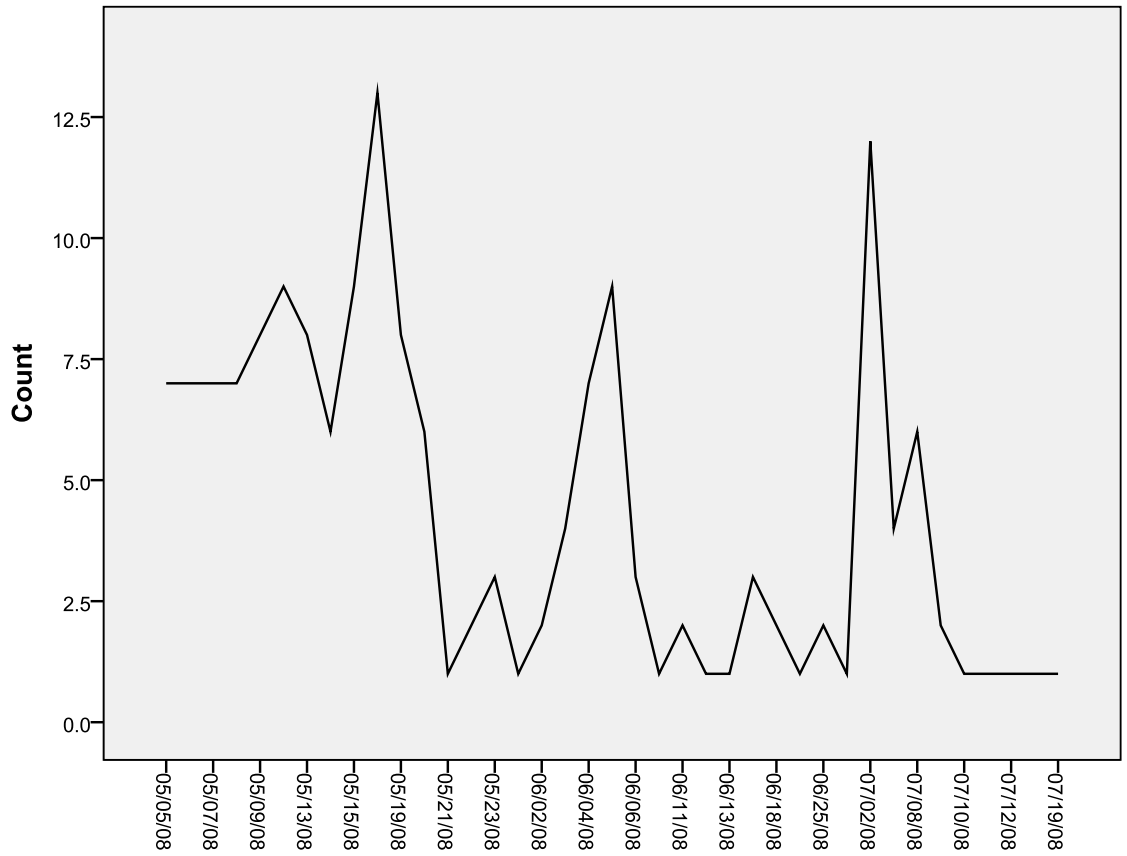

Figure 3.1 Frequency of received responses by date.

3.3 Lack of Conservation Practice Adoption by the Farmers of the BSW

Survey recipients were asked about 11 different conservation practices that are associated with water quality mitigation. The most common conservation practices that

were adopted were: conservation tillage (84[1]; 52.5%[2]), structures for water control (70; 44%), and cover cropping (60; 37.5%). Below is a list of the conservation practices ranked by number of respondents indicated that they adopted the practice:

1) Conservation Tillage (84; 52.5%)
2) Structure for Water Control (70; 44%)
3) Cover Cropping (60; 37.5%)
4) Filter or Buffer Strips (32; 20.3%)
5) Field Border (31; 19.7%)
6) Grassed Waterways (25; 15.9%)
7) Prescribed Forestry (23; 14.6%)
8) Sediment and Water Retention Basins (17; 10.8%)
9) Riparian Forested Buffers (15; 9.6%)
10) Prescribed Grazing (8; 5.1%)
11) Strip cropping (4; 2.6%)

Conservation tillage, structures for water control, and cover cropping were the only conservation practices that had a frequency of adopters over 35% for this study. RFBs ranked in the bottom three, with just 9.6% (15) of respondents indicating they were adopters. The presence of wildlife on the farm is important to farmers in the BSW, but in spite of this result, there is a lack of adoption of conservation practices that would provide habitat and movement corridors for wildlife within the farms of the BSW. According to Skelton et al. (2005) lack of knowledge of RFBs is a major barrier to

[1] The number refers to total number of respondents for that question.

[2]% = valid percent refers to the total number of respondents for that question excluding missing values.

adoption. This contradiction between the importance of wildlife and the adoption of conservation practices that benefit wildlife will be discussed in the conservation practice section.

3.4 Factors Affecting the Adoption of Conservation Practices

Previous research has identified many factors that affect farmers' adoption of RFB's and other practices. Adapting the models developed from Clearfield and Osgood (1986), Duff et al. (1990), and Stonehouse (1994), the researcher grouped the factors into four main categories:

1) Personal (Bultena, 1983; Christensen, 1983; Clearfield, 1986; Duff, 1990; Ervin, 1982; Gill, 2001; Skelton, 2005; Stonehouse, 1996)
    a. Gender
    b. Ethnic Background
    c. Marital Status
    d. Age
    e. Farming experience
    f. Education
    g. Information sources
2) Farm Operation Characteristics (Bultena, 1983; Clearfield, 1986; Gill, 2001; Soule, 2000)
    a. Size of farm
    b. Tenure characteristics
    c. Family involvement
3) Economic (Ervin, 1982; Dutcher, 2004; Hoban, 1992; Pampel, 1977; Skelton, 2005; Stonehouse, 1996; Valentin, 2004)
    a. Incentive Programs
    b. Farm Sales
    c. Supplemental income
4) Ecological (Bultena, 1983; Christensen, 1983; Clearfield, 1986 Ryan, 2003):
    a. Proximity to surface waters,
    b. Perceptions of water quality
    c. Use of Hunting and Fishing Resources
    d. Importance of Wildlife

3.4.1 Demographics

Respondents in this study were overwhelmingly male (84.5%), Caucasians (82.1%), that were married (79.9%). The age range of the farmers that responded ranged from 25 to 93 (Figure 3.2), with the majority between the age ranges 50-59 and 60-69 (55%).

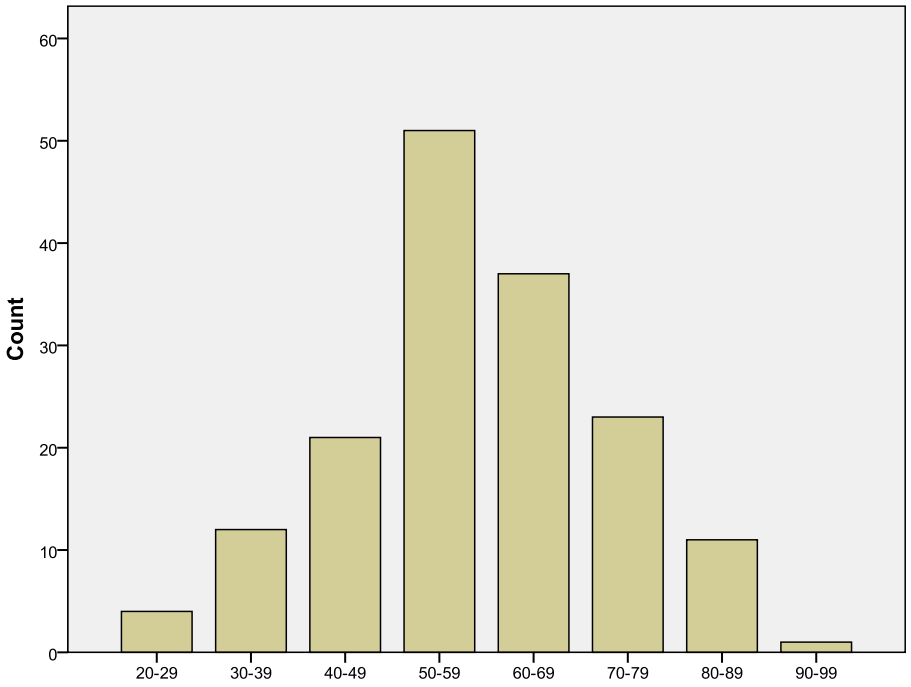

Figure 3.2 Age range of the respondents.

Age has been previously identified as having had a significant relationship with the adoption of conservation practices. According to past research, the results are contradictory. Younger farmers are more likely to adopt conservation practices (Bultena and Hoiberg, 1983; Culver and Seecharan, 1986), although research by Clearfield and Osgood (1986), Hoover and Wiitala (1980), and Lasley and Nolan (1981) found that older farmers were SCS cooperators and adopters of conservation tillage and research by

Carlson et al. (1981) and Skelton and Josiah (2005) found no relationship between age and adoption of conservation practices. The ages of adopters of RFBs in the BSW were distributed across the age ranges. In this study, the youngest farmers, ages 20 – 29, did not indicate they adopted RFBs. Of the remaining conservation practices, the adoption of the conservation practice prescribed forestry showed that BSW farmers above the age of 50 adopted the practice prescribed forestry and more adopters than non-adopters above the age of 80 (Figure 3.3). Until 2009, Prescribed Forestry was a Natural Resource Conservation Service (NRCS) conservation practice that is prescribed for a minimum of ten years, is commonly associated with RFBs, and is focused on the management of "forest health, wood and/or fiber, water, recreation, aesthetics, wildlife habitat, and plant biodiversity." (USDA, 2009). Older farmers that are retiring land from production may adopt prescribed forestry because of the many benefits described. Farmers that are interested in retiring land from production can be influenced to adopt the practice of Prescribed Forestry and other buffer type practices through Forest Management Plans (FMPs). In 2011, the criteria for prescribed forestry was rescinded from the New Jersey NRCS and replaced with the Forest Management Plan Criteria (New Jersey NRCS, 2011). FMPs are record of decision documents that can be produced using Decision Support Systems (DSS) and GIS. The field of Landscape Architecture, utilizing a stakeholder approach, can design, implement, and monitor Forest Management Plans for rural areas that are empowered by the local community.

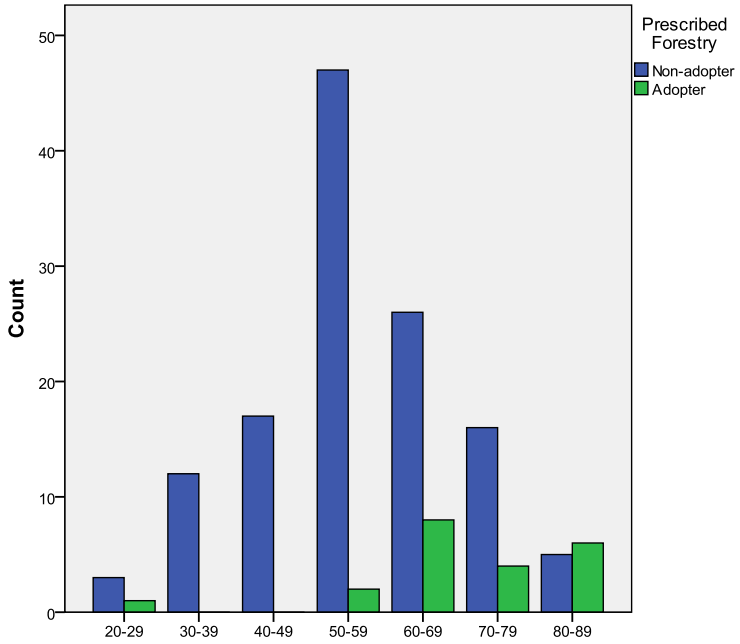

Figure 3.3 The age of respondents and the adoption of prescribed forestry.

The survey population was asked about their highest educational degree; the largest portion of respondents held a bachelor's degree (58, 34.5%) (Figure 3.4) and the second largest group held a high school diploma (57, 33.9%). 18 respondents held an associate's degree (10.7%), 14 respondents held a master's degree (8.33%), 13 respondents had some high school (7.7%), 1 respondent held a post-doctoral degree (.6%), and the response "other" was checked by 7 respondents (4.2%).

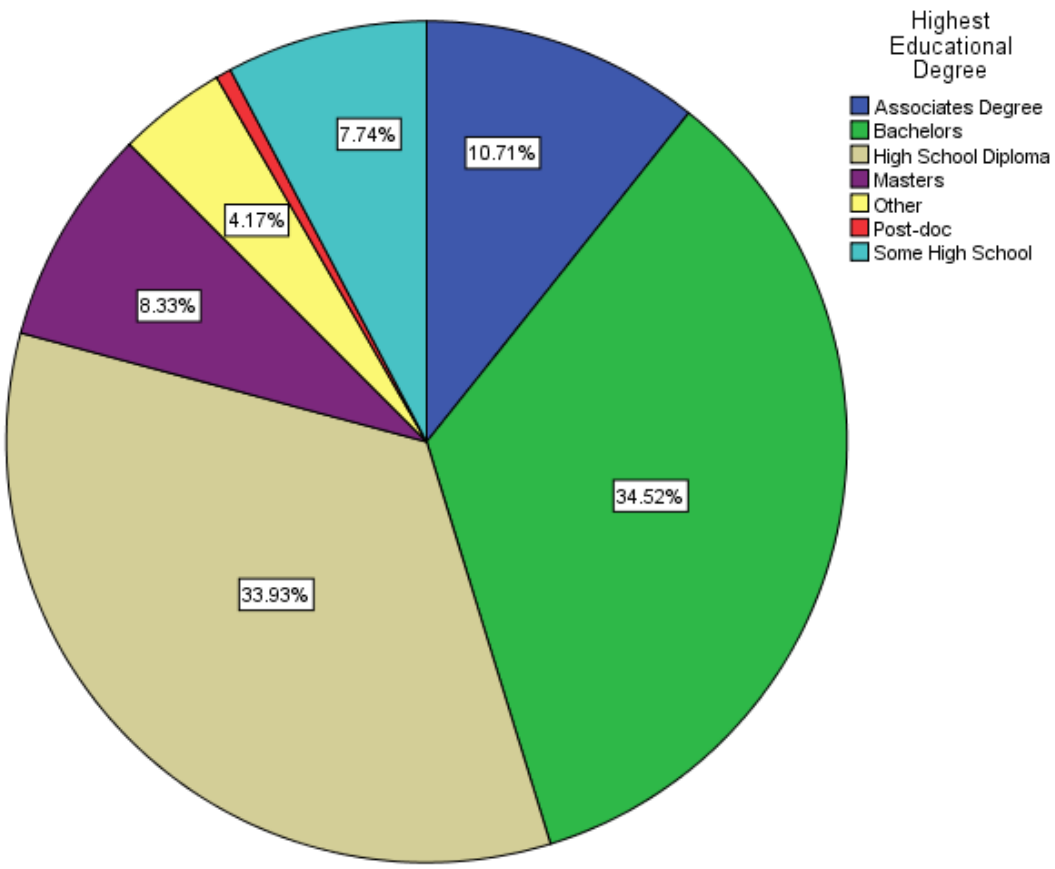

Figure 3.4 Highest educational degree.

Education is positively associated with the adoption of conservation practices according to the past research (Bultena and Hoiberg, 1983; Carlson et al, 1981; Ervin and Ervin, 1982; Fuglie and Kascack, 2001; Kim, 2005; Pampel and Van Es, 1977). Farmers with higher levels of education are more likely to adopt conservation tillage (Figure 3.5) and structures for water control (Figure 3.6) in the BSW. Farmers with higher levels of education know that conservation tillage and structures for water control have immediate short-term benefits. This result implicates institutions to promote the short-term and long-term benefits of conservation practices. Skelton et al. (2000) finds that lack of knowledge of RFBs is a major barrier to adoption. The lack of a correlation between the

adoption of RFBs and education may result from a lack of knowledge of the many benefits of RFBs. Knowledge of the benefits of RFBs is further explored in the Conservation Practices section.

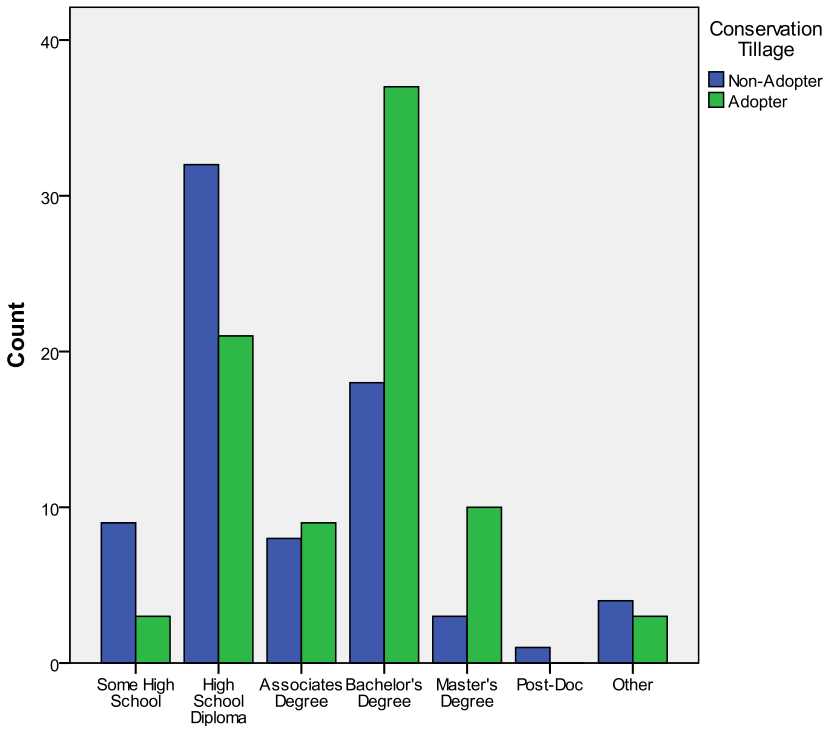

Figure 3.5 Respondents' highest educational degree and the adoption of conservation tillage.

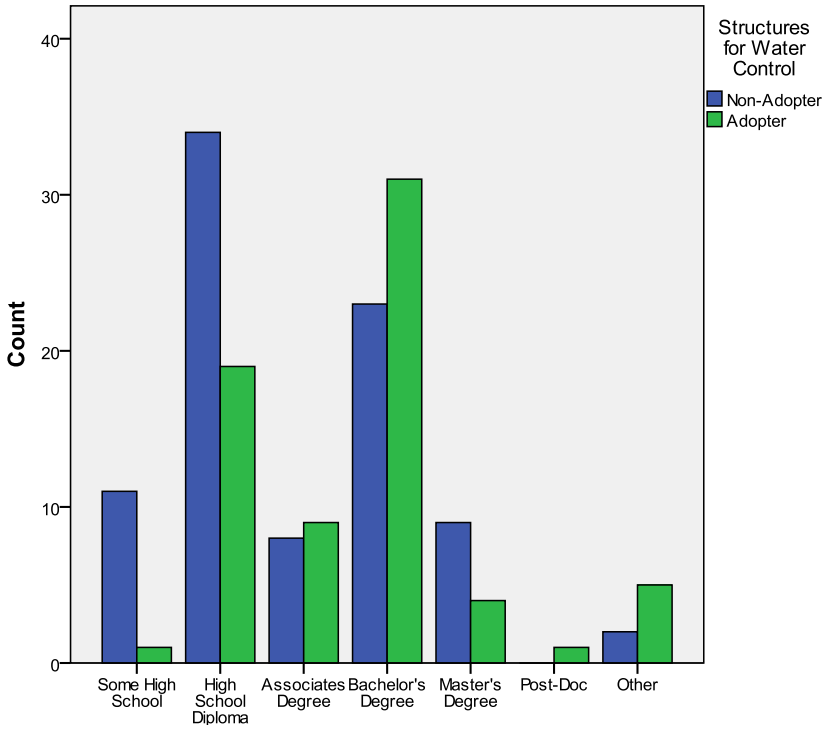

Figure 3.6 Respondents' highest educational degree and the adoption of structures for water control.

The focus of the question "College Education Background" was on agricultural and life sciences degrees; the majority of respondents checked "other" and "none" (117, 70%), resulting in a sample population that was predominantly not trained in an agricultural or life science major. Of the remaining respondents, the major Agricultural Economics was represented by 10.8% (18) of the respondents (Figure 3.7).

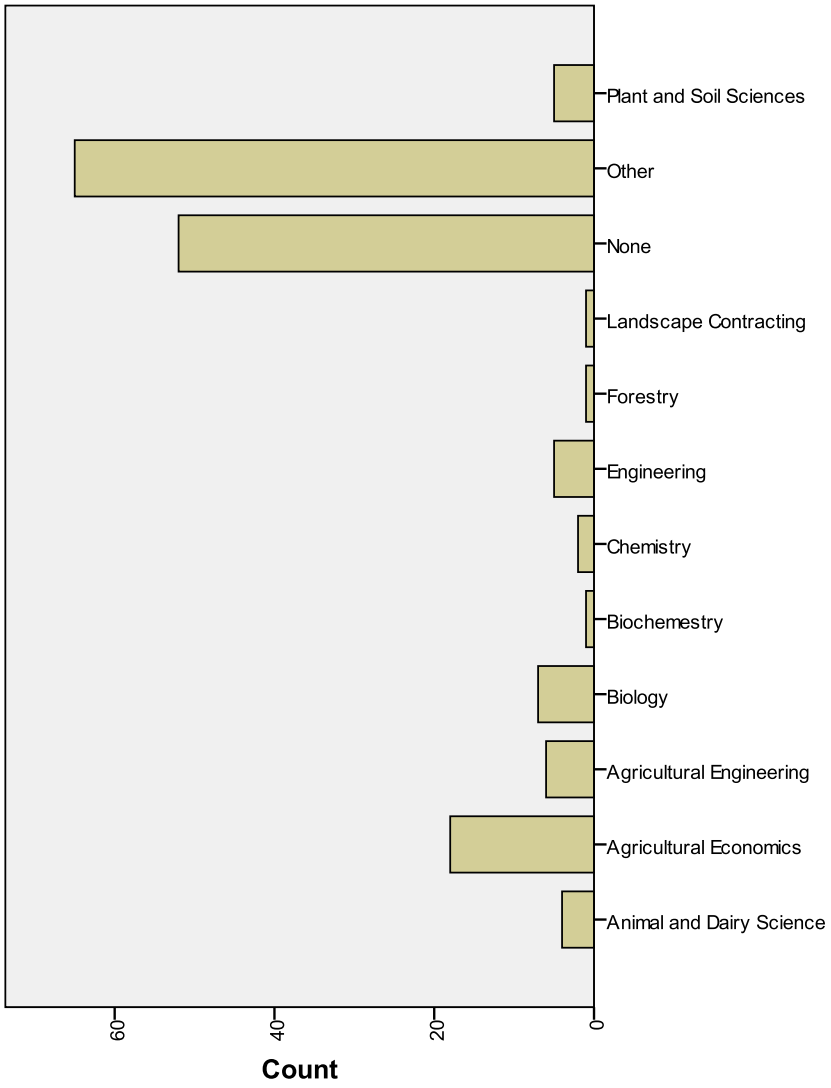

Figure 3.7 Respondents' College education background.

Conservation tillage was the only conservation practice that was associated with the respondents' college education background. The respondents' indication of "other," plant and soil sciences, agricultural economics, agricultural engineering, and animal and dairy science showed more adopters of conservation tillage than non-adopters (Figure 3.8). Conservation tillage is a "field and crop residue" type conservation practice that has shown short term benefits for adopters in the past research (Soule et al., 2000).

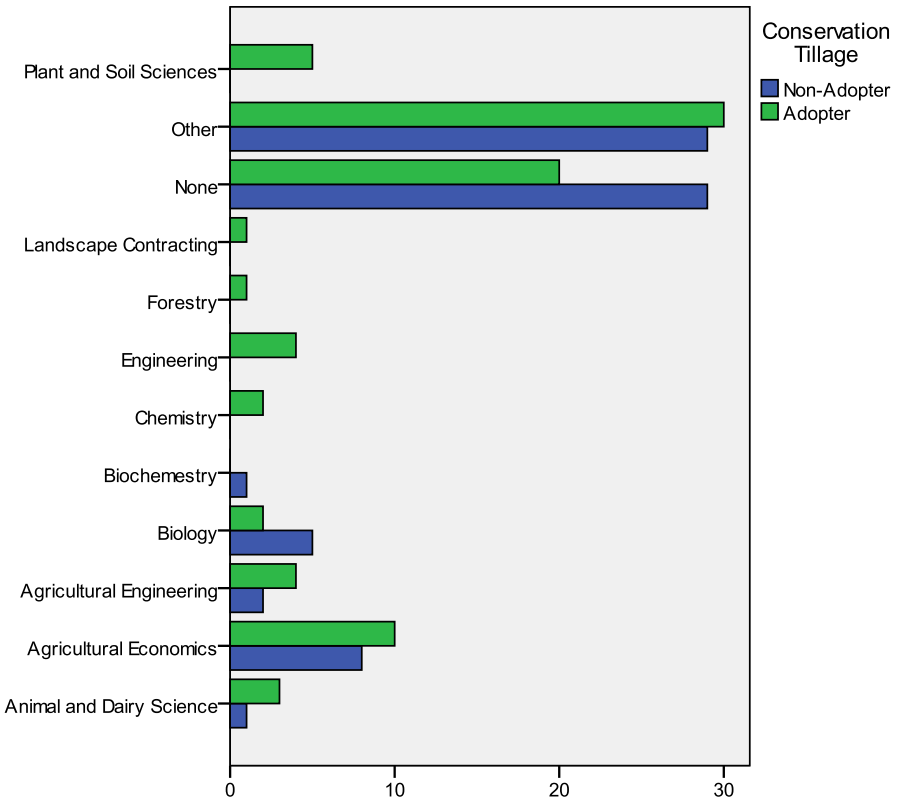

Figure 3.8 Respondents' college education background and the adoption of conservation tillage.

The sample population was asked about their influences in managerial decisions in the farm operation. The farmers were given a list of potential sources and were asked to indicate if the source was no influence, little influence, moderate influence, or high influence on the management decisions of the farm operation The sources that have the most influence were found by combining the valid percentage of respondents that checked moderate influence and high influence. The list of these sources from most influential to least influential is represented by Table 3.1.

Table 3.1 Information sources that have influence in the management decisions of the farm operation (most influential to least influential in ascending order).

Information Source	No Influence	Little Influence	Moderate Influence	High Influence
Farm Service Agency	9.9%	19.9%	42.2%	28%
Other Farmers	10.4%	22.6%	47.6%	19.5%
Crop or Farm Consultants	18.8%	20.6%	44.4%	16.3%
MS Extension	14.3%	25.5%	37.3%	23%
Family and Friends	14.6%	26.2%	39%	20.1%
NRCS	18%	23%	33.5%	25.5%
Farm Magazines	12.3%	31.9%	42.3%	13.5%
MS Soil and Water Conservation Commission	20.9%	25.8%	35.6%	17.8%
Local Soil and Water Conservation Commission	20%	33.8%	32.5%	13.8%
Community Members	23.6%	36.6%	32.3%	7.5%
YMD	27.3%	32.9%	26.7%	13%
MDEQ	27.5%	36.3%	29.4%	6.9%
Radio and Television	33.5%	35.4%	26.2%	4.9%
Local Newspapers	38%	38%	19.6%	4.3%
Other	62.9%	20.3%	14%	2.8%
Non-farm Magazines	48.7%	41.1%	8.9%	1.3%

Information sources for conservation practices are related positively to the adoption of conservation practices in the past literature (Gill, 2001). The Farm Service Agency (FSA), other farmers, crop or farm consultants, MS Cooperative Extension Service (Extension), family and friends, Natural Resource Conservation Service (NRCS) and farm magazines were the highest ranked information sources respectively. The following paragraphs describe the relationship between the highest-ranked information sources and the adoption of conservation practices.

The FSA was the highest ranked (113; 70.2% of respondents ranked the FSA as moderate and high influence) information source related to most influential source of information for the farm operation. The influence source FSA was not related to the adoption of RFBs. More adopters of conservation tillage than non-adopters indicated that the FSA was a moderate influence and high influence (Figure 3.9). Also, more adopters of structures for water control than non-adopters rated the FSA as a high influence (Figure 3.10). According to this study, the FSA influences farmer adoption of conservation tillage and structures for water control. This result implies that the FSA is a factor in the adoption of conservation practices in the BSW. The FSA could promote the adoption of buffer type conservation practices within the BSW, increasing the level of adoption in an area with low adoption rates of buffer type conservation practices.

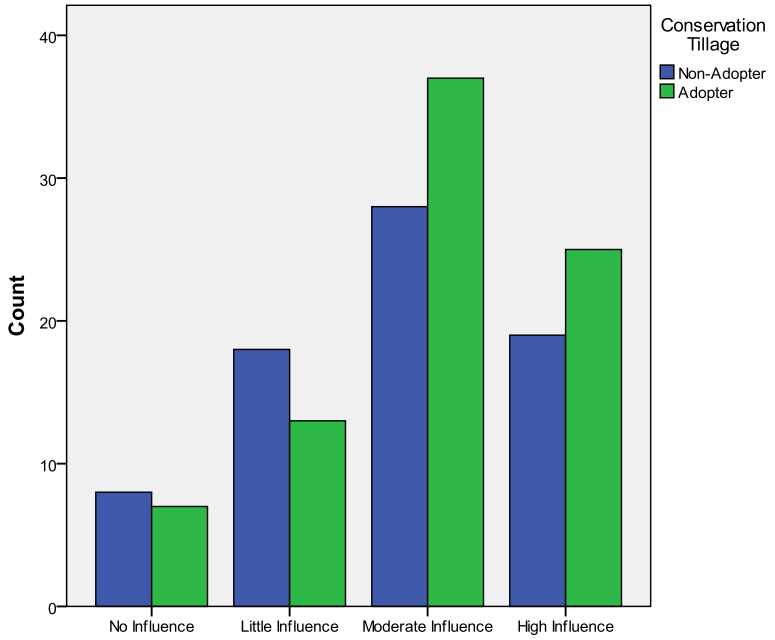

Figure 3.9 Influence of information source FSA and the adoption of conservation tillage.

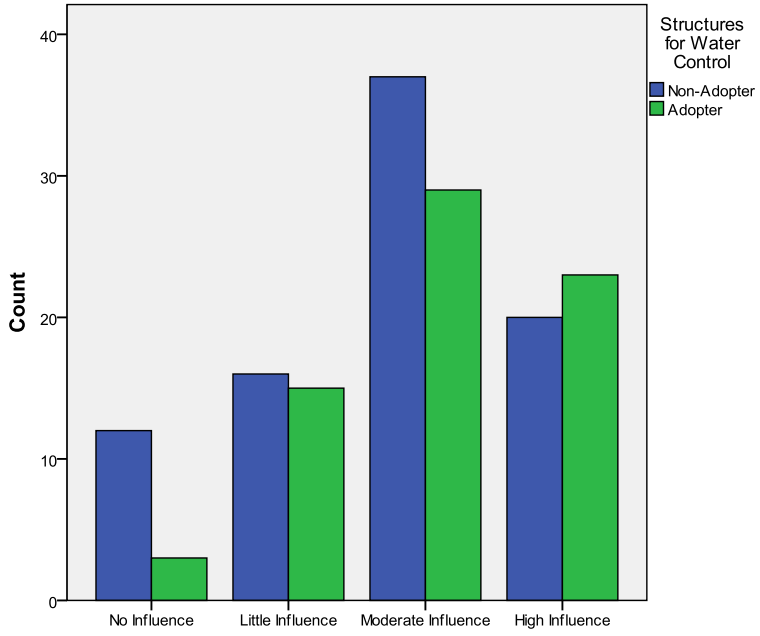

Figure 3.10 Influence of information source FSA and the adoption of structures for water control.

"Other farmers" was the second highest ranked (110; 67.1% of respondents ranked other farmers as moderate or high influence) information source ranked by the respondents. The information source "other farmers" was related to the adoption of conservation tillage and structures for water control; more adopters of conservation tillage (Figure 3.11) and structures for water control (Figure 3.12) indicated the information source "other farmers" was a moderate influence and high influence than non-adopters. Similarly to the information source FSA, the trend was that adopters of conservation practices ranked the information source other farmers higher than non-adopters. The information source "other farmers" and the adoption of conservation practices cross tabulation is a valuable result and may be able to lead to policy implications to promote the adoption of conservation practices. Lovejoy and Parent (1981) found that farmers that are "local opinion leaders" are more likely to adopt conservation practices. These leaders in the community may be able to facilitate the spread and adoption of conservation practices within the BSW according to this study. Farmers in the BSW are influenced by the management decisions and actions of other farmers; and the implication is agencies should begin to develop plans to promote the adoption of conservation practices to these community leaders.

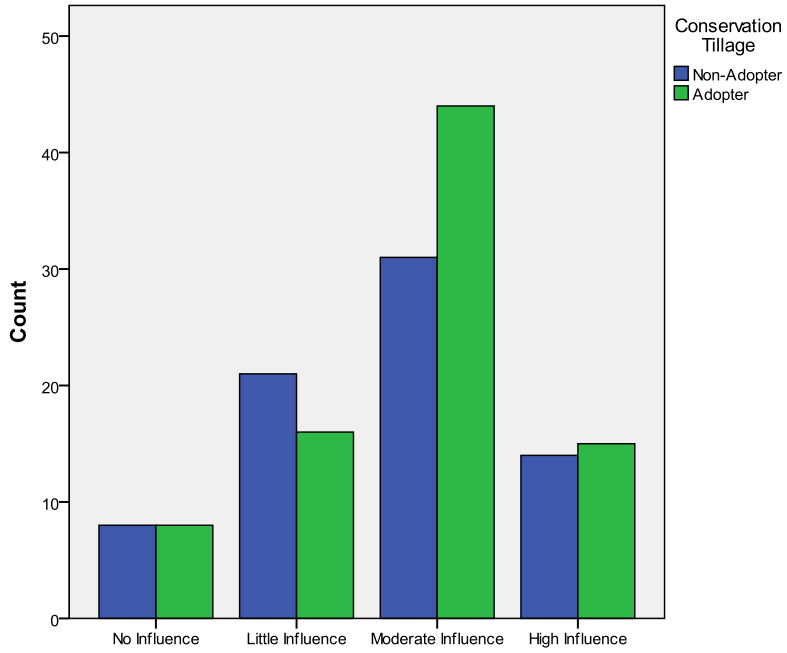

Figure 3.11 Influence of information source "other farmers" and the adoption of conservation tillage.

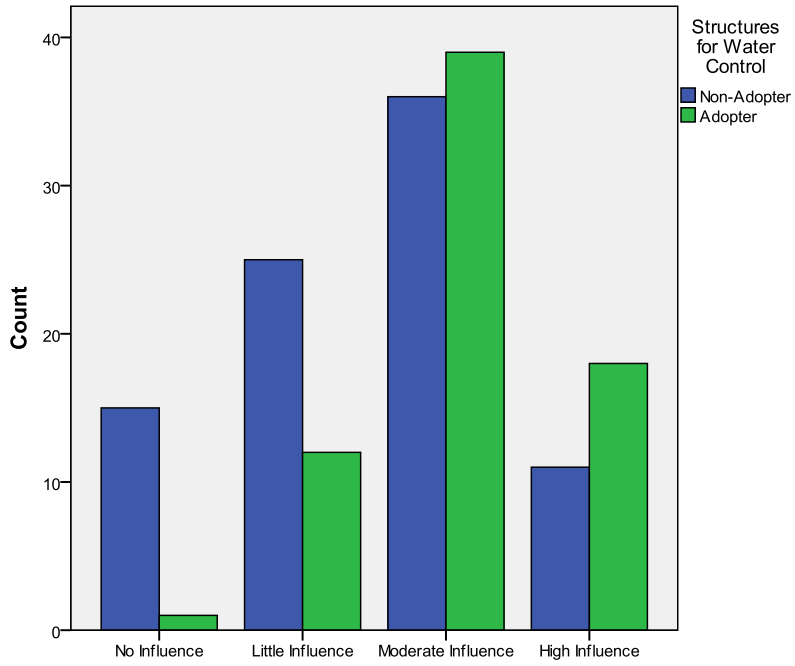

Figure 3.12 Influence of information source "other farmers" and the adoption of structures for water control.

The third highest ranked information source indicated by the respondents was "crop or farm consultants" (97; 60.7% of respondents indicated that the information source "crop or farm consultants" was a moderate or high influence in the farm operation). The information source "crop or farm consultants" was related to the adoption of the conservation practice conservation tillage. More adopters than non-adopters of conservation tillage indicated that crop or farm consultants were a moderate influence and a high influence. The field of Landscape Architecture and Planning can develop consultant plans for the establishment of conservation practices. Designers and planners can fill the role of crop or farm consultants for the development of conservation plans that promote the restoration of impaired water quality and wildlife habitats. This result shows the niche that the field of Landscape Architecture and Planning can fill for the agricultural community; resulting in productive farms, ecological integrity, and community health.

The fourth highest ranked information source was the MS Cooperative Extension Service (97; 60.3% of respondents indicated that the Extension Service was a moderate or high influence in the farm operation). Conservation tillage adoption was related to the information source "Extension Service." More adopters than non-adopters of conservation tillage indicated that the "Extension Service" was a moderate influence and a high influence. This results shows that the "Extension Service" influences the adoption of the conservation practice conservation tillage.

Family and Friends (97; 59.1%) as an information source was the fifth highest ranked source that was moderately and highly influential in the farm operation. Abd-Ella et al. (1981) and Carlson and Dillman (1983) found a positive relationship to the use of

conservation practices when the family is involved in gathering farm-related information, but Christensen and Norris (1983) found a negative relationship between family involved farm operations and the adoption of conservation practices. In this study, "family and friends" as an information source was not related to the adoption of conservation practices.

According to the respondents, the NRCS was ranked sixth as a moderately or highly influential information source in the farm operation. Although the NRCS was ranked lower (95; 59% of respondents indicated that the NRCS was moderately and highly influential in the farm operation) than the FSA, other farmers, crop or farm consultants, MS Cooperative Extension Service, and family and friends; the research showed that the NRCS is related as an information source to the adoption of the conservation practice structures for water control. There are more adopters than non-adopters of structures for water control that indicate the NRCS is highly influential. The Incentive Program section further explores the relationship between the NRCS and the producers of the BSW.

There are more adopters than non-adopters of conservation tillage that indicate "Farm magazines", the MS Soil and Water Conservation Commission (MSWCC) the Local Soil and Water Conservation Commission (Sunflower SWCD), "community members", the Yazoo Joint Management District (YMD), and the MS Department of Environmental Quality (MDEQ) is moderately influential and highly influential.

The BSW producers' information sources are related positively to the adoption of the field and crop residue conservation practice conservation tillage and the water conveyance conservation practice structures for water control. Conservation buffer

practices are not related to the influence of information sources. Although the adoption of RFBs is found to not be influenced by information sources, the adoption of two conservation practices (conservation tillage and structures for water control) is found to be influenced by information sources. The varied governmental organizations, non-governmental organizations (NGOs), stakeholders, community leaders and publications that influence the adoption of conservation practices and are involved in the conservation process implicates the field of Landscape Architecture and Planning to develop multi-scale conservation plans that promote the adoption of conservation practices through the dissemination of information. Focusing on the highest ranked information sources for the promotion of conservation plans that are aligned with the goals of the stakeholders and environment will increase adoption of conservation practices and help mitigate NPS pollution caused by agriculture dominated regions.

3.4.2 Farm Structure

Family involvement of the farming operation is an important factor in managerial decisions on the farm according to past literature (Abd-Ella et al., 1981; Pampel and van Es, 1977). The majority of the respondents (99; 58.2%) have family that is somewhat involved and very involved in the farm operation decision-making (Figure 3.13).

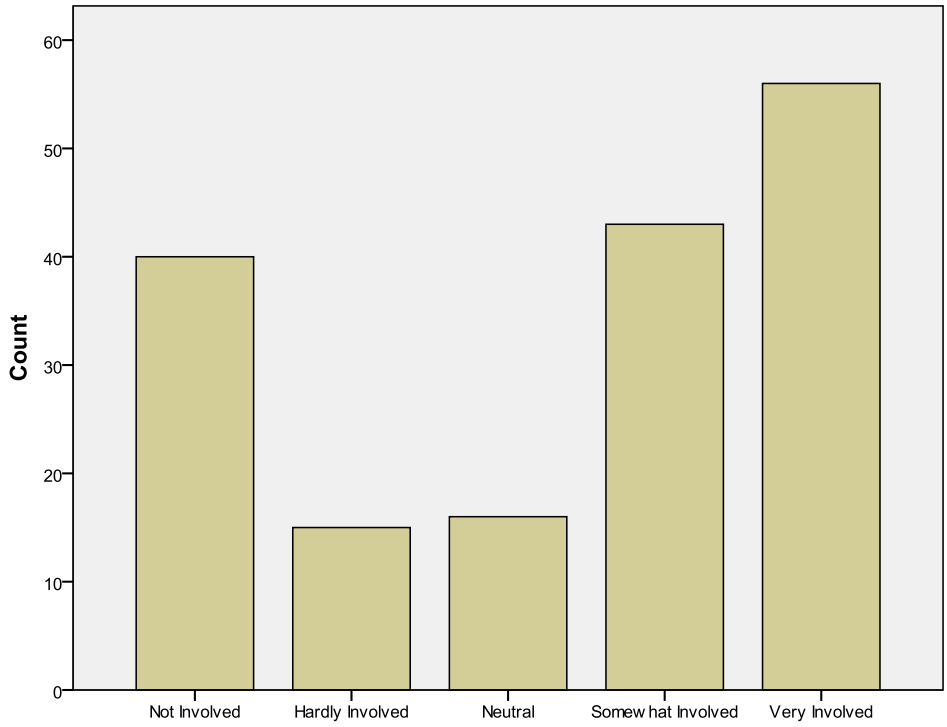

Figure 3.13 Family involvement in making farm-related decisions.

Past research has contradicted the influence that family involvement has on conservation practices. The literature has related positively to the adoption of conservation practices (Abd-Ella et al., 1981; Clearfield, 1986; Dillman, 1983) or found that family organization of the farm operation was related to non-adoption (Christensen and Norris, 1983; Duff et al., 1990). Christensen and Norris (1983) stated that a possible conclusion to the negative influence of family involvement and attitudes towards conservation results from the size of the farm; family farm operations may be smaller and in need of more revenue. This study found that BSW operations that farmed over 100 acres indicated that the family is "very" involved in the farm operation (Figure 3.14). Contradictory to Christensen and Norris (1983), family influenced operations are larger in the BSW.

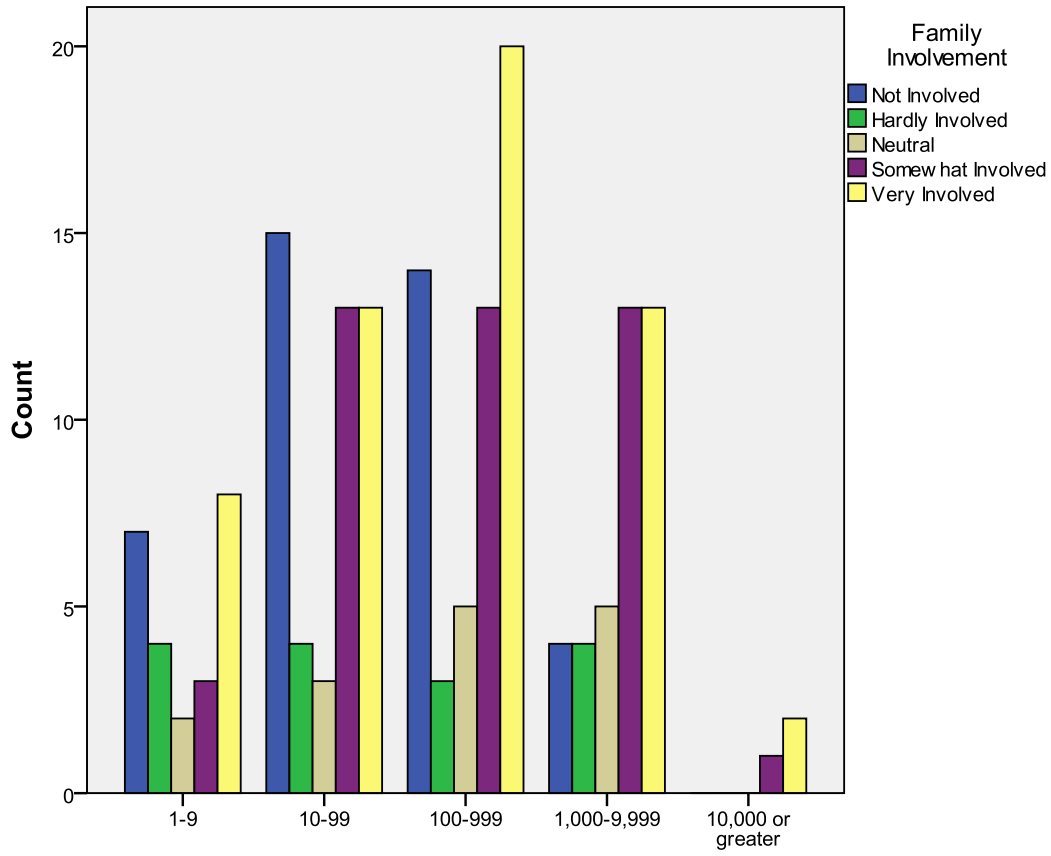

Figure 3.14 Total acres farmed and family involvement in the farm operation.

According to this study, the adoption of the conservation practice grassed waterways, cover cropping, filter or buffer strips, sediment and water control basins, conservation tillage, prescribed forestry, field border, structures for water control, and RFBs showed an increase in number of adopters with the amount of family involvement in the farm operation. The conservation practices of conservation tillage (Figure 3.15) and structures for water control (Figure 3.16) had more adopters than non-adopters within the farm operations that the family is very involved. Family involvement is an important indicator of adoption of conservation practices in the BSW. According to this research,

adoption of conservation practices increased as family involvement increased, indicating that family involvement is an avenue of exploration to increase adoption of conservation practices in the BSW.

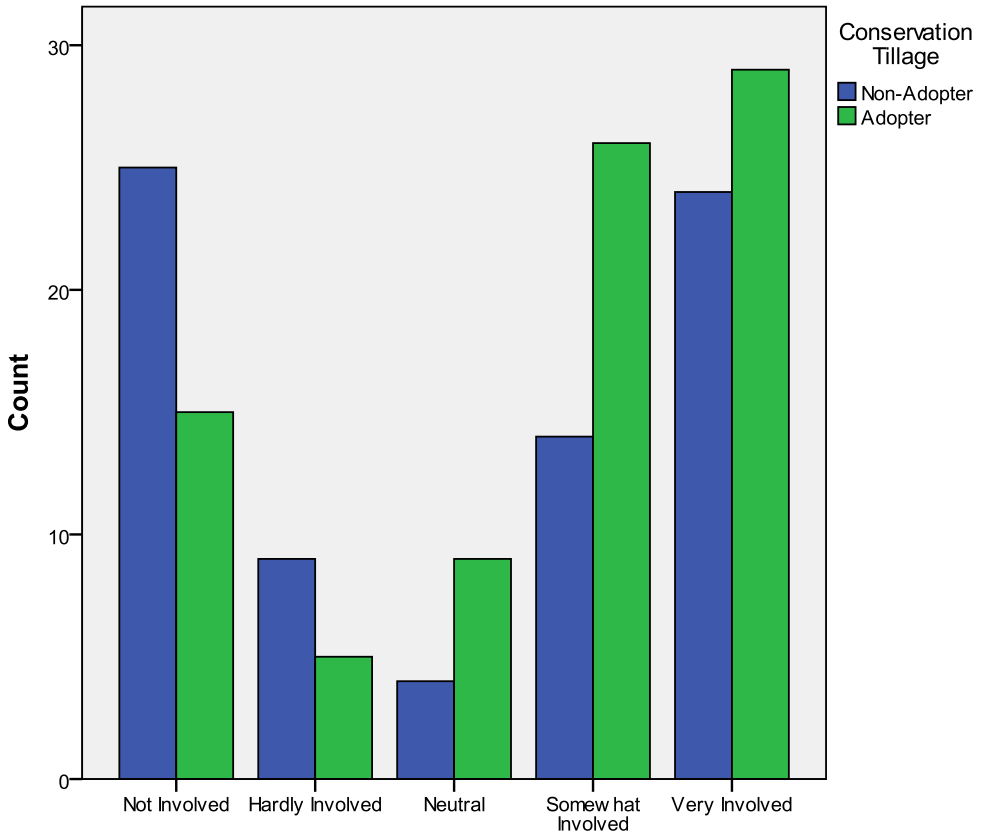

Figure 3.15 Family involvement in the farm operation and the adoption of conservation tillage.

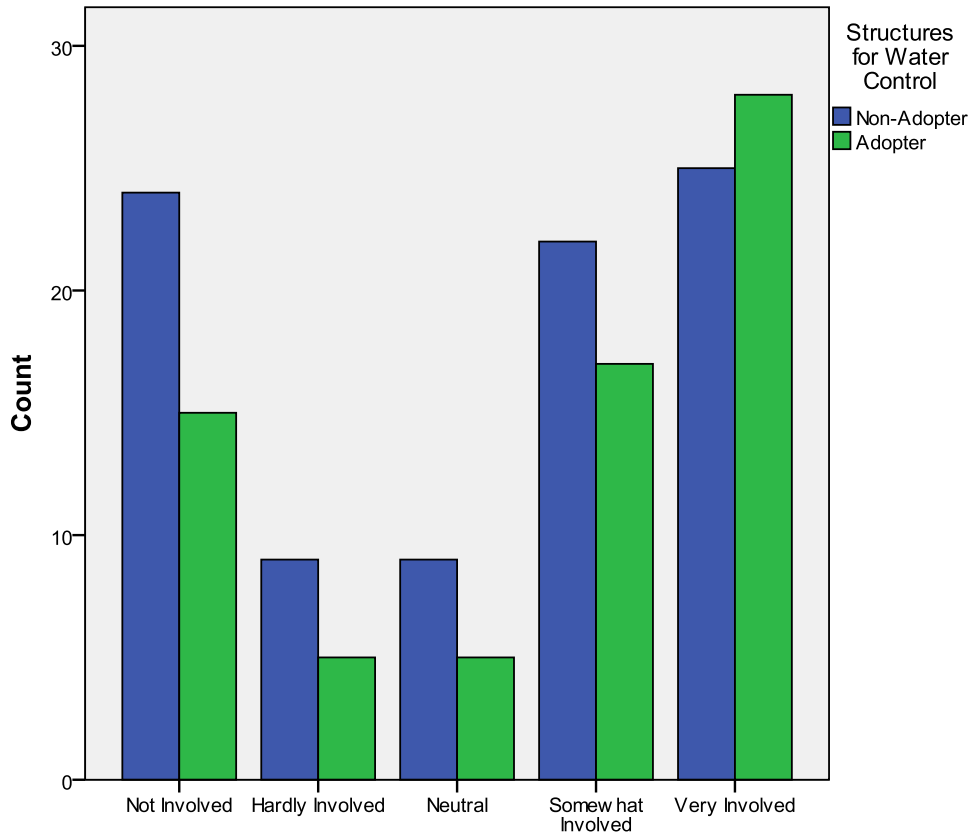

Figure 3.16 Family involvement in the farm operation and the adoption of structures for water control.

Farm size is positively and significantly related to the adoption of conservation practices as found by the majority of the past research (Abd-Ella et al., 1981; Carlson et al., 1981; Choi and Coughenour, 1979; Coughenour and Kothari, 1962; Ervin and Ervin, 1982; Fuglie and Kascak, 2001; Gill, 2001; Nowak and Korsching, 1981; Pampel and van Es, 1977; Steil, 2005). Gill (2001) and Steil et al. (2005) found that farm size was a very influential factor in adopting innovations. Tenure characteristics influence adoption of conservation practices according to Ervin (1985) and Soule et al. (2000). Soule et al. (2000) found that owner-operators are more likely to employ conservation practices with long-term benefits.

Farm size was divided into two variables in this study: total acres farmed (rented and owned) and total acres owned. In addition, tenure characteristics were also divided into two variables: land rented from other farmers and land leased to other farmers. The majority of respondents farmed 10 – 999 acres (103, 60.9%), 41.2% of respondents owned 100 – 999 acres, 45.9% rented 0 – 9 acres from others, and 62.4% of respondents leased 0 – 9 acres to others (Table 3.2).

Table 3.2 Total acres farmed, owned, rented, and leased.

Total Acres	Farmed	Owned	Rented	Leased
0-9	14.2%	14.7%	45.9%	62.4%
10-99	28.4%	31.8%	18.8%	15.3%
100-999	32.5%	41.2%	19.4%	20%
1,000-9,999	23.1%	12.4%	15.3%	2.4%
10,000 or greater	1.8%	0%	.6%	0%

Operations that farmed over 1,000 total acres (rented and owned) had more adopters of cover cropping (Figure 3.17), conservation tillage (Figure 3.18), and structures for water control (Figure 3.19) than non-adopters according to this study. This variable tells the researcher that operations that farmed large tracts within the BSW are more likely to adopt the conservation practices cover cropping, conservation tillage, and sediment and water retention basins. Cover cropping and conservation tillage are field and crop residue type conservation practices that are shown to provide immediate short-term benefits (Soule, 2000). This result again indicates that the perception of the

conservation practice (immediate, short-term benefits) influences the rate of adoption. The perceptions of RFBs will be further explored in the Conservation Practice section. Perception studies of other conservation practices may result in promotion of conservation practice adoption.

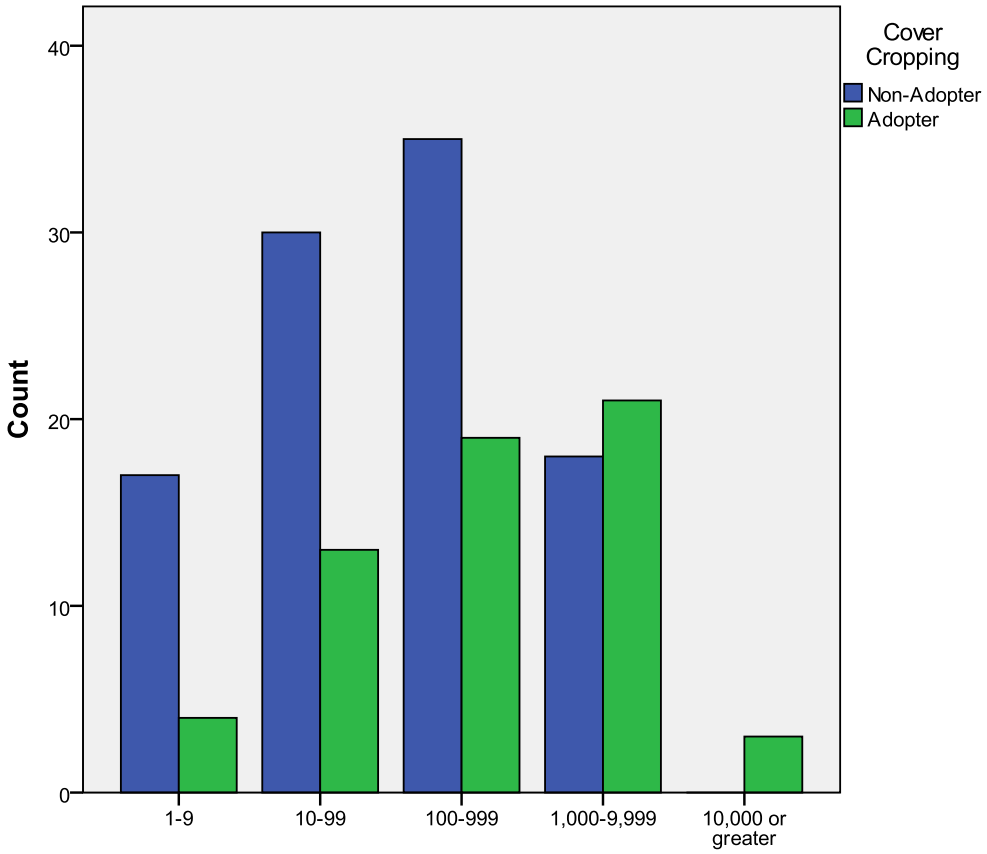

Figure 3.17 Total acres farmed (rented and owned) and the adoption of cover cropping.

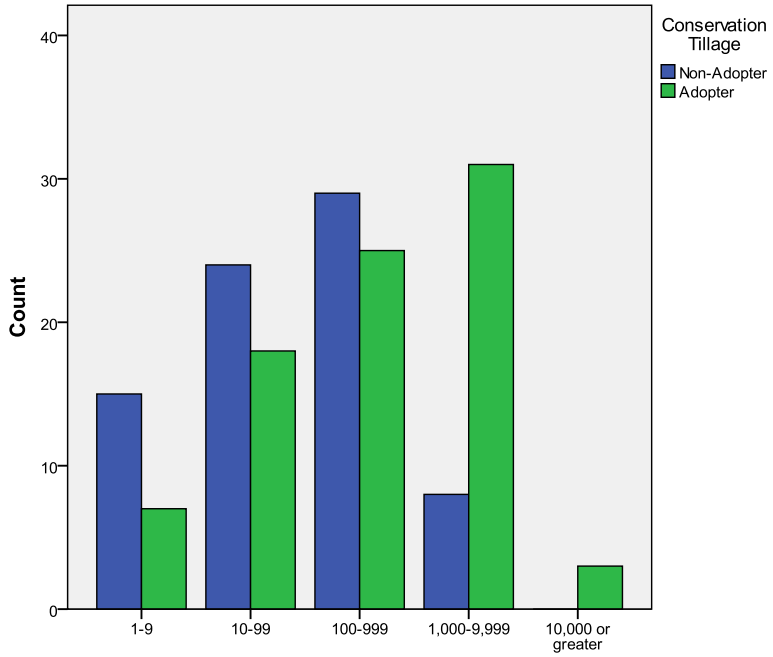

Figure 3.18 Total acres farmed (rented and owned) and the adoption of conservation tillage.

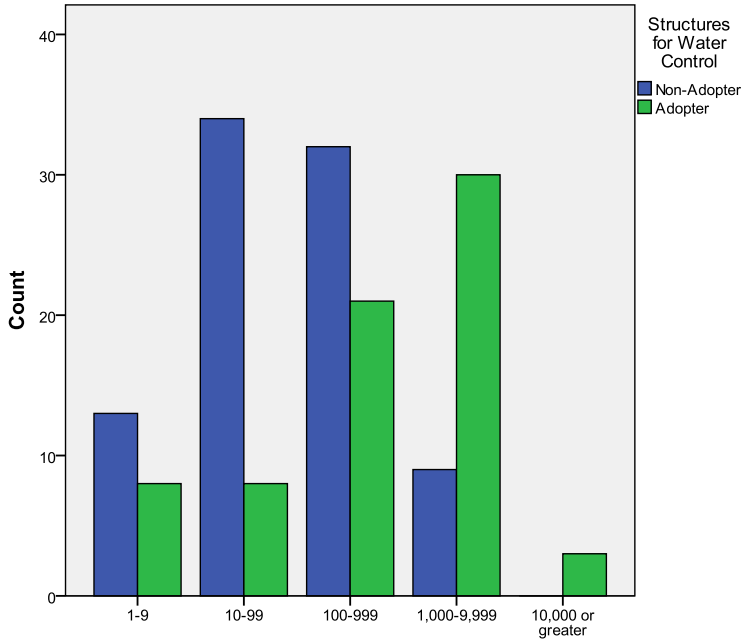

Figure 3.19 Total acres farmed (rented and owned) and the adoption of structures for water control.

Total acres owned was indicated as all acres owned by the farmer including land that was rented to other farmers. The variable total acres owned was closely associated with total acres farmed. Cover cropping, conservation tillage, and structures for water control had more adopters than non-adopters when the total acres owned was greater than 1,000 acres. This indicates that large farms (over 1,000 acres) are more likely to adopt the three conservation practices cover cropping, conservation tillage, and structures for water control. Landscape architecture can develop conservation plans that illustrate the short-term and long-term benefits of conservation practice adoption and help in the decision process of large farm management.

Farm operations that rented 10 or more acres had more conservation tillage adopters than non-adopters (Figure 3.20), farm operations that rented 100 or more acres had more structures for water control adopters than non-adopters (Figure 3.21), and farm operations that rented 1,000 acres or more had more cover cropping adopters than non-adopters (Figure 3.22). A review of prior research states that soil conservation is not applied to rented land (Duff et al., 1990). Practices that provide long-term benefits are found not as likely to be adopted on rented land, but conservation practices that provide short-term benefits, such as conservation tillage, are more likely to be adopted on rented land (Soule, 2000). This relationship between land rented and the adoption of conservation practices that increase field and crop residues confirms the past literature that renters are more likely to adopt these conservation practices that have immediate short-term benefits (Soule, 2000).

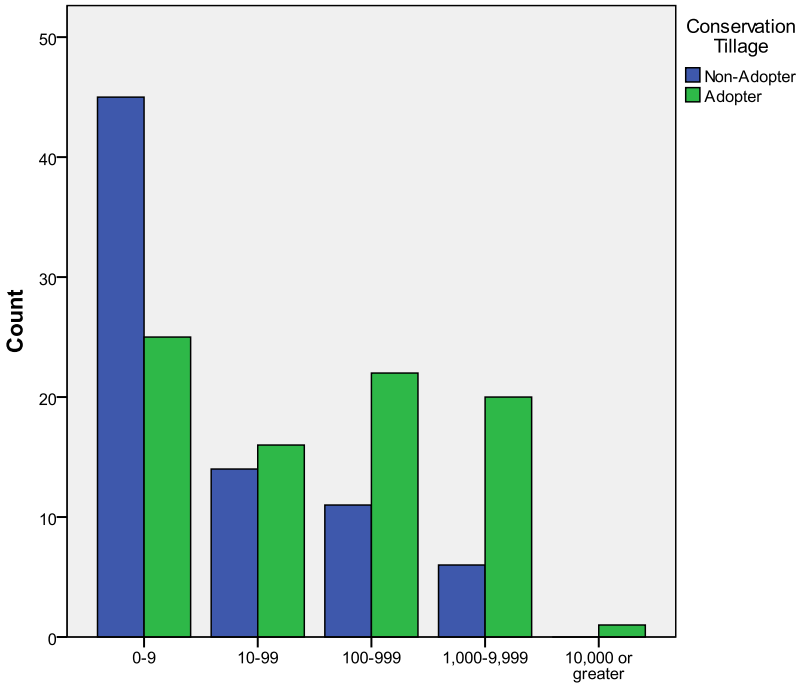

Figure 3.20 Total acres rented and the adoption of conservation tillage.

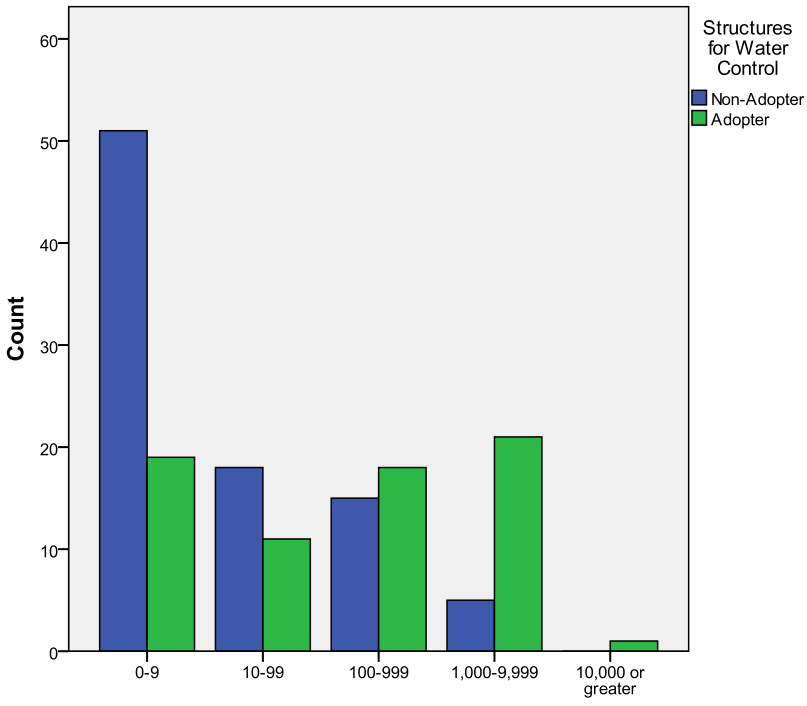

Figure 3.21 Total acres rented and the adoption of structures for water control.

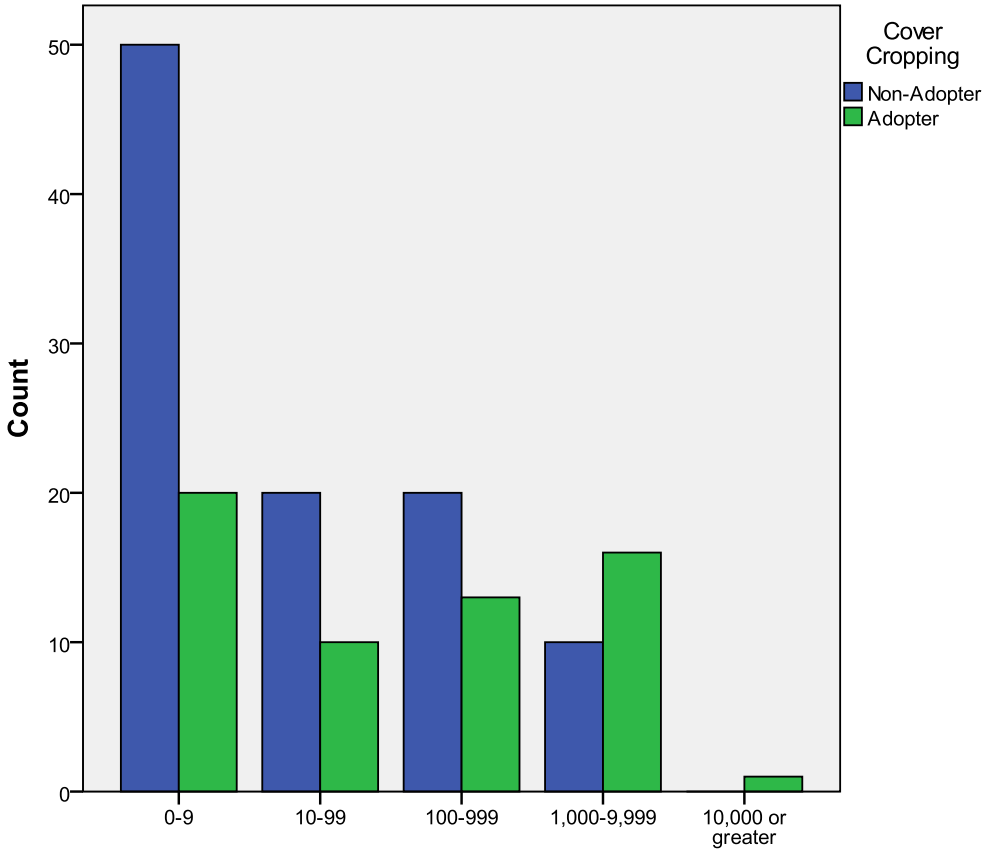

Figure 3.22 Total acres rented and the adoption of cover cropping.

Total acres leased (total acres rented to others) was not associated with the adoption of conservation practices. Further research into tenure characteristics of adopters may lead to increased adoption of conservation practices on rented land. Perceptions of field and crop residue conservation practices may indicate strategies to increase adoption of other conservation practices. The perceptions of RFBs will be explored further in the Conservation Practice section.

The farmers were asked about their years of farm experience. The majority of the respondents have farmed for 11 – 50 years (109, 64.9 %) and the majority of respondents have farmed for 11 – 50 years in the BSW (87, 52.1%) (Table 3.3).

Table 3.3 Total number of years respondents have farmed and total number of years respondents have farmed in the BSW.

Total Years	Farmed	Farmed in the BSW
	14.3%	29.9%
6-10 years	10.1%	9%
11-30 years	37.5%	31.7%
31-50 years	27.4%	20.4%
Over 50 years	10.7%	9%

Farming experience is a factor that affects adoption according to the past research. However, the research is contradictory: Christensen and Norris (1983) discovered that farmers with more experience were more likely to keep traditional practices and not likely to adopt BMP's while Pampel and van Es (1977) stated that number of years farming is related to adoption positively. Once again, RFB adoption was not related to farming experience and farming experience within the BSW. Farmers with 50 or more years of experience had more adopters than non-adopters of cover cropping (Figure 3.23), farmers with 11 – 30 years of experience had more adopters than non-adopters of conservation tillage (Figure 3.24), and farmers with 50 or more years experience had more adopters than non-adopters of prescribed forestry (Figure 3.25), according to this study. Farming experience compared with experience within the BSW was related, indicating no differences in total farming experience and farming experience within the BSW. Farmers with more experience (50 or more years) have more adopters of cover cropping and prescribed forestry. Stated previously in this section, older farmers (50

and over) adopted prescribed forestry; this result relates to farming experience, in that older farmers may have more experience. Prescribed forestry is signed up for a minimum of ten years (NRCS, 2009). This result may indicate that older farmers with more experience may retire more land from production. The field of Landscape Architecture can develop conservation plans that indicate how much land must be retired for farmers to reach a retirement goal. Further research into land retirement, and incentive payments may lead to policy changes for the retirement of farmland as current farmers reach the age of retirement.

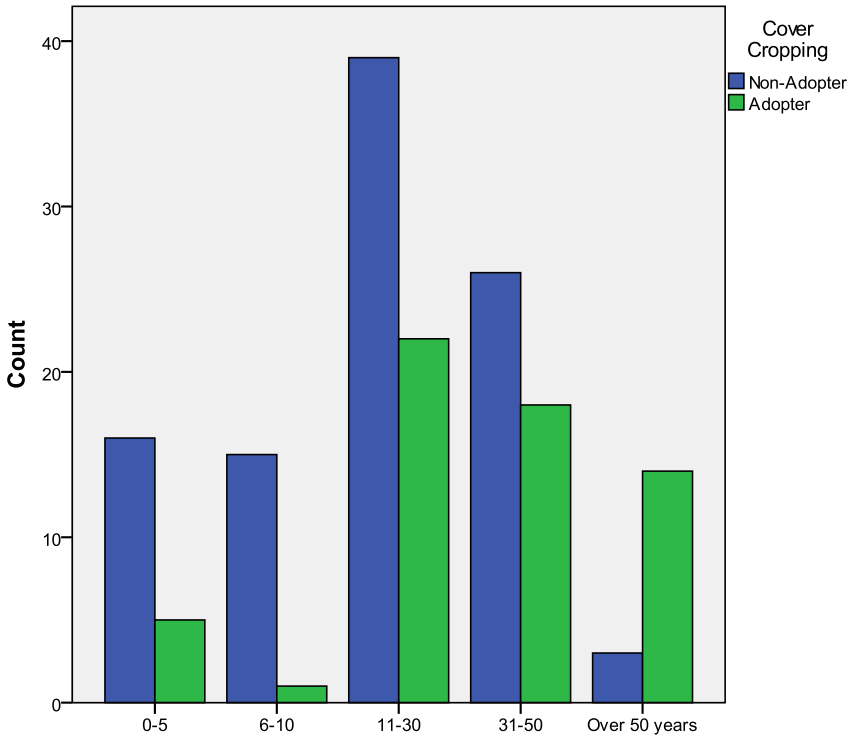

Figure 3.23 Total years farmed and the adoption of cover cropping.

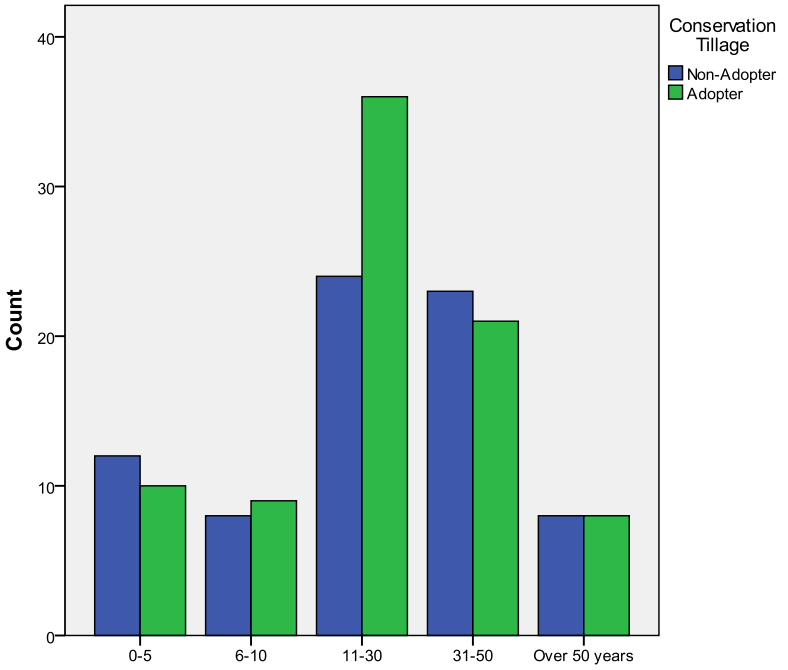

Figure 3.24 Total years farmed and the adoption of conservation tillage.

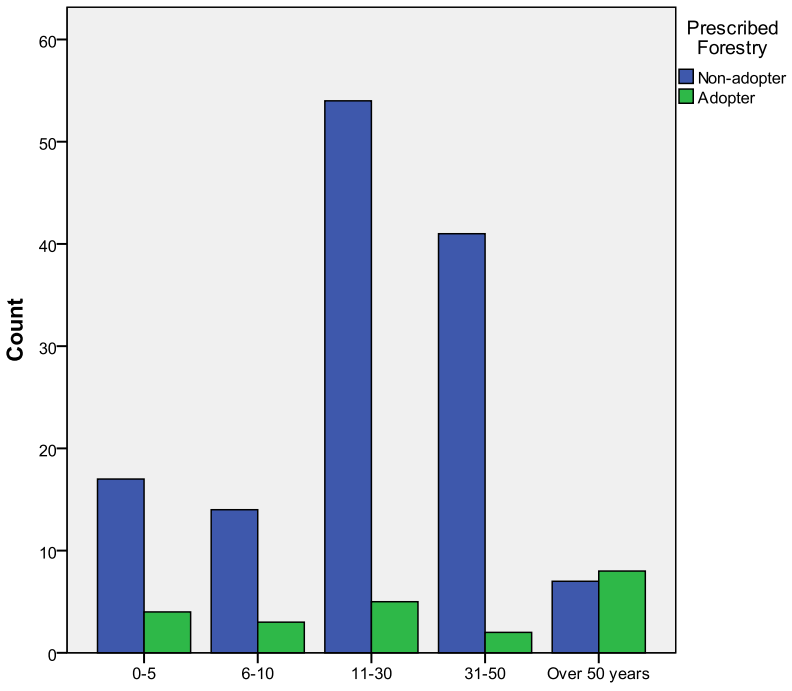

Figure 3.25 Total years farmed and the adoption of prescribed forestry.

The farmers were asked about the operation's gross sales in 2007. 22.5% of the respondents indicated that their gross sales in 2007 were below $5,000 (Figure 3.26) and 18.3% of the respondents indicated that their gross sales in 2007 were above $500,000, the rest of the respondents were evenly distributed between $5,000 - $499,999 gross farm sales. When asked if the respondent holds a non-farming job to supplement their income, the response was almost evenly halved. The representative of farmers that hold a non-farming job for supplemental income was 48.8% and the representative of farmers that do not hold a non-farming job was 51.2%.

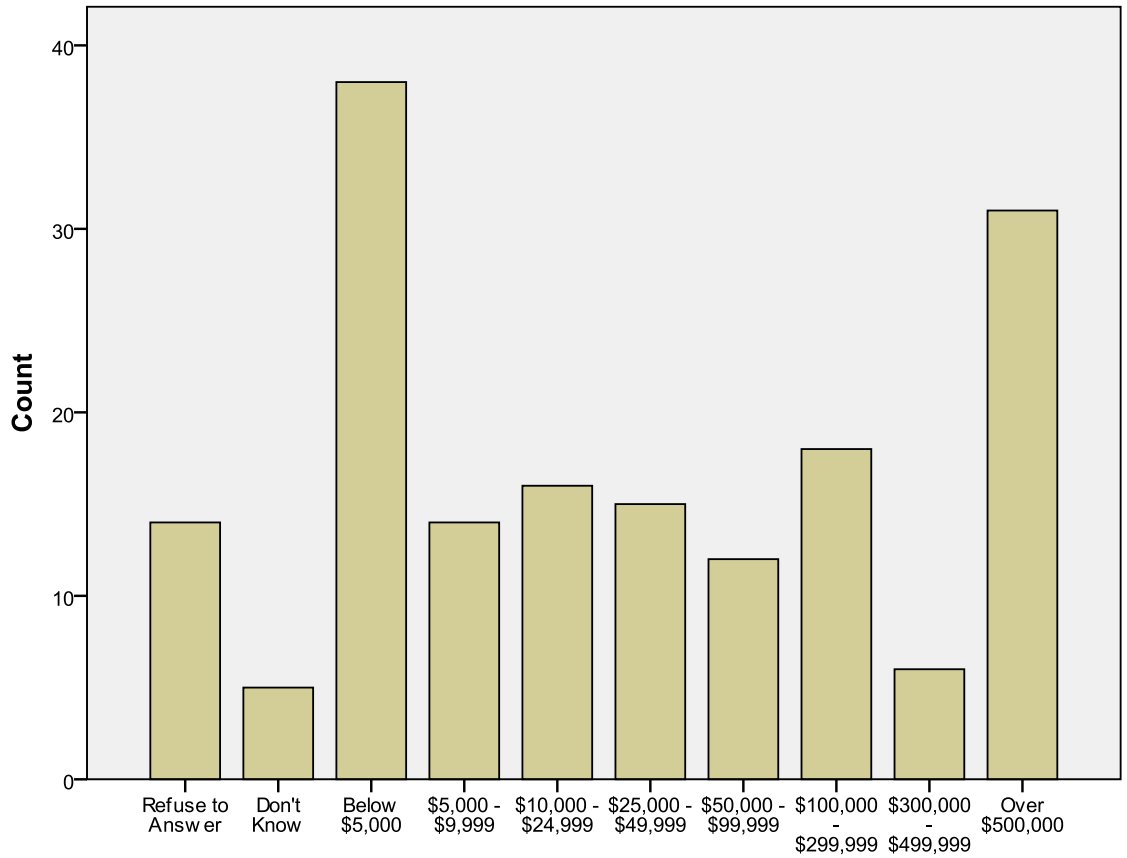

Figure 3.26 Total gross farm sales in 2007.

Gross farm sales was a factor that affects adoption of conservation practices according to prior research. Other studies have indicated that the larger the income, the more likely the adoption of conservation practices is to occur (Abd-Ella et al., 1981; Ervin and Ervin, 1982; Fuglie and Kascak, 2001; Steil, 2005). This study found that operations with gross farm sales of $500,000 or more had more adopters than non-adopters of cover cropping (Figure 3.27), operations with gross farm sales of $100,000 or more had more adopters than non-adopters of conservation tillage (Figure 3.28) and structures for water control (Figure 3.29). This indicates that farm operations with gross sales of $100,000 or more were more likely to adopt the conservation practices conservation tillage and structures for water control and farm operations with gross farm sales of $500,000 or more were more likely to adopt the conservation practice cover cropping. This result implies that smaller farm operations may perceive the costs of conservation practices as too great. The variable total acres farmed (rented and owned) was similar to this result in that larger farms adopt more cover cropping, conservation tillage, and structures for water control than non-adopters.

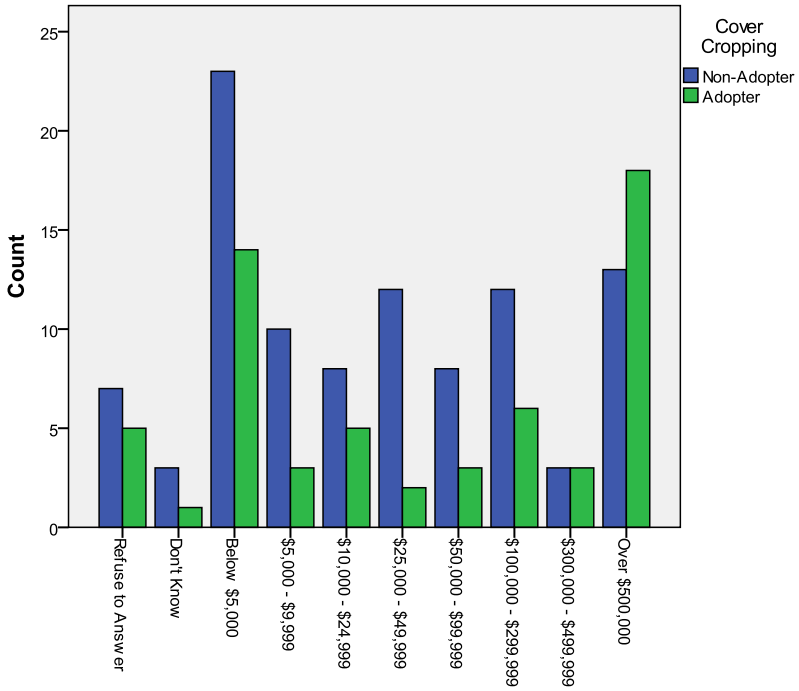

Figure 3.27 Total gross farm sales in 2007 and the adoption of cover cropping.

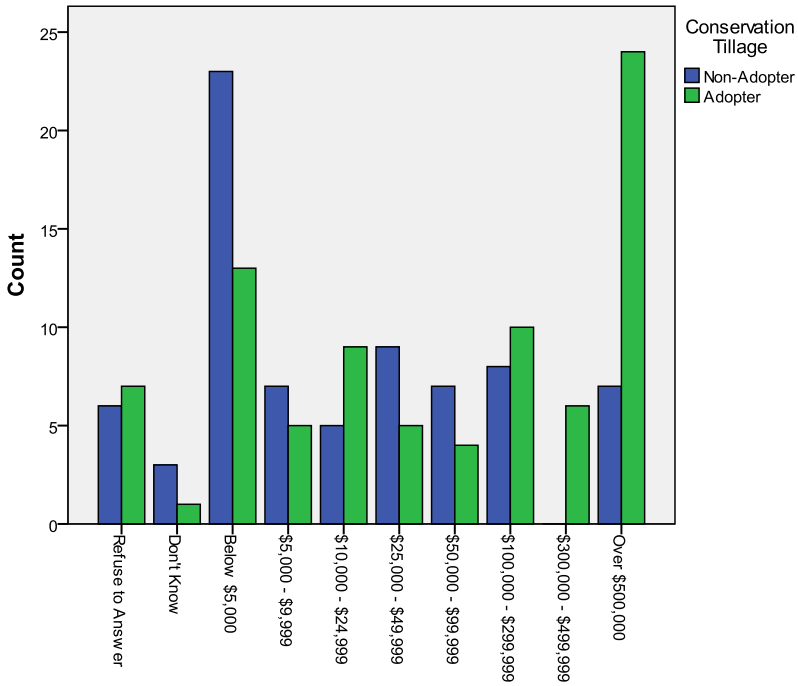

Figure 3.28 Total gross farm sales in 2007 and the adoption of conservation tillage.

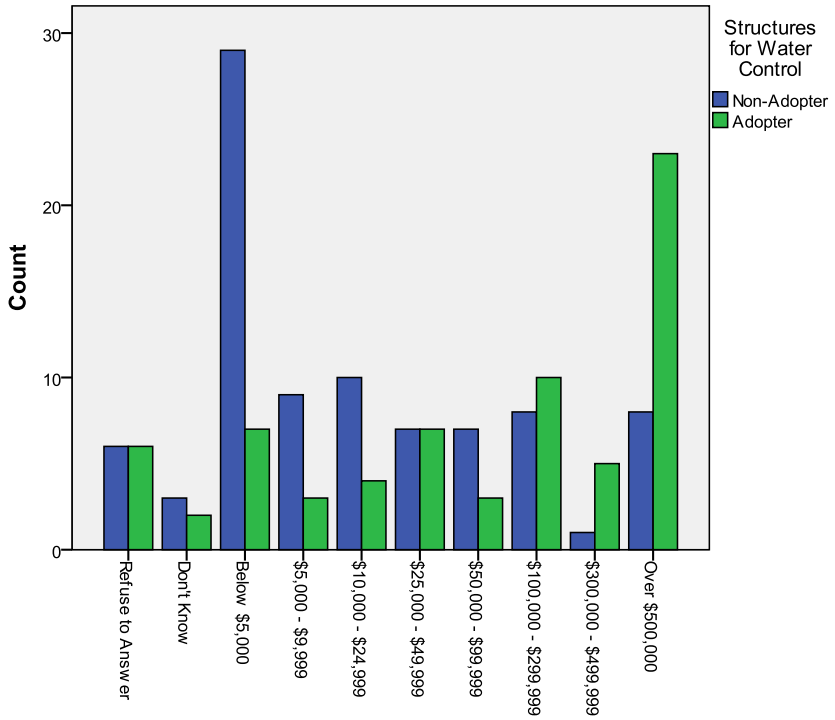

Figure 3.29 Total gross farm sales in 2007 and the adoption of structures for water control.

As seen in the literature review of this study, off-farm employment may or may not affect the adoption of conservation practices. Ervin and Ervin (1982) found that off-farm employment is negatively related to the adoption of conservation practices while Clearfield (1986) states that stakeholders that have off-farm employment may have higher education levels and availability of cash income and may be more likely to adopt conservation practices. Every conservation practice except field border has more adopters that do not have off-farm employment than adopters that have off-farm employment (Table 3.4). This relationship may indicate that farmers that have off-farm employment are less likely to adopt conservation practices in the BSW. According to Ervin and Ervin (1982), farmers that hold off-farm employment may do so to overcome financial troubles and be more than ever concerned with profit maximization. Farm

operations that have gross farm sales below $10,000, and between $50,000 and $99,999, have more off-farm employment than no off-farm employment (Figure 3.30). This result indicates that farm operations that have lower gross farm sales and off-farm employment do not readily adopt conservation practices.

Table 3.4 Adopters and non-adopters of conservation practices and off-farm employment.

Conservation Practice	**Holds off-farm employment**		**Does not hold off-farm employment**	
	Adopters	**Non-adopters**	**Adopters**	**Non-adopters**
Grassed Waterways	7	69	17	62
Cover Cropping	21	57	38	42
Filter or Buffer Strips	13	64	18	61
Sediment and Water Control Basins	6	70	11	69
Conservation Tillage	40	38	43	37
Prescribed Grazing	3	73	5	74
Prescribed Forestry	9	67	14	66
Field Border	15	61	15	64
Stripcropping	1	75	3	76
Structures for Water Control	29	47	40	41
RFBs	2	72	13	67

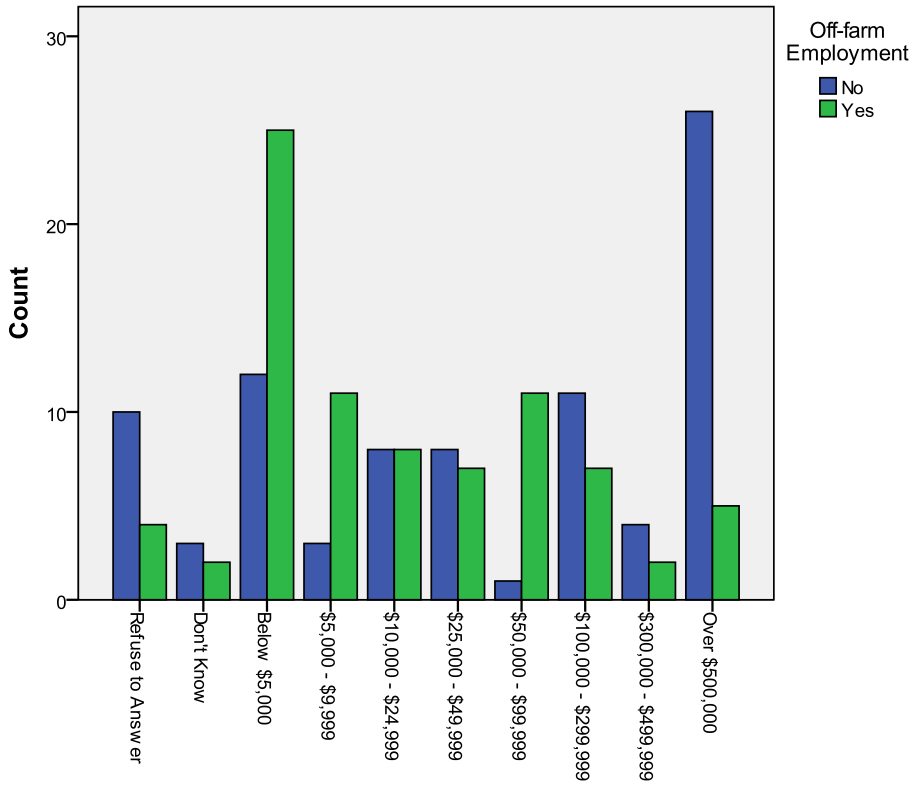

Figure 3.30 Total gross farm sales in 2007 and off-farm employment.

3.4.3 Ecological

This study questioned farmers about their proximity to five different surface waters common in the MS Delta: oxbow lakes, lakes, rivers, creeks or streams, and drainage ditches. The respondents were questioned about their farms' proximity to oxbow lakes, lakes, drainage ditches, streams, and rivers to understand farmers' perceptions and knowledge of their surrounding ecosystems and how it affects managerial decisions and conservation practice adoption. In the BSW, 10.7% of the respondents' farm operations are located near an Oxbow lake, 19.5% of the respondents have farms near a lake, 71% of the respondents have farms near a drainage ditch, 34.3% of the respondents have farms

located near a creek or stream, and 32% of the respondents have farm operations near a river (Table 3.5).

Table 3.5 Farm proximity to oxbow lake, lake, drainage ditch, creek or stream, and river.

Surface Water Body	Frequency	Valid Percent
Oxbow Lake	18	10.7%
Lake	33	19.5%
Drainage Ditch	120	71%
Creek or Stream	58	34.3%
River	54	32%

Gill (2001) found, in a study of the MS Delta, that farmers with farmland in close proximity or adjacent to oxbow lakes and streams and creeks more readily adopted BMPs than farmland without similar landscape characteristics. Rahelizatovo (2002), in a study on BMP adoption by dairy farmers in Louisiana, found that farms that were in close proximity to a stream or had a creek or stream running through the farm, were more likely to adopt conservation practices. In contrast, Ryan et al. (2003) found that landscape characteristics had an insignificant effect on adoption of conservation practices. This study found no relationship between the adoption of conservation practices and the farm operations' proximity to an oxbow lake, a lake, a river, and a creek or stream (Table 3.5). Although past research has found a significant relationship between the farm's proximity to a creek or stream and the adoption of conservation practices; our study did not find a relationship between adoption of conservation practices and the farm's proximity to a creek or stream (Gill, 2001; Kim et. al., 2005; Rahelizatovo, 2002). The adoption of RFB's were shown to not have a significant

relationship to the proximity of oxbow lakes, lakes, rivers, and creeks or streams within the study (Table 3.6), this result may be due to the lack of RFB adoption within the study area and implicates the need for outreach and education of the benefits of RFB adoption and other conservation practice adoption within the watershed. The respondents were asked about their farm's proximity to drainage ditches, 71% of the respondents indicated that their farm operation was in close proximity to a drainage ditch (Table 3.6). This result shows that farmers of the BSW may understand that their farm is nested in the watershed through surface water connections. The next section describes the perceptions the respondents have of water pollution on the farm, the county, and the region.

Table 3.6 Adoption and non-adoption of conservation practices and proximity to surface water body.

Conservation Practice		Farm Located near an Oxbow Lake		Farm Located near a Lake		Farm Located near a River	
		Yes	**No**	**Yes**	**No**	**Yes**	**No**
Grassed Waterways	**Adopters**	4	21	6	19	13	12
	Non-Adopters	14	118	25	107	40	92
Cover Cropping	**Adopters**	8	52	18	42	21	39
	Non-Adopters	10	90	14	86	32	68
Filter or Buffer Strips	**Adopters**	8	24	10	22	14	18
	Non-Adopters	10	116	22	104	39	87
Sediment and Water Control Basins	**Adopters**	5	12	5	12	8	9
	Non-Adopters	13	128	26	115	45	96
Conservation Tillage	**Adopters**	13	71	18	66	33	51
	Non-Adopters	5	71	14	62	20	56
Prescribed Grazing	**Adopters**	1	7	1	7	3	5
	Non-Adopters	17	131	29	119	49	99
Prescribed Forestry	**Adopters**	4	19	3	20	12	11
	Non-Adopters	14	120	27	107	41	93
Field Border	**Adopters**	6	25	7	24	13	18
	Non-Adopters	12	114	24	102	40	86
Stripcropping	**Adopters**	0	4	0	4	1	3
	Non-Adopters	18	134	30	122	51	101
Structures for Water Control	**Adopters**	12	58	19	51	33	37
	Non-Adopters	6	83	13	76	21	68
RFBs	**Adopters**	4	11	5	10	6	9
	Non-Adopters	14	127	26	115	47	94

Table 3.6 continued.

Conservation Practice		Farm Located near an Creek or Stream		Farm Located near a Drainage Ditch	
		Yes	**No**	**Yes**	**No**
Grassed Waterways	**Adopters**	16	9	19	6
	Non-Adopters	41	91	93	39
Cover Cropping	**Adopters**	28	32	44	16
	Non-Adopters	29	71	71	29
Filter or Buffer Strips	**Adopters**	12	20	25	7
	Non-Adopters	45	81	88	38
Sediment and Water Control Basins	**Adopters**	7	10	14	3
	Non-Adopters	50	91	99	42
Conservation Tillage	**Adopters**	38	46	62	22
	Non-Adopters	19	57	53	23
Prescribed Grazing	**Adopters**	1	7	5	3
	Non-Adopters	54	94	106	42
Prescribed Forestry	**Adopters**	9	14	17	6
	Non-Adopters	46	88	94	40
Field Border	**Adopters**	12	19	24	7
	Non-Adopters	45	81	88	38
Stripcropping	**Adopters**	0	4	3	1
	Non-Adopters	55	97	108	44
Structures for Water Control	**Adopters**	26	44	58	12
	Non-Adopters	31	58	55	34
RFBs	**Adopters**	6	9	13	2
	Non-Adopters	51	90	99	42

The respondents were asked about their perceptions of surface water pollution around their farm, their county, and their region. This question will allow the researchers to understand if the farmers perceive a problem of water quality in the region, the county, and their individual farms and understand how scale (region, county, farm) can affect the perceptions of the environment. Lichtenberg and Lessley (1992) found that Maryland farmers perceive water quality is an issue outside of the local and farm level. Although a large portion of respondents indicated that they "don't know" if there is surface water pollution on the farm, the county, or the MS Delta, the remaining respondents tend to believe that the surface waters of the Delta, their county, and their farms are somewhat polluted. 44.1% perceive surface waters of the MS Delta are somewhat or very polluted (Figure 3.31), 36.4% perceive surface waters of their own county are somewhat or very polluted (Figure 3.32), and 27.8% perceive surface waters of their farm operations are somewhat or very polluted (Figure 3.33). This result shows that farmers perceive that surface waters are polluted in the region, less polluted in the county, and even less polluted on the individual farm. The hypothesis that better educated farmers is positively associated with the perception of water quality impairments is contradicted in the past research. Clearfield and Osgood (1986) find a positive relationship in education and perception of soil erosion problems, but Green and Heffernan (1987) found education to be negatively related to the perception of the problems. This study found no significant relationship between education and perception of water quality problems. The perception of surface water quality problems and the adoption of conservation practices were not related in this study. This is similar to the findings of Clearfield (1986) which states that just because a farmer perceives an environmental impairment, he/she may not have the

resources, financial backing, or information to resolve it. The farmers may perceive that water quality is a problem, but not their problem; Lichtenberg and Lessley (1992) discussed that although Maryland farmers perceived that there were water quality problems, they tended to perceive it is not their problem. Once again this result may indicate that education and outreach of the benefits of conservation practices may aide in adoption and resolving water quality impairments within the BSW. Educating farmers of non-point source (NPS) pollution will promote the understanding of how water quality perceptions can differ in scale, and will promote the adoption of conservation practices to mitigate the causes of NPS pollutants within the watershed.

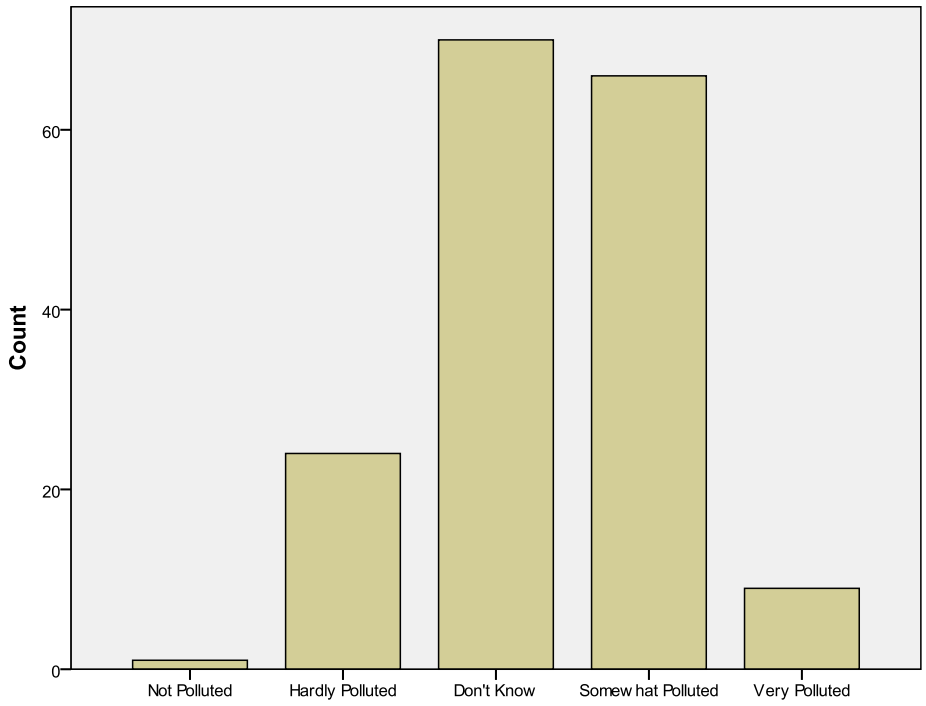

Figure 3.31 Surface water pollution of the MS Delta.

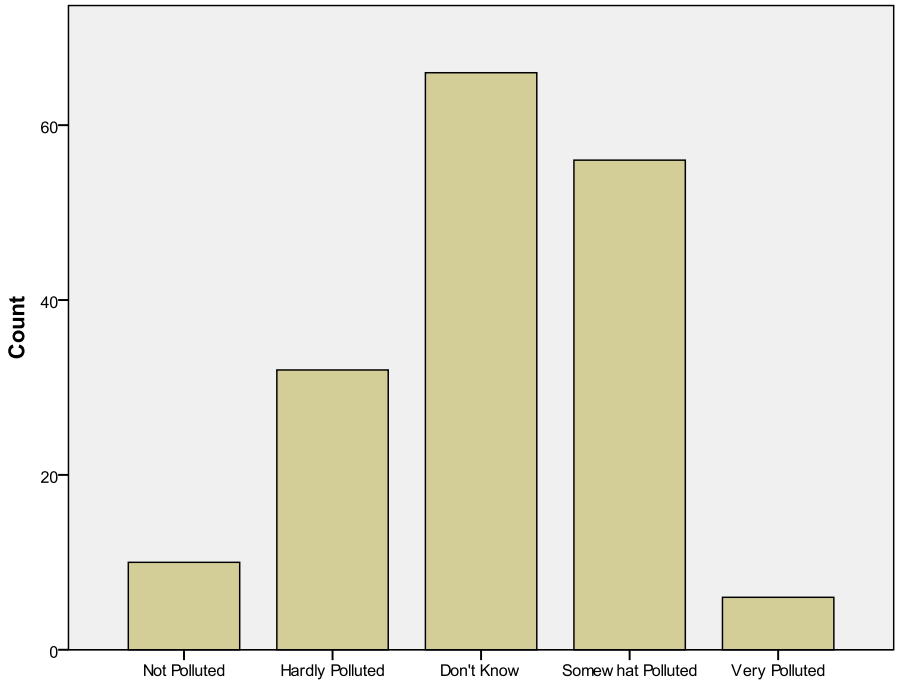

Figure 3.32 Surface water pollution in the respondents' county.

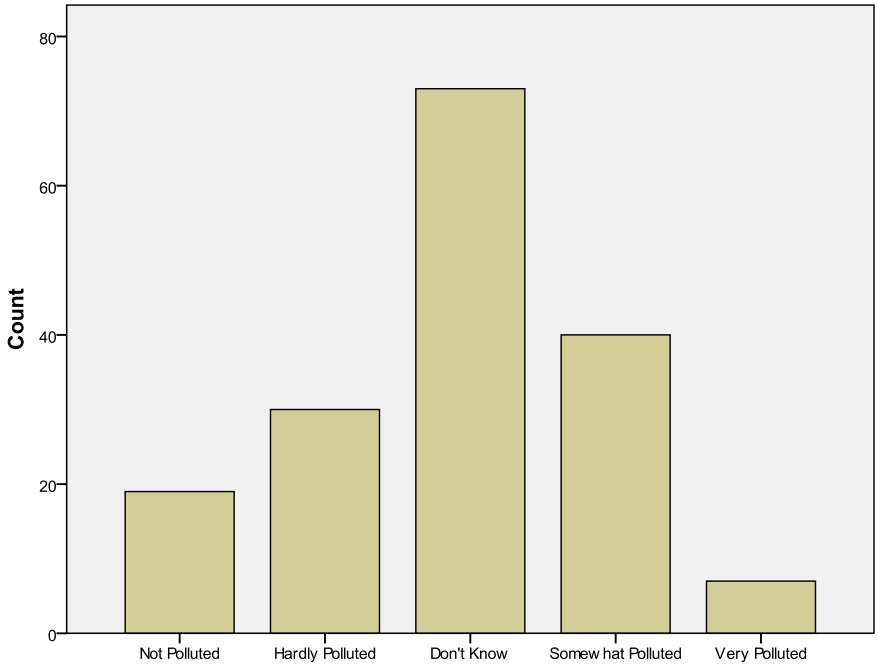

Figure 3.33 Surface water pollution around respondents' farms.

Among the demographic questions about environment, the researcher asked the study population how important the presence of wildlife was on the farm. The majority of the respondents felt that presence of wildlife was very important (58.6%) and 27.2% of the respondents felt that the presence of wildlife was somewhat important, while a much lower percentage felt the importance of wildlife on the farm was neutral (5.9%), hardly important (3.6%), or not important (4.7%) (Figure 3.34).

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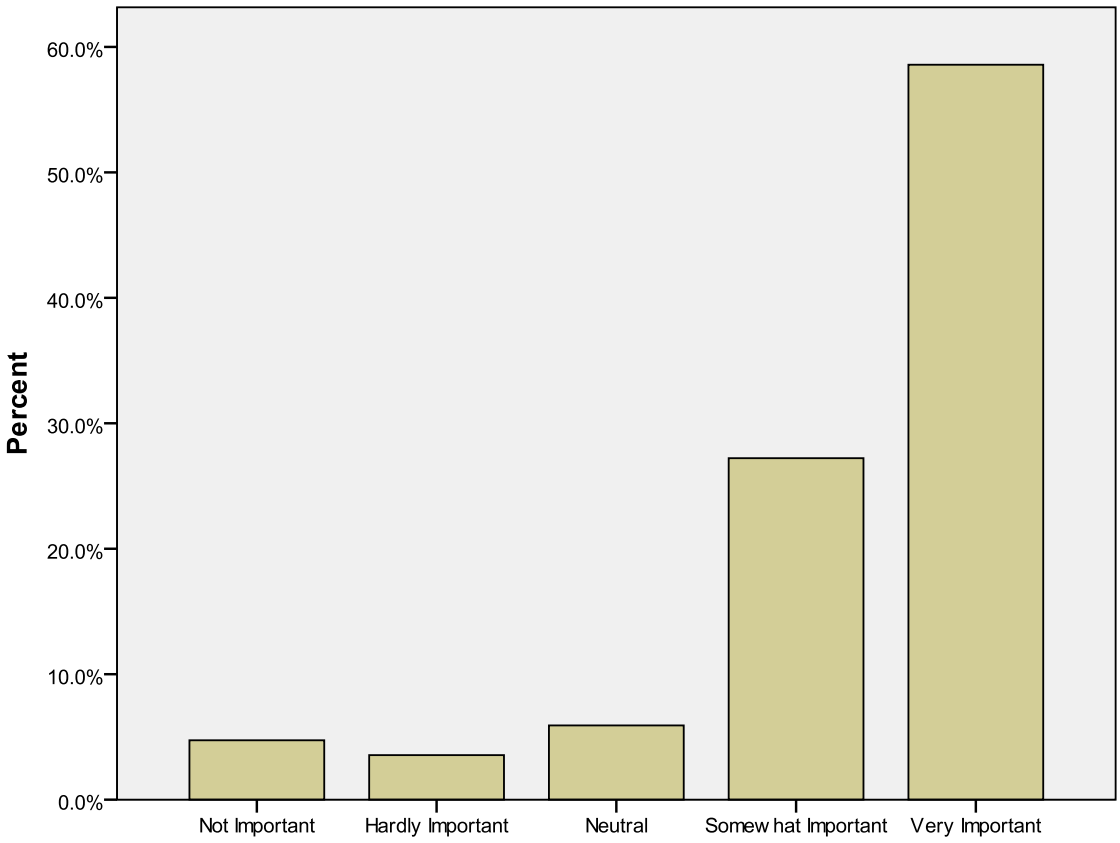

Figure 3.34 Importance of the presence of wildlife on the farm.

According to previous research, the importance of wildlife to farmers may have an affect on the adoption of conservation practices. Lovell and Sullivan (2006) found that conservation buffers provide habitat and forage for wildlife, but Skelton (2005) states

that RFBs are not widely adopted by farmers. The adoption of RFBs and other conservation practices may be increased through the outreach and education of the many wildlife benefits conservation buffers and conservation practices provide. This study found that the majority of respondents (145; 85.8%) indicated that the presence of wildlife on the farm was somewhat or very important, but adoption of conservation practices that promote the presence of wildlife on the farm is lacking. Buffer type conservation practices provide environmental benefits through wildlife habitat, increased biodiversity, and green corridors for the movement of wildlife (Lovell and Sullivan, 2006; Ryan et al., 2003; Skelton et al., 2005). The buffer type conservation practices analyzed in this section are filter or buffer strips, prescribed grazing, prescribed forestry, field borders, strip cropping, and RFBs.

The majority of adopters and non-adopters of filter or buffer strips (137; 87%) indicated that the presence of wildlife was somewhat important and very important (Figure 3.35). According to the NRCS "Conservation Practice Standard: Filter Strip" (2003), filter or buffer strips provide habitat and forage for wildlife and beneficial insects. Filter or buffer strips are implemented alongside RFBs and help to reduce sedimentation, fertilizers, and pesticides associated with NPS pollution (Lovell and Sullivan, 2006; NRCS, 2003). Although filter or buffer strips in the BSW were only indicated to be adopted by 32 respondents, a large portion of filter or buffer strip non-adopters (107) indicated that the benefits of filter or buffer strips was somewhat important and very important. The disconnection of adoption of filter or buffer strips and the importance of the benefits of filter or buffer strips presents implications for conservation practice adoption strategies.

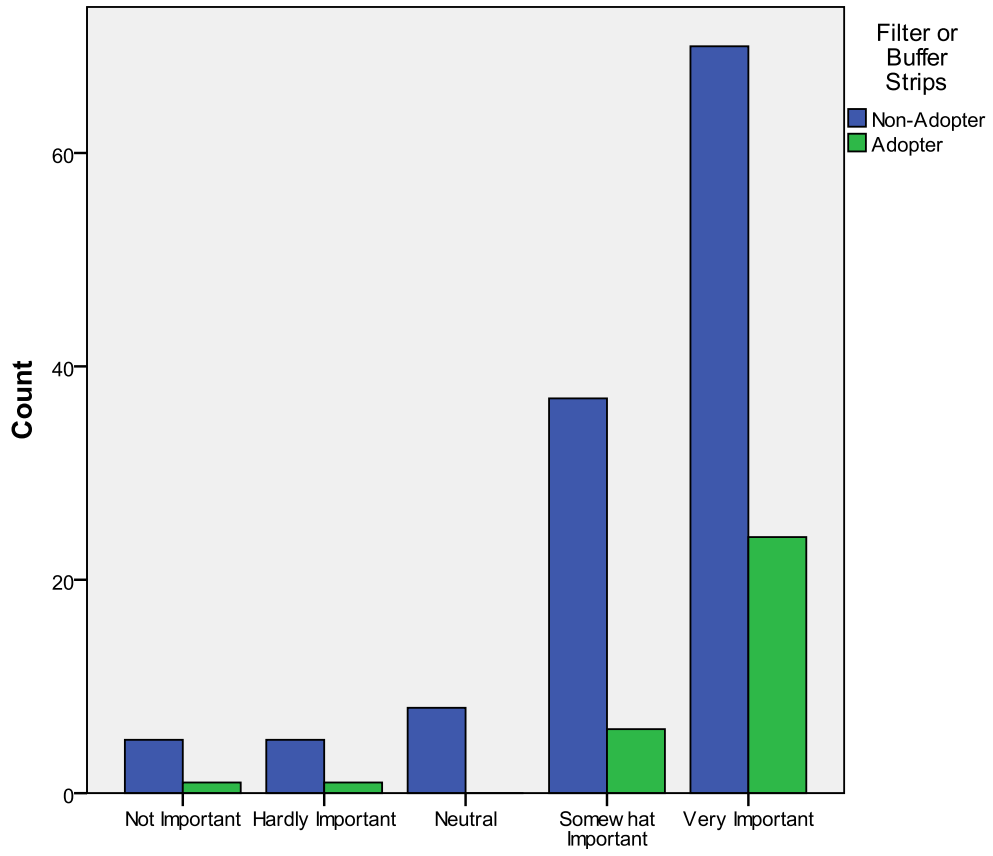

Figure 3.35 The importance of the presence of wildlife on the farm and the adoption of filter or buffer strips.

Although the number of respondents that indicated they were adopters of prescribed grazing was very small (8), the total number indicated that the presence of wildlife was somewhat important and very important on their farm.

The importance of the presence of wildlife on the farm cross tabulated with the adoption of the conservation practice prescribed forestry indicated that the majority of adopters and non-adopters of prescribed forestry (136; 87 %) found that the presence of wildlife was somewhat important and very important on their farm. The prescribed forestry conservation practice may be associated with the incentive program CRP for the

reforestation of agricultural lands (NRCS, 1998) and associated with Forestry Management Plans (FMPs) (NRCS, 2009). Prescribed forestry is a conservation practice that can provide large amounts of habitat and forage for wildlife and when combined with buffer practices can provide travel corridors for wildlife between patches of fragmented habitat.

The cross tabulation of the importance of the presence of wildlife on the farm and the adoption of the conservation practice field border found that the majority of adopters and non-adopters of field borders (136; 87%) indicated that the presence of wildlife was somewhat important and very important on their farm. Field borders are a buffer type conservation practice that may provide habitat, forage, and travel corridors for wildlife (Lovell and Sullivan, 2006; Ryan et al., 2003). The overall lack of adoption indicated by the respondents (32, 20.3%) may show a lack of knowledge of the benefits of buffer type conservation practices and according to Skelton et al. (2005) lack of knowledge of benefits of buffers may be a major impediment to adoption.

The adoption of strip cropping had no relationship when cross tabulated with the importance of the presence of wildlife on the farm. The low number of strip cropping adoption indicated by the respondents (4; 100%), was split evenly between somewhat important (2; 50%) and very important (2; 50%) when asked about the presence of wildlife on the farm. The NRCS (1998) states that strip cropping's main benefits are to reduce soil erosion caused by water and wind and to mitigate water quality impairments caused by water transportation of sediment, nutrients, and contaminants. Strip cropping can mitigate impaired water quality for the benefit of surface water habitats.

According to this study, the low number of adopters of RFBs (15) indicated that the presence of wildlife on the farm was somewhat important and very important (Figure 3.36). This result shows that RFB education and outreach may be able to improve RFB adoption rates. The discrepancy between the importance of the benefits of RFBs (presence of wildlife) and the lack of RFB adoption in the BSW provides strategies for the implementation of RFBs. The promotion of wildlife presence on the farm, through the design, implementation, and monitoring of conservation plans that utilize buffer type conservation practices could showcase the many wildlife benefits of conservation buffers in the farm operation.

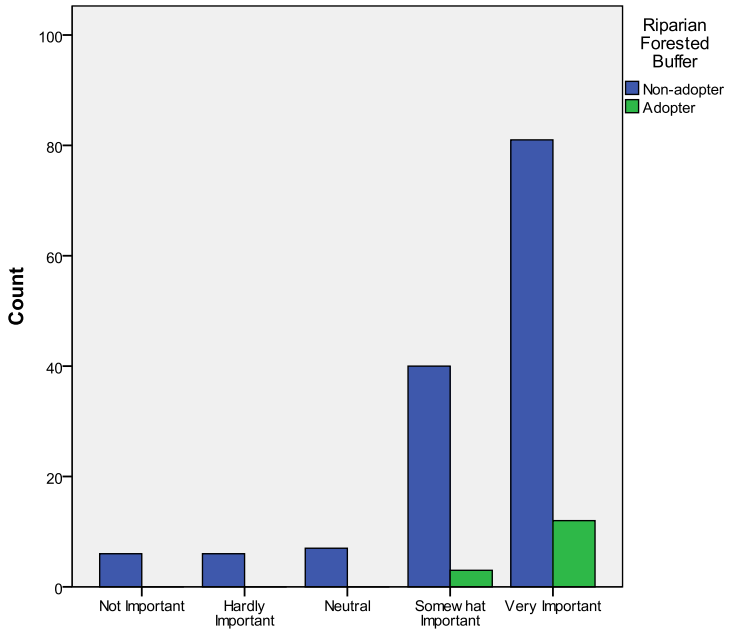

Figure 3.36 The importance of the presence of wildlife on the farm and the adoption of RFBs.

The next set of questions about the sample population's environment was their use of the natural environment through hunting and fishing. The majority of the

respondents answered that they fish (67.5%), hunt deer (65.7%), and hunt dove (63.3%) in the MS Delta (Table 3.7). Surprisingly, only 50% indicated that they hunt waterfowl in the MS Delta and just 14.8% indicated that they fish in the Gulf of Mexico.

Table 3.7 Respondents' use of hunting and fishing resources.

Activity	**Yes**	**No**
Fish in the MS Delta	67.5%	32.5%
Fish in the Gulf of Mexico	14.8%	85.2%
Hunt Deer in the MS Delta	65.7%	34.3%
Hunt Dove in the MS Delta	63.3%	36.7%
Hunt Waterfowl in the MS Delta	50%	50%

As discussed in the literature review, Lovell and Sullivan (2006) find that conservation buffers (upland and riparian) provide foraging, shelter, habitat, and corridors for wildlife. The Conservation Technology Information Center (2006) found that when marginal land is set aside under the WRP, farmers can see an increase from $20 per acre for soybeans to $80 - $100 per acre for hunting and fishing leases. Hunting and fishing opportunities have been important revenue generators for the state of Mississippi for generations. This study asked the study population of farmers of the BSW whether they hunted and fished in the Delta. Not surprisingly, the majority of respondents indicated that they did in fact hunt and fish within the Delta.

This study found that more adopters of conservation practices hunt deer than adopters that don't hunt deer, except for prescribed grazing; and more non-adopters hunt deer than non-adopters that don't hunt deer in the MS Delta (Table 3.8). Buffer type conservation practices provide habitat, foraging, and green corridors for the movement of wildlife, these benefits of buffers can provide excellent deer hunting opportunities within the BSW. More adopters of conservation practices hunt dove than adopters that don't hunt dove, except for prescribed grazing; and more non-adopters hunt dove than non-adopters that don't hunt dove in the MS Delta (Table 3.8). Conservation buffers in combination with field and crop residue practices provide excellent shelter and foraging for birds of the BSW. More adopters of conservation practices hunt waterfowl than adopters of conservation practices that don't hunt waterfowl, except for prescribed grazing. Water conveyance practices, grassed waterways, sediment and water control basins, and structures for water control show a positive relationship with the hunting of waterfowl within the MS Delta (Table 3.8). Water conveyance practices, when combined with riparian systems may increase waterfowl production for the leasing of land for hunting. Adopters and non-adopters that fish in the MS Delta are more than adopters and non-adopters that don't fish in the MS Delta (Table 3.8). Impaired water quality can be detrimental to the fisheries of the MS Delta. The education of the benefits of conservation practices and the connection to water quality is a strategy for the promotion of conservation practice adoption. Lovell and Sullivan (2006) state that RFBs and other conservation buffers, especially buffers that implement trees, benefit aquatic species through stream shading and cooling, providing forage and habitat, and increasing dissolved oxygen (DO). More adopters and non-adopters of conservation practices do

not fish in the Gulf of Mexico than adopters and non-adopters that do fish in the Gulf of Mexico. The formation of an enormous "dead zone" within the Gulf of Mexico has been attributed to NPS pollution of intensive agriculture practices within the Mississippi River Basin (Devine et al., 2008). The education of BSW farmers' connection of the Gulf of Mexico hypoxia zone and the lack of adoption of conservation practices within the BSW will determine strategies for the restoration of the Mississippi River Basin and Gulf of Mexico's water quality impairments. These restoration strategies can be implemented by educating producers of the benefits (economic, societal, environmental) of conservation adoption. Farm operations that have an opportunity to sell hunting leases will need to develop plans for the type and extent of wildlife management needed. Conservation plans that are associated with wildlife management and developed in line with wildlife incentive programs will be able to generate income for the farm operation through eco-tourism. These results indicate the importance of wildlife to the farmers of the BSW, and may drive policy implications to increase the adoption of conservation practices and the involvement of governmental programs that are associated with an increase in wildlife, an increase in incentives to conservation, and restoration of impaired water quality. The importance of eco-tourism within the MS Delta provides strategies for the application of the field of Landscape Architecture and Planning within the BSW.

Table 3.8 The adoption of conservation practices and the use of hunting and fishing resources.

Conservation Practice		Hunt Deer in the MS Delta		Hunt Dove in the MS Delta		Hunt Waterfowl in the MS Delta		Fish in the MS Delta		Fish in the Gulf of Mexico	
		Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
Grassed Waterways	**Adopters**	19	6	16	9	18	7	16	9	5	20
	Non-adopters	85	45	84	46	62	68	91	41	18	112
Cover Cropping	**Adopters**	46	13	42	17	34	24	45	15	10	48
	Non-adopters	60	39	60	39	47	52	64	36	14	85
Filter or Buffer Strips	**Adopters**	24	8	22	10	22	10	23	9	9	23
	Non-adopters	81	43	79	45	59	65	85	41	15	109
Sediment and Water Control Basins	**Adopters**	14	3	12	5	12	5	12	5	7	10
	Non-adopters	90	49	88	51	68	71	95	46	16	123
Conservation Tillage	**Adopters**	61	21	57	25	48	34	59	25	15	67
	Non-adopters	45	31	45	31	33	43	49	27	9	67
Prescribed Grazing	**Adopters**	4	4	4	4	3	5	5	3	3	5
	Non-adopters	98	48	94	52	75	71	100	48	19	127
Prescribed Forestry	**Adopters**	15	8	15	8	14	9	18	5	5	17
	Non-adopters	88	44	84	48	65	67	88	46	17	115
Field Border	**Adopters**	19	12	21	10	22	9	19	12	8	23
	Non-adopters	85	39	79	45	58	66	88	38	15	109
Stripcropping	**Adopters**	2	1	2	1	2	1	3	1	1	2
	Non-adopters	100	51	96	55	76	75	102	50	21	130
Structures for Water Control	**Adopters**	56	14	52	18	46	24	50	20	13	57
	Non-adopters	50	38	50	38	36	52	58	31	11	76
RFBs	**Adopters**	10	5	9	6	9	6	9	6	1	14
	Non-adopters	93	46	90	49	71	68	97	44	22	117

3.5 Conservation Practices

In order to assess the respondents' knowledge, perceptions, and utilization of conservation practices, a list of conservation practices that are commonly used to mitigate pollutants that cause impairment of water quality was generated through research and

meetings with the NRCS, the YMD, the Friends of the Sunflower River, and professionals in the agriculture industry. The conservation practices that restore water quality were organized into three groups: 1.) buffer type practices (riparian forested buffers (RFBs), filter or buffer strips, field borders, prescribed forestry, prescribed grazing, and stip cropping); 2.) crop residue practices (conservation tillage and cover cropping) and 3.) water control and conveyance (grassed waterways, water and sediment control basin, and structures for water control). The respondents were asked to indicate whether they have ever heard of the practice, adopted the practice, and how many acres were serviced by the practice in 2008 (Table 3.9). Table 3.9 ranks the conservation practices from highest to lowest according to the respondents' indication that they have heard of the practice. RFBs ranked last in respondents indicating that they heard of the practice, but 9.6% (15) of the respondents indicated that they were adopters of RFBs. Respondents indicated that 61.8% (97) have heard of the practice strip cropping, but just 2.6% (4) have adopted the practice and the respondents indicated no acres were serviced by the practice in 2008. The conservation practices that most producers of the BSW adopted are the field and crop residue practices (conservation tillage, cover cropping) and 1 water conveyance practice (structures for water control).

Table 3.9 Respondents' knowledge and use of the various conservation practices.

Conservation Practice	Heard of Practice	Adopted Practice	Acres Serviced by Practice in 2008 by Respondents
Conservation Tillage	83%	52.5%	39,488
Cover Cropping	81.8%	37.5%	5,065
Structures for Water Control	69.6%	44%	38,794
Filter or Buffer Strips	67.7%	20.3%	5,792
Field Border	65%	19.7%	11,378
Grassed Waterways	64.3%	15.9%	4,400
Strip cropping	61.8%	2.6%	0
Sediment and Water Retention Basins	57.9%	10.8%	2,860
Prescribed Forestry	49.7%	14.6%	1,197
Prescribed Grazing	44.8%	5.1%	740
Riparian Forested Buffers	36.1%	9.6%	3,362

3.5.1 Riparian Forested Buffers

Riparian Forested Buffers (RFBs) are a proven conservation practice for mitigating impaired water quality and maintaining the ecological health of lakes, streams, and rivers that are located within agricultural watersheds (Belt et al., 1992; Ryan et al., 2003; Skelton et al., 2005). This study attempted to understand the perceptions of RFBs among the stakeholder that most influences the BSW's water quality. According to Skelton et. al. (2005), the main barrier to adoption of the RFB conservation practice was

RFB knowledge. According to this study, the wildlife benefits of RFBs are very important to the stakeholders of the BSW. This section attempts to understand the BSW farmers' perceptions of RFBs in more detail. The respondents were given a list of comments about riparian forested buffers (RFBs) in which the respondent indicated whether he or she strongly agreed, agreed, was undecided, disagreed or strongly disagreed with the comment. This set of data will be a valuable insight into the relationship of farmers and RFB's and will inform the researchers of the respondents' attitudes, knowledge, and perceptions of RFBs. Below is a complete list of the comments given to the respondents:

1) RFB's are compatible with current farming practices.
2) Establishment of an RFB is difficult.
3) RFB's do not require much maintenance.
4) Signing up for governmental programs for the establishment of RFB's is easy.
5) Financial incentives for the establishment of RFB's are adequate.
6) I am less likely to establish an RFB due to government regulation.
7) RFB's provide stream bank stabilization and prevent erosion.
8) RFB's provide habitat for beneficial insects that prey on pests.
9) Reduced profitability will prevent me from installing an RFB.
10) RFB's do not improve water quality.
11) RFB's provide wildlife movement and habitat for hunting and fishing.
12) If I had help in designing, establishing, and maintaining an RFB, I would be more likely to implement an RFB on my property.

13) If I were allowed to periodically harvest trees from an RFB, I would be more likely to sign up for an RFB program.

The respondents' perception of the compatibility of RFB's and current farming practices indicated that the largest portion of respondents was undecided (49%) about the compatibility of RFB's and current farming practices, but 43.3% of the respondents agreed and strongly agreed that RFB's are compatible with current farming practices (Figure 3.37).

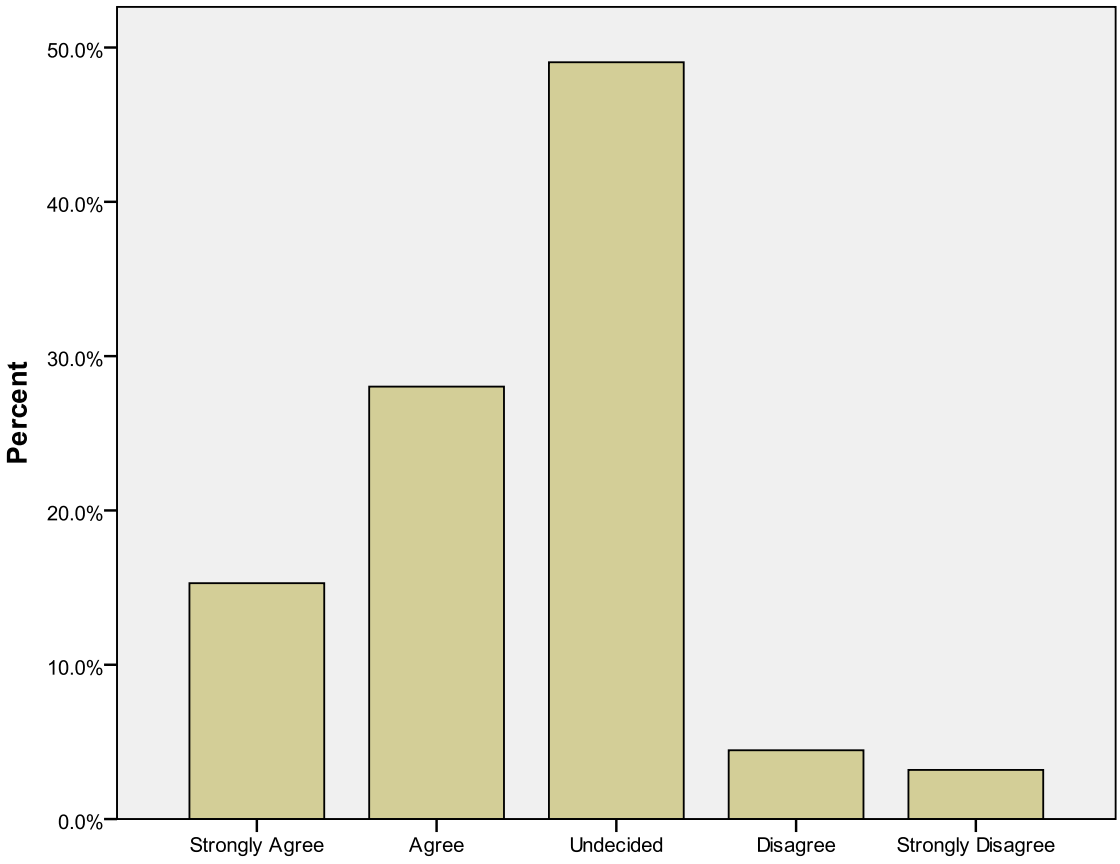

Figure 3.37 Respondents' perception of the comment, "RFBs are compatible with current farming practices."

The comment, "RFBs are compatible with current farming practices" is related to the adoption of RFBs. Six adopters of RFBs strongly agree, five RFB adopters agree, three RFB adopters are undecided, and 1 RFB adopter strongly disagrees that RFBs are compatible with current farming practices. The majority of non-adopters (73; 53.3%) are undecided about the compatibility of RFBs (Figure 3.38). This result shows that education and outreach may help non-adopters understand the compatibility of RFB adoption and current farming practices and the understanding of RFB compatibility may cause an increase in the adoption of RFBs. Also, RFB adopters may understand the benefits of RFB adoption and the compatibility of RFBs with current farming practices and utilize this knowledge to influence other farmers to adopt RFBs.

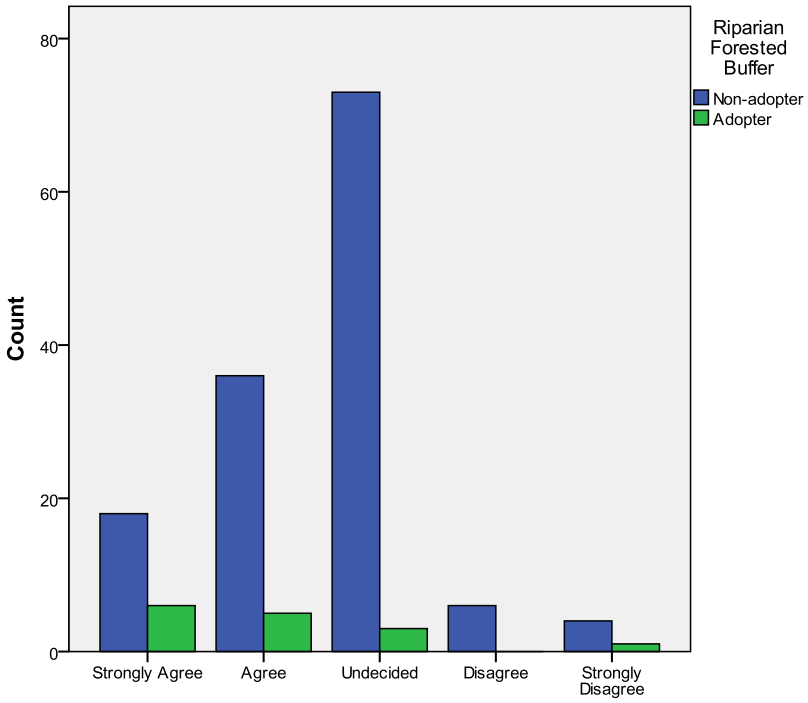

Figure 3.38 Perception of comment "RFBs are compatible with current farming practices," and the adoption of RFBs.

When asked to agree or disagree with the comment, "Establishment of an RFB is difficult" the respondents were undecided (52.9%), agreed or strongly agreed (29.3%), and disagreed or strongly disagreed (17.8%) (Figure 3.39).

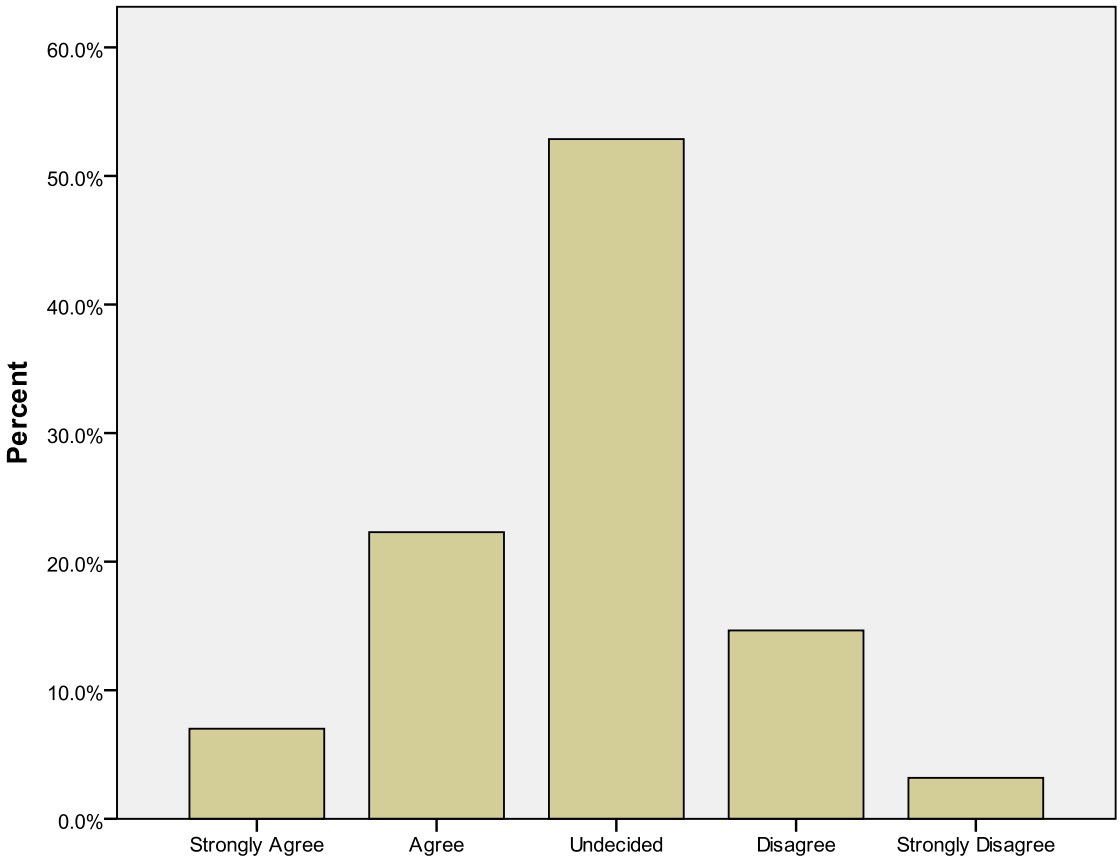

Figure 3.39 Respondents' perception of the comment, "Establishment of an RFB is difficult."

The statement, "Establishment of an RFB is difficult" is not related to the adoption of RFBs. Again, the majority of non-adopters of RFBs (56.2%) indicated that they were undecided about the difficulty of establishing an RFB. Of the adopters of RFBs, three respondents indicated that they were undecided about the statement, and the remaining adopters were split between strongly agreeing and agreeing with the statement

(6) and strongly disagreeing or disagreeing with the statement (6). Although the adopters indicated a split about the difficulty of establishing an RFB, the result of the majority of non-adopters indicating "undecided" implicates the field of Landscape Architecture and Planning to develop conservation plans that communicate the practice of establishing an RFB.

The comment, "RFB's do not require much maintenance," was the next statement presented to the survey population. A slight majority of respondents were undecided (77, 50.7%); of the remaining respondents 36.9% (56) indicated they strongly agreed and agreed with the comment and 12.5% (19) indicated they strongly disagreed and disagreed with the statement (Figure 3.40).

The statement, "RFBs do not require much maintenance" was not related to the adoption of RFBs. 53.3% (8) of adopters of RFBs agreed and strongly agreed with the statement and the majority of non-adopters of RFBs (53%) were undecided about this statement. Once again, implications for the promotion of RFB conservation practices fall on the influence of RFB adopters on non-adopters.

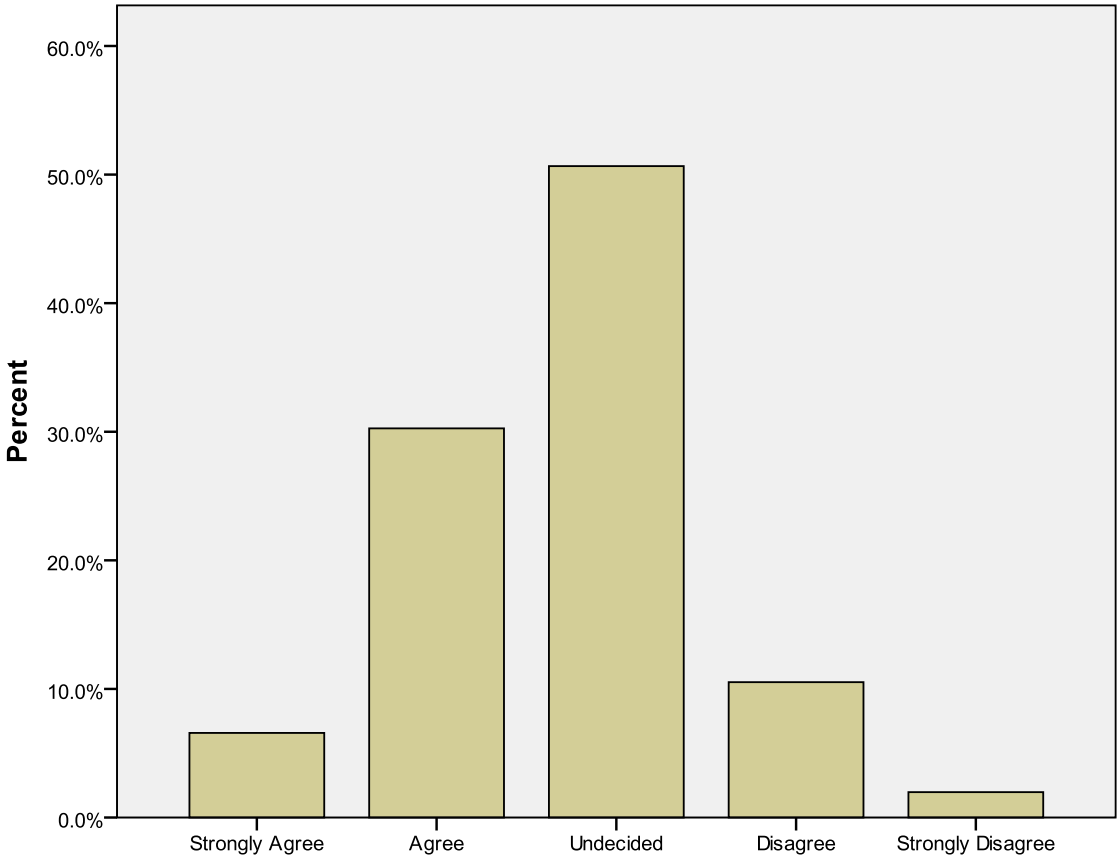

Figure 3.40 Respondents' perception of the comment, "RFBs do not require much maintenance."

"Signing up for governmental programs for the establishment of RFBs is easy" was the next comment the researcher asked the respondents to rate. The majority of the respondents was undecided (60.9%) about this comment, 21.2% agreed and strongly agreed and 17.9% disagreed and strongly disagreed (Figure 3.41).

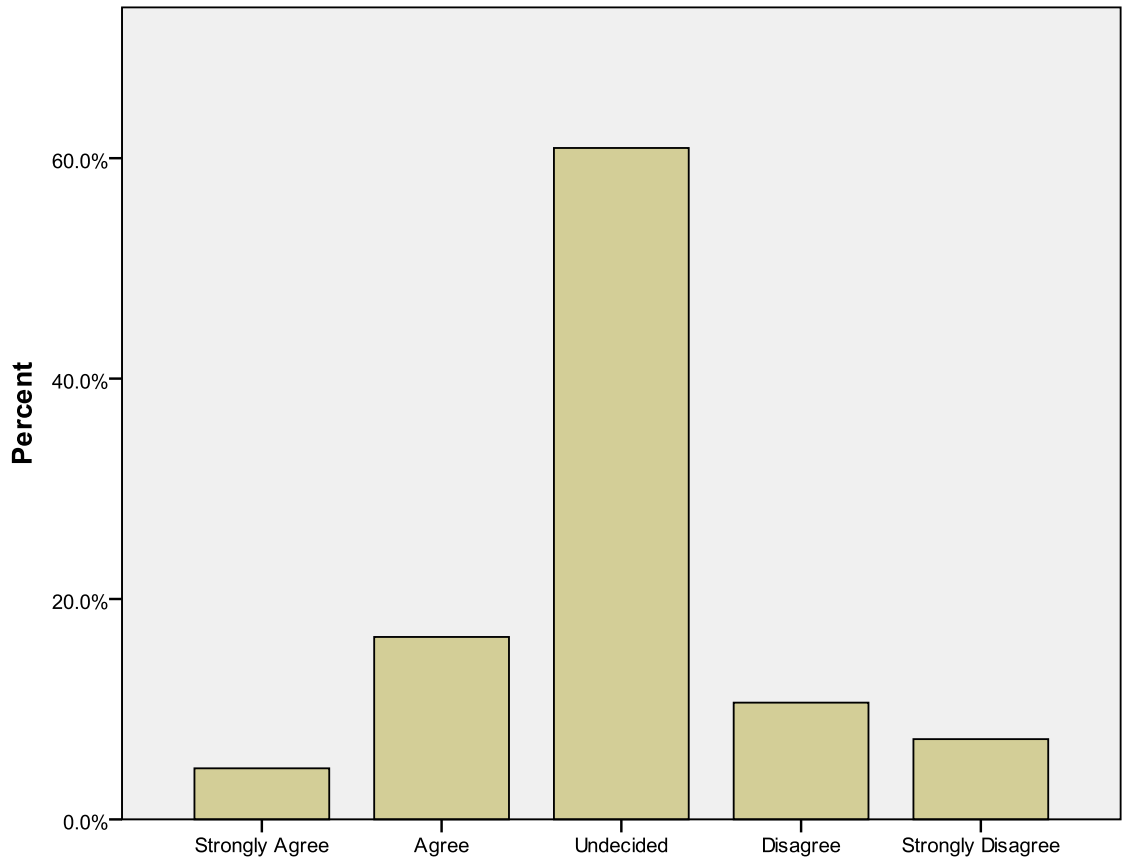

Figure 3.41 Respondents' perception of the comment, "Signing up for governmental programs for the establishment of RFBs is easy."

The statement, "Signing up for governmental programs for the establishment of RFBs is easy" was not related to the adoption of RFBs. The majority of RFB adopters (60%) and RFB non-adopters (60.9%) were undecided about the statement. The perception of the difficulty of signing up for incentive programs may impede the adoption of conservation practices. As will be discussed in the Incentive Programs section, the open-ended question "What are the reasons you think farmers choose not to participate in the incentive programs," the majority of respondents indicated that governmental red tape was the reason farmers chose not to participate in the programs. The statement, "Signing up for governmental programs for the establishment of RFBs is

easy" was cross tabulated with participants in the governmental incentive programs CRP, EQIP, and WRP. The statement was not related to the participants in the three incentive programs.

Again, when presented with the comment "Financial incentives for the establishment of RFB's are adequate," the majority of respondents was undecided (65.8%), of the remaining respondents, 19.1% strongly agreed and agreed and 15.1% strongly disagreed and disagreed (Figure 3.42). The statement, "Financial incentives for the establishment of RFBs are adequate" did not show a relationship with the adopters of RFBs. The majority of non-adopters (90; 67.2%) indicated that they were undecided about the adequacy of financial incentives for the establishment of RFBs. This result is an opportunity for government agencies and NGO's to promote the adoption of RFBs through incentive programs. 33.3% (5) adopters indicated that governmental incentive programs were not adequate, implying a need for further research into the adequacy of financial incentives for the establishment of conservation practices. Participants of the WRP were found to not be related to the statement, "Financial incentives for the establishment of RFBs are adequate." The cost of the practice is the main reason farmers do not adopt conservation practices according to Hoban (1992). Incentive programs are governmental programs that aide in the up-front costs associated with the establishment of conservation practices.

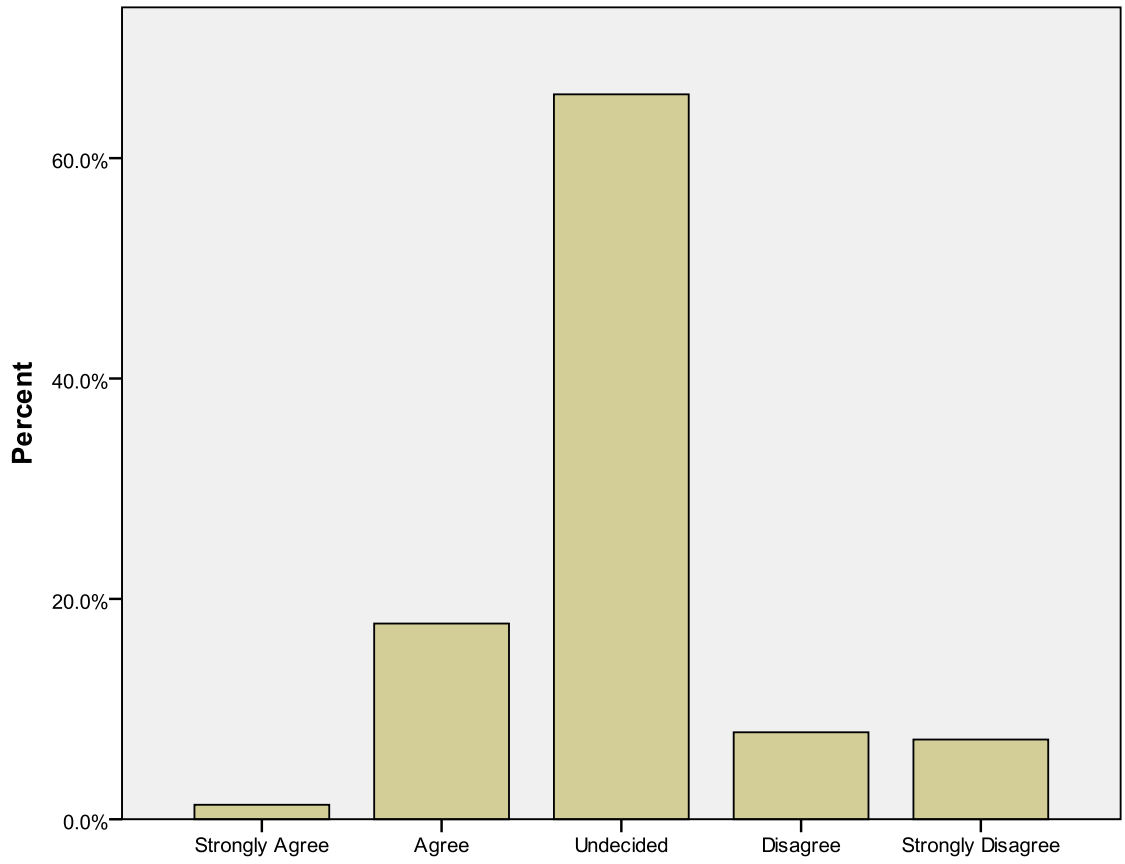

Figure 3.42 Respondents' perception of the comment, "Financial incentives for the establishment of RFBs are adequate."

When presented with the comment, "I am less likely to establish a RFB due to government regulation," the majority of respondents indicated that they were undecided (65.1%) and of the remaining respondents, 23% agreed and strongly agreed with the statement (Figure 3.43).

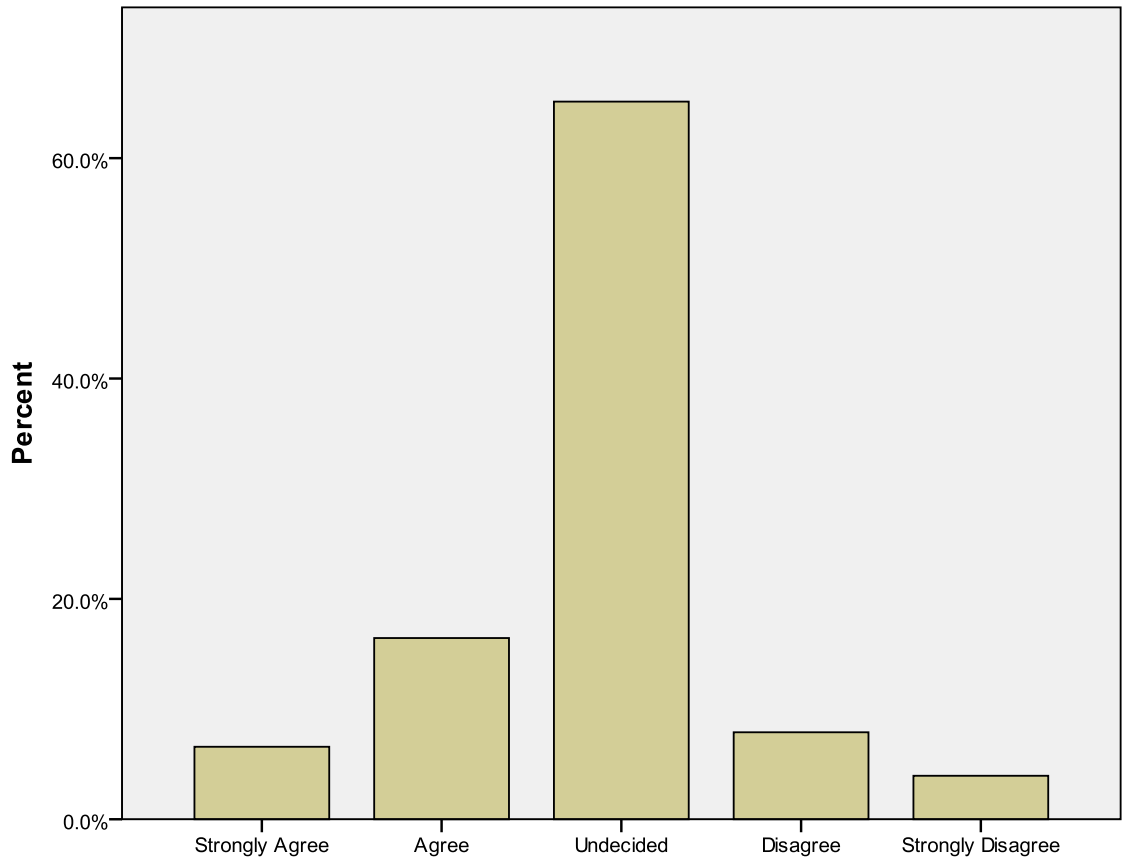

Figure 3.43 Respondents' perception of the comment, "I am less likely to establish a RFB due to government regulation."

The statement, "I am less likely to establish a RFB due to government regulation" was not related to the adopters of RFBs. 33.4% (5) of adopters agreed and strongly agreed with this statement, 40% (6) of adopters of RFBs were undecided about the statement, and 26.7% (4) of adopters of RFBs disagreed and strongly disagreed with the statement (Figure 3.44). The statement was not related to participants of the CRP, EQIP, and WRP. This statement may indicate a problem with adoption of RFBs and other conservation practices; that farmer's perceptions of enrolling land in conservation practice programs or participating in government incentive programs is difficult due to government regulation. As discussed in the Incentive Program section, the open-ended

question about the reasons why farmers choose to not enroll in governmental programs; farmers indicated that government red tape was the reason other farmers choose not to enroll in governmental programs. In order to promote and increase adoption of RFBs and other conservation practices, policymakers, government officials, government agencies, and community leaders may need to ease the governmental red tape and regulations associated with the enrollment of land in conservation programs.

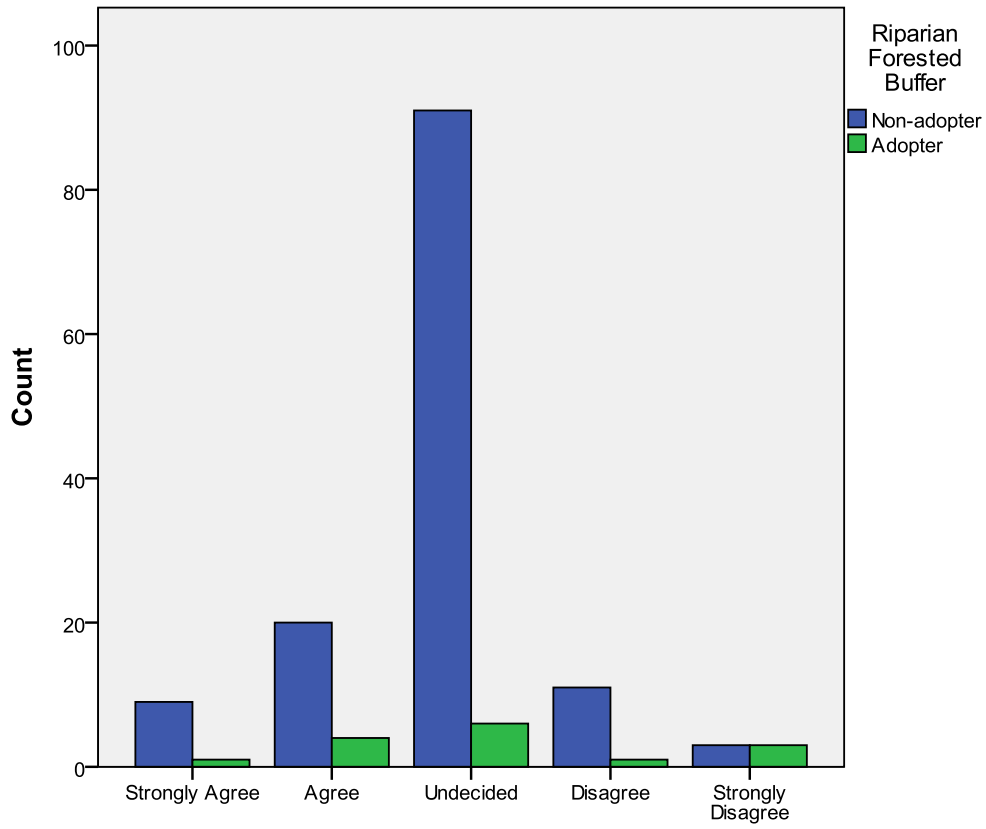

Figure 3.44 Perception of comment, "I am less likely to establish a RFB due to government regulation," and the adoption of RFBs.

The majority of respondents agreed and strongly agreed (55.5%) with the comment, "RFBs provide stream bank stabilization and prevent erosion," of the

remaining respondents, 40.5% were undecided and 4% disagreed and strongly disagreed (Figure 3.45).

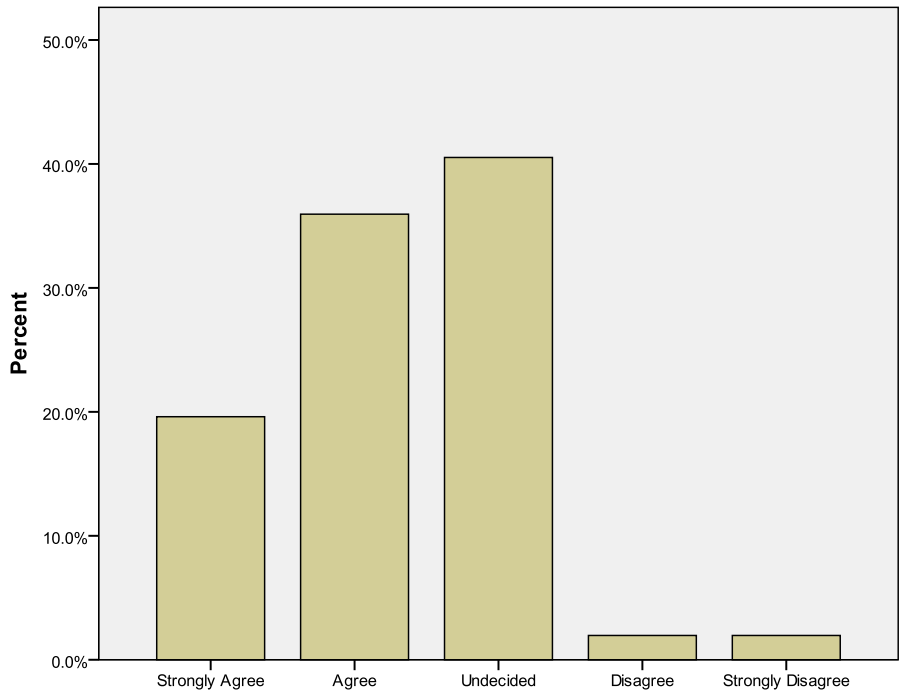

Figure 3.45 Respondents' perception of the comment, "RFBs provide stream bank stabilization and prevent erosion."

The statement, "RFBs provide stream bank stabilization and prevent erosion," was not found to be related to the adoption of RFBs. However, the majority of adopters of RFBs (10; 66.6%) indicated that they agreed and strongly agreed with the statement and the majority of non-adopters of RFBs (72; 53.8%) also indicated that they agreed and strongly agreed with the statement. 43.3% (58) of non-adopters of RFBs and 20% (3) of adopters of RFBs indicated that they were undecided when presented with the statement, "RFBs provide streambank stabilization and prevent erosion" (Figure 3.46). These results implicate the need for education and outreach of the benefits of RFBs, which are

the stabilization of the stream bank and alleviation of erosion, therefore mitigating impaired water quality (Lovell and Sullivan, 2006; Ryan et. al., 2003; Skelton et. al., 2005).

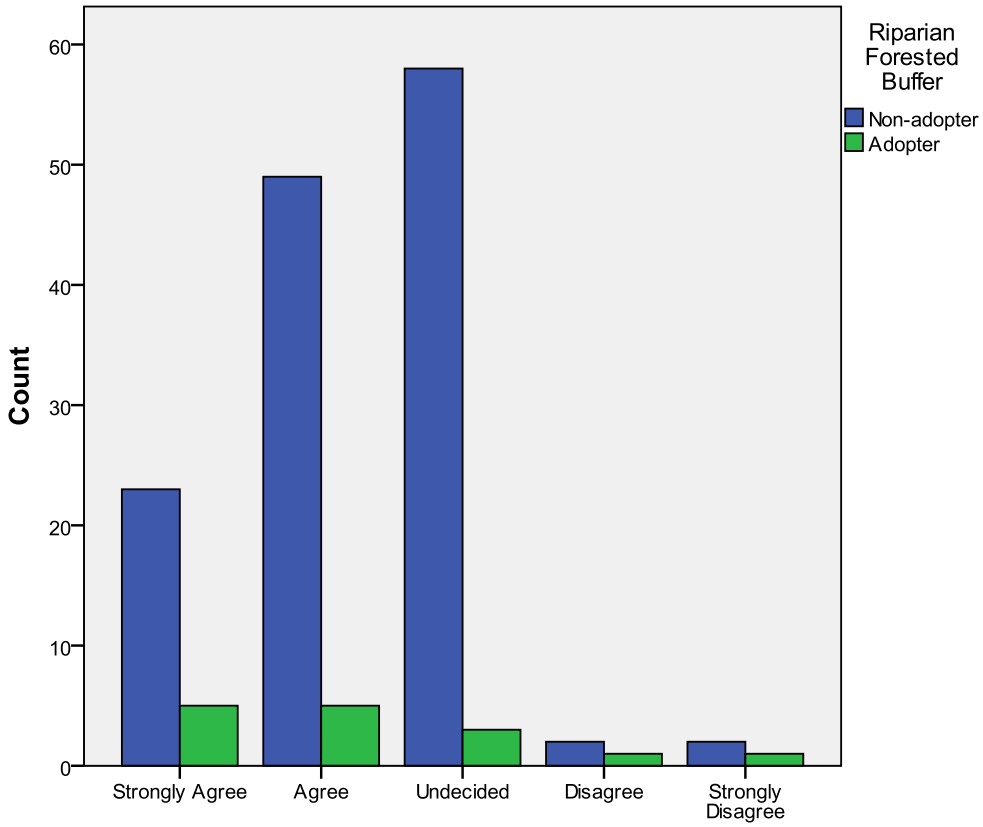

Figure 3.46 Perception of comment, "RFBs provide streambank stabilization and prevent erosion," and the adoption of RFBs.

The comment, "RFB's provide habitat for beneficial insects that prey on pests," was presented to the farmers in the survey sample, and the majority of respondents was undecided (52%), of the remaining respondents, 42.1% agreed and strongly agreed and 5.9% disagreed and strongly disagreed (Figure 3.47).

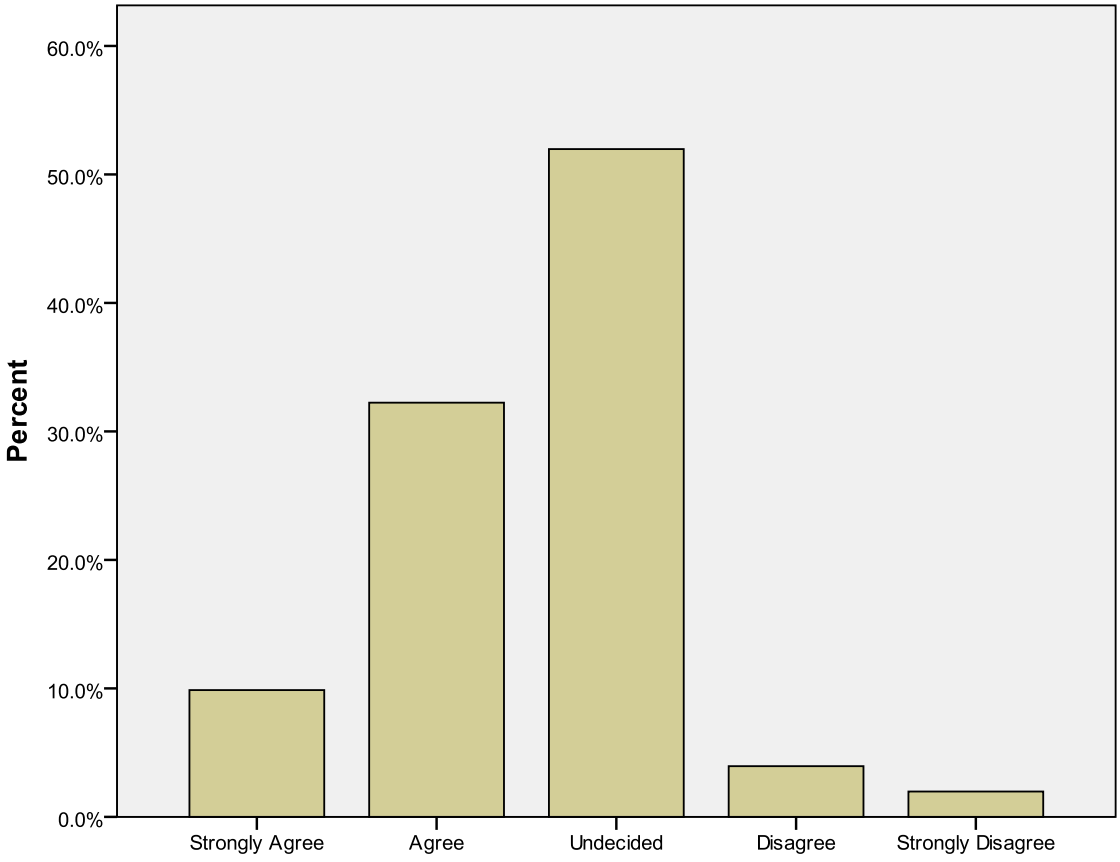

Figure 3.47 Respondents' perception of the comment, "RFBs provide habitat for beneficial insects that prey on pests."

The statement, "RFBs provide habitat for beneficial insects that prey on pests," was not related to the adoption of RFBs. The majority of non-adopters of RFBs (70; 52.2%) and 46.7% (7) of adopters of RFBs indicated that they were undecided about the statement. Further research into predator/prey relationships on agricultural land is needed to understand the benefits of RFBs on pest management. Although 43.2% of non-adopters of RFBs and 33.4% of adopters of RFBs indicated that they agreed and strongly agreed with the statement, a large portion of the study population indicated that they were undecided. This implies that through further research, the benefits of predator/prey relationships may be a strategy in the promotion of RFB adoption.

"Reduced profitability will prevent me from installing an RFB," was the next comment presented to the respondents; 65.6% of the respondents were undecided about this statement, 22.5% agreed and strongly agreed with this statement, and 11.9% disagreed and strongly disagreed with this statement (Figure 3.48).

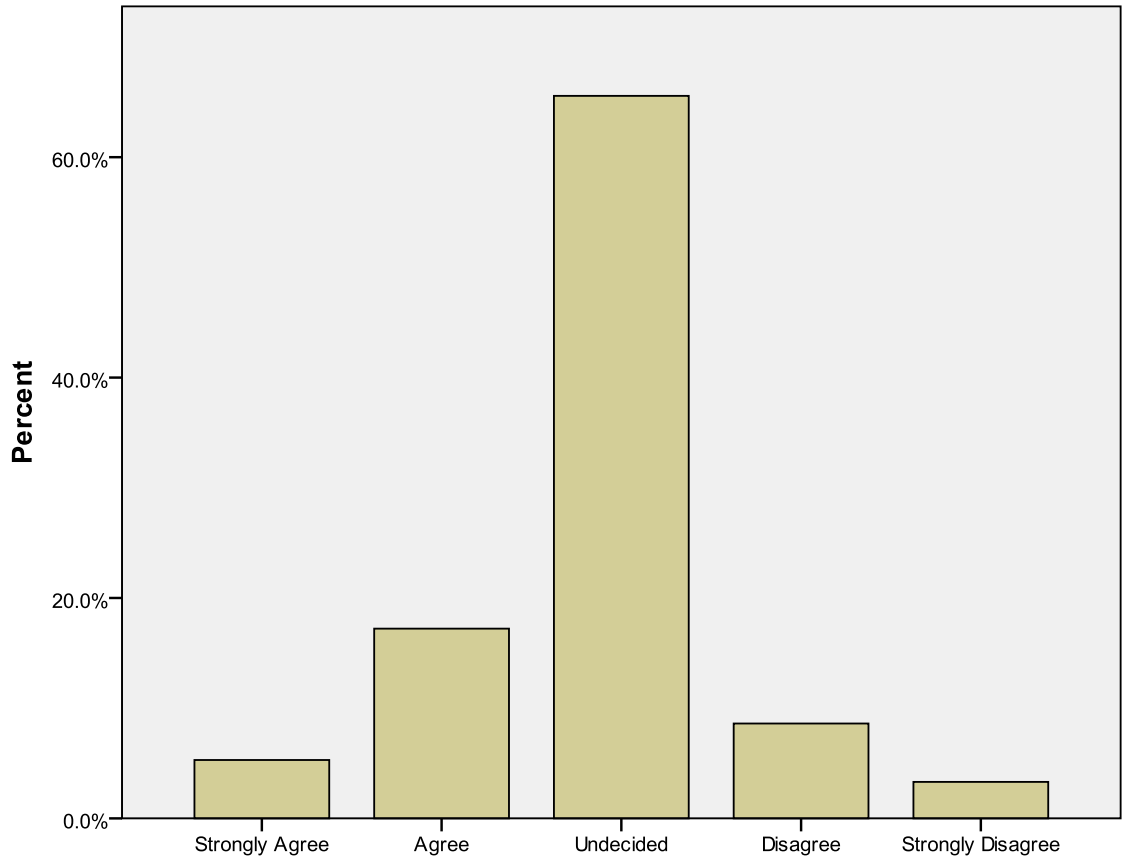

Figure 3.48 Respondents' perception of the comment, "Reduced profitability will prevent me from installing a RFB."

"Reduced profitability will prevent me from installing a RFB," was cross tabulated with the adoption of RFBs and found to not be related. 40% (6) of adopters of RFBs indicated that they disagreed and strongly disagreed with this statement and 40% (6) of adopters of RFBs were undecided about this statement. The majority of non-

adopters of RFBs indicated they were undecided about this statement (92; 68.7%). Once again, education and outreach will help the non-adopters understand the benefits of RFBs and promote adoption of the conservation practice. Another implication of this result is the need to utilize the "other farmer influence" on the non-adopters of RFBs. "Other farmers" were found to be a major source of information, as a result, the farmers that have adopted RFBs and see that there is no reduced profitability, may influence the non-adopters decisions on adoption of conservation practices.

"RFBs do not improve water quality," was the next statement given to the survey population. Once again, the majority of the respondents was undecided (82; 54.3%) about the statement and of the remaining respondents, 35.1% disagreed and strongly disagreed with this statement and 10.6% agreed and strongly agreed with this statement (Figure 3.49).

The statement, "RFBs do not improve water quality," was cross tabulated with the adoption of RFBs and was found to be related. The majority of adopters of RFBs (10; 66.6%) indicated that they disagreed or strongly disagreed with this statement and the majority of non-adopters of RFBs indicated that they were undecided about this statement (78; 58.6%). This result implies a need in the BSW for the adopters of RFBs to educate and therefore influence non-adopters about the benefits of RFBs.

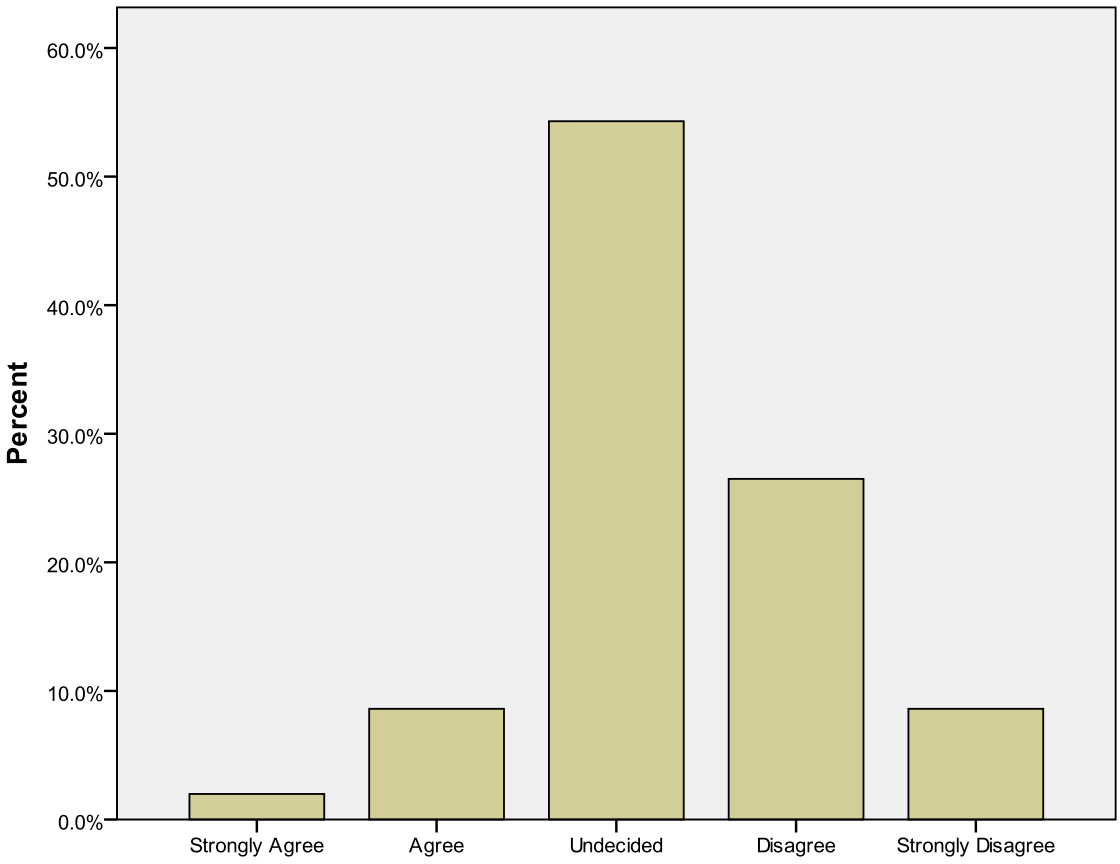

Figure 3.49 Respondents' perception of the comment, "RFBs do not improve water quality."

"RFBs provide wildlife movement and habitat for hunting and fishing," was the next comment given to the survey sample. This statement will help the researchers understand the attitudes and perceptions farmers have of RFB's and their connection to the environment. The majority of respondents agreed and strongly agreed (65.1%) with this statement, of the remaining respondents, 31.6% were undecided and 3.3% disagreed or strongly disagreed with this statement (Figure 3.50).

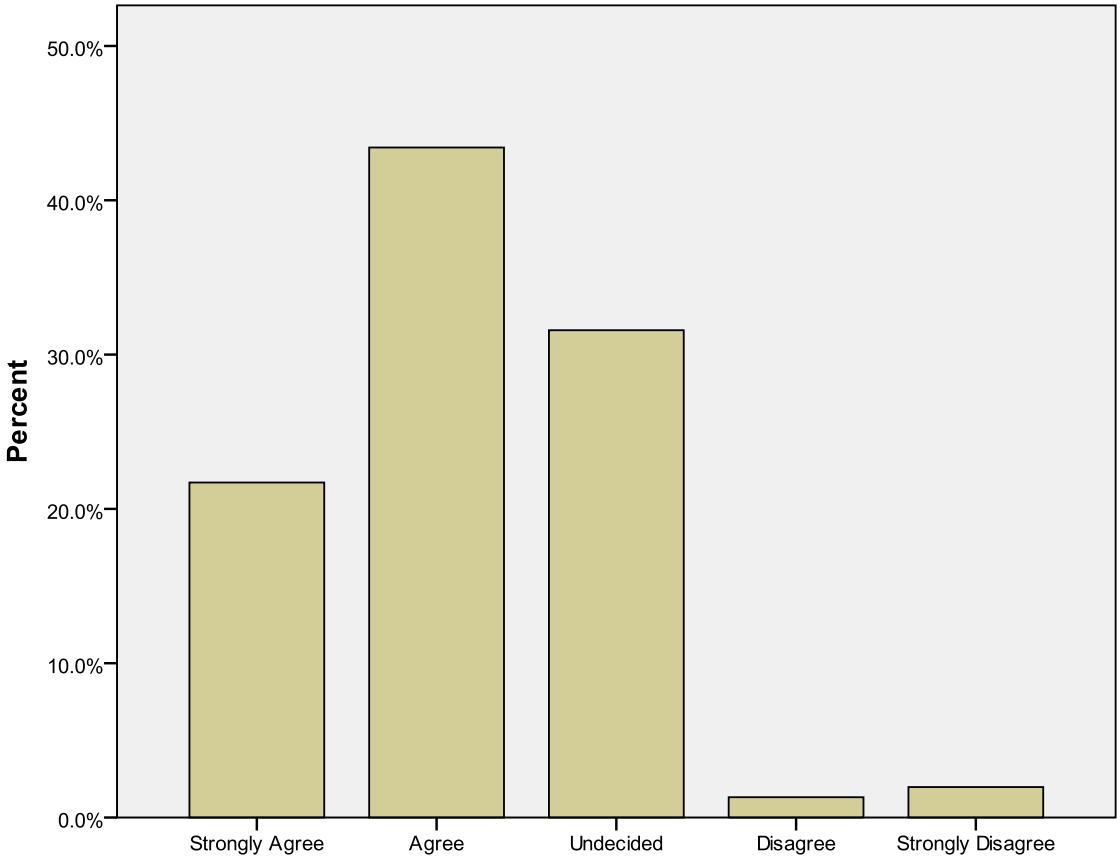

Figure 3.50 Respondents' perception of the comment, "RFBs provide wildlife movement and habitat for hunting and fishing."

The statement, "RFBs provide wildlife movement and habitat for hunting and fishing," was cross tabulated with adoption of RFBs and was found to be related. This statement was the only one presented to the study population that the majority of respondents indicated that they agreed and strongly agreed (65.1%). When the statement is cross tabulated with the adoption of RFBs, the majority of adopters of RFBs (10; 66.7%) indicated that they agreed and strongly agreed with the statement and the majority of non-adopters (86; 64.6%) indicated that they agreed or strongly agreed with the statement (Figure 3.51). This is an interesting result that implies that adopters and non-adopters recognize the wildlife benefits of RFBs, and, as shown earlier in this chapter, the

presence of wildlife on the farm is somewhat or very important to the farmers of the BSW, yet RFBs have not been widely adopted in the BSW. Future research may help policymakers understand why farmers that indicate wildlife presence on the farm is important and seem to understand the wildlife benefits of RFBs have not adopted RFBs.

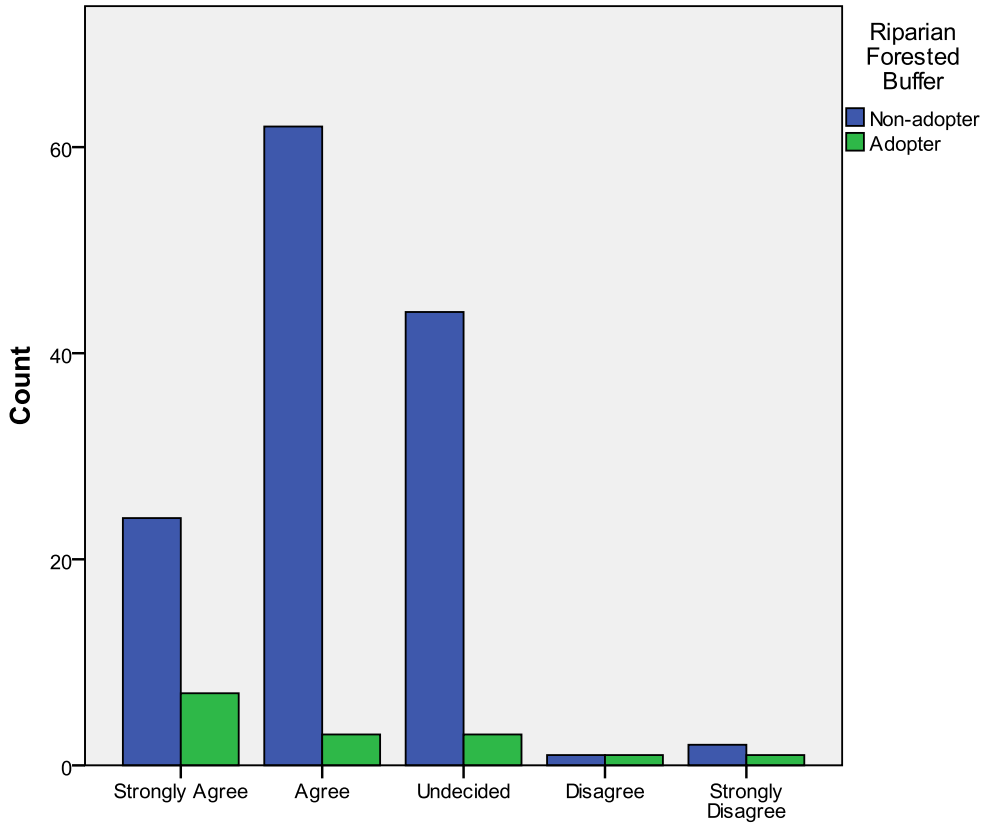

Figure 3.51 Perception of the comment, "RFBs provide wildlife movement and habitat for hunting and fishing," and the adoption of RFBs.

The next comment in the section given to the respondents was, "If I had help in designing, establishing, and maintaining an RFB, I would be more likely to implement an RFB on my property." The response to this statement was 55.6% undecided, 37.1% agreed and strongly agreed, and 7.3% disagreed and strongly disagreed (Figure 3.52).

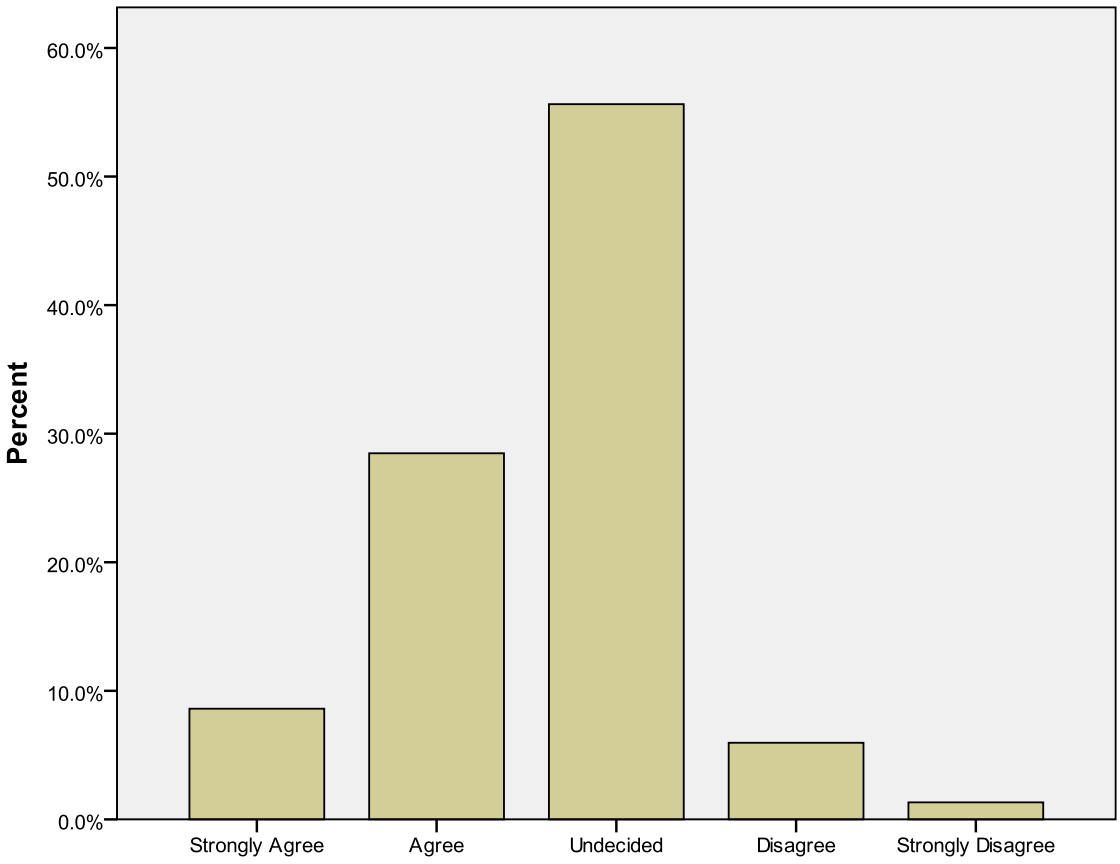

Figure 3.52 Respondents' perception of the comment, "If I had help in designing, establishing, and maintaining a RFB, I would be more likely to implement a RFB on my property."

The statement, "If I had help in designing, establishing, and maintaining a RFB, I would be more likely to implement a RFB on my property," was found to not be related to the adoption of RFBs. The majority of non-adopters of RFBs (76; 57.1%) indicated that they were undecided about this statement. Although the result does not indicate that RFB adoption could be increased if the non-adopter had help designing, establishing, and maintaining an RFB, this result may imply a need for more outreach in the design/build process. 35.4% (47) of non-adopters indicated that they agreed and strongly agreed with the statement, this gives Landscape Architecture a niche in the agricultural community to

help in the designing, establishing, and maintaining of the conservation practices implemented within the larger context of conservation plans.

The last statement about RFB's was "If I were allowed to periodically harvest trees from an RFB, I would be more likely to sign up for an RFB program." This statement is intended to help understand factors that would help progress the adoption of RFB's. As can be seen in Figure 3.53, the respondents were mostly undecided (54%), but among the remaining respondents, 41.4% agreed and strongly agreed while just 4.6% disagreed and strongly disagreed.

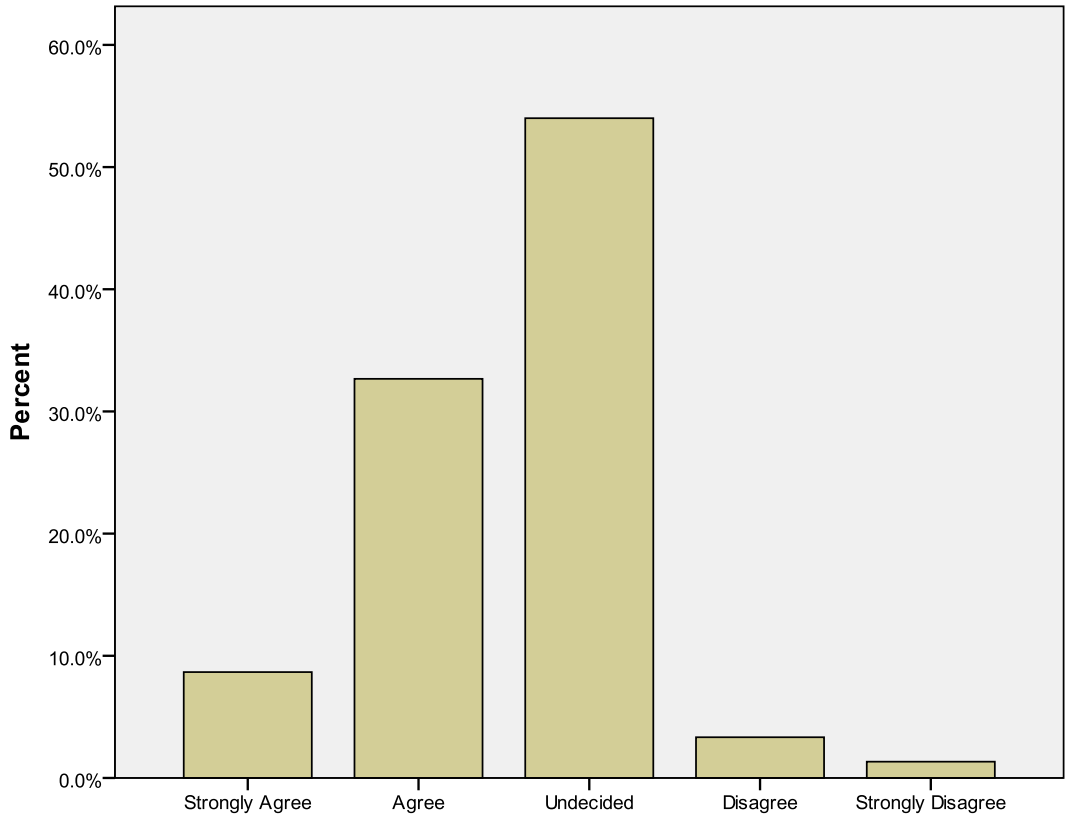

Figure 3.53 Respondents' perception of the comment, "If I were allowed to periodically harvest trees from a RFB, I would be more likely to sign up for a RFB program."

The statement, "If I were allowed to periodically harvest trees from an RFB, I would be more likely to sign up for a RFB program," was cross tabulated with the adoption of RFBs and found to be related. The majority of adopters of RFBs (9; 60%) indicated that they strongly agreed and agreed with the statement, while the majority of non-adopters of RFBs (73; 55.3%) indicated that they were undecided about the statement (Figure 3.54). Lovell and Sullivan (2006) state that stakeholders must be provided information about buffer crops and the income the stakeholders can generate from materials that are planted in their buffers. Although non-adopters indicated they were undecided about the statement, the income possibilities of buffer crops, combined with incentive programs and the wildlife benefits of buffers may help non-adopters become adopters of RFBs if costs of the practice is a barrier to adoption.

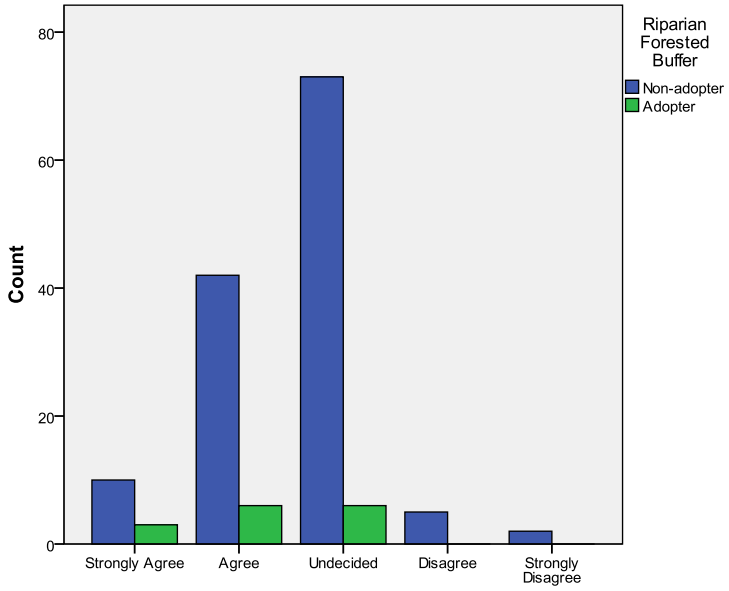

Figure 3.54 Perception of comment, "If I were allowed to periodically harvest trees from a RFB, I would be more likely to sign up for a RFB program," and the adoption of RFBs.

The most common result in the perceptions of RFBs is that a large portion of non-adopters are undecided in every statement except, "RFBs provide wildlife movement and habitat for hunting and fishing." This result implies that education of RFBs will be beneficial to the promotion of adoption. Skelton et. al. (2005) found that the lack of information was a major barrier to adoption and the same could be said for the farmers of the BSW. The information source section shows us that farmers are highly influenced by "other farmers." This influence of adopters on non-adopters may be a valuable result in promoting the adoption of conservation practices. Clearfield and Osgood (1986) found in their review of past literature, that the number of institutional contacts is related positively to the adoption of conservation practices. Other farmers or community leaders influence the adoption of conservation practices for producers. Promoting the adopters of RFBs influence on non-adopters of RFBs is a strategy to increase adoption in the BSW. The result that non-adopters were undecided on the majority of RFB perception comments implicates policymakers to develop education strategies that reverse the lack of knowledge about the benefits of conservation buffer practices.

The following question approached the subject of understanding conservation practice design and implementation. According to the respondents, the majority of farmers were somewhat comfortable and very comfortable with conservation practice design and implementation (59.7%) (Figure 3.55). Although there is a lack of adoption of conservation practices in the BSW, the respondents indicated that they were somewhat comfortable or very comfortable with conservation practice design and implementation.

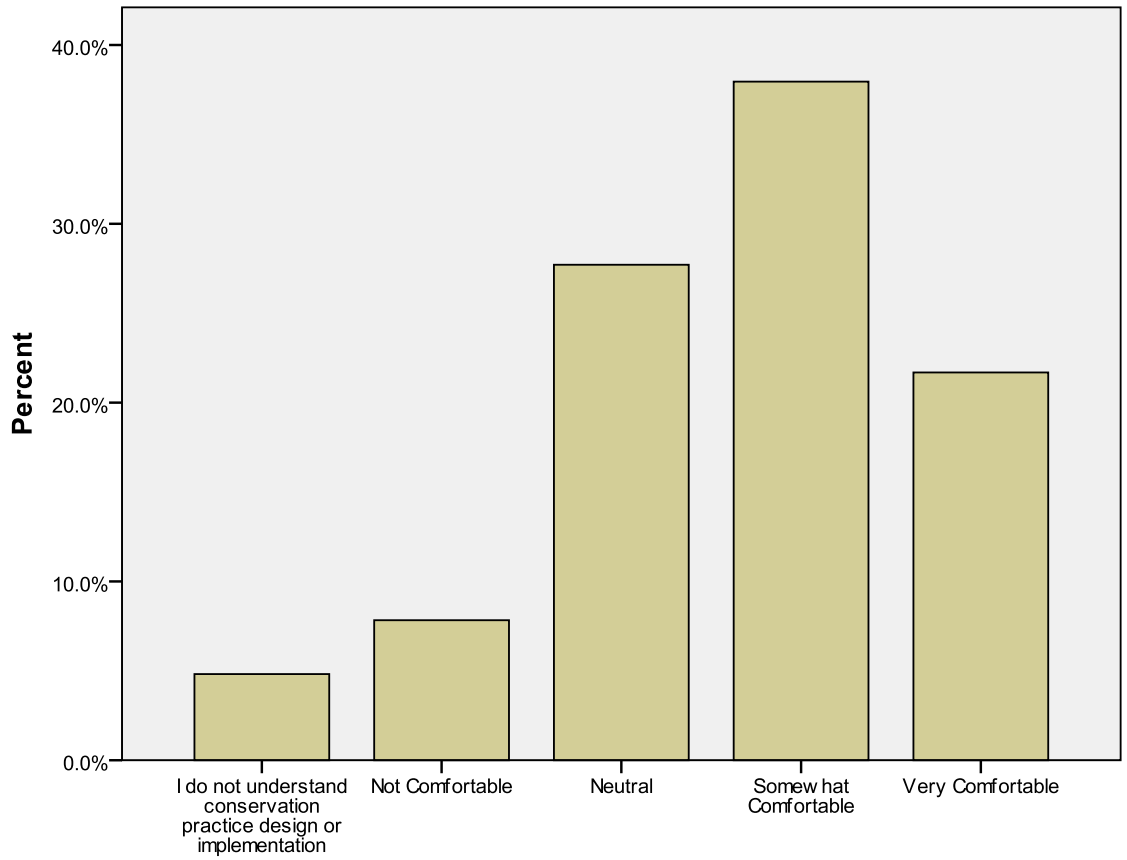

Figure 3.55 Respondents' comfort level with understanding conservation practice design or implementation.

According to Clearfield and Osgood (1986), attitudes toward conservation did not indicate behavior. A farmer that is somewhat or very comfortable with conservation practice design or implementation may not have the resources, knowledge, or financial backing to adopt. The disconnection between conservation practice design and implementation and the lack of adoption of conservation practices may indicate other barriers to adoption besides knowledge.

When asked if farmers felt that other farmers and landowners were well educated about the benefits of conservation practices, the result was split with 44.2 % indicating

that other farmers and landowners are well educated, 47.9% indicating that other farmers and landowners were not well educated, and 8% responding "other."

New technology in conservation planning was presented to the respondents as a two question set that was divided between workshop/weekend training and "in the field" training and asked the sample what the likelihood of participation would be if this type of training was made available. A large portion of the respondents indicated that it would be possible for them to attend "workshop/weekend" training (46.7%) and "in the field" training (43.4%). Of the remaining respondents, participation of "in the field" training was more popular with 6% of respondents indicating "certain" participation and 28.9% indicating "likely" participation whereas "workshop/weekend" training was indicated by 4.2% "certain" participation and 23.4% "likely" participation.

The last question of the conservation practices section was having the sample population indicate whether they have been provided technical assistance about the use of conservation practices on their farm. The responses were close to evenly split (Table 3.9), with the narrow majority of 55.1% of respondents not being provided technical assistance and 44.9% being provided with technical assistance.

Table 3.10 Technical assistance about the use of conservation practices provided.

Technical Assistance Provided	**Frequency**	**Valid Percent**
Yes	75	44.9%
No	92	55.1%
Total	167	100%

3.6 Incentive Programs

There are numerous available incentive programs that promote conservation stewardship to farmland. The topic of incentive programs as factors in promoting the adoption of conservation practices for the mitigation of water quality impairments is vast and varied. The first question presented to the survey sample dealt with technical assistance provided about the available incentive programs to the survey sample. The majority of respondents (104; 62.7%) indicated that they have not been provided technical assistance about the available incentive programs and 35.5% (59) of the respondents indicated that they have been provided technical assistance about the available types of incentive programs. The next question concerned with how well informed farmers/landowners are about the available incentive programs. The majority of respondents felt that other farmers and landowners are not well informed about the available incentive programs (106; 65.4%). The next set of questions in the survey lists the available types of incentive programs to farmers as of 2008 and asked the respondents to indicate how often they have been recommended each incentive program. The incentive programs provided in this survey are as follows:

1) Cooperative Conservation Partnership Initiative (CCPI)
2) Conservation Reserve Program (CRP)
3) Conservation Security Program (CSP)
4) Conservation Technical Assistance (CTA)
5) Environmental Quality Incentive Program (EQIP)
6) Emergency Watershed Protection (EWP)
7) Grazing Land Conservation Initiative (CI)

8) Healthy Forests Reserve Program (HFRP)
9) Resource Conservation and Development Program (RC&D)
10) Wildlife Habitat Initiatives Program (WHIP)
11) Wetlands Reserve Program (WRP)

The frequency of enrollment of incentive programs corresponds with the frequency of recommendations for the incentive programs. EQIP (18,602), CRP (8,058), and WRP (4,725) have the most acres enrolled in the given incentive programs; consequently, respondents indicated that they have always or often been recommended the incentive programs EQIP (25.3% indicated that they have always or often been recommended EQIP), CRP (31.1% indicated that they have always or often been recommended CRP), and WRP (20% indicated that they have always or often been recommended WRP) (Table 3.11).

Past research is historically economic centered, based on the assumption that the cost of the practices is the most influential factor of the adoption of conservation practices (Batie, 1986; Duff et al., 1990; Hoban, 1992; Smith, 2007). According to Skelton (2005), financial assistance may help promote adoption. The United States government has established numerous incentive programs to aid in the cost, installation, maintenance, and lost production associated with many conservation practices. As can be seen in Table 3.11, the indication of recommendations is related to the participation in the incentive programs, showing that the programs with the most acres enrolled have indicated the most recommendations.

Table 3.11 Amount of recommended incentive programs and the total acre enrollment of incentive programs.

Incentive Programs	Always	Often	Occasionally	Seldom	Never	Total acres enrolled by respondents
CCPI	1.3%	3.3%	9.2%	11.8%	74.5%	100
CRP	8.1%	23%	14.3%	15.5%	39.1%	8,058
CSP	0%	7.2%	7.2%	15%	70.6%	0
CTA	.6%	3.2%	12.3%	13%	70.8%	200
EQIP	5.2%	20.1%	16.9%	14.9%	42.9%	18,602
EWP	.7%	3.9%	5.9%	17%	72.5%	20
CI	1.3%	1.3%	3.9%	12.4%	81%	33
GRP	.7%	2.6%	2%	11.8%	83%	80
HFRP	1.3%	1.3%	4.6%	10.5%	82.4%	0
RC&D	.7%	3.9%	7.2%	10.5%	77.8%	0
WHIP	3.3%	9.2%	13.7%	19%	54.9%	282
WRP	5.2%	14.8%	18.7%	12.3%	49%	4,725

The amount of recommendations per incentive programs is not related to the adoption of conservation practices. According to the respondents, the adopters of RFBs were more likely to be participants of the Conservation Reserve Program (CRP) and the Environmental Quality Incentives Program (EQIP). This result may indicate that the recommendations of the various incentive programs may result in participation of incentive programs and the adoption of conservation practices. Prior research has indicated a contradiction in the recommendation of the CRP (Murdock, 2007). The

NRCS provides the assistance for the implementation of the CRP (NRCS, 2011), therefore Murdock (2007) in a needs assessment study of the NRCS asked NRCS personnel how often they recommend the CRP to landowners (Figure 3.56).

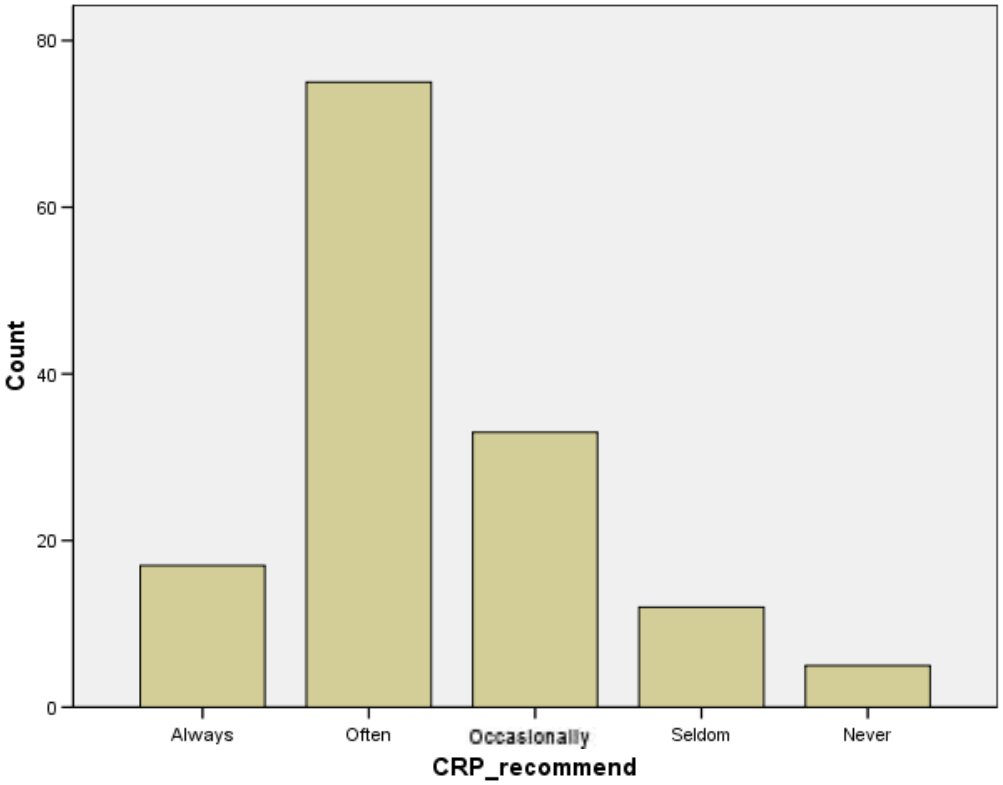

Figure 3.56 How often NRCS personnel recommend the CRP to landowners? (Murdock, 2007).

This study asked the counterpoint to Murdock's (2007) question, "How often have you (the farmer) been recommended the CRP?" (Figure 3.57). The results show a discrepancy between what the NRCS stated and what the farmers of the BSW stated. This disconnect is an implication for the NRCS to refocus recommendations of incentive programs for the promotion of conservation.

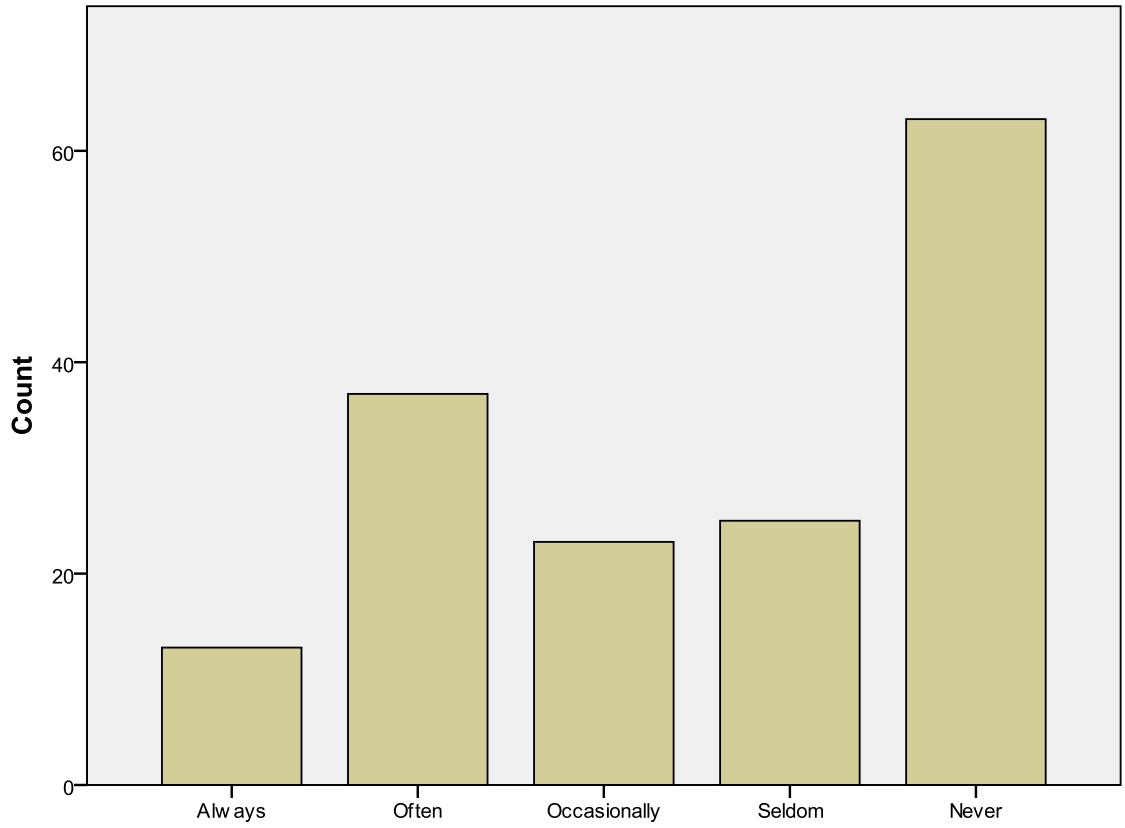

Figure 3.57 Frequency farmers of the BSW have been recommended the CRP.

An open question asking the respondents for the reasons they think farmers choose not to participate in incentive programs was the last question of the incentive programs section. The total number of respondents to this open question was 53. Each response was categorized into six categories, the following is a list of the 6 categories that the open question answers were coded with samples of the open question answers:

1) Red Tape (15; 28.3%, Figure 3.58)
    a. "Too much red tape."
    b. "Too much paperwork."
    c. "The amount of government hurdles is too much"

2) Costs (8; 15.1%)
    a. “Too expensive”
    b. “Not enough payment”
    c. “Can’t afford to have land out of production”
    d. “The payments are not enough to cover the loss [of productivity]”
3) Too Busy (6; 11.3%)
    a. “Don’t have the time to fool with it”
    b. “I’m too busy to devote my day to looking [up programs]”
4) Lack of Knowledge (7; 13.2%)
    a. “Farmers don’t know the benefits or costs.”
    b. “Hard to tell if land will fit into program.”
    c. “We don’t have anyone telling us which programs we are capable of participating in.”
5) Too Restrictive (5; 3.9%)
    a. “I don’t want somebody telling me what to do with my own land”
    b. “I might need that land if I have a bad year”
    c. “Government can change its mind, but I can’t change mine? That’s bull****.”
6) Don’t Know (12; 22.6%)
    a. “Who knows?”
    b. “You figure it out.”
    c. “I don’t know.”

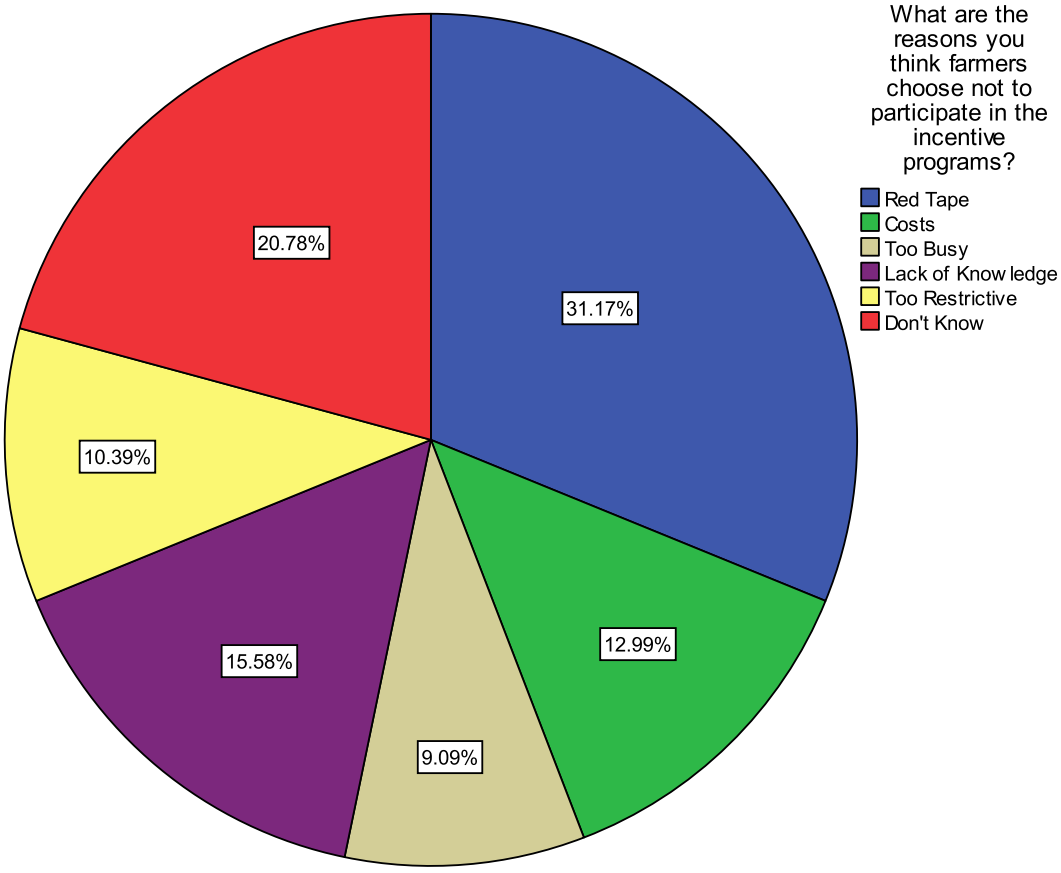

Figure 3.58 Reasons farmers think other farmers choose not to participate in the incentive programs.

Lack of contact with agencies, lack of knowledge, negative perceptions, and costs are the major contributions to a lack of incentive program enrollment in the BSW. The majority of the respondents indicated that they have not been provided technical assistance about the various inventive programs and that they are not well informed of the various types of incentive programs. According to the amount of recommendations for each incentive program, the programs that indicate the least amount of never recommendations are correlated with having the most acres enrolled. Conservation plans, Forest Stewardship Plans, and Forestry Management Plans (FMPs) are strategies

that organize the enrollment of incentive programs, provide decision documents for conservation plans, and achieve client objectives. These strategies can be achieved through the design process, developing working plans that empower and educate the community of stakeholders of the watershed processes and environmental impairments within the region.

3.7 Digital Technology Use

The survey populations' use of digital technology in the farming operation was developed to help the researchers understand the use, perceptions, and willingness to be trained in digital technologies as they are applied to the farming operation and conservation planning. Farm use of computer software for businesses, designers, and planners is discussed in this section. The computer applications that respondents indicated that they use in the farm operation were Internet (55.9%), Microsoft Word (37.6%), GPS (30.6%), and Microsoft Excel (28.8%) (Table 3.12). The computer applications that the respondents indicated they needed additional training were GPS (28.2%) and Internet (20.6%) (Table 3.12).

Table 3.12 Which digital technologies do you use today and which technologies/programs do you feel you should have additional training.

Digital technology/program	Use in farming operation	Need additional training
Internet	55.9%	20.6%
Microsoft Word	37.6%	13.5%
Microsoft Excel	28.8%	12.4%
Microsoft Powerpoint	7.6%	13.5%
Microsoft Outlook	14.1%	7.1%
Adobe Photoshop	12.4%	8.2%
Adobe Acrobat	20.6%	7.1%
AutoCAD	1.2%	7.1%
GPS	30.6%	28.2%
ArcView	1.2%	14.1%
ArcGIS	1.2%	13.5%
Basins/HSPF	0%	10.6%
Other	4.1%	5.3%

The digital technologies most used in the farm operation indicated by the respondents was: internet (55%), Microsoft Word (37.6%), GPS (30.6%) and Microsoft Excel (28.8%). Planning and design software utilization was negligible as indicated by the respondents. Once again, this implies a need for education and outreach to promote the use of digital technology in the farm operation.

Hoag et. al. (2000) in a survey to Great Plains producers found that only 11% of producers used the internet in the farm operation. This study of MS Delta producers eight years later indicated a much larger use of the internet, over half (55%) of BSW farmers use the internet in the farm operation. Internet use was found to be significantly related to the age of the farmers of the BSW in a decreasing of use with an increase of age (Figure 3.59), this confirms past research results (Amponsah, 1995; Putler and Zilberman, 1988). Aligning with the variable age, past research has also found a negative significant relationship with farming experience (Amponsah, 1995; Putler and Zilberman,

1988). The cross tabulation of the use of the internet and total years farming did not find a relationship. According to the review of the literature, education was believed to be correlated positively with the use of the internet in the farm operation (Hoag, 2000). This study found a positive relationship between education and the use of the internet in the farm operation (Figure 3.60). Farm size was a variable that was identified as having a positive correlation with internet use in the farm operation. According to Putler and Zilberman (1988) computer use increases with the increase of farm size because business transactions, payroll, operation tasks, and management tasks increase. This study of BSW producers found that farm size was positively significant with the use of the internet (Figure 3.61). Marital status and family involvement were found to not have a significant relationship with the use of the internet in the farm operation. Likewise, the utilization of the internet was found to not be significantly related to the adoption of conservation practices in this study. Although there was no significant relationship, the majority of adopters of grassed waterways (56%), cover cropping (55%), sediment and water retention basins (64.7%), conservation tillage (60.7%), prescribed forestry (52.2%), field border (54.8%), structures for water control (67.1%), and RFBs (60%) indicated that they used the internet in the farm operation.

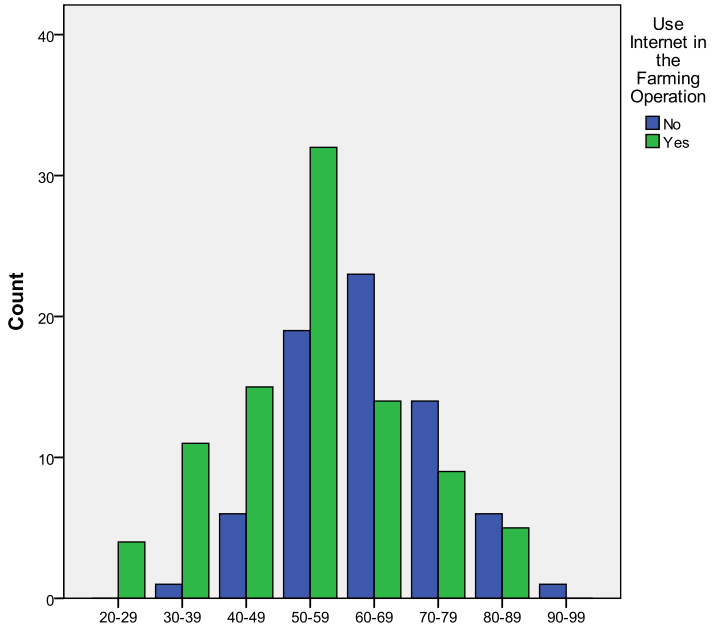

Figure 3.59 The use of the internet in the farming operation and the respondents' age.

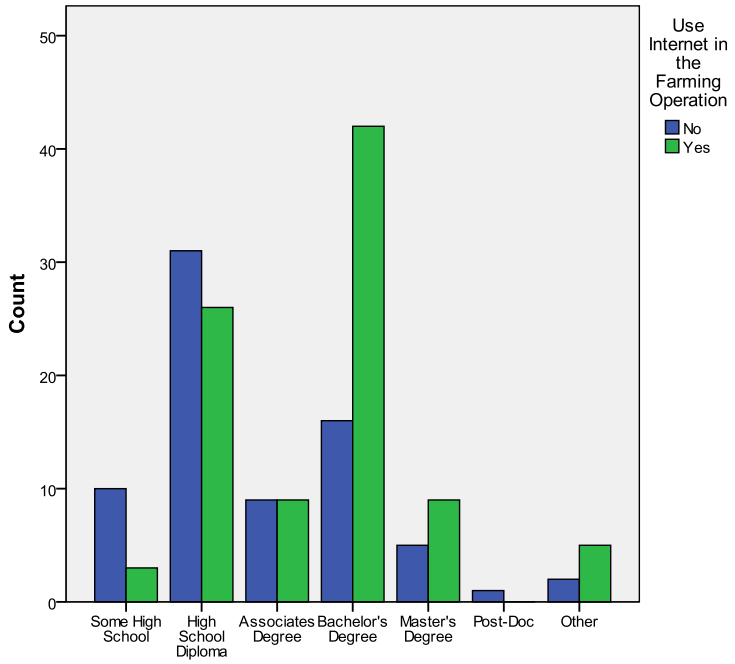

Figure 3.60 The use of the internet in the farming operation and the highest educational degree.

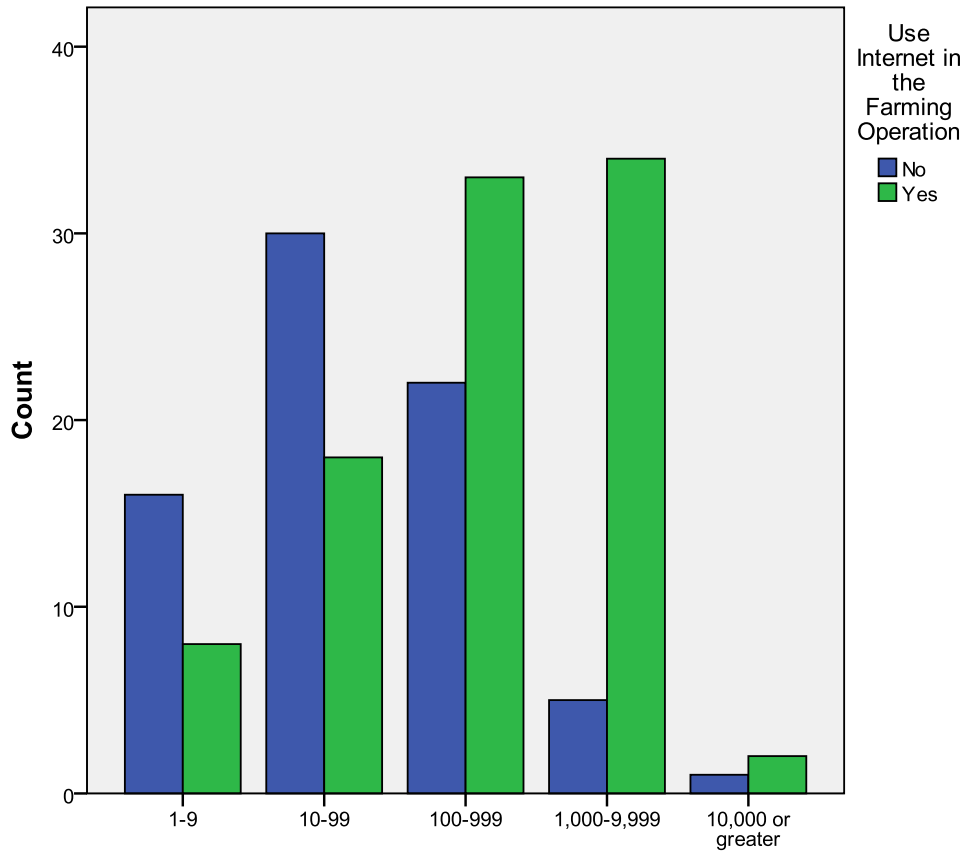

Figure 3.61 The use of the internet in the farming operation and total acres farmed.

Microsoft Word utilization was found to not be related to the adoption of conservation practices. When compared, the majority of adopters of conservation practices do not use Microsoft Word in the farming operation. The use of Microsoft Word in the farming operation was significantly related negatively to age and significantly related positively to farm size and education.

The use of GPS was found to have a positive relation to the adoption of conservation tillage, more adopters than non-adopters of conservation tillage utilize GPS in the farm operation. GPS technology can be used for the implementation and maintenance of many conservation practices, especially water conveyance and storage.

GPS installed in tractors informs tractor operators of land that should not be used for production. Further research into the use of GPS and the adoption of conservation practices may lead to an increased education and outreach effort of designing, implementing, and maintaining conservation practices through GPS technologies. Table 3.13 represents the cross tabulation of the adoption of conservation practices and the use of GPS technology in the farm operation. Education, marital status, and total years farmed were not related to the use of GPS in the farm operation, but age, total acres farmed, and family involvement were related to the use of GPS. Aligned with the past research, use of GPS in the farm operation decreased as age increased, increased as farm size increased, and increased as family involvement increased.

Table 3.13 The use of GPS technology in the farm operation and the adoption of conservation practices.

Conservation Practice	**Use GPS**	**Do Not Use GPS**
Grassed Waterway	52%	48%
Sediment and Water Retention Basin	64.7%	35.3%
Conservation Tillage	41.7%	58.3%
Field Borders	48.4%	51.6%
Structure for Water Control	55.7%	44.3%
RFBs	60%	40%

The sample population was asked about their willingness to be trained in new digital technologies, the 5 point Likert scale question could be answered with certain, likely, possible, not likely, and would not attend. A large portion of the respondents indicated that the likelihood they would participate in additional training for new digital technologies was "possible" (81; 49.7%). The remaining respondents indicated that the likelihood they would participate in additional training for new digital technologies was "likely to attend" (30; 18.4%), not likely to attend (27; 16.6%), would not attend (20; 12.3%), and certain to attend (5, 2.9%) (Figure 3.62).

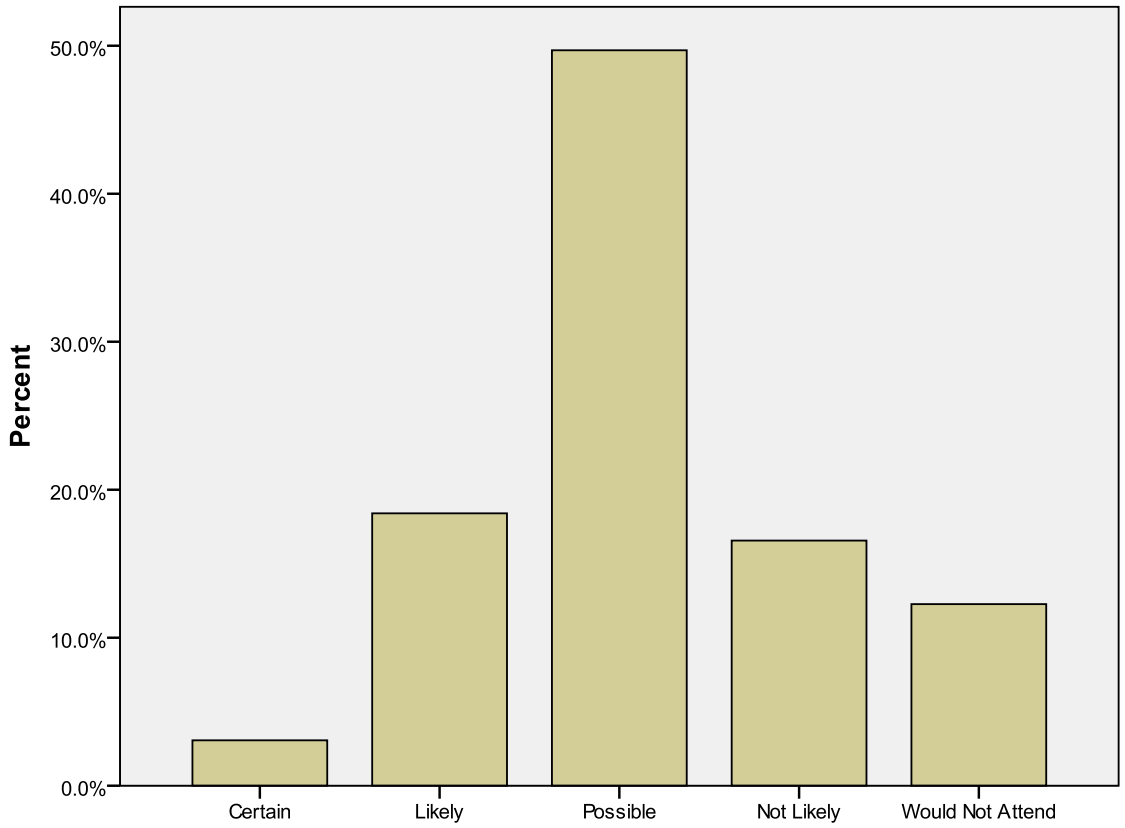

Figure 3.62 Likelihood that the respondent would participate in additional training in new digital technologies.

The last question of the survey was an open question that asked the respondents what they felt were farmers' needs technologically. The total number of responses to this question was 23. Responses were categorized into 4 different categories as can be seen in Figure 3.63. The following list is the categories that emerged and samples of the open-question answers.

1) Business technologies (3; 13%)

    -"I need help organizing my operation on the computer"

2) Planning technologies (7; 30.4%)

    -"A computer based production system where Google Live, satellite imaging, site specific fertilization/irrigation, interactive budgeting could be done."

    -"One of my neighbors uses GPS in his tractors and I wish I knew more about that."

    -"We need help in organizing our [land use strategies] on the computer"

3) None (4; 17.4%)

    -"Nothing"

4) Don't Know (9; 39.1%)

    -"Don't know"

    -"Wouldn't know"

    -"Not sure"

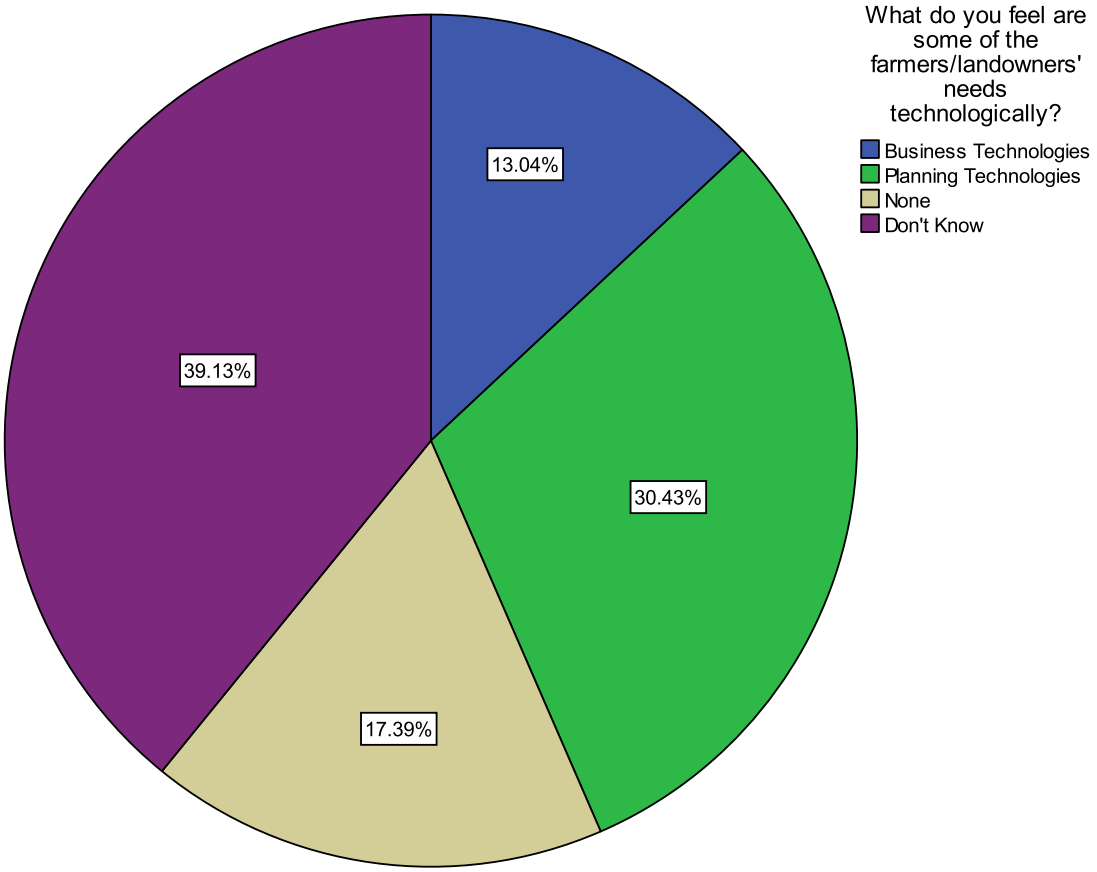

Figure 3.63 Farmers' perceptions of technology needs of other farmers/landowners.

CHAPTER IV

CONCLUSION

4.1 Introduction

The amount of data provided by this study has helped inform the researcher about BSW producers' factors that affect the adoption of conservation practices, use of digital technology in the farm operation, perceptions of the environment, perceptions and use of conservation practices that mitigate impaired water quality, and perceptions and use of RFBs. In addition to summarizing the meaning of the data provided, this chapter will also showcase the importance of the field of Landscape Architecture and Planning to the environmental restoration of the watershed of the Big Sunflower River and identify implications for future research in conservation planning. Despite the environmental benefits of RFBs and governmental incentive programs for RFB installation, they have not been widely adopted in the BSW. An exploration of the barriers of RFB adoption and implications for the promotion of RFB adoption is discussed. This study was an attempt to understand farmer's perceptions and utilization of RFBs within the BSW.

4.2 Limitations of Study

There were several limitations to this study that emerged during the process. First, a pre-notice letter was not utilized in this study, resulting in a lower return of the first survey package. The following reminder survey packages and postcard reminder returns were increased after the initial mailing. The list of active farmers of the BSW study sample was developed from the Farm Service Agency (FSA), the Natural Resource Conservation Service (NRCS), and the local non-governmental organization (NGO) the Friends' of the Sunflower River. This list only indicated farmers and landowners that had previously registered with the FSA, the NRCS, and the Friends' of the Sunflower River. Landowners, farm managers, owner operators, and renter managers were represented from the list generated. Although prior research has found that farmers are a low response rate population

4.3 Landscape Architecture Implications for Conservation Planning

"Agricultural production and ecological health" are goals of the sustainable agricultural landscape (Nassauer, 1997). Nassauer (1997) also states that these ends must be supported by a landscape that communicates the paradigm of the beauty of the rural countryside. Conservation practices that might make a farm appear "messy," RFBs and fallow fields may be perceived as "weedy" or "overgrown" for example; these practices are perceived negatively by farmers (Ryan, 2003). This negative perception implicates designers and planners to produce conservation plans that provide the essential services (agricultural production and ecological health), but also convey a sense of beauty to the community members. Farmers are intrinsically motivated to be good stewards of the

land, and according to Nassauer (1988, 1989), this stewardship is conveyed to the community by the visual appearance of the farm. Landscape architecture researchers are motivated by the past research to develop conservation buffers that make the farm appear neat, tidy, and environmentally sustainable (Nassauer, 2001; Ryan, 2003).

Community involvement implicates the Landscape Architecture industry in the research, design, and development of sustainable landscapes. Non-point source pollution, very common in agricultural watersheds, is a difficult scientific and political issue (Burroughs, 1999). The "stakeholder approach" (Burroughs, 1999) is a way to empower the local community of watersheds to make the best environmental and farm management decisions. In order to reduce environmental impacts, communities must be involved in the design process, Sim Van Der Ryn states in his book, Ecological Design, "design is far too important to be left solely to designers" (1996). Stanton Jones, an assistant professor in the Department of Landscape Architecture at the University of Oregon, argues that Landscape Architecture and stakeholder participation processes in design and planning are able to move the participatory process from the urban density scale to the larger regional scale associated with rural environments (1999). The multidisciplinary nature of regional planning is a perfect fit for the Landscape Architecture industry. Planners, scientists, sociologist, educators, outreach personnel, and stakeholders are just a few of the designers involved with a conservation plan for an impaired watershed.

This study is an ethnographic study of a stakeholder/natural resource user's influence on a finite resource. In relative terms to other sciences, ecology is young and ecological design even younger. Eugene Odum, known as the "father of modern ecology", was the first director of the Institute of Ecology at the University of Georgia in

Athens, GA in 1960 (Greenberger, 2002). Odum's holistic viewpoint (1977) is a basis for this research and informs Regional Planning and the development of conservation plans from the watershed scale to the local scale. "Agroecology" (Francis et. al., 2003), is defined as the "ecology of food systems" and asks for a redefining of the holistic viewpoint of agricultural research and calls for a connection of the disciplines of sociology, anthropology, environmental sciences, ethics, and economics. Unfortunately Francis et. al. (2003), in his work that defines "agroecology" briefly discusses how research to understand the design of natural systems is valuable to the development of productive landscapes and research in natural science methods will inform decision support tools and design of ecologically sound agriculture. Although the definition of "agroecology" (Francis et. al., 2003) is valuable, the paper never mentions the field of Landscape Architecture and Planning. Landscape Architecture and Planning, through research informed design, has the ability to combine these fields into large scale regional conservation plans, utilizing digital spatial models that ensure grassroots stakeholders are represented throughout the process. Milburn and Brown (2003) in their study about the relationship of research and design in Landscape Architecture state, "the introduction of research into design can lead to a more rational, objective process without a loss of creativity or synthesis." The inclusion of research, design, implementation, and monitoring of agro-ecosystems can inform the Landscape Architecture and Planning industry to develop beautiful designs with cues to care (Nassauer, 1989), as defined by farmers and community members that are agriculturally productive and ecologically healthy.

4.4 Further Research

This study has identified several areas for further research opportunities in Landscape Architecture and Planning. Farmers are intrinsically motivated to be good stewards of the land through their direct connection to the land and may be more likely to adopt conservation practices if they are supported by a range of motivations, including economic (Ryan, 2003). This section discusses opportunities for future research in the areas of restoration of riparian systems, information sources and the adoption of conservation, farm structure, incentive programs, perceptions of water quality, perceptions of wildlife, use of digital technology, and knowledge of RFBs.

Ryan (2003) found that farmers were more likely to adopt no-till farming and grass buffer strips along the riparian edge. This study was focused on farmers of the BSW, not just farm operations that were in close proximity to a riparian system. A study that would be beneficial to the body of knowledge of Landscape Architecture and Planning would be similar to Ryan's (2003) study, "Farmers' Motivations for Adopting Conservation Practices along Riparian Zones in a Mid-western Agricultural Watershed." A study of farmers' management decisions along the riparian edge in the BSW could lead to an increased adoption of RFBs along the Big Sunflower River and its tributaries within the BSW. RFBs and riparian wetlands of the Big Sunflower River are able to store large quantities of water that otherwise would be rushed to the Yazoo River and MS River confluence. As of this writing in 2011, record breaking flood stages are cresting along the MS River causing backing and flood stages in the Yazoo River, the Big Sunflower River, and other tributaries of the MS River. This flooding has caused major damage to

homes, businesses, crop production, and catfish production. The restoration of riparian systems and wetland systems may have the capacity to store large quantities of water during flood stages, easing the downstream affects of the swollen rivers.

The researcher found that the Farm Service Agency (FSA), other farmers, crop or farm consultants, MS Cooperative Extension Service (Extension), family and friends, Natural Resource Conservation Service (NRCS) and farm magazines were the highest ranked information sources, respectively. An in depth study of information sources, institutional contacts, and social participation as it relates to the adoption of conservation practices may provide strategies for the promotion of conservation within the BSW and participatory watershed stewardship.

4.5 Conclusions and Recommendations

The BSW farm operations were characterized by the adoption of cover cropping, conservation tillage, and structures for water control. Buffer type conservation practices were not widely adopted by the respondents. RFBs provide many environmental benefits through slowing runoff; filtering sediment, pesticides, and fertilizers; providing wildlife forage and habitat, and providing green corridors for the movement of wildlife. The entire perception comment list was indicated by "undecided" except for the wildlife benefits of RFBs. There is a disconnection between the importance of wildlife indicated by the respondents, the benefits of conservation buffers, and the lack of buffer adoption. This result confirms Skelton et al. (2005) that lack of knowledge of RFBs is a major barrier to adoption. Although there is a lack of adoption of conservation practices, except for conservation tillage, cover cropping, and structures for water control, the respondents

indicated that they were somewhat comfortable and very comfortable with conservation practice design and implementation. This discrepancy is confirmed in the research, Clearfield and Osgood (1986) found that attitudes do not translate into behavior.

This study was mainly represented by Caucasian, married, men, therefore these results limited the researcher in the testing of gender, race, and marriage as factors in the influence of adoption. The conservation practice prescribed forestry was correlated with farmers above the age of 50. Prescribed forestry was rescinded in 2009 by the USDA and developed as part of Forestry Management Plans (FMPs) as a purpose of the Environmental Quality Incentives Program (EQIP) (NRCS, 2009). FMPs can be aligned with agroforestry and can be designed using GIS and implemented in rural and urban watersheds (Bentrup and Leininger, 2002). As the current generation of farmers age and practice the retirement of cropland, the field of Landscape Architecture can promote the adoption of conservation plans that are environmentally, economically, and agriculturally sustainable.

Education was related to the adoption of conservation tillage and structures for water control, but not related to the adoption of RFBs. College background was related to the adoption of conservation tillage, but further research is needed to understand the entire college background of the study sample. A large portion of respondents indicated "other" as their college background. Conservation tillage is a field and crop residue type practice that the past research has indicated is a short-term benefit practice (Soule et al., 2000). The immediate returns noted from the implementation of conservation tillage should be applied to other conservation practices. Buffer type practices are perceived as providing long-term benefits with large up front costs. The education of the benefits of

conservation practices, both short-term and long-term benefits, will utilize economic and intrinsic motivations for the adoption of conservation practices. This result implicates the field of Landscape Architecture and Planning to develop planning tools that can model conservation plans that correspond with the needs of the farm operations, the environment, and the communities of the BSW. The implementation of educational strategies, combined with planning tools that showcase the benefits and costs of conservation will influence the adoption of conservation practices within the watershed.

Information sources are related to the adoption of conservation tillage and structures for water control and can be utilized to disseminate the benefits of conservation practices in order to increase adoption. The multi-disciplinary nature of the field of Landscape Architecture and Planning will involve the various information sources in the conservation planning process and these high ranked information sources will have the ability to disseminate information about the benefits of conservation practices and therefore influence the adoption of conservation practices.

Family involvement in the BSW operations contradicts prior research; this study shows that larger farms indicate that the family is somewhat involved and very involved. The family farm organization is an important factor in the influence of adoption, and within the BSW, family involvement is related positively to the adoption of conservation practices. Cover cropping, conservation tillage, and structures for water control are related to large farm operations (rented and owned). Both crop and field residue type conservation practices are associated with tenure characteristics. Producers that rent large amounts of land are more likely to adopt conservation practices that provide immediate short-term benefits (Soule et al. 2000). Farms that gross $100,000 and over

are related to the conservation practices conservation tillage and structures for water control and farms that gross $500,000 and over are related to the conservation practice cover cropping. This result indicates that cost of practice is a barrier to adoption to smaller farm operations. Off-farm employment is related negatively to the adoption of conservation practices. Off-farm employment indicates that farmers are trying to overcome financial hardship and are more than ever concerned with profit maximization. The farm operation characteristics influence the adoption of conservation practices and implicate policy and governmental agencies to focus adoption of conservation practices on smaller non-family farms that gross less than $100,000 and hold off-farm employment.

The farms proximity to surface waters in the MS Delta was not related to the adoption of conservation practices, this result may indicate a lack of awareness of the downstream impacts of farming practices. Also, the farmers of the BSW perceived that the surface waters of the region (MS Delta) were polluted, that the surface waters of the county were less polluted, and the surface waters of the farm were the least polluted. This perception shows that there is a disconnection between the farmers' knowledge of causes of impaired water quality in the BSW (NPS pollution from agriculture) and the actual water pollution. Education strategies for stakeholders' understanding of watershed processes, NPS pollution, and the benefits of conservation practices will increase the adoption of conservation practices within the BSW. The majority of respondents felt that wildlife was important. The education of the wildlife benefits of buffer type conservation practices will increase adoption of conservation buffers. The field of Landscape Architecture and Planning, utilizing decision support systems (DSSs) can design,

implement, monitor, and research conservation plans that utilize a variety of different conservation practices for an end goal. Conservation plans can be implemented in agricultural watersheds for the resolution of NPS pollutants, implemented in urban watersheds for watershed restoration, implemented in fragmented landscapes for connectivity of wildlife, and used to explore the relationship between the urban and wildland interface.

Eco-tourism opportunities in the BSW can be managed with conservation plans for the management of wildlife. Wildlife management plans will generate income for the farm operation through the sale of hunting and fishing leases. The use of the wildlife resources through hunting, fishing, and other eco-tourism activities can lead to environmental restoration. Impaired water quality can be detrimental to the fisheries of the MS Delta and the Gulf of Mexico, by developing conservation plans that restore water quality for fish habitat, landscape architects and planners are connecting the stakeholder (user of the natural resource) to the greater watershed and eco-region.

The BSW producers' perceptions of their environment do not influence the adoption of conservation practices. This study found a disconnect between the perceptions and uses of the farmers' environment and the adoption of conservation practices that provide benefits that BSW farmers indicated were important. This study confirms the findings of Clearfield and Osgood (1986) that attitudes do not indicate behavior. Strategies to educate the stakeholders of the BSW of the environmental benefits of conservation practices include the understanding of NPS pollution, the awareness of the farm operations connections to surface water, and knowledge of watershed processes at work within the BSW.

The Environmental Quality Incentives Program (EQIP), the Conservation Reserve Program (CRP), and the Wetlands Reserve Program (WRP) are the highest enrolled incentive programs according to the respondents. According to prior research, there is a discrepancy between the amount the NRCS recommends CRP and the amount that the farmers of the BSW indicate they have been recommended the CRP. The NRCS gives the technical and financial assistance associated with the CRP, so a lack of recommendations and contacts to stakeholders may result in a decreased enrollment of incentive programs. The correlation between the frequency of enrollment and the frequency of recommendations implicates governmental agencies to increase the recommendations of incentive programs for the adoption of conservation practices. This study also indicated that governmental red tape is a barrier to the enrollment of incentive programs. Strategies to ease the governmental red tape and to increase recommendations of incentive programs will promote the enrollment of incentive programs. Modeling tools that include checklists of requirements for the enrollment of land in programs can ease the farmers' or landowners' decisions to enroll land.

Technology use is characterized by the use of the internet and bookkeeping technologies. Planning technologies are not widely used by the farmers of the BSW. This result indicates that a decision support system (DSS) for the application of conservation planning and watershed management must have a user-friendly interface that could resemble a web browser (Hoag et al., 2000). DSS's, developed by the field of Landscape Architecture and Planning can increase the adoption of conservation plans through farm, watershed, and regional scale digital modeling of the costs and benefits of conservation practices. Digital modeling tools are able to combine the economic,

environmental, and aesthetic needs of farm operations at multi-scale applications. In addition to showcasing the costs and benefits of conservation plans, digital models can help inform the farm operator of environmental degradation issues, of opportunities for the restoration and connection of fragmented wildlife habitats, of opportunities for production, and of requirements to enroll farmland in governmental incentive programs.

The field of Landscape Architecture and Planning can develop a niche in the agricultural landscape for the restoration of water quality. The multidisciplinary approach to site design will use the goals and needs of the surrounding community and the nested ecosystem to design, develop, and implement plans that are empowered by the stakeholder community to make the correct environmental restoration decisions. Through the understanding of the stakeholders' perceptions and use of RFBs, the landscape architecture profession can develop strategies to promote the adoption of RFBs, for the implementation of a variety of conservation practices into conservation plans, and the applicability to the rural as well as built landscape.

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APPENDIX A

BIG SUNFLOWER WATERSHED PRODUCERS'

SURVEY PACKAGE

Dear Respondent,

We at Mississippi State University need your input and opinions! We are inviting you to participate in a survey about your farming practices and perceptions of your environment. The survey will help to inform the department of Landscape Architecture about the technological needs of farmers in the Delta. Our ultimate goal is to develop a digital program and software that will help you decide what practices are advantageous and bring a larger return on your investment with minimal impact to the surrounding environment. I have attached a short survey about your farming practices and perceptions of your environment which I am hoping you will fill out and return to MSU in the provided stamped, addressed envelope. It should take you fifteen to twenty minutes to complete.

You will see that we have all types of questions about your farming experience in the MS Delta. Participation is completely voluntary and you have the choice to quit the survey whenever you want, or skip any question you would not like to answer. Your response is important to our study and your complete privacy is assured throughout the process. Confidentiality is important to us at MSU, and your answers will not be linked to you personally when we report our results.

Once again, participation in the survey is voluntary and if you choose not to participate that is fine. There are no anticipated risks to you or your privacy if you decide to fill out the survey. If you would like, we at MSU would be glad to share our results. To receive a copy of the report please call me, Hall Roberts at (662) 325-3190.

An addressed, stamped envelope is provided for you to mail the survey back to MSU. If you have any questions about the survey, or about being in the study, please contact me at (662) 325-3190 or Dr. Timothy Schauwecker at (662) 325-7895. This project has been approved by the Institutional Review Board for the Protection of Human Subjects in Research (IRB) for MSU under Docket #08-047. IRB may be contacted at (662) 325-5220 please refer to Docket #08-047 when contacting IRB.

Finally, we need your honest input and opinions for our research to benefit the farmers and landowners of the Mississippi Delta. It should only take fifteen to twenty minutes of your time and a stamped, addressed envelope is provided for the return. Thanks so much for your participation!

Sincerely,

Hall Roberts,
Graduate Student, Department of Landscape Architecture

I. Demographic Information

We would like to begin by getting some background information about you and your farm operation. We are only concerned with the land that you farm in the MS Delta.

1) Gender

Male	
Female	

2) What is your age? _____ years old

3) What is your race or ethnic background?

Caucasian	
Latino	
African American	
Native American	
Asian American	
Other	

4) What is your highest educational degree?

Some High School	
High School Diploma	
Associates	
Bachelors	
Masters	
PhD	
Post-doc	
Other	

5) What is your college education background?

None	
Agricultural Economics	
Agricultural Engineering	
Animal & Dairy Science	
Aquaculture	
Biochemistry	
Biology	
Chemistry	
Engineering	
Food Science	
Forest Resources	
Forestry	
Geosciences	
Landscape Architecture	
Landscape Contracting	
Plant & Soil Science	
Poultry Science	

Wildlife & Fisheries	
Other:	

6) What is your marital status?

Married	
Never Married	
Divorced or Separated	
Widowed	

7) How involved are family members in making farm-related decisions?

Very Involved	
Somewhat Involved	
Neutral	
Hardly Involved	
Not Involved	

8) In 2008, how many acres of cropland (rented and owned) do you farm?

0-9	
10-99	
100-999	
1,000-9,999	
10,000 or greater	

9) In 2008, how many acres of cropland are <u>owned</u> by you?

0-9	
10-99	
100-999	
1,000-9,999	
10,000 or greater	

10) In 2008, how many acres of cropland do you <u>rent from others</u>?

0-9	
10-99	
100-999	
1,000-9,999	
10,000 or greater	

11) In 2008, how many acres of cropland do others <u>rent from you</u>?

0-9	
10-99	
100-999	
1,000-9,999	
10,000 or greater	

12) How many years have you farmed?

0-5 years	
6-10 years	
11-30 years	
31-50 years	
Over 50 years	

13) How many years have you farmed in the Big Sunflower Watershed?

0-5 years	
6-10 years	
11-30 years	
31-50 years	
Over 50 years	

14) For 2007, were your total gross farm sales…

Below $5,000	
Between $5,000 and $9,999	
Between $10,000 and $24,999	
Between $25,000 and $49,999	
Between $50,000 and $99,999	
Between $100,000 and $299,999	
Between $300,000 and 499,999	
Over 500,000	
Don't Know	
Refuse to Answer	

15) Do you presently have a non-farming job that supplements your income?

Yes	
No	

16) Is your farming operation located near a ….(check all that apply)

Oxbow lake	
Lake	
Drainage Ditch	
Creek or Stream	
River	

17) How polluted would you say are the surface waters around your farm?

Very Polluted	Somewhat Polluted	Don't Know	Hardly Polluted	Not Polluted

18) How polluted would you say are the surface waters in your county?

Very Polluted	Somewhat Polluted	Don't Know	Hardly Polluted	Not Polluted

II. Conservation Practices

19) Below is a list of conservation practices that are commonly used for water quality. For each one, please indicate if you have ever heard of the practice, ever used it, and if you are currently using it, please indicate the number of cropland acres that were serviced by that practice in 2008.

Management Practice	**Ever heard of the practice?**	**Ever used the practice?**	**Acres serviced by the practice in 2008.**
Grassed Waterways	Yes No	Yes No	
Cover Cropping	Yes No	Yes No	
Filter or Buffer Strips	Yes No	Yes No	
Sediment and Water Retention Basins	Yes No	Yes No	
Conservation Tillage	Yes No	Yes No	
Prescribed Grazing	Yes No	Yes No	
Prescribed Forestry	Yes No	Yes No	
Field Border	Yes No	Yes No	
Stripcropping	Yes No	Yes No	
Structure for Water Control (Water Level Control Structures, Flashboard Risers, Pipe Drop Inlets, and Box Inlets)	Yes No	Yes No	
Riparian Forest Buffers	Yes No	Yes No	

20) The following are statements about Riparian Forested Buffers (RFB). An RFB is a strip of forested land that is immediately adjacent to water bodies. Please indicate whether you strongly agree or strongly disagree with the statement by circling the corresponding number.

Riparian Forest Buffer Statement:	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
RFBs are compatible with	1	2	3	4	5

current farming practices.					
Establishment of an RFB is difficult.	1	2	3	4	5
RFB statement:	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
RFBs do not require much maintenance.	1	2	3	4	5
Signing up for governmental programs for the establishment of RFBs is easy.	1	2	3	4	5
Financial incentives for the establishment of RFBs is adequate.	1	2	3	4	5
I am less likely to establish an RFB due to government regulation.	1	2	3	4	5
RFBs provide streambank stabilization and prevent erosion.	1	2	3	4	5
RFBs provide habitat for beneficial insects that prey on pests.	1	2	3	4	5
Reduced profitability will prevent me from installing an RFB.	1	2	3	4	5
RFBs do not improve water quality.	1	2	3	4	5
RFBs provide wildlife movement and habitat for hunting and fishing.	1	2	3	4	5
If I had help in designing, establishing, and maintaining an RFB, I would be more likely to implement an RFB on my property.	1	2	3	4	5
If I were allowed to periodically harvest trees from an RFB, I would be more likely to sign up for an RFB program.	1	2	3	4	5

21) How important is the presence of wildlife on your farm to you?

Very Important	Somewhat Important	Neutral	Hardly Important	Not Important

22) What is your comfort level with understanding conservation practice design or implementation?

Very Comfortable	Somewhat Comfortable	Neutral	Not Comfortable	I do not understand conservation practice design or implementation

23) Do you…

a) Fish in the MS Delta	yes	no
b) Fish in the Gulf of Mexico	yes	no
c) Hunt deer in the MS Delta	yes	no
d) Hunt dove in the MS Delta	yes	no
e) Hunt waterfowl in the MS Delta	yes	no

24) How polluted would you say are the surface waters in the MS Delta?

Very Polluted	Somewhat Polluted	Don't Know	Hardly Polluted	Not Polluted

25) Do you feel that farmers/landowners are well educated about the benefits of conservation practices applied or installed on their property?

Yes	
No	
Other	

Comments:

26) People receive information on management practices from many different sources. Please indicate how much each of these sources influence your farming operation. Do they have no influence, little influence, moderate influence, or high influence? Please circle the corresponding number with the amount of influence you feel that source as made on your farming operation.

Source	No Influence	Little Influence	Moderate Influence	High Influence
Family and Friends	1	2	3	4
Community Members	1	2	3	4

Other Farmers	1	2	3	4
Local Newspapers	1	2	3	4
Radio and Television	1	2	3	4
Source	No Influence	Little Influence	Moderate Influence	High Influence
Farm Magazines	1	2	3	4
Non-Farm Magazines	1	2	3	4
Crop or Farm Consultants	1	2	3	4
MS Cooperative Extension Service	1	2	3	4
MS Dept. of Environmental Quality (MDEQ)	1	2	3	4
MS Soil and Water Conservation Commission	1	2	3	4
Natural Resources Conservation Service (NRCS)	1	2	3	4
Farm Service Agency (FSA)	1	2	3	4
YMD Joint Water Management District	1	2	3	4
Local Soil and Water Conservation District	1	2	3	4
Other: _____	1	2	3	4

27) If workshop/weekend training in new technologies related to conservation practice use were available, the likelihood that you would participate is:

certain	likely	possible	not likely	would not attend

28) If "in the field" training in new technologies related to conservation practice use were available, the likelihood that you would participate is:

certain	likely	possible	not likely	would not participate

29) Have you been provided technical assistance about the use of conservation practices on your farm?

Yes	
No	

Other	

If yes, by whom? _____

Comments:

III. Incentive Programs

30) Have you been provided technical assistance about the available types of incentive programs?

Yes	
No	
Other	

If yes, by whom? _____

Comments:

31) Do you feel that farmers/landowners are well informed about the available incentive programs?

Yes	
No	

Comments:

32) How often have you been recommended the following incentive programs to develop conservation plans? Please circle the corresponding answer.

CCPI *(Cooperative Conservation Partnership Initiative)*	always	often	occasionally	seldom	never
CRP *(Conservation Reserve Program)*	always	often	occasionally	seldom	never
CSP (*Conservation Security Program)*	always	often	occasionally	seldom	never
CTA *(Conservation Technical Assistance)*	always	often	occasionally	seldom	never
EQIP *(Environmental Quality Incentive Program)*	always	often	occasionally	seldom	never
EWP *(Emergency Watershed Protection)*	always	often	occasionally	seldom	never
CI *(Grazing Land Conservation Initiative)*	always	often	occasionally	seldom	never
GRP *(Grassland Reserve Program)*	always	often	occasionally	seldom	never
HFRP *(Healthy Forests Reserve Program)*	always	often	occasionally	seldom	never
RC&D *(Resource Conservation and*	always	often	occasionally	seldom	never

Development Program)					
WHIP *(Wildlife Habitat Initiatives Program)*	always	often	occasionally	seldom	never
WRP *(Wetlands Reserve Program)*	always	often	occasionally	seldom	never
Comments					

33) What incentive programs do you participate in on your farm? Please indicate which incentive programs your farm operation is enrolled in 2008 by filling in the number of acres enrolled.

Incentive Program	# Acres enrolled
CCPI *(Cooperative Conservation Partnership Initiative)*	
CRP *(Conservation Reserve Program)*	
CSP (*Conservation Security Program)*	
CTA *(Conservation Technical Assistance)*	
EQIP *(Environmental Quality Incentive Program)*	
EWP *(Emergency Watershed Protection)*	
CI *(Grazing Land Conservation Initiative)*	
GRP *(Grassland Reserve Program)*	
HFRP *(Healthy Forests Reserve Program)*	
RC&D *(Resource Conservation and Development Program)*	
WHIP *(Wildlife Habitat Initiatives Program)*	
WRP *(Wetlands Reserve Program)*	

34) What are the reasons you think farmers choose not to participate in the incentive programs?

IV. Technology Use

35) In your farming operation, which digital technologies do you use today? (Check all that apply.)

Internet	
Microsoft Word	
Microsoft Excel	
Microsoft PowerPoint	
Microsoft Outlook	
Adobe Photoshop	
Adobe Acrobat	
AutoCAD	
GPS *(Global Positioning System)*	
ArcView	
ArcGIS	
Basins/HSPF	
Other	

36) If additional training in new digital technologies for your operation were available, the likelihood that you would participate is:

certain	likely	possible	not likely	would not attend

37) Which programs do you feel you should have additional training? (Check all that apply.)

Internet	
Microsoft Word	
Microsoft Excel	
Microsoft PowerPoint	
Microsoft Outlook	
Adobe Photoshop	
Adobe Acrobat	
AutoCAD	
GPS *(Global Positioning System)*	
ArcView	
ArcGIS	
Basins/HSPF	
Other	

38) What do you feel are some of the farmer/landowner's needs technologically?

39) Thank you! Your input will be of great help to Mississippi State University and the Department of Landscape Architecture. If you have any additional comments please write them here.

Comments:

APPENDIX B

REMINDER POSTCARD AND REPLACEMENT COVER LETTERS

Dear Respondent,

This postcard is to remind you that your input and opinions are extremely important to us at Mississippi State University and to thank all of you that have responded so far!

If you have not responded to our survey, we ask that you do so for the benefit of the MS Delta farmers, communities, and environment. The survey should take around fifteen minutes to complete and all respondents that complete the survey will be entered into a raffle for $100.00.

We would like to thank all of you that have responded to our farm management survey. If you have already responded you may disregard this postcard, your opinions and input have already been helpful to us at MSU. Thanks Again!

If you would like another copy of the survey please email or call me, Hall Roberts at (662) 325-3012.

Thank you so much for your input and opinions! If you would like to see a write up of our results, please contact Hall Roberts or Timothy Schauwecker.

Thank you!

Hall Roberts
Department of Landscape Architecture
Box 9725
Mississippi State, MS 39762

Dear Respondent,

We at Mississippi State University still need your input and opinions! If you have not responded to our survey, we encourage you to do so for the benefit of the MS Delta communities and farmers. If you have already responded to our survey, you have received this second survey by mistake and we apologize for the inconvenience. If you have already responded and know of someone whose opinions would be important to our study, we encourage you to pass the survey package on to them. The survey will help to inform the department of Landscape Architecture about the technological needs of farmers in the Delta. Our ultimate goal is to develop a digital program and software that will help you decide what practices are advantageous and bring a larger return on your investment with minimal impact to the surrounding environment. I have attached a short survey about your farming practices and perceptions of your environment which I am hoping you will fill out and return to MSU in the provided stamped, addressed envelope.

You will see that we have all types of questions about your farming experience in the MS Delta. Participation is completely voluntary and you have the choice to quit the survey whenever you want, or skip any question you would not like to answer. Your response is important to our study and we will be glad to conduct the survey by phone if that is more convenient. Confidentiality is important to us at MSU, and your answers will not be linked to you personally when we report our results.

Once again, participation in the survey is voluntary and if you choose not to participate that is fine. There are no anticipated risks to you or your privacy if you decide to fill out the survey. If you would like, we at MSU would be glad to share our results. To receive a copy of the report please call me, Hall Roberts at (662) 325-3190.

An addressed, stamped envelope is provided for you to mail the survey back to MSU. If you have any questions about the survey, or about being in the study, please contact me at (662) 325-3190 or Dr. Timothy Schauwecker at (662) 325-7895. This project has been approved by the Institutional Review Board for the Protection of Human Subjects in Research (IRB) for MSU under Docket #08-047. IRB may be contacted at (662) 325-5220 please refer to Docket #08-047 when contacting IRB.

Finally, we need your honest input and opinions for our research to benefit the farmers and landowners of the Mississippi Delta. It should only take fifteen to twenty minutes of your time and a stamped, addressed envelope is provided for the return. Thanks so much for your participation!

Sincerely,

Hall Roberts,
Graduate Student, Department of Landscape Architecture

Dear Respondent,

We at Mississippi State have received many responses from our survey, but we still need your valuable input and opinions! If you have not responded to our survey, we encourage you to do so for the benefit of the MS Delta communities and farmers. If you have already responded to our survey, you have received this third survey by mistake and we apologize for the inconvenience. If you have already responded and know of someone whose opinions would be important to our study, we encourage you to pass the survey package on to them. The survey will help to inform the department of Landscape Architecture about the technological needs of farmers in the Delta. Our ultimate goal is to develop a digital program and software that will help you decide what practices are advantageous and bring a larger return on your investment with minimal impact to the surrounding environment. I have attached a short survey about your farming practices and perceptions of your environment which I am hoping you will fill out and return to MSU in the provided stamped, addressed envelope.

You will see that we have all types of questions about your farming experience in the MS Delta. Participation is completely voluntary and you have the choice to quit the survey whenever you want, or skip any question you would not like to answer. Your complete privacy is assured throughout the process. Confidentiality is important to us at MSU, and your answers will not be linked to you personally when we report our results.

Once again, participation in the survey is voluntary and if you choose not to participate that is fine. There are no anticipated risks to you or your privacy if you decide to fill out the survey. If you would like, we at MSU would be glad to share our results. To receive a copy of the report please call me, Hall Roberts at (662) 325-3190.

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Sincerely,

Hall Roberts,
Graduate Student, Department of Landscape Architecture

APPENDIX C

IRB APPROVAL

Mississippi State University

February 25, 2008

Hall Roberts
Landscape Architecture
Mail Stop 9725

RE: IRB Study #08-047: Perceptions and Utilization of Riparian Forest Buffers by Farming Interest Located in the Big Sunflower Watershed

Dear Mr. Roberts:

The above referenced project was reviewed and approved via administrative review on 2/25/2008 in accordance with 45 CFR 46.101(b)(2). Continuing review is not necessary for this project. However, any modification to the project must be reviewed and approved by the IRB prior to implementation. Any failure to adhere to the approved protocol could result in suspension or termination of your project. The IRB reserves the right, at anytime during the project period, to observe you and the additional researchers on this project.

Please refer to your IRB number (#08-047) when contacting our office regarding this application.

Thank you for your cooperation and good luck to you in conducting this research project. If you have questions or concerns, please contact irb@research.msstate.edu or 325-3294.

Sincerely,

Katherine Crowley
Assistant IRB Compliance Administrator

cc: Dr. Tim Schauwecker

Office for Regulatory Compliance
P. O. Box 6223 • 70 Morgan Avenue • Mailstop 9563 • Mississippi State, MS 39762 • (662) 325-3294 • FAX (662) 325-8776