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Factors that Influence the Adoption of Agricultural Conservation Programs in Northwest Arkansas

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Abstract

A survey was developed and administered to agricultural producers in Northwest Arkansas in order to better understand producer awareness of, application for and participation in six federal and state conservation programs available in Arkansas: the Environmental Quality Incentives Program, the Conservation Reserve Enhancement Program, the Arkansas Revolving Loan Program, the Arkansas Nonpoint Pollution Management Program , the Arkansas Soil Nutrient and Poultry Litter Application and Management Program, and the Surplus Poultry Litter Removal Incentives Cost Share Program. Survey results found that less than half of the sample was aware of any one of the programs. A logit model was developed to identify those factors that significantly influenced the likelihood of program awareness. Demographic and choice variables that proved significant in at least one of the six examined programs were: *On-Farm Income, Years of Farm Operation, County of Operation, Operator Education, Type of Agricultural Operation, and Source of Conservation Program Information.* The most commonly significant variables were *Source of Conservation Program Information* and *On-Farm Income*. Policy recommendations include a general increase in on-farm conservation education in NWA; to specifically target smaller operations with basic information about the nature of government-organized agricultural conservation programs; and to target larger farms with information about program participation.

This thesis is approved for
Recommendation to the
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Chapter 1. Introduction

1.1. Northwest Arkansas and Agriculture

Northwest Arkansas, identified for the purposes of this research as Benton and Washington counties, is one of the fastest growing metropolitan areas in the nation. Both Benton and Washington counties encountered population growth over 24% between 2000 and 2008, far exceeding the state's growth of 6.8% (U.S. Census Bureau, 2010). This growth, in large part, is due to the presence of several of the large multi-national firms, including Wal-Mart, Tyson Food, and J.B. Hunt. Despite its metropolitan aspirations and affinity toward big business, Northwest Arkansas remains deeply rooted in the land and agriculture.

Agriculture in the northwestern corner of Arkansas is primarily defined by the animal sector. In Northwest Arkansas, crop agriculture only accounts for a fraction of the market value of products sold, with animal products accounting for almost 98% of the value. Benton and Washington counties rank 1st and 2nd in the state for market value of livestock, poultry and their products, and are the center of Arkansas' $3.7 billion dollar poultry industry (NASS, 2007).

As with most production processes, the growth, harvesting, and processing of agricultural products results in externalities. An externality is a market failure in which an activity or transaction by some parties causes an unintended loss or gain in welfare to another party and no compensation for the change in welfare occurs (Daly and Farley, 2004). In the case of agriculture, because of its direct connection with the environment in which it operates, production externalities can lead to negative environmental outcomes.

In an effort to mitigate these outcomes, state and federal agencies have developed programs that encourage resource conservation and environmental stewardship.

1.2. State and Federal Conservation Programs

The federal government utilizes Farm Bill legislation to create programs that affect agriculture on the nation-wide scale. One such effort is the Environmental Quality Incentives Program (EQIP). EQIP is a voluntary conservation program designed for agricultural producers that serves to "promote agricultural production and environmental quality as compatible national goals" (NRCS, 2009). Through EQIP, NRCS staff provides technical and financial assistance to optimize environmental benefits and meet environmental regulations while not sacrificing production or profitability (NRCS, 2008).

Another expansive federal program is the Conservation Reserve Enhancement Program (CREP). CREP, an offshoot of the Conservation Reserve Program, is a "community-based, results-oriented effort centered on local participation and leadership" that uses the tools of land retirement and conservation practices to protect environmentally sensitive lands (FSA, 2009). As of January, 2009, the sections of Northwest Arkansas that comprise the Illinois River watersheds were selected as a targeted area for CREP (FSA, 2009b).

In addition to federally provided conservation programs, many states offer their own programs to promote agricultural conservation. Although states could certainly not afford to match the monetary input of Farm Bill programs, state efforts could theoretically be more tailored to specific geographies or circumstances within the state and thus complement the larger federal programs. In this spirit, the Arkansas Natural Resources Commission (ANRC) provides a number of programs to producers in the state. Of these programs, this study focuses on the Arkansas Revolving Loan Program (LOAN), the Arkansas Nonpoint Pollution Management Program (NONPOINT), the Arkansas Soil Nutrient and Poultry Litter Application and Management Program (APPLICATION), and the Surplus Poultry Litter Removal Incentives Cost Share Program (REMOVAL).

LOAN encourages the adoption of several conservation practices through the provision of loans at a low interest rate. NONPOINT utilizes money given by the EPA to fund projects connected to the abatement of nonpoint source pollutants. Projects are selected based on state and federally determined criteria. REMOVAL offers state dollars to offset some of the cost of the transportation of litter from regions deemed 'Nutrient Surplus Areas'. APPLICATION is a regulatory structure that requires all individuals who wish to utilize animal manure in a Nutrient Surplus Area to develop and implement a Nutrient Management Plan. The ANRC provides educational courses to develop a Nutrient Management Plan and become certified for fertilizer application. All of these programs encourage natural resource conservation and environmental stewardship.

Environmental stewardship is a subject about which government conservationists and agricultural producers often share a common view, namely that the security of the natural resources held in farming land is important (Kash, 2008). Many producers, especially those with small operations and those who are motivated by the lifestyle associated with farming as much as profitability, view land maintenance as an important task for farmers (Paudel, 2008). With thousands of potential program participants, millions of dollars in state and federal funding available, and some mutual agreement about on-farm conservation between producers and government officials, it would seem logical that many producers would take part in the conservation programs.

Participation in conservation programs in Northwest Arkansas, however, is fairly limited. Limited participation could be the result of lack of producer interest, lack of knowledge, lack of trust in government institutions, or one of many other possible explanations. It is hoped that, by examining the determinates of agricultural conservation program awareness and adoption in Northwest Arkansas, conservation policy at the local or state level could be altered to better suit the needs of the region.

The goal of this research is to use survey data to better understand Northwest Arkansas producer opinions and knowledge of conservation programs and, with this in mind, to critically examine program participation in the two counties. This goal was met through two objectives. The first objective of this study was to survey agricultural producers in Benton and Washington counties to discover perceptions and knowledge levels of two federally administered and four state run conservation-oriented programs. It is hoped that gaining a better understanding of these experiences will enable policy development in state and federal conservation organizations that will better target agricultural producers in Northwest Arkansas and agriculturally similar regions across the United States.

The second major objective of the study was to discover producer characteristics that affect conservation program knowledge, opinion and participation. With this goal in mind, participants were asked to disclose important demographic information about themselves and their agricultural operation as well as the participant's source of information about the programs. If differences exist between likely adopters and non-adopters, this knowledge will help policy-makers better target their educational outreach.

It is important to note that this study focuses on conservation *program* participation and not *best management practice adoption*. Many producers have adopted best management practices completely voluntarily and without financial assistance from any agency of the government. Adoption of those practices is not examined in this research.

1.3. Hypotheses

Throughout this research hypotheses will be tested related to: Characteristics of producers in the two Northwest Arkansas counties, producer program knowledge levels and participation rates and factors associated with program knowledge and participation rates. Detailed hypotheses will be presented in the Methods section 3.7.

1.4. Study Overview

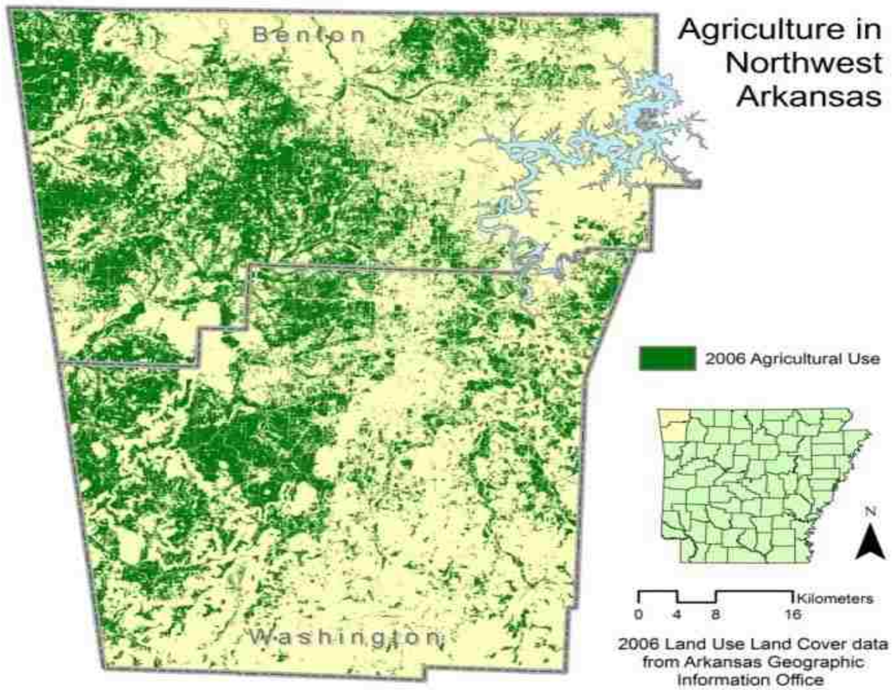
The rest of the thesis will be organized as follows. Chapter two contains a review of pertinent literature for the subject. Chapter three outlines the methodology used in the research. Chapter four presents and discusses the results of quantitative analysis and hypothesis testing. Finally, chapter five offers conclusions, policy implications and suggestions for future research.

Chapter 2. Literature Review

2.1. Agriculture in Arkansas

While the economies of many southern states are influenced by the agricultural sector, few are as reliant on the production, processing and retail of food and fiber as Arkansas. Agriculture, defined in this context as the "sum of agricultural production and processing activities, including crop and animal production and processing, agricultural support industries, forestry and forest products, and textile goods," is vital to the state's economy. With 12.03% of the state's GDP created by agriculture in 2007, compared with a 5.5% nationwide average, agricultural economics and policy take special precedence in the state (Popp et al., 2010). Agriculture in the state of Arkansas is characterized by distinct geographical regions that lead production decisions: flatter eastern sections of the state are dominated by the production of crops like rice and cotton, while the wooded hills of northwestern Arkansas are heavily involved in animal agriculture (Figure 2.1) (NASS, 2007; Popp et al., 2010).

Figure 2.1: Agricultural Land Use in Northwest Arkansas, 2006



Source: 2006 Land Use Cover Data, Arkansas Geographic Information Office

With an aggregated value-added impact of $16.3 billion in 2008, the agricultural sector is an important source of jobs and income in Arkansas. When the direct, indirect and induced factors were combined, the industry accounted for 17% of the state's economy (Popp et al., 2010). In that same time period, agriculture supplied 261,101 jobs, more than a sixth of the state's entire workforce and 15% of all labor income. Animal agriculture alone employed 57,601 and added $2.55 billion to the economy (Popp et al., 2010). Arkansas ranks in the top 5 in the production of rice, broilers, cotton, sweet potatoes, catfish and turkeys in the United States (NASS, 2007).

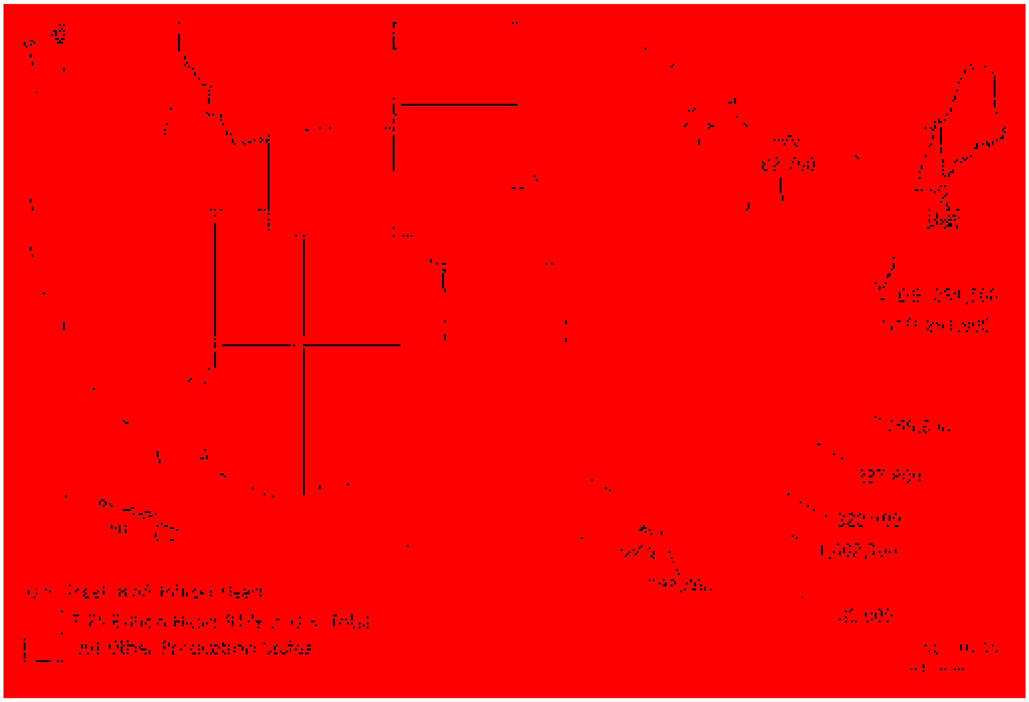
Benton and Washington counties are geographically adjacent counties with populations of 225,504 and 200,181, respectively (U.S. Census Bureau, 2010). The population of concern for this study is Northwest Arkansas agricultural producers. The National Agricultural Statistics Service (NASS) defines a farm as an operation that "produces, or would normally produce and sell, $1,000 or more of agricultural products per year" (NASS, 2007). According to the 2007 Census of Agriculture, Benton County had 2,151 farms and Washington had 2,915, for a combined total of 5,066 (NASS, 2007). In this region small herd cattle operations dominate the agricultural landscape in terms of farm participation and devoted acreage. Of the 5,066 farms in Northwest Arkansas, almost 70% (3,484) participate in cattle production (NASS, 2007). The average cow-calf operation in the state has 36 cows, and 80 percent of cow-calf farms keep less than 50 cows (Troxel, 2007), which is common for the southeast region of the United States (Gillespie, 2007). This holds true in Northwest Arkansas, with 69% of Benton County's cattle and calf operations with less than 50 head and 78% of the county's beef cattle operations reporting less than 50 head. Similarly, in Washington County 72% of cattle and calf farms and 80% of beef cow farms stock less than 50 head of cattle. Examining planting in the two counties offers more evidence of the animal sector's dominance. The most widely reported crop was forage, with 2,852 farms devoting acreage to "land used for all hay and all haylage, grass silage, and greenchop" (NASS, 2007). Put differently, the prevailing crop grown in Northwest Arkansas is food for livestock.

Although cattle farming is the agricultural activity that dominates the landscape of the region, farms in Northwest Arkansas also produce a diverse range of outputs, including poultry, timber, fruits and vegetables. With 889 of 5,066 farms dedicating resources to layers, pullets, broilers and other meat type chickens, turkeys geese and other poultry species, poultry operations are a minority in the farming landscape of Benton and

Washington counties (NASS, 2007). In terms of value of products sold, however, poultry production is the dominant economic force in Northwest Arkansas agriculture. In 2007, Arkansas was the nation's second leading producer of poultry and eggs with over 1 million head sold and $1.6 billion in sales (Figure 2.2). All four of the state's congressional districts are ranked in the top 50 out of a pool of 395 districts in the country (NASS, 2007 c), and poultry production and processing accounts for one in four of the state's agricultural jobs (Popp et al.,2010). The poultry production and processing sector, combined with the egg production sector, provided 71% of jobs, 80% of income and 74% of value added in Arkansas' animal agriculture sector.

With four of the top six grossing counties in the state (Benton, Washington, Carrol and Madison counties), the northwestern corner of Arkansas is the hub of the state's poultry industry. By ranking 1st or 2nd in the state in almost every sector of the poultry industry, Benton and Washington counties are the locus of that hub. Benton and Washington counties are equally competitive nationally, ranking 4th and 5th, respectively, out of 2,476 counted counties in the United States for sales of broilers and other meat-type chickens (NASS, 2007). Benton and Washington counties are leaders in poultry production with $378,588,000 and $365,621,000, respectively, in market value of sales, ranking them fourth and eighth of 3,020 producing counties in the country (NASS, 2007).

Figure 2.2: Broiler Production by State Number Produced (In Thousands), 2009



Source: USDA/NASS, 2010

It is undeniable that agriculture represents an important sector of the economy in the state of Arkansas. Growth in agriculture will be influenced by federal, state and local conservation policy, which implies that conservation plays a role in the economic development of the state. If this is true, the need for conservation policies to be efficient, effective and tailored to meet regional concerns becomes evident.

2.2. Non-Point Pollution and Agriculture

The relationship between agriculture and the environment is complex, with dedicated stakeholders touting scientific evidence on each side of every issue. Production agriculture, for example, provides food and fiber to the people of the world and can do so while simultaneously using environmentally benign management practices that serve to reduce negative environmental outcomes. Other beneficial effects of agricultural production include rural landscapes, habitat for wildlife, and cleaner air due to the absorption of emissions via plant life (Kash, 2008; Fish, 2006; Langpap, 2006; Claassen, 2000). On the other hand, negative impacts of agriculture on the environment, like soil erosion and nutrient runoff, are also well documented (EPA, 2009; Wu, 2004; Ribaudo, 2004; Claassen, 2000; Houston, 1999; Carpenter et al. 1998; Bouwman et al., 1992). Unlike heavy industry or automobiles, which tend to release pollutants from a pipe or smokestack, almost all agricultural environmental externalities that aren't already regulated come in the form of non-point pollution (Houston, 1999).

The negative environmental effects of modern agriculture have been studied by the scientific community. Livestock, for example, contribute approximately 16% of the world's annual production of methane - a potent greenhouse gas (Bouwman et al, 1992). SARS, Salmonella, E. coli and Listeria are all health externalities generated from human contact with livestock, among other sources (Chakravorty, 2007). The most widely examined environmental impact of agriculture, however, is its effects on water quality. Agricultural activities are the number one source of impairment for rivers and streams and the third largest source of impairment for lakes, ponds and reservoirs in the United States (EPA, 2009).

Although the effects of point-source pollution on air and water quality are quantifiable and attributable, non-point agricultural pollution cannot be easily isolated from other non-point sources, which can include runoff from rural, urban and suburban activities (Carpenter et. al., 1998). These activities are linked as important sources of the nutrients that flow into bodies of water, which in turn can lead to the over-nutrification of those bodies. Agricultural runoff has been implicated as a source of the nutrients that have led to hypoxia in the Gulf of Mexico (Helmers, 2007; Wu, 2004) and animal waste is a source of nitrogen and phosphorous, two nutrients linked with water quality problems (Ribaudo, 2004).

Although the theoretical links between agricultural activity and pollution are well established, linking measured externalities to a distinct responsible party is often difficult, if not impossible. The attempt to overcome this quandary has become a primary goal for policy-makers and regulators. A compounding difficulty for policy-makers and regulators is that the relationship between conservation behavior and positive environmental outcomes is not yet fully understood. In other words, it is often exceedingly difficult to measure both the cause *and* the effect of agricultural pollution (Claassen, 2000).

The challenge of agricultural non-point pollution has been referred to as a “wicked problem” – a dilemma which is not clearly defined, has many stakeholders on opposite sides and for which apparent solutions only generate more problems (Batie, 2008). Because “true solutions” to wicked problems don’t exist, stakeholders must attempt to create policy that balances the needs of many interested parties. A confounding factor that adds to the debate of agro-environmental problems is that, although there exists a relatively substantial quantity of research regarding the effectiveness of conservation activities in combating agro-pollution at the micro level, the overall macro-level effectiveness of these practices is still up for debate (Helmers, 2007; Claassen, 2000).

Regardless of the scientific validity of claims that agriculture is a major contributor to environmental degradation, the decision to regulate has been made by state and federal legislatures. With this in mind, government agencies have allocated billions of dollars for conservation purposes. Traditionally, conservation programs have involved reducing the environmental impacts of agriculture by encouraging farmers to retire farmland out of production. In more recent history the federal government has placed emphasis on agricultural land conservation programs like the Environmental Quality Incentives Program (EQIP) and the Conservation Security Program (CSP) that encourage environmental stewardship on actively farmed lands. With this increase in legislative attention to working land conservation, the conservation goals of the 2008 Farm Bill legislation are clear: the reduction of environmental harms through the use of conservation practices on working agricultural land is a top priority for the United States Department of Agriculture (USDA) (ERS, 2008).

Individual states have followed suit by developing agencies and legislation to support positive environmental outcomes in agriculture. One such agency in Arkansas is the Arkansas Natural Resources Commission (ANRC). The ANRC is a body whose mission is to "manage and protect our water and land resources for the health, safety and economic benefit of the State of Arkansas" through legislative action, regulation, and programs made available to farmers throughout the state (ANRC, 2010). The ANRC commits state dollars through local conservation districts, offers training in nutrient management, and provides rules and regulation to complete its goals, all tailored to meet the unique environmental issues and concerns important to stakeholders within the state.

In Northwest Arkansas intensive animal agriculture has contributed to water quality problems in the Illinois River watershed. As of 2003, major portions of Benton and Washington counties were declared Nutrient Surplus Areas (ANRC, 2007) by the ANRC. A Nutrient Surplus Area (NSA) is defined by the act as a geographic area in which the "soil concentration of one or more nutrients is so high or the physical characteristics of the soil area is such that continued application of the nutrients to the soil could negatively impact soil fertility and the waters within the state" (ANRC, 2005). Because of this designation, one of the potential side-effects of water pollution has been realized; the mere presence of pollution has the potential to create a more complex regulatory environment for all of those involved. By utilizing regulation ("sticks" over "carrots" in this case) added burden is placed on those who fall under the regulatory structure. Any agricultural producer with 2.5 acres or more in a Nutrient Surplus Area who intends to utilize manure as fertilizer is required to develop and implement a Nutrient Management Plan. A Nutrient Management Plan is "any plan prepared to assist landowners and operators in the proper management and utilization of nutrient sources for maximum soil fertility and protection of the waters within the state" (Goodwin et al., 2003). Although not exceedingly difficult or costly to create, the development and implementation of a Nutrient Management Plan takes time and effort. On top of the time and effort, the NSA designation also exposes the producer to penalties if nutrient management requirements are not fully satisfied (Baber, 2004).

Nutrient runoff, particularly phosphorous and nitrogen, is the heart of a longstanding dispute between Oklahoma lawmakers and Northwest Arkansas. With a landmark U.S. Supreme Court decision in 1992 (503 U.S. 91, 112 S.Ct. 1046), it was determined that upstream states must meet the water quality limits set by downstream states. Phosphorous levels in these bodies of water rose from the mid-1990's (U.S. Water News Online, 2005) until ten years later when Oklahoma regulators approved a phosphorous limit of .037 parts per million in the Illinois River and other designated "scenic rivers" (Davis and Moritz, 2003). Of the six Oklahoma rivers designated "scenic," four begin in Arkansas (Davis and Moritz, 2003). In 2003, Oklahoma, Arkansas and EPA officials called a “truce” with the five largest municipalities in Northwest Arkansas (U.S. Water News Online, 2005), settling the case and granting them ten years to implement programs that would reduce nutrients to meet Oklahoma water quality standards (Davis, 2003). The implementation of this settlement required the parties to develop a new Phosphorous Index, a document that would serve as a guide for individuals or organizations who were to apply phosphorous to the watershed in some way (Maguire et al., 2009)

Accompanying this truce was a series of three pieces of legislation passed in 2003, all three of which directly affected agricultural producers in Northwest Arkansas. The first, act 1059, requires training and certification to use litter as fertilizer. Act 1060 requires poultry growers to register the number of birds in their operation with the state in order to secure better knowledge of the poultry population in the area. The third act, Act 1061, designates the Illinois River watershed as a Nutrient Surplus Area and requires litter spreaders to follow a Nutrient Management Plan (Acts 1059-1061, 2003; Davis, 2009).

Of the many parties involved in the development of the ten year agreement of 2003, poultry producers were not at the table (U.S. Water News Online, 2005). Producers were left out of the truce because Oklahoma legal representation was of the opinion that the application of poultry litter was polluting the watershed with a laundry list of contaminants including phosphorous, nitrogen, arsenic, estrogen, antibiotics and pathogens. In order to force the hand of producers, Oklahoma’s Attorney General sued eight poultry companies and six of their subsidiaries operating in Northwest Arkansas, claiming that the poultry litter produced in the area had leached into the groundwater and led to the contamination of the Illinois River and Lake Tenkiller, the source of drinking water for Tahlequah, Oklahoma (Moore, 2007). Representatives of the poultry companies assert that the state, through the regulation of nutrient application, had in fact condoned the practice of controlled litter application (Juozapavicius, 2009). The companies also assert that the initial settlement did not provide adequate time to truly test the effectiveness of the regulation on water quality (Maguire et al., 2009).

Regardless of the validity of claims on either side or the outcome of the lawsuit, Oklahoma's challenge of traditional agricultural practices for the sake of water quality is setting legal precedent for future water quality disputes. The effects of the quarrel will certainly ripple through the regional economy and the legislation passed in 2003 has already altered the structure of poultry production in Northwest Arkansas. An important sticking point for this case has been the scientific validation of the claims of both sides. Scientists have vouched that water quality testing indicated high phosphorous levels found in Oklahoma waters were the result of the over application of poultry manure on fields in the watershed. A scientific rebuttal asserted that the findings of the previous study were flawed and that the phosphorous could have come from any number of sources, including power plants, urban runoff and cattle farms (Juozapavicius, 2009b). The clash between qualified witnesses regarding the source of environmentally damaging nutrients highlights a difficult truth; that the source of agricultural pollutants is often difficult, if not impossible, to identify.

Two of the major problems in identifying environmental issues in agriculture are the geographical scale in which agriculture functions and actually attributing environmental harms to a specific source or activity. Unlike the regulation of heavy industry and automobiles, there is often no smokestack or tailpipe to easily measure emissions. Agricultural emissions often are, by their very nature, diffuse and non-point (Houston, 1999; Strauss, 2007). Nonpoint pollution from agricultural runoff is challenging to measure, trace and regulate because it diffuses over the large geographic scale that is typically associated with agriculture (Carpenter, 1998). Because of the large scale and the difficulty pinpointing sources for agricultural pollution, clean up is cost prohibitive in most cases (Houston, 1999; Lichtenberg, 2003), implying that prevention is the most cost-effective means of abatement. Best management practices (BMPs), defined as “a set of practices that are at least as profitable as existing practices and protect or enhance (environmental) quality,” are widely regarded as a viable method of reducing or preventing harms (Ghazalian et al., 2009; Amacher and Feather, 1997).

BMPs are farming and land management procedures that have been carefully developed with the twin goals of being at least environmentally benign, if not beneficial, and profit-neutral. The USDA asserts that many BMPs will be beyond profit neutral and actually improve farm efficiency (DeVuyst, 1999). Some studies have found that BMPs increase farm profitability while others don’t fully meet the goals of profit neutrality (Valentin, 2004; Aigner and Hopkins, 2003).

There exists in the farming population a perception of an income drag associated with BMPs, in spite of the design goal of profit neutrality, and many farmers still see BMPs as an economic disadvantage when compared with traditional production methods (DeVuyst, 1999). Much research has been done to test the effects of BMP adoption on profitability and the results have been mixed. Researchers measured profitability effects of the implementation of BMPs in 12 water basins with contaminants in Kansas and found that in this case nutrient BMPs were profit positive, herbicide BMPs were profit negative and soil conservation BMPs were profit neutral (Valentin, 2004). In another study, the adoption of land management BMPs on Iowa corn farms actually led to increased profitability (Aigner and Hopkins, 2003). In contrast, modeling of pollution abatement through BMP adoption in a watershed in Georgia showed that abatement would be extremely expensive and that ex-post water treatment would in fact be more cost-effective (Houston, 1999). That true consensus does not yet exist in the aggregation of the research on BMP profitability is a reflection of the incredibly complex nature of non-point pollution abatement.

There is a strong body of literature discussing the environmental effectiveness of BMPs (Wu, 2004; Strauss, 2007; Cook, 1996; Valentin, 2004; Aigner and Hopkins, 2003; Chakravorty, 2007; DeVuyst, 1999). As agricultural conservation has emerged to take a larger role in policy decision making, BMPs have been presented to farmers as scientifically developed procedures by which an individual's agricultural operation can become more environmentally sound. For example, BMPs have been developed to directly target water quality by reducing run-off of nutrients, pesticides and sediment (Valentin, 2004). Many studies have found that the implementation of BMPs can have a significant positive impact on environmental quality on the farm and throughout entire watersheds (Easton, 2008). In areas with intensive animal agriculture, BMPs have been shown to be effective at keeping water clean enough to safely maintain the water body's intended use (Cook, 1996).

In a demonstration project implemented in an impaired watershed in North Carolina in 1996, researchers found that BMPs could significantly improve both ground and surface water quality. In this study, comprehensive nutrient management plans and pest management plans were developed for certain amounts of cropland, 80% and 60%

respectively, for the 2,100 hectare watershed. Prior to implementation, water tests found that nitrate-nitrogen and ammonium-nitrogen levels in the water were unacceptably high, due mainly to swine and poultry agriculture. Water tests over time found reductions in the levels of these pollutants (Cook, 1996). Due to the presence of poultry-generated externalities in the study, these results are of particular significance to Northwest Arkansas.

Best management practices on working agricultural land, when implemented correctly, act to reduce or even neutralize the negative environmental impact of agricultural production with the goal of remaining profit neutral (Valentin, 2004). While the profit neutrality caveat has been disputed in some cases, the positive environmental impacts of BMPs, especially when implemented by the majority of polluters in a watershed, have been corroborated many times in research (Easton, 2008; Strauss, 2007; Yates, 2007; Aigner and Hopkins, 2003; Cook, 1996). Whether or not the marginal effectiveness of conservation practice adoption is worth the effort, however, is an issue that is not yet fully uncovered (Wu, 2004). Some have suggested that the targeting of BMPs to critical source areas would be a more cost-effective way of abating agricultural externalities. Critical source areas, defined as geographically small sections of land that tend to be the source of disproportionately large amounts of pollutants, exist in many watersheds and represent opportunities for increased BMP effectiveness and cost efficiency (Strauss, 2007).

In terms of BMP implementation, the largest burden to the farmer comes in the form of the up-front expenses of practice set-up. This expense has created a conflict. While non-farming parties have an incentive to demand the adoption of BMPs by farmers, agricultural producers face a cost barrier that limits the appeal of voluntary practice adoption. The theoretical outcome of BMP adoption is a cleaner environment, which can be thought of as a public good inasmuch as it is not limited to a specific consumer (nonrival) and one person's consumption does not diminish what is available to others (nonexcludable) (Daly and Farley, 2004). Since this public good is garnered through the use of BMPs, producers will not capture all of the benefits associated with BMP adoption (DeVuyst, 1999). Because the costs of nonpoint pollution prevention and abatement are rarely fully incorporated in the price of agricultural goods (Chakravorty, 2007), producers are left to pick up the left-over cost of adoption. This represents a distinct gap in the system that the market would be unlikely to fill. It is in this gap between an agricultural producer's desire to implement pollution abatement practices and the willingness to pay to do so that the government has entered the market. By providing agricultural producers with incentives in the form of cost-share and technical assistance, the barriers to participation in agricultural conservation activities are lowered and BMP adoption increases which in turn leads to improved environmental outcomes.

2.3. Conservation Programs

In American history, the relationship between agriculture and the environment has taken many forms and changed dramatically with shifts in public opinion and government policy. Traditional government agricultural policy since the 1920's was focused primarily on protecting the agricultural sector and the maintenance of farm profitability. More recent agricultural policy has adopted a multi-pronged position of (1) keeping the U.S. agricultural industry internationally competitive, (2) promoting agriculture as a means of environmental stewardship (Doering, 2006), and (3) retaining production agriculture as a means of sustaining an important part of our national heritage (Fish, 2006). One of the largest reasons for this shift in policy was the growth of the environmentalist movement in the 1960's, where the Jeffersonian ideal of the yeomen farmer was threatened by public opinion that held many agricultural practices in disdain, an opinion that was exacerbated by popular media like Rachel Carson's (1962) *Silent Spring*. Instead of abandoning support of agriculture all together, environmentalists, the farming community and the government have adopted a truce that has enabled the simultaneous advancement of conservation policy and growth of intensive agricultural production (Kash, 2008).

Federal and state conservation agencies have developed programs in order to increase adoption of best management practices on actively farmed land. These programs, generically referred to as "working land conservation programs," contrast with conservation efforts of the past that focused on land retirement. Land retirement programs, like the Conservation Reserve Program (CRP) seek to reduce environmental damages by pulling acreage out of active agricultural production. Generally, working-land conservation programs encourage the adoption of BMPs on land in current agricultural production through technical and financial support. The two federal conservation programs examined in this study are the Environmental Quality Incentives Program and the Conservation Reserve Enhancement Program.

The Environmental Quality Incentives Program, or EQIP, is a federally led working land conservation program aimed at encouraging farm-level practices that will improve the environmental quality of America's farmland through cost-share for approved practices and technical support. The stated goal for fiscal year 2009 was to provide "technical and financial assistance (that) facilitates the adoption of conservation practices that, when installed or applied to technical standards, can mitigate degradation of the environment" (EPA, 2009b).

Created by the 1996 Farm Bill legislation with a mandate to improve working agricultural land and an initial annual funding of $200 million (Zinn, 1998), EQIP has since ballooned to the most heavily funded working land agricultural conservation program in the nation. With its legislative continuation in the 2008 Farm Bill, EQIP was allocated $7.325 billion over the five-year period beginning in fiscal year 2008 through fiscal year 2012 (NRCS, 2009).

Under this program, national conservation priorities are set at the regional level through annual meetings held through conservation districts by "Local Led Work Groups," assemblies of government officials that provide a forum in which public opinion and advice is encouraged. The most important local issues are then relayed to state NRCS officials, which in turn are delivered to the national level NRCS policy-makers. As of 2006, these national priorities are:

- Reductions of nonpoint source pollution, such as nutrients, sediment, pesticides, or excess salinity in impaired watersheds consistent with Total Maximum Daily Loads (TMDLs) where available as well as the reduction of groundwater contamination and reduction of point sources such as contamination from confined animal feeding operations;
- Conservation of ground and surface water resources;
- Reduction of emissions, such as particulate matter, nitrogen oxides (NOx), volatile organic compounds, and ozone precursors and depleters that contribute to air quality impairment violations of National Ambient Air Quality Standards;
- Reduction in soil erosion and sedimentation from unacceptable levels on agricultural land, and;
- Promotion of at-risk species habitat conservation.

These priorities are used by the NRCS to allocate available EQIP funds to state officials who, after identifying the priority natural resource concerns in the State, guide which applicants are awarded EQIP assistance. After identifying these priority natural resource concerns, state officials decide several things: how funds will be allocated, what practices will be offered, what the cost-share rates will be, the ranking process used to prioritize contracts, and which of these authorities will be delegated to the local level. The local designated conservationist, with the advice of local work groups made up of producers and other stakeholders, adapts the State program to conditions on the ground. Because of this, EQIP theoretically has a great deal of flexibility and can vary between states and even counties. (NRCS, 2009)

When it comes to the creation of environmental externalities, all agriculture is not equal. Some forms of production naturally lend themselves to greater likelihood of negative environmental outcomes (Chakravorty, 2007). Both crop and animal agriculture create environmental externalities, but, historically, more scientific attention has been given to the study of row crop externalities and the conservation practices needed to handle them. Federal conservationists deal with this by not insisting on equal allocation of funding between crop and animal agriculture. In the EQIP funding scheme administrators are directed to reach as close to a 60/40 split between funding for livestock and crop conservation efforts, with animal agriculture receiving higher funding. In Benton and Washington counties, livestock is by far the most fiscally important sector in agriculture, representing 98% of the market value of products sold (NASS, 2007). It would follow, therefore, that Northwest Arkansas would be a prime target for EQIP funding, especially given the current legal dispute between Arkansas and Oklahoma over water quality.

The list of covered practices for EQIP in the state of Arkansas for the year 2009 includes 74 different activities (Appendix A) with cost share ranging from 60% to 100%. While some of these practices are not applicable to animal agriculture, many have been specifically developed for poultry or cattle production and are pertinent to agriculture in Northwest Arkansas. The Arkansas-specific list of funded practices has been developed by locally led work groups and is subject to change from year to year based on the needs of the state's agricultural community (Arkansas NRCS, 2009).

An example of the program responding to the needs of the agricultural community is the inclusion of several practices that relate to the release of phosphorous, an issue of importance in Northwest Arkansas. The University of Arkansas Cooperative Extension Service has recognized nine specific practices for the abatement of phosphorous runoff, including ponds, filter strips, grassed waterways, fencing and field borders (Sharpley et al., 2010). All but one of the recommended practices, terracing, are included in EQIP's 2009 covered practices list.

The other federal program examined in this study is the Conservation Reserve Enhancement Program (CREP). CREP is a voluntary conservation program that allows agricultural producers to protect their land through targeted land retirement and the implementation of certain conservation practices. Through CREP, participants receive monetary incentives from the Commodity Credit Corporation (CCC) to enroll in the Conservation Reserve Program (CRP), a federal conservation program that encourages land owners to retire land from agricultural production (FSA, 2009). Participants remove cropland and pastureland from agricultural production and convert the land to non-agricultural vegetation. CREP is administered by the Farm Service Agency (FSA) and funded partly through Farm Bill legislation via CRP allocation and partly by state, tribal or other non-federal sources. Local work groups isolate agriculturally related environmental concerns, inform FSA, and together craft a project to deal with the issue. Project participation is limited to producers within the geographical area selected for the program (FSA, 2009).

Land retirement contracts featured in CREP, like CRP, last 10 to 15 years with a federally developed annual rental rate. In addition to land retirement, participants are provided information regarding recommended conservation practices that producers are encouraged to adopt. Not including a “sign-up incentive” featured in some cases, cost share for the adoption of a recommended practice is up to 50% of the cost of implementation. For the landowner this represents two benefits – it improves the environmental quality of their land, water and air, and provides a viable source of supplementary income (FSA, 2009).

The USDA has a practice of isolating regions of the United States that are of special environmental significance upon which it wishes to focus its conservation efforts. Once an area has been selected the USDA, through the Commodity Credit Corporation, and state officials enter into a CREP agreement to meet conservation goals. CREP was chosen for this study because of its application in Northwest Arkansas (FSA, 2009b). As of January 2009, the state of Arkansas and the USDA entered into a CREP agreement with the goal of reducing nutrient, bacterial and sediment loading into the waters of the Illinois River watershed, meaning that eligible land owners in Northwest Arkansas are able to access CREP funding for land retirement and conservation practice adoption (Collins, 2010). Land entered into the program must meet a few requirements, including that riparian buffers must be a minimum averaged width of 50 feet and maximum average no greater than 300 feet, that land in the program must be at least 1/10th of an acre, and that land must follow all applicable FSA and CREP regulations (FSA, 2009b).

The two approved conservation practices and their association acreage goals under the Illinois River watershed CREP are:

- CP22 Riparian Buffer (Cropland and Marginal Pastureland) – 9,750 acres
- CP29 Marginal Pastureland Wildlife Habitat Buffer– 5,250 acres

The program, viewed as a “partnership between USDA and the State of Arkansas” intends to enroll 15,000 acres of eligible pastureland and cropland in order to restore riparian buffers and wildlife habitat (FSA, 2009b). By encouraging participants to plant native grasses, trees and shrubs, conservationists intend to meet two primary goals; first, to enhance wildlife habitat in the Illinois River watershed, and second to improve water quality by filtering agricultural runoff.

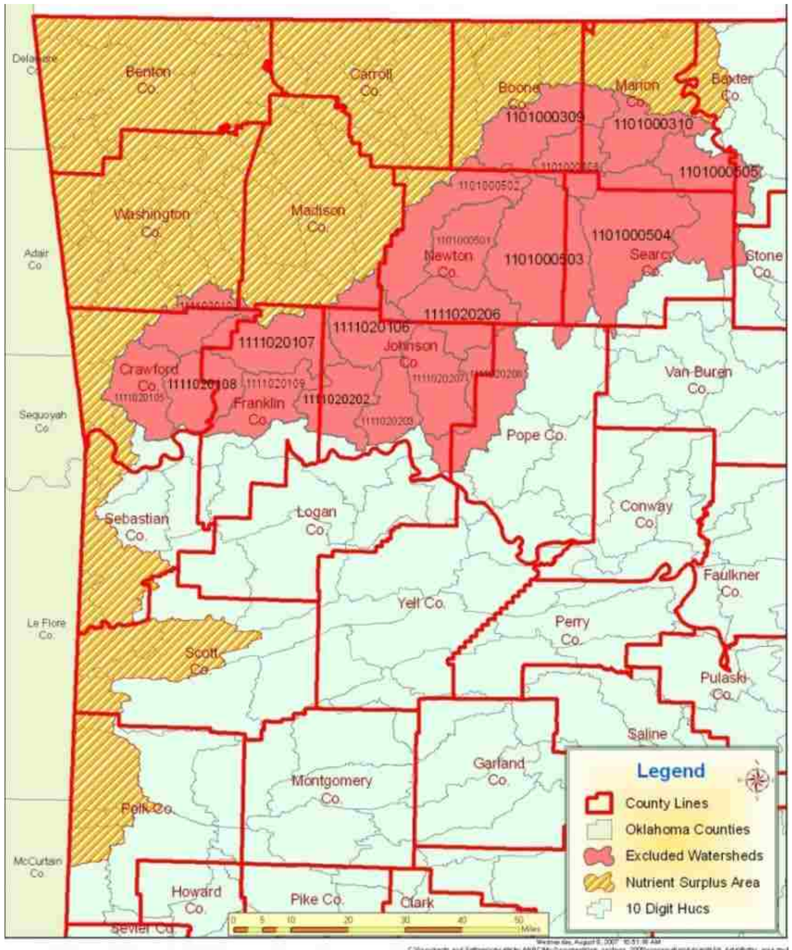
Around the country state agencies have developed their own agricultural conservation programs that are tailored to meet locally important conservation needs. In Arkansas, the Arkansas Natural Resources Commission (ANRC) has developed a program known as the Surplus Poultry Litter Removal Incentives Cost Share Program (REMOVAL) in which the cost of the transportation of poultry litter is offset with money generated by water quality bonds (Goodwin, 2008).

Created in 2007 under the legislative auspices of Act 532 of 2007, the “Surplus Nutrient Removal Incentives Act” (Arkansas Code, §§ 15-20-1201 through 1206), REMOVAL is a conservation program that provides monetary incentives in order to “encourage the removal of excess poultry litter from Arkansas’s nutrient surplus areas” (ANRC, 2007). As of 2003, major portions of Benton and Washington counties were declared Nutrient Surplus Areas (Figure 2.3), and REMOVAL is specifically tailored to meet the needs of nutrient producers in the area. For the purposes of this legislation, litter is defined as the "byproducts associated with the confinement of poultry, including excrement, feed wastes, bedding materials, composted carcasses, and any combinations thereof," (ANRC, 2007).

According to the program's rules, the ANRC may provide cost share, taken from the Water Development Fund, of up to $15 dollars per ton for the purchase and transportation of surplus litter from within any NSA. This litter is allowed to be moved anywhere within the state of Arkansas that is outside of an NSA or any of 19 excluded watersheds in the state and within 300 miles of the source. Eligible to participate in the program are entities that purchase 100 or more tons of litter from a registered poultry feeding operation and transport or arrange the transportation of the litter (ANRC, 2007).

REMOVAL, originally completely managed by the ANRC and funded by the state of Arkansas, transitioned from a full state funding to half state funding and half federal funding via the Environmental Protection Agency in May of 2009. From REMOVAL's inception in September of 2007 until March of 2009, the period of time that the program was completely state funded, total outlays were $198,783. In May of 2009, the EPA committed $125,000 to the program which was to be matched by the state of Arkansas.

Figure 2.3: Nutrient Surplus Areas in Northwest Arkansas, 2007



Source: ANRC Title XI, 2007

The ANRC also offers loans to producers who wish to utilize BMPs through the Arkansas Clean Water Revolving Loan Program (LOAN), which provides money through the EPA at a rate of 3%. The five practices covered are water recovery, irrigation reservoirs, no-till drills, stacking sheds and fencing. Because row-crop and irrigated agriculture is rare in NWA, fencing and stacking sheds, which are structures designed to prevent runoff from stacked poultry litter, are the most commonly funded practices in the area (Chandler, 2009). As of March, 2009, there had been a statewide total of 767 loans for a sum of $38,313,202.

The Arkansas Nonpoint Pollution Management Program (NONPOINT) is a state administered program that funds projects associated with the reduction of nonpoint source pollution. The program, a cooperative effort of local, state and federal agencies, distributes EPA funding to projects like BMP implementation, demonstration projects, technical assistance, education, monitoring, and BMP cost share (ANRC, 2010). NONPOINT offers grants to non-profit entities and cost-share to individual for-profit agricultural producers. These individual producers register as “Conservation District Cooperators” and, with the help of their local Conservation District, submit an application for funding of the project (Ramick, 2009).

NONPOINT funding is directed toward priority watersheds, those seen as at risk or most in need of nonpoint pollution management, as established via analysis under the Unified Watershed Analysis process and the ANRC. The current priority watersheds are as follows (ANRC, 2010b):

- Illinois River
- Upper White River
- Lake Conway – Point Remove
- Bayou Bartholomew
- L’Anguille River
- Upper Saline

Of the six priority watersheds, only the Illinois River watershed is located in Northwest Arkansas. This means that only agricultural producers in Northwest Arkansas who operate within the Illinois River watershed are eligible to receive funding from this program.

While the aforementioned programs interact with active farm practices, one program in the area was created with the goal of raising awareness of conservation efforts. The Environmental Stewardship Program was a local effort that sought to bring positive attention to land owners and agricultural operators who actively engaged in resource conservation in the Lincoln Lake Watershed. It was noted that many non-farming individuals were unaware of BMP usage in agriculture, and the Environmental Stewardship Program was an effort to spread awareness of these important efforts. In order to be eligible to participate in the program, an agricultural producer had to be executing three or more BMPs on their land and be compliant with existing regulations. The program was developed in a cooperative effort between producers and NRCS, Conservation District and Extension Service personnel. Although the Environmental Stewardship Program has been shelved for the time being, it still exists on paper and interest in reinstating it remains (Pennington, 2010). A question regarding the program was included in the survey in order to gauge awareness of the program in NWA.

The previously examined conservation efforts are all voluntary programs in which eligible agricultural producers assent to provide conservation activity for some sort of monetary premium. Some important conservation strategies, however, take the form of regulation. For example, in the state of Arkansas Soil Nutrient and Poultry Litter Application and Management Program (APPLICATION) of 2003 requires individuals who wish to utilize animal waste as fertilizer in a Nutrient Surplus Area take a course and pass a test in order to become a Nutrient Management Planner (ASNMPAC Act, 2003).

The purpose of comparing voluntary and mandatory programs is to better understand the nature of the flow of information to producers. It should be expected that a higher percentage of producers will comply with regulation than volunteer to participate in a program (Langpap and Wu, 2002), but comparing knowledge levels of the programs could reveal useful information. If, for example, more producers have heard of the management program than any of voluntary program, the implication is that efforts to provide information to farmers about the voluntary programs may have been insufficient.

If conservation behavior is thought to be optimized by maximizing participation in conservation programs, it follows that understanding the factors that motivate farmers to participate or, more importantly, not participate, is important in optimizing environmental outcomes. The objective of this study is to survey agricultural producers in Benton and Washington counties to discover perceptions and knowledge levels of EQIP, CREP and four conservation-oriented state-run programs, with an emphasis on comparing experiences and opinions of producers between state and federal programs.

Many studies have sought to discover factors that increase the likelihood of BMP adoption or conservation program participation (Asafu-Adjaye, 2008; Paudel et al., 2008; Gillespie et al., 2007), but relatively few have looked into factors that decrease those likelihoods. Fewer still, if any, have compared participation in federal and state programs in a particular region. In this research, producers with experience in conservation programs were asked specifically to compare their perceptions of these programs, what factors encouraged and discouraged program participation, whether or not the participant would recommend participation in any of the programs, and what changes, if any, could be made to improve farmer participation.

2.4. Adoption of BMPs and Conservation Programs

Lambert et al. (2006) argue that it is in the best interest for the land-owner to actively participate in land conservation programs because it is in the long-term interest of their main ownership right – their land. If this is true but participation in conservation programs is sub-optimal, we must assume there exist barriers between producers and conservation program adoption. Three major barriers seem to be a general lack of interest in participation, distrust of the programs or those who administer them, and the costs of conservation practice adoption.

It is important to note that in Northwest Arkansas sub-optimal participation in conservation programs does not necessarily translate into sub-optimal adoption of best management practices. Paudel et al. found that 80% of dairy farmers already utilized some BMPs (Paudel et al., 2008). Similarly, Gillespie et al. found that the beef cattle industry is more likely to adopt BMPs without funding than other fields of agriculture and that they do so without involvement in conservation programs (Gillespie et al., 2007). Research into the Water Quality Incentives Program, a precursor to EQIP, found that the large majority of BMP practitioners were not involved in conservation programs (Cooper, 1997). This trend reflects several things: that some BMPs truly are profit neutral and thus attractive to an operator equally concerned about conservation and profitability; that land management, to a certain extent, has become a norm for some sectors of agriculture; and that protection of natural resources is a priority for many farmers.

Producers have heterogeneous beliefs and knowledge about the effectiveness of BMPs and the outcomes of conservation program participation, and it is likely that individual producers will have varied probabilities of program adoption (Ghazalian et al., 2009). This implies that the effectiveness of conservation often relies on the motivation of the individual producer, and thus the environmental effectiveness of on-farm conservation behavior often comes down to the beliefs and knowledge of the producer. Research has found, for example, that farmer environmental awareness is equally important in pollution abatement as the actual adoption of prescribed practices, because awareness causes the farm operator to focus on active stewardship and the prevention of negative environmental outcomes (Yates, 2007). It was found that there was an apparent threshold effect for best management practices; that complex synergistic elements within conservation practices result in higher than expected marginal gains as participation increases past the threshold participation level. This implies that policy-makers have reason to focus on multiplying the adoption of conservation practices on a given farm or a specific geographical region.

Conservation officials should take note that research has shown that agriculturalists tend to group conservation practices into bundles, meaning that a producer who went through the process of implementing one type of conservation practice would naturally be inclined to simultaneously invest in other forms of conservation because some of the costs could be split amongst the various practices (Rahelizatovo et al., 2004). If this is true, it can guide the recommendations made to agricultural producers interested in environmental conservation. The combination of synergistic elements of conservation behaviors and the tendency to bundle multiple practices implies that the goal of maximizing best management practice effectiveness is feasible given willingness to adopt conservation practices.

Farmers generally perceive environmental stewardship as an aspect of agricultural operation that is secondary to profit. In specific populations, however, this is not the case. The growing subset of “hobby” and “retirement” farmers place less emphasis on profitability and more importance on lifestyle goals (Gillespie et al., 2007). Particularly pertinent to NWA is that operations with less than 50 head of cattle are especially likely to view land maintenance and conservation as high priorities (Basarir, 2002). Although these small operations seem as though they would be primary adopters for funded land conservation programs, research has shown that size of operation positively correlates with BMP adoption. This is most likely because operations of greater size face a larger opportunity cost of non-adoption for any given production practice and are more fully engaged in managing the productivity of the agricultural operation (Ward et al., 2008).

Research has shown that agricultural producers will be less likely to participate in conservation programs when there is uncertainty about the timeframe of a program's availability. When a program is available for only a short period of time, maximizing individuals will act quickly to take advantage of whatever programs best fit their needs. Uncertainty causes producers to withhold action when the time horizon of a conservation program is lengthy or hazy (Isik, 2004; Kim et al., 2008). Because most Farm Bill conservation programs have legislative lives of many years, the length of availability of these programs might actually be a factor that decreases participation. It might prove to be true that if the window of availability of conservation programs was shorter, program adoption would increase. In its current state, with programs lasting many years, there is little incentive for agricultural producers who are uncertain about conservation programs to go through the steps necessary to participate in them at any given time.

While uncertainty in the timeline of a program leads to decreased participation, uncertainty about the background threat of increased regulation is likely a factor that increases participation in conservation programs. If voluntary participation in conservation programs is seen as a means to reduce the probability of mandatory regulation, then participation will be higher. In this case, participation is seen as a defense against regulation. Such situations in which voluntary participation serves as an assurance against future regulations are socially optimal and maximize participation, but are less than optimal in terms of resulting levels of conservation than mandatory regulation (Langpap and Wu, 2002).

Conservation programs are not without flaw or controversy. EQIP administrators were confronted with a rules issue that created a situation in which conservation behavior was not maximized. Prior to a major legislative overhaul with the 2002 Farm Bill legislation, contracts for EQIP funding were won through a bidding process in which state administrators selected those projects that contained the maximum amount of conservation activity. Participants would over-promise in order to secure project acceptance and then back out of practices they never intended to pursue. USDA research found that 17% of the individuals who signed an EQIP contract withdrew one or more practices (Cattaneo, 2003). The problem was resolved in 2002 with adjustments to the program, but it highlighted the fact that agricultural producers are intelligent, maximizing agents who would most certainly take advantage of loopholes in program rules.

The combination of a large population of agricultural producers and a bevy of complicated rules, paired with the diffuse nature of non-point pollution naturally leads to issues of low participation and free-ridership, defined as a situation in which one party is able to enjoy the benefits of a public good without paying a share of the cost of its provision and maintenance (Daley and Farley, 2004). Because these limiting factors are inherent in voluntary conservation, policy-makers are forced to examine methods of creating a communal sense of environmental stewardship to combat them. Understanding the three major underlying factors – economic, social capital and social values – are crucial in creating cooperation amongst farmers and between farmers and government officials (Lubell, 2004). These distinct factors must also be considered in the process of program development; that producers will be making their decision to participate based on many points of reference, including personal opinions about conservation and its effectiveness (Lynne et al., 1988). With the goal of understanding commonly held attitudes, survey participants were asked to describe their opinions and shared experiences regarding state and federal conservation programs.

The assumed goal of farm production is to maximize profits subject to technical and economic limitations (Ward et al., 2008). Profit maximizing agricultural producers will seek to gain all of the information that they can and will almost always choose to avoid instances of environmental regulation. The development of norms of reciprocity and networks of engagement helps to alleviate and maximize social capital gained from conservation behavior. When the agricultural sector has developed a sense of communal responsibility for the environment in which they work, they will be better able to self-monitor and pass conservation knowledge within the community. Finally, the recognition that every individual has unique social values that influence conservation behavior decisions is key in creating cooperation (Lubell, 2004). There are many individuals who place equal weight on environmental stewardship and the feeling of personal freedom, or feel as though it is not appropriate for government entities to engage in interfering activities. These individuals, in spite of the fact that they may hold positive views of conservation behavior, might choose to not become involved in a government run conservation program because of perceived restrictions on personal decision-making. Even if the individual holds in common the views of conservation and wishes to adopt BMPs the cost alone could be enough to turn away a profit-maximizing producer.

One way that the government chooses to circumvent this reality is through funded cost-share for selected conservation practices. EQIP provides funds to offset some of the costs associated with the adoption of selected BMPs, defined as land management strategies that prevent or reduce the movement of sediment, nutrients, pesticides and other pollutants from the land to surface or groundwater (Pennington, 2008). Examples of common agricultural BMPs are prescribed grazing, field boarders, nutrient and waste management, and no-till cropping (Paudel et al., 2008; Gillespie et al., 2007; Aigner and Hopkins, 2003). A number of these BMPs have been developed specifically for the reduction of potential negative impacts from both cattle and poultry production.

EQIP offers funding and technical assistance to agricultural producers in exchange for the adoption of selected best management practices. In order to secure funding, however, farmers are asked to sign a contract guaranteeing sustained usage of the practice throughout the life of the contract, which is usually between 5 and 10 years, and the promise to only use approved materials. There is valid concern that producers feel as though the hassle of dealing with contractual obligations and agency personnel, as well as the requirement that farmers "overbuild" by utilizing expensive new materials, is not worth the money granted (Pennington, 2008; Foster, 2008).

In order to maintain flexibility and relevance, the BMPs that are covered by cost share with EQIP are determined at the state level. Priorities are locally determined in each conservation district with the aid of working groups of local stakeholders who provide input about those issues that are regionally important. In spite of the availability of funding and the increased scrutiny upon agriculture in Northwest Arkansas as a result of widely covered water-quality disputes with the state of Oklahoma, applications to the

EQIP program are relatively low. Between the years of 2007 and 2008, there were a combined 185 applications to EQIP between Benton and Washington counties (Mobley, 2009). Of those 185 applications, 119 were accepted (AR NRCS, 2009). An acceptance rate of 65% is fairly high, implying that the problem with EQIP adoption does not lie within acceptance, but within application. But why would agricultural producers choose to not participate in conservation programs?

While participation in NWA is generally fairly limited (Table 2.1), Benton County is more involved in EQIP than Washington County, despite their similarities in producer population. Between 1999 and 2008, there were 671 approved EQIP contracts in NWA. Of those 671 contracts, 502 were from Benton County (NRCS, 2008). The most common practices funded were heavy use area reinforcement, fencing, prescribed grazing, and pond development.

Despite NWA's statewide agricultural importance, EQIP participation doesn't match that of other regions of the state. Benton County's 68 approved contracts from 2007 to 2008 represents only 2.2% of the state's EQIP contracts, despite holding over 4% of the state's farms (NASS, 2007). Similarly, although the 2,915 farms of the county represent almost 6% of the state's total (NASS, 2007), Washington County accounted for around 1.5% of the 3,065 contracts approved over that time span in the state (NRCS, 2008). This discrepancy in funding does not necessarily imply bias in statewide funding allocation, but could be indicative instead of a simple lack of applicants. In 2007, there were 84 applications for funding between Benton and Washington counties combined, which amounted to 3.7% of the 2,232 applications statewide. Similarly in 2008, there were 101 contracts in NWA, 4% of the state total (Mobley, 2009).

Table 2.1: Conservation Program Participation, NWA

Program	Year	Number of Applications	Number of Acceptances	Dollars Allocated
EQIP	2007	84	51	$651,704.68
	2008	101	68	$740,635.36
CREP	2009	Unknown	2	$25,000,000 for total project
LOAN	2007	29	29	$704,517
	2008			
NONPOINT	2007	140	140	$1,109,800+
	2008			
REMOVAL	2007	59	55	$198,783
	2008	38	37	$125,000+

Sources: Mobley, 2009; Collins, 2010b; Chandler, 2009; Alberson, 2010

Participation in CRP, CREP and the state conservation programs is similarly low. Of the 144,929 acres enrolled in traditional CRP in the state of Arkansas (USDA, 2008), only 122 acres are in Benton or Washington counties (Colvard, 2010). This low participation in CRP in NWA is expected, however, as very little of the agricultural land in the area is historically used in crop production. Participation in CREP is equally limited, although perhaps only because of the program's newness; whereas CRP has been included in Farm Bill legislation since 1986, CREP was initiated in the Illinois River watershed in January of 2009. As of September, 2010, there were two CREP contracts signed, with one each from Benton and Washington counties (Collins, 2010b).

Through the LOAN program, as of March 2009, the state had made 29 loans in Washington and Benton counties which averaged $24,293 per loan. Total outlays in NWA from the program's inception to March, 2009, $704,517, with poultry farm stacking sheds being the most common practice funded (Chandler, 2009).

From REMOVAL's inception in 2007 until March of 2009, the time period that the program was completely funded by the state, there were a total of 55 contracts in Northwest Arkansas. Of the total, 37 originated in Benton County and the other 18 from

Washington County. During this period, there was one additional (Washington County) application that was rejected. In terms of dollars funded, Washington County applicants received $159,891 and Benton County applicants received $38,892 (Fisk, 2010).

As REMOVAL transitioned to half federal funding, applications concurrently rose. In less than one year, from May 5, 2009 to April 19, 2010, there were 35 Washington County participants and 12 from Benton County with one application rejection between the counties (Fisk, 2010).

NONPOINT receives its funding from the EPA and directs it toward special "project areas" determined through watershed-level assessments. There were a combined three projects in NWA between 2000 and 2008, with a total of 140 individuals applying for funding (Table 2.2).

Table 2.2: NONPOINT Applications, 2000-2008

Targeted Waterway	Number of Applicants
Spavinaw Creek, Benton Co.	54
Ballard Creek, Washington Co.	32
Illinois River, Benton Co.	54

Source: Alberson, 2010

A common thread for these programs is low participation by producers in NWA. The issue of non-adoption reveals the difficulty associated with completely voluntary, ad hoc adoption of best management practices – it tends to eliminate the scale related environmental benefits of conservation behavior. For example, some water-quality focused BMPs tend to display synergistic outcomes with one another – BMPs that are adopted across a widespread area or watershed will tend to improve water quality beyond what might be expected from the predicted results on the per farm basis (Yates, 2007). These synergies are lost with geographically sporadic BMP adoption within a region or watershed, thus reducing the overall effectiveness of such actions.

In this context the benefits of conservation programs become clear – using federal or state funding to encourage the widespread adoption of best management practices in a region or watershed will theoretically have the effect of intensifying conservation behavior in that area and increase the positive environmental outcomes in that area. The goal of maximizing these synergistic elements is reflected in the targeting of programs.

From the perspective of conservation administrators, EQIP's covered practices are updated frequently, regionally flexible, and developed at the state level, allowing them to be targeted to immediate local environmental concerns (NRCS, 2009). CREP is a completely regional program in which certain regions are selected by a national committee based on environmental concerns with the goal of maximizing the aggregated effect of many separate conservation activities in that particular area. The Surplus Poultry Litter Removal Incentives Cost Share Program was developed with NWA in mind, as it is a fairly unique area of the state in regards to poultry litter production. Similarly, the Arkansas Soil and Poultry Litter Application and Management Program regulation is fairly focused on production and environmental issues found in Northwest Arkansas.

If these programs are indeed targeted to meet the needs of NWA, what accounts for the low level of applications in these programs in Benton and Washington counties? The body of literature suggests that factors like operator age and race, educational attainment of the principal operator, on and off farm income and several other demographic and choice variables significantly affect both conservation views and conservation behaviors (Gan et al., 2009; Ghazalian et al., 2009; Ward et al., 2008). In a study of small farmers' reasons for not participating in CRP, researchers found that participation was most significantly negatively affected when crop production was a significant source of income or if the farmer was a tenant (McLean-Meyinsse et al., 1994). This negative correlation is logical because CRP requires producers to retire land from production for long periods of time, which makes much more economic sense for owners of marginally productive land or those who have off-farm income than for those who rely on their agricultural production. Research on CREP found that development pressure and the percentage of land developed with irrigation were both significant and negative indicators, meaning that farmers with both or either of those factors in play may be less likely to participate in a land retirement program (Suter et al., 2008). If these findings translate to Northwest Arkansas producers, the implications are important. Most farmers do not rely solely on income derived from agricultural production, agricultural land is undeveloped, with only 1,186 acres in irrigation out of almost 600,000 acres in agriculture in the counties (NASS, 2007), and the pressure of urban and suburban development has been high for several years.

Individual farm operator characteristics have been used to describe reasons for non-adoption of best management practices and non-participation in conservation programs. Operator age, on and off farm income, farming experience, farm size, education, contact with conservation organization personnel, nearness to retirement, membership in a production organization, perception of environmental degradation as a problem, land ownership status, the likelihood of environmental regulation and many other factors have been correlated with conservation behavior (Ghazalian et al., 2009; Ward et al., 2008; Obubuafu, 2008; Paudel et al., 2008; Asafu-Adjaye, 2008; Rice et al., 2007; Gillespie et al., 2007; Rahelizatovo et al., 2004; Langpap and Wu, 2002; Soule et al., 2000; Traore et al., 1998; Lynne, 1988).

By analyzing data gathered from surveys delivered to potential conservation program participants in Northwest Arkansas, we hope to add to the body of literature about program adoption and help to mold conservation policy to better target those individuals who might participate but for lack of knowledge or negative perceptions of the programs.

2.5. Survey Design

There is a wide body of literature written with the intent to aid the reader in the development and analysis of surveys (Dillman et al., 2009; Dillman, 2000; Rea and Parker, 1992; Thibault and Kelly, 1952; James and Bolstein, 1992). Some of the most important information provided are examples and definitions of key statistical terms, including accuracy, sample and error in the framework of a survey.

Accuracy in surveys specifically relates to the proximity of the results to the "true population value." A sample is a subset of individuals chosen with specific intent or at random from a greater population. Samples are taken in order to save time and money and because, when done correctly, they can represent the greater population very accurately (Dillman et al., 2009).

Questionnaire design is the basis for solid survey research (Dillman, 2000). When designing a question, the researcher should always keep in mind the clarity of questions, the thoroughness of the range of questions and the perceived appropriateness of the questions (Rea and Parker, 1992). Questions should be kept simple and the structure and syntax of the questions should remain consistent throughout the survey (Dillman et al., 2009). Using emotional language or setting up questions from a specific mindset or opinion will lead to biased results (Dillman, 2000). Once the survey is complete, it is important to utilize a test group, when possible, to identify problems in question design and any confusing structural issues (Dillman et al., 2009).

In any survey there are four major types of error that need to be avoided in order to secure valid and reliable data. Sampling error occurs when one is unable to achieve the necessary amount of observations or his or her population is not appropriately balanced between various strata. Measurement error is the result of questions that are presented or obtained in a way that makes comparison to other answers to the same questions meaningless. Nonresponse error is the result of too few of the desired population participating in the project and the responding group not being an accurate reflection of the population. The final type of error is coverage error, which occurs when the probability of any given individual in the population receiving the survey is not equal across the population (Dillman et al., 2009).

Although the formation of the questionnaire is important for the success of a survey, the primary determinant of response rates is method of implementation. The five major methods for survey delivery are (1) face-to-face, in which the respondent is interviewed in person, (2) telephone, in which the respondent is interviewed on the telephone, (3) mail-in, in which surveys are mailed to preselected addresses, (4) drop-off, in which surveys are hand delivered to potential respondents, and (5) internet, where any of the previous techniques are implemented on-line (Dillman, 2000). Each method is effective in its own way, and each method has its limitations (Rea and Parker, 1992). Selecting the appropriate method of implementation based on time and resources is key to survey success. Due in part to the large population examined limited resources, and the length of the survey instrument, the face-to-face and telephone forms of survey distribution were dismissed as options. As e-mail addresses were not readily available and internet correspondence with agricultural producers would be unlikely to yield satisfactory results, the mail-in method was chosen.

The importance of timing in the development and delivery of a survey is easy to underestimate. Rea and Parker suggest time frames of 14 weeks for mail-out surveys, eight weeks for telephone surveys and 18 weeks for face-to-face surveys (Rea and Parker, 1992). Needless to say, a well organized survey is not a short process. Another aspect of timing that is often overlooked was discovered in the course of survey distribution in this study. This aspect is the relationship of timing to the unique characteristics of a studied population. As an undergraduate, the researcher made an early attempt at delivery of a survey similar to the one used in this research in the spring of 2008. Spring is a time when agricultural producers are especially busy and distracted with day to day affairs, and the results of this first attempt were limited enough as to not produce data of any value. Had this unique aspect of the population been noted and accounted for when the initial timeline was developed, some distribution problems could have been avoided. This issue was taken into account on the second attempt by delivering the surveys in the winter of 2009, when farming responsibilities are considerably lower.

Another aspect of the survey development and implementation process that is initially more difficult to comprehend is the relationship between the survey and the human psyche. The “Social Exchange Theory” is a framework for studying and predicting human interaction in a scientific manner (Dillman, 2000). In essence, the theory posits that every human interaction is led by an inherent cost-benefit analysis and comparison of alternatives (Thibault and Kelly, 1952). Therefore, when applied in the realm of survey research, it becomes apparent that the respondent needs to get *something* out of the process if he or she is going to complete the survey.

There are three major components necessary to understand the individual's decision making process, which are rewards, costs and trust (Dillman et al., 2009). In developing a survey, it is very important to keep rewards high, costs low and attempt to develop some kind of trust. It is not as simple, however, as providing a promise of riches or the opportunity to win a new car. There are times when the actual delivery of a small, token gift is much more effective than promising something much larger (James and Bolstein, 1992). This is because a small gift, for example a five dollar bill, accompanying a survey or questionnaire makes the recipient instantly feel indebted to the researcher. Although the previous example involved the transfer of money, a token offering can be something as ethereal as thanking the recipient in advance or informing the individual of the importance of participation. This indebtedness can lead to a sense of responsibility to complete the survey. The promise of a reward or the chance of earning something larger upon completion is completely different in the mind of the recipient, because he or she will view the reward as a payment for work completed, which is something much more easily ignored (Dillman et al., 2009). Due to financial constraints, no token offerings were made in the delivery of the survey used in this research.

It is important for anyone wishing to develop and administer a survey that will yield valid data and be organized in an effective, efficient manner to utilize the resources provided by scholarly studies of the process. An effective survey needs researched and statistically relevant questions, an accurate sample population, methodological distribution and a strategic plan dealing with the inherent social exchange represented by asking someone to fill out a questionnaire.

2.6. Theoretical Foundation

The encompassing theory of technology adoption, in this case the adoption of conservation programs, relies on the assumption that producers are profit maximizers (Equation 2.1). The traditional framework for this assumption is mathematically modeled with a simple single good profit maximization function (Varian, 1992):

(2.1)

- Where p is the price of the output;
- *w* is vector of factor prices;
- *x* is input and;
- is output.

Using a slightly modified version of this framework, program adoption will occur if:

$$\pi\ (p,w) = \max\ pf(x_i) - w_i x_i \quad \leq \quad \pi\ (p,w)\ \max\ pf\ (x_j) - (w_j)x_j + C \qquad (2.2)$$

- Where C is the fixed cost of conservation practice implementation;
- is a vector of factor prices under normal conditions;
- is a vector of factor prices under conservation program participation;
- x_i is input associated with production without program participation;
- x_j is input associated with production with program participation;
- $f(x_i)$ is output without program participation and;
- $f(x_j)$ is output with program participation.

A second method for understanding program adoption likelihood lies in the utility maximization paradigm (Equation 2.3). Decision to participate shown via a probability model in which y_i is a binary variable in which a value of 1 indicates participation and 0 is non-participation in a given conservation program. The decision to participate will only occur if the utility derived from participation is greater than not participating, as determined by a set of choice attributes and demographic characteristics of the individual which will be inherently unique to that individual (Equation 2.3). These attributes and their expected relationship to program adoption are highlighted in Table 2.3. In this case, the probability of program adoption is:

(2.3)

- Where X_i' is a set of choice attributes and demographic characteristics of the operator and;
- β_i is a vector of coefficients to be estimated

Table 2.3: Covariate Expected Signs for Conservation Program Adoption

Positive (+)	**Negative (-)**	**Uncertain (+/-)**
On Farm Income	Nearness to Retirement	Age
Years Farming Experience	Land Development Pressure	Off Farm Income
Contact with Conservation Personnel	Primarily Land Renter	Environmental Perceptions
Education		
Farm Size		
Primary Land Owner		
Perceived Regulation Environment		

Because of the dichotomous nature of the dependent variables examined in this study (yes/no to knowledge and participation), it becomes possible to use Logit analysis. The Logistic distribution is represented by the equations 2.4 and 2.5 (Weisstein, 2010):

(2.4)

and:

(2.5)

A binomial logit model is a technique that allows the use of dummy dependent variables and avoids boundary issues by using the cumulative logistic function in equation 2.6:

(2.6)

- Where is a dummy variable;
- β_0-β_{2i} are estimated coefficients;
- X_1-X_{2i} are choice variables and;
- is an estimated error term.

The expected value of is the probability that the *i*th person will fulfill the positive expectations of the model, here meaning knowledge of or participation in a given conservation program. Although logit models cannot be estimated using traditional "Ordinary Least Squares" methodology, Maximum Likelihood (ML) estimation proves robust for this kind of analysis (Studenmund, 2001).

In order to better understand the factors that influence program awareness, application and participation, several types of statistical analysis were utilized for this research. Those tests are discussed in the following chapter, along with the development and delivery of the survey instrument.

Chapter 3. Methods

3.1. Introduction

This chapter describes in five sections the methods used to gain better understanding about producer knowledge levels, participation rates and opinions of agricultural conservation programs in Northwest Arkansas. The second section covers the development of the survey instrument used in the research. The third section examines the study area in which the survey was delivered, the delivery of the survey, and the response rate of surveys distributed. The fourth section details the statistical tools used for data analysis. The fifth section details the hypotheses tested.

3.2. Survey Development

The survey questionnaire was developed over a period of months through a process of literature review and interviews with conservation personnel. The survey consisted of six primary sections with 33 total questions and a seventh section in which participants were invited to leave comments. The survey is presented in Appendix B. Questions generally focused on conservation program experience, opinions about the programs and demographic information.

The first (1) section dealt with EQIP and CREP, asking participants to disclose knowledge of and participation in the federal programs and their sources of information for these programs. Any individual who had applied for funding through one or both of the programs was asked to relay if they were funded, and if so, what practices were funded and their satisfaction with the experience in the program.

The following two (2,3) sections ask similar questions regarding two state funded conservation programs, LOAN and NONPOINT, and two poultry specific conservation programs, APPLICATION and REMOVAL. The greatest difference between Section One and Sections Two and Three of the survey was the suggested list of organizations through which information could be gathered by producers on the federal and state programs.

Section Four (4) asks participants to provide feedback – both positive and negative - based on their experiences and knowledge of the programs. A major portion of the section is dedicated to understanding the factors (positive and negative) that influence participation in the program. The fifth section (5) of the survey is shorter than the rest and consists of questions about the Environmental Stewardship Program, Local Led Work Groups, and Nutrient Management Plans. Participants were asked about participation and awareness in these activities. The sixth section (6) focuses on demographic information, including: acreage owned and rented, years in agricultural operation, county or counties of operation, on-farm income, long-term anticipated land use, education, age and agricultural activity.

3.3. Study Area and Survey Delivery

The study area selected for this research is broadly described as Northwest Arkansas; specifically, the study focuses on agricultural producers in Benton and Washington Counties (see Figure 2.1). Given the producer population of 5,066 farms (NASS, 2007) across both counties, 357 responses are necessary to achieve a 95% confidence interval and a 5% margin of error (Raosoft, 2009).

With an assumed response rate of 20%, 1,785 surveys would be ideally delivered to achieve responses from the desired 357 producers. The initial mailing took place in November, 2009. Given financial constraints, only 1500 surveys were sent. Three follow up mailings to non-respondents were sent in December, 2009, January, 2010, and March, 2010. The total number of surveys delivered was approximately 3,500. All mailings of the surveys were delivered with an accompanying postage paid, pre-addressed envelope. The final mailing included an additional insert on yellow colored paper with the intention of capturing the producer's attention and increasing response rates (Appendix C).

Addresses for Washington County farmers were obtained from the Washington County Cooperative Extension Service. Benton County addresses were obtained from a list of rural addresses provided by the Benton County Tax Assessor's office. Rural addresses were filtered based on acreage and selected randomly.

3.4. Data Collection

After being reviewed for obvious errors or incompletion, data from returned surveys were entered into Microsoft Excel spreadsheets twice; once by the primary researcher and once by a pair of research assistants. These two spreadsheets were compared with one another to identify any errors in data entry. The formatting of the survey created data in continuous form for three questions (years of farming experience, acreage owned and acreage rented), while the rest of the data were discrete numeric or categorical data.

After the data set was finalized, summary statistics - basic count analysis on nominal variables and measures of central tendency on continuous variables - were computed using Microsoft Excel. After this initial analysis, data were input into SAS for more in depth analysis, with the goal of finding variables that would prove significant in determining conservation program knowledge and participation.

3.5. Data Analysis

Initial data analysis consisted of summary statistical testing using the SAS software package. The methods used for this section, and their associated SAS commands, included frequencies (PROC FREQ), cross-tabulation tables (TABLE), chi-square analysis (CHISQ), and t-tests (PROC TTEST). The variables used for this basic analysis generally corresponded directly with data gathered from specific questions in the survey (Table 3.1). Frequency testing allowed for easy, surface level analysis of the survey results and allowed for data inconsistencies to be easily isolated. Cross-tabbed tables were created for several variables; most notably Information Source and County of Operation, to better understand the distribution of those variables when compared with program knowledge, application and participation.

Table 3.1: Variables Used for Basic Data Analysis

Variable Name	Type	Description
Acres Owned	Continuous, Ordinal	Total acres owned that were used in production in 2009.
Acres Rented	Continuous, Ordinal	Total acres rented that were used in production in 2009.
Acres Total	Continuous, Ordinal, Computed	Sum of Acres Owned and Acres Rented.
Years Operated	Continuous, Ordinal	The number of years, including 2009, that farm/ranch activities have taken place at the current location.
County	Discrete, Nominal	Primary county in which the participant's agricultural operation is located.
Age	Discrete, Nominal	Age of the operation's principal operator.
Operation	Discrete, Nominal	Type of activities engaged in on the participant's agricultural land in 2009[1].
Education	Discrete, Nominal	Highest level of education attained by the owner/operator of the agricultural operation.
Continue Operation	Discrete, Nominal	Survey Respondent's intention for the use of his or her farmland in the long term.
Income	Discrete, Nominal	Gross income from agricultural activities in 2008. Does not include income earned off-farm.

Chi-square analysis (Equation 3.1) on tables of variables was completed in order to test hypotheses relating to direct relationships amongst survey variables (H_O 1- H_O 4**)** presented in section 3.7. Goals of testing included determining if there were significant differences between Benton County and Washington County survey participants and contrasting the key demographic indicators of survey participants with NASS data at the county and regional level. Chi-square is a test statistic such that (Lind et. al, 2005):

(3.1)

[1] Options presented in the survey for type of agricultural operation were: Broiler Houses, Other Poultry, Beef Cattle, Dairy, Swine, Other Livestock, Hay Production, Pasture Production, Tree Farming/Logging, Vegetable Production, Fruit Production, and Other Agriculture.

- With k-1 degrees of freedom, such that:
- K is the number of categories
- F_0 is an observed frequency in a particular category
- F_e is an expected frequency in a particular category

In order to complete chi-square analysis, some variables had to be altered from their original form in order to be compared with NASS Census of Agriculture data (Table 3.2). The original groups developed for this research are presented in the survey instrument (Appendix B). The variables altered for this analysis were: (1) Total Acres, (2) Years Operated, (3) Age and (4) Income. The other variables that were compared with NASS data using the chi-squared technique were: Acres Owned, Acres, and Years Operated.

Table 3.2:Variables Altered for NASS Comparison

Name	Type	Groups Created					
Acres Total	Discrete, Nominal	1 thru 9	10 thru 49	50 thru 179	180 thru 499	500 thru 999	1,000 or More
Age	Discrete, Nominal	< 25	25 to 34	35 to 44	45 to 54	55 to 64	> 64
Income	Discrete, Nominal	$1 to $4,999	$5,000 to $9,999	$10,000 to $24,999	$25,000 to $49,999	$50,000 to $99,999	$100,000 or more
Years Op.	Discrete, Nominal	2 years or less	3 or 4 years	5 to 9 years	10 years or more		

A final comparison between survey and NASS data involved the reported type of agricultural operation. Separate analysis of this variable, *Operation*, was necessary due to a low level of responses for some of the operation types (low level is traditionally less than five). Chi-square analysis of the variable was compared in a two by two table with NASS data by utilizing Fisher’s Exact Test. Fisher’s Exact Chi-Square Test is a method that uses a slightly different and more precise calculation than traditional chi-square testing and provides accurate results for this situation (Dodge, 2003).

The t-test is a valuable tool that can help determine whether or not there exists a significant difference in means between two groups. Because the t-test cannot operate on nominal level data, however, it had limited application with the data generated from the survey used in this research. Of the variables directly measured in the survey, three were suitable for t-testing: Acres Owned, Acres Rented and Years Operated. Acres Owned and Acres Rented were further developed into three more variables: Acres (a combined measure of Acres Owned + Acres Rented), AcresOwnPct (percentage of the total acres measure that was owned) and AcresRentPct (percentage of the total acres measure that was rented). In total there were six variables used in t-testing to determine if significant differences existed in knowledge levels between producers of different farm acreages.

In order to measure the effects of explanatory variables, several tests of correlation were executed, including the Pearson Chi-Squared Test, the Pearson Correlation Coefficient, and Kendall's Tau-b (Kendall's τ-b). The Pearson Chi-squared Test is one of the most widely used tests to compare data derived from a sample to population data. If the results from a given test result in a p-value that meets the researcher's selected criteria, p=<0.0500 for this study, then it is supposed that the sample data are significantly different from the data with which they are being compared, in this case NASS Census of Agriculture data (Lind et al., 2005; Dodge, 2003).

The Pearson Correlation Coefficient, also known as the Pearson's ρ, describes the strength of the relationship between two sets of interval or ratio-scaled variables (Lind et al., 2005). The test of Pearson's ρ uses the scaled sum of squares method comparing entries from each of the groups to come up with a coefficient of correlation. The results of Pearson's ρ range from negative one (-1) to positive one (+1), with a value of negative one implying a negative perfectly monotonic relationship, a score of zero implying no correlation, and a score of positive one implying a positive perfectly monotonic relationship (Lind et al., 2005; Dodge, 2003).

In one case two binary variables were tested for correlation. In this situation, SAS utilizes the Phi-Coefficient for its test statistic, a measure which yields results that are identical to Pearson's ρ (Dodge, 2003). As with Pearson's ρ, a phi-coefficient closer to positive one implies positive correlation while closer to negative one implies a negative relationship and a value near to zero implies no statistical correlation. The binary variables tested in this way were EQIP participation by awareness of other programs, the results of which are presented in chapter four (Table 4.11).

Kendall's τ is a test of statistical correlation used by SAS in which a bivariate normal distribution is assumed and correlation is estimated based on the number of inversions in one ranking compared with another. Kendall's τ-b, specifically, tests the strength of association of cross-tabulated ordinal level data. As with Pearson's ρ, the results of Kendall's τ-b range from negative one (-1) to positive one (+1), with a value of negative one implying a negative perfectly monotonic relationship, a score of zero implying no correlation, and a score of positive one implying a positive perfectly monotonic relationship (Lind et al., 2005; Dodge, 2003).

Associated with most of the tests is Asymptotic Standard Error (ASE). ASE is an estimate that can provide an approximate confidence interval for a given point estimate (Dodge, 2003) and is the preferred measure of error used by SAS in logit analysis. As with the p-value in other analysis, the benchmark ASE used for this research is to not reject when the ASE=<0.0500.

After the raw survey data had been examined using basic frequency, cross-tabulation and chi-squared analysis, it became clear that the groups of some of the explanatory variables needed to be collapsed due to low or zero counts in response categories to be usable in modeling. Contrast analysis (CONTRAST) was completed to identify which variables needed to be reduced and in what way. This procedure examines the variance of parameters to see if there is a significant difference between two sub-groups within a set of values (Dodge, 2003). A result indicating a significant difference between two groups means that it would be inappropriate to combine the groups.

3.6. Logit Model

One major goal of this thesis was to identify through modeling factors that influenced program knowledge, program application and program participation. In each model, the dependent variable is a binary or dichotomous measure where 1 = Knowledge/ Application/ Participation and 0 = No Knowledge/ No Application/ No Participation. A dichotomous dependent variable makes traditional Ordinary Least Squares (OLS) estimation impossible, thus it is common to estimate the Maximum Likelihood Estimation (MLE) parameters with a cumulative distribution function (CDF) and to use logit or probit models. MLE is an efficient method of determining the parameters that maximize the probability of the sample data, which works by assuming the known likelihood (based on observations) is a maximum (Weisstein, 2010b). While the probit model assumes a normal distribution, the logit model assumes a logistic distribution, which closely approximates the normal distribution but is more heavily weighted in the tails (Dodge, 2003). The logit model was used to test the determinants of program awareness, but because the data for program application and participation were not plentiful enough, logit modeling for those variables was not completed.

Initially six separate logit models (one for each conservation program) of factors that influence program awareness were developed. In order to successfully implement Logit modeling with the limited dataset some alterations to the data had to be made, often by transforming discrete numeric data into binary data (Table 3.3). The independent variables tested in these models were: (1) Total Acres, (2) Years of Operation, (3) County of Operation, (4) On-Farm Income, (5) Age of Principal Operator, (6) College Education, (7) Animal Agriculture, (8) Continue Operation and (9) Sources of Program Information. Additional specifications were conducted as variables were eliminated if found to be insignificant in the modeling process.

In addition to testing for factors that influenced program knowledge, as mentioned, two major goals of the study were to test factors that influence program application and program participation. However, given the limited number of respondents who actually applied for or participated in the programs, such analysis was impossible. Although this rendered impossible testing of two major goals of the study, the modeling of program awareness provided interesting results and implications for conservation policy in Northwest Arkansas.

Table 3.3: Description of Variables Used in Logit Modeling

Name	Type	Description
Acres	Continuous, Ordinal, Computed	Sum of Acres Owned and Acres Rented
Years Operated	Continuous, Ordinal	The number of years, including 2009, that farm/ranch activities took place at the current location
County	Binary	Benton County = 1, Washington County = 0
Income	Discrete, Nominal, Grouped	Gross income from agricultural activities in 2008. Grouped in the same manner as presented in table 3.2.
Sources 1-5/6	Binary	Five information sources for EQIP and CREP, six for LOAN, NONPOINT, APPLICATION and REMOVAL. Received information = 1, No information = 0.
College Ed	Binary	College Degree = 1, No Degree = 0
Animal	Binary	Whether or not the participant indicated some form of animal agriculture on his or her farm operation. Animal Agriculture = 1, No Animals = 0
Continue	Binary	Survey Respondent's intention for the use of his or her farmland in the long term. Continued Agricultural Operation = 1, Halt Operation = 0
Under Fifty-Five	Binary	Age of Primary Operator Below 55 = 1, Age of PO Above 55 = 0

3.7. Hypothesis Testing

In this study, eleven different hypotheses were tested:

- **H_O 1:** *Survey response data is* ***not*** *significantly different from Washington and Benton County Census of Agriculture data for Total Acres, Years Farmed, Age of Principal Operator, Education of Principal Operator, On Farm Income and Agricultural Operation.*

- **H_O 2:** *There will be* ***no*** *difference in survey respondents' awareness among conservation programs*

- **H_O 3:** *There will be* ***no*** *significant difference in survey respondents' application among conservation programs.*

- **H_O 4:** *There will be **no** significant difference in survey respondents' participation among conservation programs.*

- **H_O 5:** *There will be **no** significant difference in survey respondents' application success rates among conservation programs*

- **H_O 6:** *There will be **no** significant difference in survey respondents' program awareness by Acres Owned, Acres Rented, Total Acreage or Years Operated*

- **H_O7:** *There will be **no** significant difference in survey respondents' program awareness by County of Operation, Age of Principal Operator, On Farm Income or Education of Principal Operator.*

- **H_O 8:** *There will be **no** significant difference in survey respondents' program awareness given participation in a different program.*

- **H_O 9:** *The demographic and choice variables Acres, Years Operated, County, Income, Age, Education, Operation Type, Long Term Farm Plans and Information Source will have **no** significant effect on the likelihood of program **awareness**.*

- **H_O 10:** *The demographic and choice variables Acres, Years Operated, County, Income, Age, Education, Operation Type, Long Term Farm Plans and Information Source will have **no** significant effect on the likelihood of program **application**.*

- **H_O 11:** *The demographic and choice variables Acres, Years Operated, County, Income, Age, Education, Operation Type, Long Term Farm Plans and Information Source will have **no** significant effect on the likelihood of program **participation***

Results from testing the hypotheses using the mentioned statistical techniques are presented in the following chapter.

Chapter 4. Results

4.1. Response Rate

Of the 1,500 addresses that were surveyed, 269 return reply envelopes were received. Of these, 70 were unusable because of incorrect address or the recipient did not engage in agricultural activities. Another 25 of the surveys were completed by agricultural producers who ran operations that were located primarily in counties other than Benton or Washington or chose not to answer the question. This left 174 usable surveys for data analysis. In terms of addresses surveyed, this is a response rate of 12%, well below the desired 20%. Considering that Northwest Arkansas has a farming population of 5,066, a respondent sample of 174 is below the 357 necessary responses for a 95% confidence interval. Because of this, any data analysis done on the data set is tempered by a 7.05% margin of error and a confidence level of 83% (Raosoft, 2010).

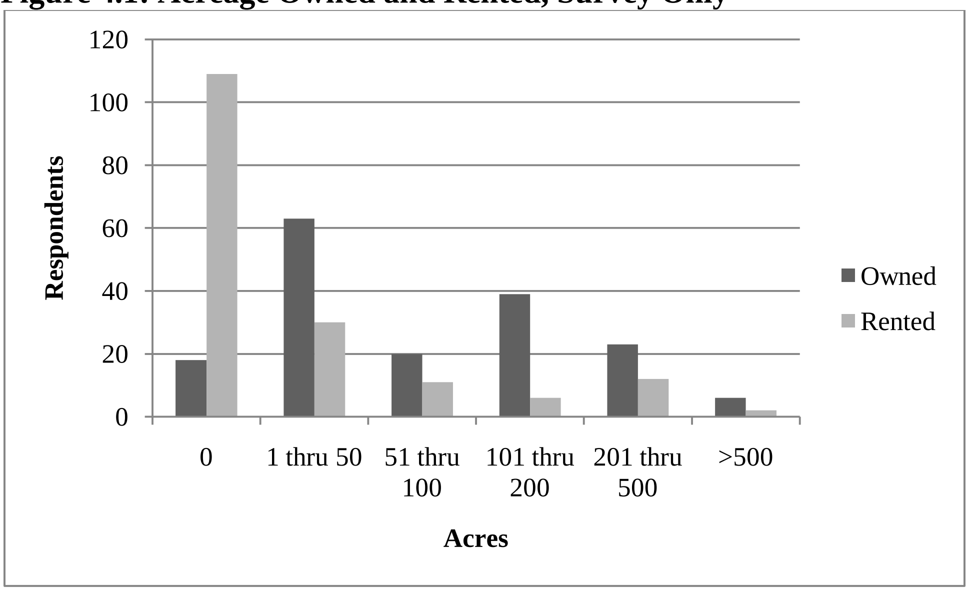
4.2. Summary Statistics

Summary statistics were calculated for each variable. Of the 199 respondents who correctly completed the survey, 105 had agricultural operations primarily in Benton County, 69 had operations predominantly in Washington County, and 25 reported operations in another county. These 25 indicated agricultural operations in neighboring Arkansas (Sebastian, Madison, and Polk) and Missouri counties. Because they came from outside the study area of interest, these surveys weren't used in data analysis.

When prompted, 169 participants disclosed how many acres they owned. Of these, 63 owned less than 50 acres and 20 respondents owned between 51 and 100 acres (Figure 4.1). Although the average respondent fell in the lower categories of land holdings, the group of respondents that fell in the higher acreage categories was noteworthy, with 23 (14%) participants owning more than 200 acres.

Fewer (170) respondents indicated the amount of acreage rented[2]. In terms of acreage rented, the distribution was skewed, with the majority (109) renting no land whatsoever; 30 of the respondents rent between 1 and 50 acres, and 11 rent between 51 and 100 acres (Figure 4.1). Although most rent no or a small amount of land, it is important to note that 14 of the 65 who rent (21%) indicated rental of more than 200 acres.

Figure 4.1: Acreage Owned and Rented, Survey Only



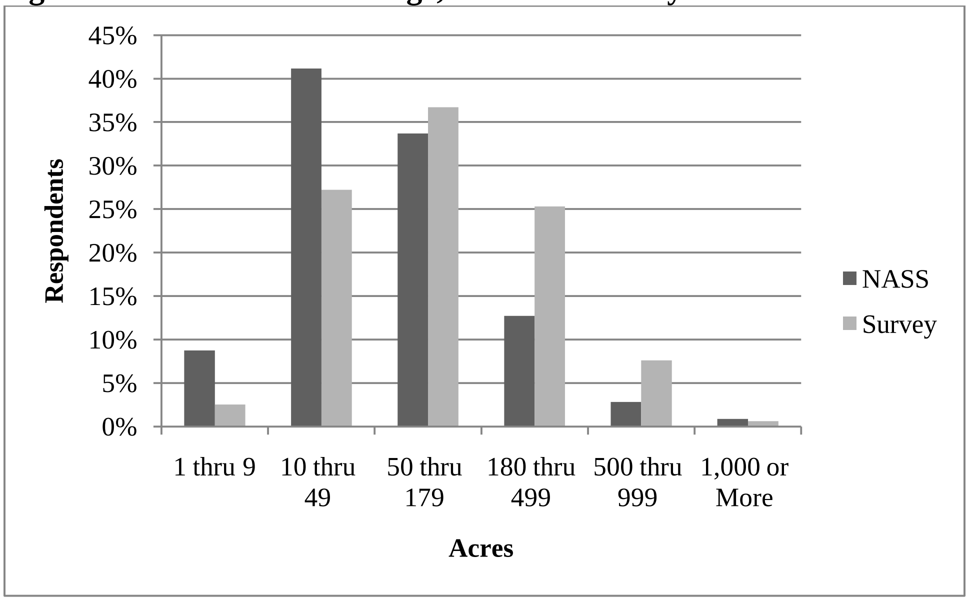
When combined for a measurement of "total farm size," the sample represented 29,181.5 acres of total agricultural land rented and owned, with an average size of 185 acres per operation. NASS (2007) reported that the average farm size as 118 acres in Benton County and 112 acres in Washington County. When compared with the data

[2] Although the assumption was not used for data analysis, it is reasonable to assume that those who answered the question about owned acreage but chose to leave rented acreage blank in fact do not rent any land, especially considering that participants were not directed to write 'zero' if he or she did not rent land.

gathered in the survey, chi-square analysis revealed that the mean acreage of survey participants' operations was significantly higher than NASS data ($p=<0.0001$). Furthermore, whereas 16.4% of farms in Benton and Washington counties have 180 acres or more (NASS, 2007), 25% of the sample reported 180 acres or more. When broken into acreage groups that are similar to those presented in NASS data, the frequency distribution of total acreage approximates a normal distribution, with the largest group being 50 to 179 acres, which represented 58 (37%) of the participants (Figure 4.2).

Chi-square analysis was conducted to compare survey results with data from the Census of Agriculture (Appendix D) found significant differences in acreage distributions between the NASS reports and the combined Northwest Arkansas survey group ($p<0.0001$) as well as between the NASS data for Washington County and the survey respondents with acreage in Washington County ($p<0.0001$). No significant difference ($p=0.0761$) was found in the distributions of the NASS data for Benton County and the respondents with acreage in Benton County. In the cases of Washington County and the combined measure of Northwest Arkansas, survey respondents tended to have higher total acreage than NASS respondents.

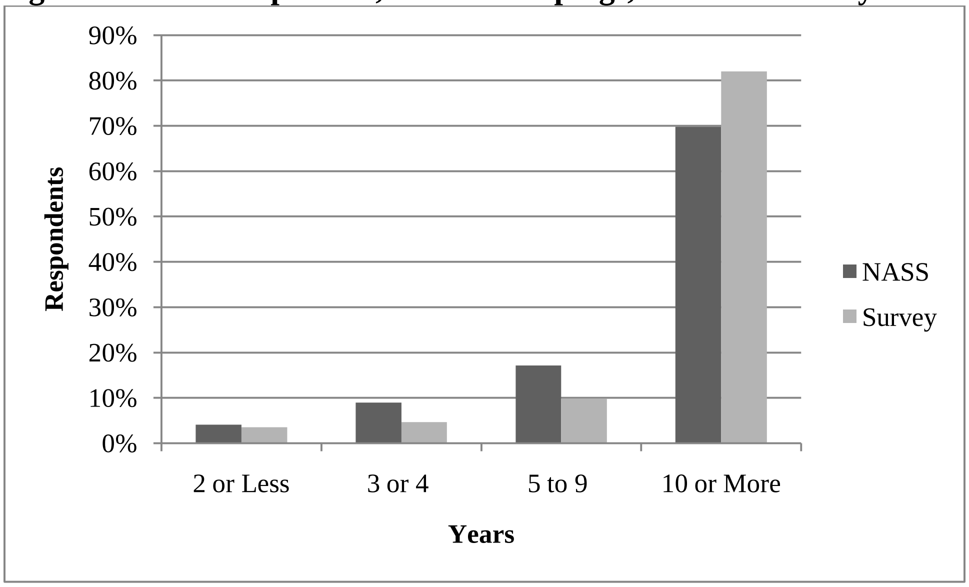
Figure 4.2: NWA Total Acreage, NASS vs. Survey



(p=<0.0001)

Survey participants were asked to describe how many years they had operated a farm or ranch at the current location; 172 responded. NASS groups answers to a similar question featured in the Census of Agriculture into four distinct segments: (1) *Two Years or Less*, (2) *Three or Four Years*, (3) *Five to Nine Years*, and (4) *Ten Years or More*. Under this classification, both NASS data and survey data were negatively skewed; 70% of the NASS data and 80% of survey respondents reported 10 years or more in operation (Figure 4.3). Chi-square statistics (Appendix D) showed no statistical difference between Benton County survey respondents and the NASS data (p=0.2633). Washington County respondents, on the other hand, were significantly different from the Washington County NASS data (p=0.0068), as was the measure of the combined counties (p=0.0063). In both cases, survey participants were more tenured than Census of Agriculture participants.

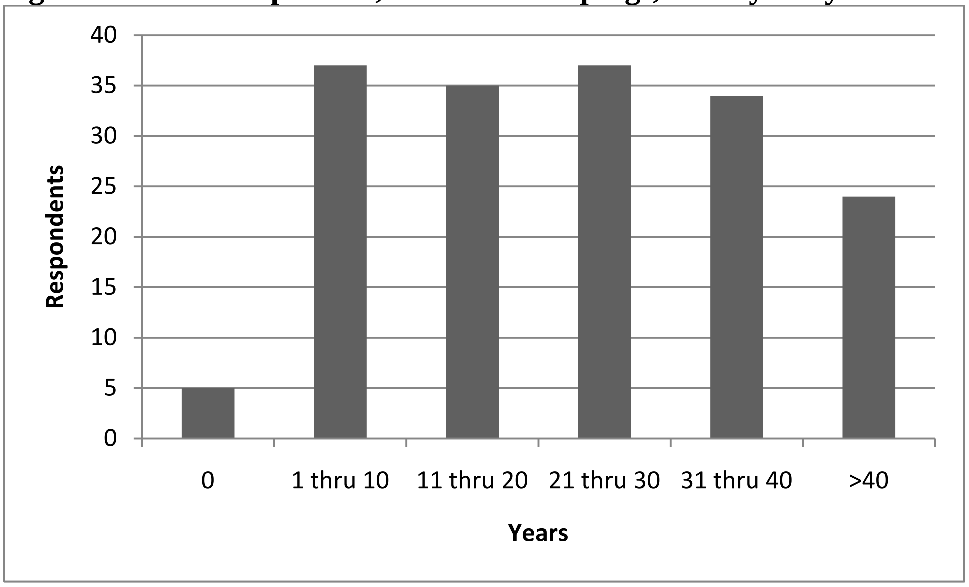
Figure 4.3: Years Operated, NASS Groupings, NASS vs. Survey



(p=0.0063)

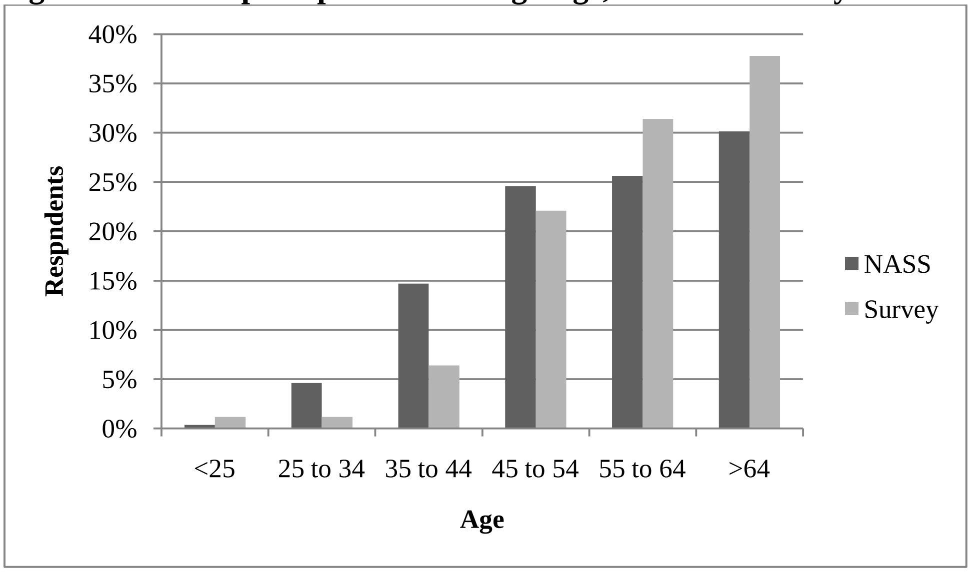
When the data are agglomerated into five ten-year groupings with a group for zero years, however, the distribution was much more even across the categories (Figure 4.4). Although NASS data are unavailable for this distribution, it is clear that grouping the survey data in ten year increments reveals a more even distribution across groups than the NASS delineation.

Figure 4.4: Years Operated, 10 Year Groupings, Survey Only



In addition to detailing their years in farming, participants were asked to disclose the age of the farm's principal operator. NASS data indicate that 56% of agricultural producers are over the age of 55 in NWA (NASS, 2007). Survey data showed that 68% of the respondents were over the age of 55 and 91% were 45 years or older. "Greater than 64" was the largest portion of the survey sample and the NASS data. Chi-square analysis (Appendix D) indicated no significant difference between survey and Census of Agriculture data for Benton County (p=.1489). On the other hand, Washington County (p=.0067) and a combined measure of the two counties (p=.0008) proved significantly different from NASS data (Figure 4.5). In both of these cases, results indicated that survey participants were significantly older than Census of Agriculture participants.

Figure 4.5: Principal Operator Average Age, NASS vs. Survey



(p=0.0008)

Because education has been shown to play a key role in the adoption of both BMPs and conservation programs, participants were asked to disclose the highest level of education of the farm's principal operator. The distribution of the 169 respondents by highest degree was as follows: high school (22%), some college (17%), undergraduate degree (7%) and trade school or two year college degree (6%). Surprisingly, a major proportion (45%) of the participants reported graduate or professional degrees (Table 4.1). Although not included in the Census of Agriculture regarding producers, data are available from the U.S. Census by county for the population as a whole (U.S. Census Bureau, 2006). There is also some evidence that the educational attainment of agricultural producers is fairly well-matched with the general population (Appendix E), but the data available is too vague to accurately apply it to the specific farming population in NWA. With 45% of the sample holding graduate or professional degrees, the survey results do not match the U.S. Census statistics for the Benton and Washington counties, where 7.5%

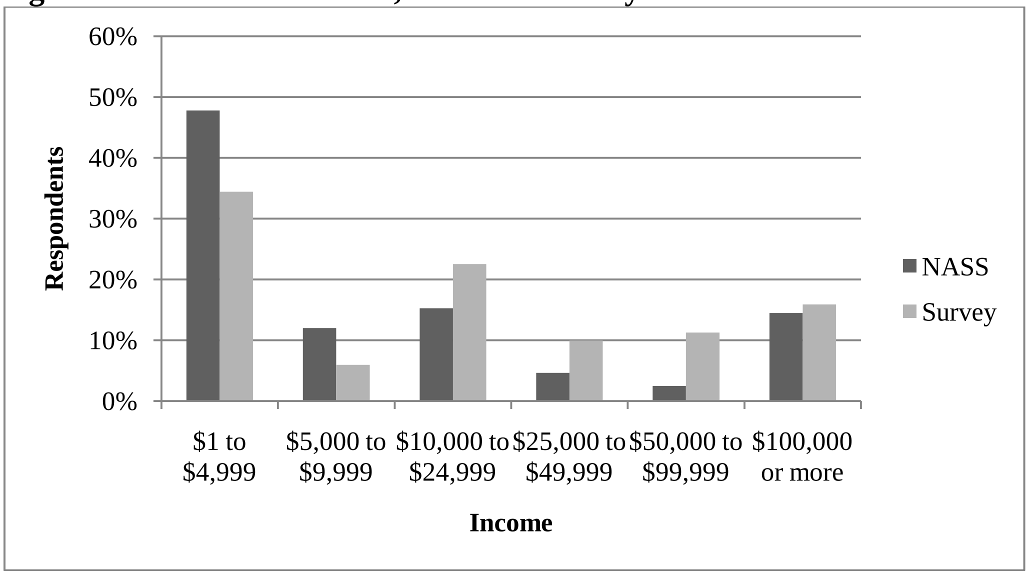
and 10.9% of the population 25 years or older, respectively, hold graduate or professional education (U.S. Census Bureau, 2006).

Table 4.1: Principal Operator Education, Survey Only

Principal Operator Education	Benton County		Washington County		Both Counties	
	Responses	%	Responses	%	Responses	%
Some High School	2	2	0	0	2	1
High School	24	23	14	21	38	22
Some College	19	18	12	18	31	18
Under-graduate	10	10	1	2	11	7
2YC / Trade School	9	9	2	3	11	7
Grad/ Professional	39	38	37	56	76	45
Total	103	100	66	100	169	100

One-hundred and fifty-one survey participants supplied their gross on-farm income from agricultural activities when prompted. Of these 34% earned less than $5,000 and a cumulative 70% of the sample indicated annual on-farm income of $50,000 or less (Figure 4.6). Although the bulk of the participants were in the lower categories of on-farm income, it is important to note that there were a number of operators who had considerably higher income levels, with 13% of NASS participants and almost 19% of survey participants reporting income over $100,000. Chi-square analysis revealed that the survey data were significantly different from NASS data for Benton County ($p=<0.0001$), Washington County ($p=<0.0001$), and a combined measure of the two counties ($p=<0.0001$). In all cases, the on-farm income of survey participants was significantly higher than that of NASS data.

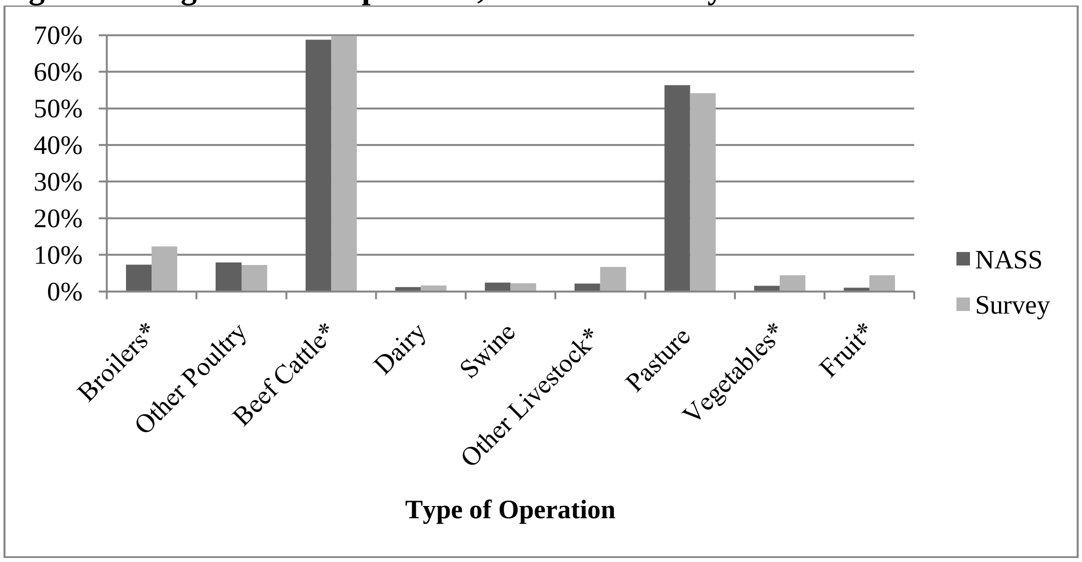
Figure 4.6: On Farm Income, NASS vs. Survey



(p=<0.0001)

Of the 5,066 farms in NWA represented in the Census of Agriculture data, 3,484 (69%) report that beef cows are part of their operation and 4,083 (80%) report acreage in pastureland. These producers commonly have a small herd, with the average farm having just under 22 head of cattle and an average of 62 acres devoted to hay or pasture production (NASS, 2007). Of the 179 participants who disclosed the nature of their agricultural operation, 125 (70%) of them indicated beef cattle and 118 (66%) indicated hay production (Figure 4.7). The next most common practice in the sample was pasture production at 54%. NASS data also indicate that 15% of the agricultural producers in NWA have layers and/or broilers. Poultry, an important aspect of the agricultural economy of NWA, was represented with 12% participating in “broiler houses” and 7% claiming “other poultry”. Finally, almost 10% of the sample participated in tree farming or logging.

Figure 4.7: Agricultural Operation, NASS vs. Survey



*(p=<0.0500)

When the entire array of operation types was compared between the survey and Census of Agriculture data, chi-square statistics showed significant differences between the survey sample and NASS data for Benton County (p=<0.0001) , Washington County (p=0.0006) and the combined measure of the counties (p=<0.0001) (Appendix F, Specification 1). Because this difference could have been caused by error in chi-square analysis due to low responses in one of several categories, chi-square analysis was run a second time with an abbreviated list of practices. Using this abbreviated list, Benton County survey data were not significantly different from NASS data (p=0.7689), Washington County survey data were significantly different than the NASS data (p=0.0002), and the combination of the two counties was not significantly different than the NASS data (p=0.0620) (Appendix F, Specification 2).

The Fisher's Exact Test was run in order to better compare the individual categories of operation type between NASS and survey data. All together, nine separate categories were tested: Broiler Houses, Other Poultry, Beef Cattle, Dairy, Swine, Other Livestock, Pasture, Vegetables and Fruit. Results (Appendix G) indicated that five of the categories for the survey data were significantly different than NASS data for the combined measure of NWA. The farm-operation categories that were different were: Broiler Houses, Beef Cattle, Other Livestock, Vegetables and Fruit (Figure 4.7).

Survey participants were asked to indicate from which institutions or individuals they received information about conservation programs. These included the ‘Conservation District,’ ‘National Resource Conservation District,’ ‘Farm Service Agency,’ ‘University Extension and Research Personnel,’ ‘Other Agricultural Producers,’ ‘Arkansas Natural Resources Commission,’ ‘Arkansas Department of Environmental Quality,’ and ‘Other’ to provide flexibility. In order to understand the relationship between program knowledge and information source, the data were cross tabulated (Table 4.2). Analysis revealed that information about the federal programs EQIP and CREP tended to come from the Conservation District and the two USDA sources, the NRCS and FSA. While awareness of the non-poultry specific state programs was minimal overall, information tended to come through the extension agency and other producers at a higher rate than for the federal programs. Information about the poultry-specific programs, APPLICATION and REMOVAL, came from diverse sources, but from extension and other producers at a higher rate than the federal programs.

Table 4.2 : Information Source by Program Knowledge

Program	Conservation District	NRCS/ ANRC	FSA / ADEQ	Extension	Other Producers	Other Source
EQIP	42	38	35	28	18	5
CREP	24	26	26	28	12	9
LOAN	8	8	2	12	7	4
NON-POINT	11	11	6	16	10	6
APPLI-CATION	32	26	14	41	25	19
REM-OVAL	22	18	6	20	12	13

Participants were also asked to indicate their long-term plans in regards to the use of their agricultural lands, and 163 individuals answered the question. With 128 respondents indicating that they intended to continue agricultural operations on their land, it was clear that the pressures of land development or land retirement were not acutely felt by participants. Of those who did not plan on continuing agricultural operations, 10% indicated land retirement and 11% indicated land development as likely outcomes in the long run.

In the fourth section of the survey (Appendix B), participants were asked to relay their thoughts and opinions of the six conservation programs. The first questions asked which of the programs were most widely used and most widely desired by producers in NWA. The questions were consistently answered incorrectly by survey participants, which can most likely be attributed to the manner in which the questions were written. Because of this, no valid data could be gleaned from the questions.

Following these questions, participants were asked to indicate the factors that encourage and discourage program participation. Given a battery of explanations, including “Other,” the most common answers for encouraging factors were “I don’t know enough about this program to answer” and “I think programs like these are effective in promoting conservation” (Table 4.3). For discouraging factors, the most common answers were “I lack knowledge regarding conservation programs” and “By participating in such programs, others will consider me a polluter” (Table 4.4).

Table 4.3: Program Awareness by Factors that Encourage Program Participation

	Aware?	Encouraging Factors								
		0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
EQIP	No	61	3	1	4	1	0	0	0	0
	Yes	22	17	7	7	7	8	3	1	1
CREP	No	57	4	3	4	1	0	0	0	0
	Yes	35	16	9	10	3	1	0	0	0
LOAN	No	89	9	7	4	2	2	1	0	0
	Yes	15	5	4	1	3	0	0	0	0
NONPOINT	No	81	12	9	1	1	0	1	0	0
	Yes	28	7	1	1	0	0	0	0	0
APPLICATION	No	29	2	5	2	0	1	0	1	0
	Yes	23	20	5	7	3	7	6	4	0
REMOVAL	No	47	9	3	0	1	0	1	0	0
	Yes	26	11	6	3	2	2	2	2	1

<u>List of Encouraging Factors</u>

0. I don't know enough about this program to answer
1. I think programs like these are effective in promoting conservation
2. I want to be an early adopter – I anticipate environmental regulations in the future
3. Integrator requires or requests participation
4. Participation would improve profitability of farm operations
5. Others would view me as a good steward of the land
6. I have participated in a conservation program in the past and have seen positive results
7. Adoption of the program has been encouraged by government/extension/university
8. Other (please specify)

Table 4.4: Program Awareness by Factors that Discourage Program Participation

	Aware?	Discouraging Factors									
		0	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
EQIP	No	3	36	6	3	1	0	0	0	0	0
	Yes	14	15	12	7	4	1	0	0	0	0
CREP	No	7	31	8	2	1	0	0	0	0	0
	Yes	12	15	14	6	2	3	1	0	0	0
LOAN	No	21	44	11	5	1	1	0	0	0	0
	Yes	7	5	2	4	0	0	0	0	0	0
NON-POINT	No	15	39	10	3	3	1	1	0	0	0
	Yes	11	11	4	3	0	0	0	0	0	0
APPLI-CATION	No	3	18	4	1	1	0	0	0	0	0
	Yes	22	21	7	4	0	2	0	0	0	0
REM-OVAL	No	9	23	6	4	1	0	0	0	0	0
	Yes	14	16	7	1	0	1	0	0	0	2

List of Discouraging Factors

0. I lack knowledge regarding conservation programs.
1. By participating in such programs, others will consider me a polluter
2. Participation in conservation programs does not make business sense
3. Programs like these require too much up front expense
4. Conservation is not a primary concern on my operation
5. Participation would interfere with regular farm operations
6. The paperwork and regulation associated with application for state conservation programs is too time consuming
7. Contract period for improvements is too long
8. I have participated in one or more conservation programs and saw no positive effects
9. Other (please specify)

4.3. Knowledge and Participation in Programs

The survey included questions related to knowledge of and participation in the federal and state conservation programs (Table 4.5). Questions regarding federal programs were asked first. Of the sample of 173 participants, 83 (48%) knew of the Environmental Quality Incentives Program (EQIP) and 41 of those had applied for program funding. Of the 41 who applied, 35 had received funding, an application success rate of 85%. Similarly, 84 participants were aware of the Conservation Reserve Enhancement Program (CREP). Unlike EQIP, however, only four of those had applied for CREP funding. Of those four who had applied for CREP funding, three participants had received funding; a 75% success rate. It should be noted that, although 97 participants were aware of both programs, the two groups were not comprised of the same respondents; 16 survey participants were aware of only CREP and 15 were aware only of EQIP.

Participants were asked to indicate their knowledge levels and participation behaviors in regards to two state-run, poultry specific programs. The Arkansas Soil Nutrient and Poultry Litter Application and Management Program (APPLICATION) was the third most known amongst the six conservation programs. Of the 173 participants, 81(47%) indicated that they were aware of its existence. Only 60 (35%) were aware of the Surplus Poultry Litter Removal Incentives Cost Share Program (REMOVAL). Unlike EQIP, actual application for and participation in the poultry-specific state programs was very low. Of the 81 participants who indicated awareness of APPLICATION, eight had applied for funding and six had received funding. Even less still was REMOVAL, for which only four operators had applied, all of whom were funded (Table 4.5).

Considering the non-poultry specific state programs, 31 participants (18%) were aware of the Arkansas Revolving Loan Program (LOAN) and 40 (23%) were aware of the Arkansas Nonpoint Pollution Management Program (NONPOINT). As with the poultry-specific programs, application for and participation in these programs was considerably lower than the federal programs, with two from the sample having applied each for both LOAN and NONPOINT. Both non-poultry specific state programs had an application success rate of 100%.

Table 4.5: Program Awareness, Application and Participation

Program	Aware of Program	Applied For Program	Received Funding	Application Success Rate
EQIP	83 (48%)	41 (24%)	35 (20%)	83%
CREP	84 (48%)	4 (2%)	3 (2%)	75%
LOAN	31 (18%)	2 (1%)	2 (1%)	100%
NONPOINT	40 (23%)	2 (1%)	2 (1%)	100%
APPLICATION	81 (47%)	8 (4%)	6 (3%)	75%
REMOVAL	60 (35%)	4 (2%)	4 (1%)	100%

Because information about each of the conservation programs travels by similar means, it is assumed that knowledge of one program would be positively related to knowledge of one or more other programs. To test this notion, chi-square analysis examining awareness given knowledge of any one program was completed (Table 4.6). In every case, knowledge of one conservation program was significantly and positively correlated with knowledge of the other programs examined in this study.

Table 4.6: Chi-Square Results, Awareness Given Awareness of One Program

Program	EQIP	CREP	LOAN	NONPOINT	APPLICATION	REMOVAL
EQIP	-	0.6412	0.3425	0.3759	0.563	0.4911
	-	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)	(<0.0001)
CREP		-	0.2397	0.4467	0.3552	0.3074
		-	(0.0018)	(<0.0001)	(<0.0001)	(0.0003)
LOAN			-	0.4213	0.3015	0.3826
			-	(<0.0001)	(0.0005)	(<0.0001)
NONPOINT				-	0.4217	0.5028
				-	(<0.0001)	(<0.0001)
APPLICATION					-	0.702
					-	(<0.0001)

T-tests were conducted to assess relationships between conservation program awareness and some key demographic variables, the results of which are presented in Table 4.7. These tests were conducted to determine if knowledge of programs differed across number of acres owned, acres rented and total acres. The mean acreage owned for producers who did and did not have knowledge of a conservation program was significantly different for all six programs. Similarly, mean acres rented for producers with and without knowledge of a conservation program was significantly different for every program except NONPOINT. The final t-test on Total Acres supported the earlier results such that all six programs were significantly different between knowledge and no knowledge of the given program ($p=<0.0500$). In general, the data showed that agricultural producers with larger operations tended to be more aware of conservation programs than those with less acreage, perhaps because agricultural producers with greater acreage are more likely invested in or reliant upon their agricultural production and thus have a higher opportunity cost associated with being unaware of potentially pertinent conservation information.

Similar analysis was conducted comparing years of farm operation and program awareness (Table 4.7). For EQIP, the mean years of operation of those who were aware of the program were significantly different, and greater, than those who were unaware of the program. This result was also found for LOAN, NONPOINT, APPLICATION and REMOVAL. Years of operation given CREP knowledge, on the other hand, were not significantly different ($p=0.0968$) than years for those without knowledge. The analysis suggests that agricultural producers with more farming experience were more likely to be

Table 4.7 : T-Test Results by Program for Select Demographic Variables, Survey Data

Program	Demographic Variable	Mean Value Aware	Mean Value Un-aware	p value	Program	Demographic Variable	Mean Value Aware	Mean Value Un-aware	p value
EQIP	*Acres Owned*	194.2	62.3598	<.0001*	CREP	*Acres Owned*	179.3	73.6686	0.0002*
	Acres Rented	76.2987	21.9	0.0017*		*Acres Rented*	64.2317	27.1264	0.0244*
	Acres Total	272.5	89.1623	<.0001*		*Acres Total*	249.6	112.9	0.0006*
	Years Operated	28.9277	21.2841	0.0014*		*Years Operated*	27.0357	23.023	0.0968
LOAN	*Acres Owned*	274.9	93.7022	<.0001*	NON-POINT	*Acres Owned*	206.6	101	0.0061*
	Acres Rented	96.9	35.1971	0.0043*		*Acres Rented*	62.8	41.0787	0.2905
	Acres Total	384.7	139.4	<.0001*		*Acres Total*	276.3	154.7	0.0097*
	Years Operated	31.9032	23.5072	0.0029*		*Years Operated*	31.075	23.1783	0.0046*
APPLI-CATION	*Acres Owned*	196.6	65.5962	0.0003*	REM-OVAL	*Acres Owned*	214.1	85.25	0.0002*
	Acres Rented	78.7595	13.717	0.0017*		*Acres Rented*	147.2	73.5598	0.0004*
	Acres Total	275.4	94.0455	0.0004*		*Acres Total*	305.7	118.7	0.0001*
	Years Operated	28.0247	20.5094	0.0066*		*Years Operated*	29.3833	21.84	0.0047*

*(p=<0.0500)

aware of the programs, most likely because more experience in agriculture implies more contact with conservation authorities and others with knowledge of programs.

Chi-square analysis was also performed on the data in order to ascertain if there were significant differences in program awareness between Benton County agriculture producers and those from Washington County (Table 4.8). Results suggest that there is a significant difference between the groups for five of the programs; EQIP, CREP, NONPOINT, APPLICATION, and REMOVAL. Washington County producers were significantly more aware of those five programs than Benton County producers were.

Table 4.8: Comparison of Knowledge Levels for Each Program between Counties

PROGRAM	Benton County Producers		Washington County Producers		p-value
	Knowledge	No Knowledge	Knowledge	No Knowledge	
EQIP	38	67	45	23	<0.0001*
CREP	39	66	45	23	0.0002*
LOAN	16	87	15	53	0.2784
NONPOINT	14	89	26	42	0.0002*
APPLI-CATION	36	40	45	15	0.0011*
REMOVAL	27	50	33	27	0.0196*

*(p=<0.0500)

Another set of measurements examined the correlation of operator age and program awareness (Table 4.9). Among others, these measurements included the Pearson Correlation test, the gamma test, and Chi-Squared analysis (Table 4.10). For this sample, the gamma and Pearson Correlation values were positive, implying that as the age of the principal operator increases, the likelihood of program awareness also increases. The correlation, however, was insignificant (χ^2=>0.0500) for all six programs.

Table 4.9: Producer Knowledge of Programs by Age

Program	Under 25		25 to 34		35 to 44	
	Knowledge	No Knowledge	Knowledge	No Knowledge	Knowledge	No Knowledge
EQIP	2	0	0	2	3	8
CREP	1	1	0	2	5	6
LOAN	0	2	0	2	2	9
NONPOINT	1	1	0	2	2	9
APPLICATION	2	0	1	1	4	6
REMOVAL	2	0	1	1	2	8
Program	**45 to 54**		**55 to 64**		**65 and Over**	
	Knowledge	**No Knowledge**	**Knowledge**	**No Knowledge**	**Knowledge**	**No Knowledge**
EQIP	20	18	27	27	31	33
CREP	20	18	27	27	31	33
LOAN	7	31	7	45	15	49
NONPOINT	6	32	12	40	19	45
APPLICATION	18	13	24	18	31	16
REMOVAL	13	18	17	26	25	22

Table 4.10: Age of Principal Operator, Measures of Accuracy

Program	Gamma		Pearson Correlation Coefficient		p-value
	Value	ASE	Value	ASE	
EQIP	0.0321	0.1186	0.0203	0.0767	0.2781
CREP	0.006	0.1189	0.0209	0.0762	0.8199
LOAN	0.164	0.1594	0.0830	0.0705	0.7254
NONPOINT	0.2186	0.1403	0.0954	0.0791	0.5252
APPLICATION	0.1414	0.1316	0.0650	0.0858	0.5559
REMOVAL	0.1686	0.1311	0.0673	0.0892	0.2282

*(p=<0.0500)

The same array of ordinal tests of association was completed in order to analyze correlation between on-farm income and program awareness (Table 4.11). As with operator age, the tests revealed a positive yet statistically insignificant relationship between income and program awareness for all six programs (Table 4.12).

Producer educational attainment and conservation program knowledge were also compared (Table 4.13). Reviewed literature suggests that there exists a positive correlation between program awareness and producer education. While the expected positive relationship was found with EQIP, CREP and NONPOINT, the other three programs were surprisingly negatively correlated (Table 4.14). In all cases, the correlation was found to be statistically insignificant.

Table 4.11 : Producer Knowledge of Programs by On Farm Income

Program	$1 to $9,999		$10,000 to $24,999		$25,000 to $49,999		$50,000 to $99,999		$100,00 and Above	
	Yes	No	Yes	No	Yes	No	Yes	No	Yes	No
EQIP	15	46	18	16	12	3	14	3	20	3
CREP	21	40	22	12	11	4	9	8	17	6
LOAN	3	58	3	29	5	10	7	9	12	12
NONPOINT	10	51	4	28	5	10	6	10	12	12
APPLICATION	14	27	17	7	11	3	12	3	22	2
REMOVAL	6	36	10	14	11	3	11	4	19	5

Table 4.12: On-Farm Income Measures of Accuracy

Program	Gamma		Pearson Correlation Coefficient		p-value
	Value	ASE	Value	ASE	
EQIP	0.7102	0.0735	0.5103	0.0645	<0.0001*
CREP	0.4231	0.1065	0.2843	0.0768	0.0021*
LOAN	0.6942	0.0848	0.4369	0.0707	<0.0001*
NONPOINT	0.4367	0.1209	0.2760	0.0831	0.0048*
APPLICATION	0.6708	0.0940	0.4662	0.0752	<0.0001*
REMOVAL	0.7139	0.0781	0.5425	0.0718	<0.0001*

*(p=<0.0500)

Table 4.13: Program Awareness by Primary Operator Education

Program	Some High School		High School		Some College	
	Yes	No	Yes	No	Yes	No
EQIP	2	0	15	23	16	15
CREP	1	1	13	25	18	13
LOAN	1	1	11	27	5	24
NONPOINT	1	1	7	31	7	22
APPLICATION	1	1	19	10	11	9
REMOVAL	1	1	14	15	9	12
Program	**Undergraduate**		**2 Year College or Trade School**		**Graduate or Professional**	
	Yes	**No**	**Yes**	**No**	**Yes**	**No**
EQIP	4	6	6	5	39	37
CREP	3	7	7	4	40	36
LOAN	0	10	2	9	12	64
NONPOINT	2	8	4	7	18	58
APPLICATION	5	6	8	1	36	24
REMOVAL	3	8	7	2	25	35

Table 4.14: Operator Education Measures of Accuracy

Program	Gamma		Pearson Correlation Coefficient		p-value
	Value	ASE	Value	ASE	
EQIP	0.0845	0.1188	0.0524	0.0771	0.5256
CREP	0.1673	0.1163	0.1075	0.0764	0.2109
LOAN	-0.2439	0.1537	-0.1224	0.0820	0.2450
NONPOINT	0.0472	0.1396	0.0310	0.0768	0.7892
APPLICATION	-0.0166	0.1378	0.0047	0.0872	0.4483
REMOVAL	-0.0608	0.1333	-0.0237	0.0871	0.3303

*(p=<0.0500)

In order to better understand the nature of the interactions between participation in one program and knowledge of others, basic frequency comparisons were made between the two groups. Because of the small sample size and the relatively small number of respondents who had actually participated in any of the programs, this analysis was only successfully completed for the program EQIP (Table 4.15). For all programs except NONPOINT (p=0.4612), participation in EQIP was significantly correlated with knowledge of the other programs (p=<0.0025). The relationship was further tested using the phi-coefficient, which is analogous to the Pearson Correlation Coefficient for this type of data, the results of which implied a positive relationship between EQIP participation and awareness of all five of the other conservation programs (Dodge, 2003). This result is not unexpected, because agricultural producers who are involved in one conservation program would likely have more contact with conservation program personnel and thus access to information about conservation programs.

Table 4.15: EQIP Participation and Other Program Awareness

Program	EQIP Participation	Knowledge	No Knowledge	Chi-Squared	Phi-Coefficient
CREP	Yes	25	10	0.0022*	0.2403
	No	54	74		
LOAN	Yes	12	21	0.0014*	0.2531
	No	16	111		
NON-POINT	Yes	9	24	0.4612	0.0583
	No	27	100		
APPLI-CATION	Yes	6	28	0.0010*	0.2901
	No	47	47		
REM-OVAL	Yes	23	11	0.0009*	0.2925
	No	33	62		

*(p=<0.0500)

4.4. The Logit Model

One objective of the study was to examine factors that influence program awareness, application and participation. First, logit models – one for each conservation program - were created to test for factors that influenced conservation program awareness. In the first specification of each model, awareness was modeled as a function of thirteen explanatory variables for EQIP and CREP and fourteen variables for the four state programs (Table 4.16). These variables, presented in Table 3.3, were: (1) Acres, a combined measure of acres owned and rented; (2) Years Operated, the number of years the survey participant had operated a farm or ranch at the current location; (3) County of Operation, either Benton or Washington County; (4) Income, gross income from agricultural activities in 2008; (5) Under Fifty-Five, a binary measure of the age of the principal operator, less than 55 years old or 55 years and older (6) College Ed, a binary variable measuring less than a two year college degree or two year degree and more; (7)

Animal, a binary variable indicating livestock activities at the participant's agricultural operation; (8) Continue, a binary variable indicating whether or not it was intended to continue agricultural operations at the current location for the long-term and; (9-13/14[3]) Sources of Information whether or not a respondent received conservation program information from a number of sources. For the federal programs, these sources were: (1) Conservation District, (2) NRCS, (3) FSA, (4) University Extension/Research Personnel and (5) Other Agricultural Producers. For the state programs the sources were: (1) Conservation District, (2) ANRC, (3) ADEQ, (4) University Extension/Research Personnel, (5) NRCS and (6) Other Agricultural Producers.

SAS generated estimates for all models (Table 4.17 and 4.18, Appendix H). However, all six models were hampered by quasi-complete separation of the data points, a data issue that occurs whenever there is a value of zero in any cell of a two by two table. In such a case, an MLE cannot be properly estimated (Allison et al., 2008).

Because and MLE could not be calculated, a second specification was estimated with the problematic variables removed. The second specification was reduced from the initial thirteen independent variables to eight (Table 4.16). In this case, none of the six models suffered from data separation and all were able to successfully estimate the model's parameters. Chi-square analysis testing the global null hypothesis, the indication of whether or not the model as a whole is able to model the dependent variable, indicated that all six were generally successful in estimating program awareness (Table 4.19 and 4.20, Appendix I). In the analysis of the effects of each independent variable, however,

[3] Analysis of the two federal programs included five information sources while the four state programs included six information sources.

few of the variables proved to be significant contributors to conservation program awareness.

Finally, a third specification was estimated using a further reduced set of independent variables. This specification included up to five explanatory variables (Table 4.16), with Acres and Years Operated removed. These two variables were selected for removal because, under Specification 3, all models passed testing of the global null hypothesis and variables proved significant in several cases (Table 4.21, Appendix J).

Table 4.16: Explanatory Variables, Specification 1, 2 and 3

Specification 1	**Specification 2**	**Specification 3**
Acres	Acres	Years Operated
Years Operated	Years Operated	County
County	County	Income
Income	Income	College Ed
Sources 1-5/6	College Ed	Animal
College Ed	Source[4]	Source[5]
Animal	Animal	
Continue	Continue	
Under Fifty-Five		

[4] Source for Specification 2 chosen by isolating and using the single most statistically significant of all sources used in Specification 1.

[5] Source for Specification 3 are as follows (Program): Farm Service Agency (CREP); University Extension/Research Personnel (LOAN and APPLICATION) and; Arkansas Natural Resource Commission (NONPOINT)

Table 4.17: Logit Specification 1 Results, Part One

Program	Value	Intercept	Acres	Years Op.	Benton County	$1 to $9,999	$10,000 to $24,999	$25,000 to $49,999	$50,000 to $99,999
EQIP	Estimate	27.91	-0.07	0.35	-0.80	3.97	-7.07	-4.90	-3.65
	p-value	(0.73)	(0.71)	(0.49)	(0.92)	(0.96)	(0.92)	(0.97)	(0.97)
CREP	Estimate	27.03	0.00	0.26	-0.79	-4.39	3.14	18.61	-17.10
	p-value	(0.78)	(0.55)	(0.09)	(0.34)	(0.91)	(0.94)	(0.90)	(0.82)
LOAN	Estimate	5.96	0.00	-0.05	0.98	-4.32	4.69	5.94	-11.06
	p-value	(0.95)	(0.68)	(0.32)	(0.15)	(0.80)	(0.73)	(0.66)	(0.80)
NON-POINT	Estimate	7.11	0.00	-0.01	-0.47	-0.73	-0.58	0.03	0.09
	p-value	(0.96)	(0.76)	(0.75)	(0.28)	(0.38)	(0.49)	(0.97)	(0.93)
APPLI-CATION	Estimate	9.09	0.00	-0.02	-0.81	-0.05	-0.02	-0.24	-1.56
	p-value	(0.91)	(0.96)	(0.53)	(0.13)	(0.96)	(0.98)	(0.85)	(0.33)
REM-OVAL	Estimate	2.21	0.00	0.00	-0.61	-1.16	-0.51	1.02	-0.02
	p-value	(0.48)	(0.84)	(1.00)	(0.17)	(0.16)	(0.53)	(0.28)	(0.99)

Table 4.18: Logit Specification 1 Results, Part Two

Program	Value	College Ed	Animal	Under 55	Cons. Dist	NRCS / ANRC	FSA / ADEQ	UA Ext.	Other Prod.	Cont. Op.
EQIP	Estimate	-1.11	-4.35	1.82	-28.37	-3.70	-13.53	-14.75	11.67	6.79)
	p-value	(0.90)	(0.76)	(0.84)	(0.21)	(0.97)	(0.56)	(0.41)	(0.91)	(0.44)
CREP	Estimate	-4.24	0.12	0.21	-11.02	-1.26	-5.90	-10.23	-7.61	3.91
	p-value	(0.10)	(0.90)	(0.78)	(0.93)	(0.99)	(0.08)	(0.80)	(0.91)	(0.08)
LOAN	Estimate	0.80	4.75	1.04	-6.55	-14.02	20.84	-18.35	11.15	0.45
	p-value	(0.21)	(0.67)	(0.16)	(0.91)	(0.95)	(0.94)	(0.79)	(0.87)	(0.45)
NON-POINT	Estimate	0.21	0.86	0.05	-6.92	-0.06	-6.20	-0.12	5.68	0.65
	p-value	(0.69)	(0.16)	(0.92)	(0.96)	(0.94)	(0.97)	(0.87)	(0.97)	(0.16)
APPLI-CATION	Estimate	1.12	-0.14	0.08	-6.15	6.23	-5.31	-1.26	-1.36	1.06
	p-value	(0.10)	(0.83)	(0.87)	(0.94)	(0.94)	(0.95)	(0.22)	(0.18)	(0.07)
REM-OVAL	Estimate	0.94	0.39	0.23	-8.29	4.22	1.12	-1.67	3.01	1.32
	p-value	(0.08)	(0.56)	(0.65)	(0.94)	(0.96)	(0.70)	(0.04)	(0.96)	(0.03)

Highlighted variables are significant (p=<.0500)

[6] The NRCS is the source for EQIP and CREP, while the ANRC is the information source for the other four programs

[7] The FSA is the source for EQIP and CREP, while the ADEQ is the information source for the other four programs

Table 4.19: Logit Specification 2 Results, Part One

Program	Value	Intercept	Acres	Years Operated	$1 to $9,999	$10,000 to $24,999	$25,000 to $49,999	$50,000 to $99,999
EQIP	Estimate	4.9577	0.0010	0.0384	-0.8706	-0.7611	0.1864	0.9746
	p-value	(0.9567)	(0.6434)	(0.0520)	(0.0746)	(0.1383)	(0.7857)	(0.1472)
CREP	Estimate	0.9334	0.0023	-0.0133	-1.1544	-0.0369	1.9014	-0.5194
	p-value	(0.3504)	(0.2298)	(0.5710)	(0.0521)	(0.9483)	(0.0927)	(0.4937)
LOAN	Estimate	0.4304	0.0019	-0.00043	-2.058	0.0604	1.4838	0.6695
	p-value	(0.7433)	(0.3282)	(0.9877)	(0.0488)	(0.9378)	(0.0370)	(0.4454)
NON-POINT	Estimate	0.9565	-0.0009	0.00456	-1.0597	-0.4694	-0.2604	0.2986
	p-value	(0.3452)	(0.4250)	(0.8383)	(0.1415)	(0.4820)	(0.7057)	(0.6910)
APPLI-CATION	Estimate	0.8217	0.0012	0.0145	-0.0903	-0.0861	-0.4421	0.0279
	p-value	(0.4219)	(0.6020)	(0.5070)	(0.8774)	(0.8905)	(0.5791)	(0.9710)
REM-OVAL	Estimate	0.9883	0.0007	0.012	-1.1207	-0.3945	1.1421	0.2781
	p-value	(0.3825)	(0.5536)	(0.5600)	(0.0657)	(0.5096)	(0.1276)	(0.7290)

Highlighted Variables are significant (p=<0.0500)

Table 4.20: Logit Specification 2 Results, Part Two

Program	Value	Benton County	College Ed	Animal	Cont. Op.	Info Source[8]
EQIP	Estimate	-0.4328	-0.5934	-0.8264	-0.0239	-7.0549
	p-value	(0.1174)	(0.0791)	(0.0586)	(0.9482)	(0.9384)
CREP	Estimate	-0.5004	-0.8128	-0.4722	0.4475	-1.2908
	p-value	(0.0854)	(0.0212)	(0.2964)	(0.2468)	(0.0026)
LOAN	Estimate	0.6567	0.202	0.7113	0.1437	-1.995
	p-value	(0.1169)	(0.6647)	(0.3681)	(0.7662)	(0.0029)
NON-POINT	Estimate	-0.5586	0.00123	0.8967	0.3514	-1.3631
	p-value	(0.0853)	(0.9976)	(0.0827)	(0.3804)	(0.0029)
APPLI-CATION	Estimate	-0.6497	0.3729	-0.4447	0.3997	-0.759
	p-value	(0.0502)	(0.3809)	(0.3597)	(0.3097)	(0.0615)
REM-OVAL	Estimate	-0.5396	0.4685	-0.1011	0.9659	-0.6581
	p-value	(0.0980)	(0.2429)	(0.8542)	(0.0220)	(0.3143)

Highlighted Variables are significant (p=<0.0500)

[8] Source for Specification 2 selected by isolating and using the single most statistically significant of all sources used in Specification 1. The sources are as follows: Conservation District (EQIP), FSA (CREP), University Extension (LOAN), NRCS (NONPOINT and APPLICATION), and ADEQ (REMOVAL).

Table 4.21: Logit Specification 3 Results

Program	Value	Intercept	Benton County	$1 to $9,999	$10,000 to $24,999	$25,000 to $49,999	$50,000 to $99,999	Animal	College Ed	Years Operated	Info Source[9]
EQIP	Estimate	-1.0263	-0.4504	-1.4281	-0.6319	0.3225	0.7889	-0.8451	-0.5558	0.0366	-
	p-value	(0.1010)	(0.0396)	(0.0001)	(0.1113)	(0.5875)	(0.1798)	(0.013)	(0.0314)	(0.0141)	-
CREP	Estimate	1.1806	-	-1.347	-0.1621	1.4978	-0.5605	-	-0.6027	-	-1.4238
	p-value	(0.0112)	-	(0.0029)	(0.7448)	(0.1261)	(0.3994)	-	(0.0433)	-	(0.0005)
LOAN	Estimate	0.4048	-	-1.608	-0.2333	1.3838	0.5849	-	-	-	-2.1864
	p-value	(0.4904)	-	(0.0298)	(0.7378)	(0.0269)	(0.4854)	-	-	-	(0.0003)
NON-POINT	Estimate	-0.1650	-0.6586	-	-	-	-	-	-	-	-1.4915
	p-value	(0.6535)	(0.0162)	-	-	-	-	-	-	-	(<.0001)
APPLI-CATION	Estimate	0.7114	-	-	-	-	-	-0.7192	-	-	-1.2433
	p-value	(0.1176)	-	-	-	-	-	(0.0667)	-	-	(0.0002)
REM-OVAL	Estimate	0.3035	-	-2.0953	-0.6400	0.9958	0.7081	-	-	-	-
	p-value	(0.1970)	-	(<.0001)	(0.1076)	(0.0737)	(0.1649)	-	-	-	-

Highlighted Variables are significant (p=<0.0500)

[9] Source for Specification 3 are as follows (Program): Farm Service Agency (CREP); University Extension/Research Personnel (LOAN and APPLICATION) and; Arkansas Natural Resource Commission (NONPOINT)

4.5. Hypothesis Testing

The following section summarizes the results from all hypothesis testing. Summary results are presented in table 4.23.

H_O 1: *Survey response data is **not** significantly different from Washington and Benton County Census of Agriculture data for Total Acres, Years Farmed, Age of Principal Operator, Education of Principal Operator, On Farm Income and Agricultural Operation.*

The variables Total Acreage (Figure 4.2), Years Operated (Figure 4.3), Principal Operator Age (Figure 4.5), On Farm Income (Figure 4.6) and five of the nine counted categories of Agricultural Operation (Figure 4.7) were significantly different than NASS results, meaning that the null hypothesis was rejected for these variables. The categories Other Poultry, Dairy, Swine and Pasture were not significantly different, thus the null hypothesis was not rejected for these variables. Data on Education of Principal Operator was not available for comparison, but it was hypothesized that the 45% of the sample with a graduate or professional degree was outside of the norm based on general population statistics.

The results of the chi-square analysis comparing survey data and NASS data are important in interpreting the analysis completed in the rest of this research. For almost every variable tested there was a significant difference between survey and census participants, meaning that it is possible that generalizations made about NWA's farming population based on survey results could be inaccurate. It is important to note that, although the chi-square analysis revealed significant differences in demographic characteristics of the survey sample and the Census data, the *thoughts* and *experiences* gathered from survey participants are not *necessarily* different from the general farming population in NWA. However, caution is suggested when generalizing these results to all NWA producers until further studies can confirm.

H_O 2: *There will be **no** difference in survey respondents' awareness among conservation programs*

Of the sample, the federal programs EQIP and CREP were equally well known (48%). The state regulation APPLICATION was a close third with 47% of the sample aware of the program. None of the other programs was known by more than 35% of the sample (Table 4.5).

Programs were compared side-by-side in several ways. Basic summary statistics revealed that the federal programs EQIP (48%) and CREP (48%) were the most known of the six programs, with the state regulation APPLICATION (47%) coming in a very close third. The other three state run programs were less known by the sample. This result is both expected and important. Federal conservation programs funded with millions, if not billions, of dollars allocated through the Farm Bill have many more resources to devote to advertising and programming than state-led programs. Simply put, the amount of funding available from Farm Bill programs means that more agricultural producers will have more exposure to these programs than their state-run counterparts. That APPLICATION was almost as well known as the federal programs is also not unexpected, and highlights the important differentiation between voluntary programming and environmental regulation. Whereas voluntary programs are a supplement to normal agricultural operation, knowledge of APPLICATION and other regulations is a necessity for many operators. In this case, operators who wish to appropriately utilize poultry litter on their land (and do so in good legal standing) *must* be aware of the regulation.

H_O 3: *There will be **no** significant difference in survey respondents' application among conservation programs.*

It was not possible to test this hypothesis based on the limited number of respondents who participated in these programs. It is important to note, however, that while no other program had applications of more than 4% of the sample, 24% of the sample had applied for EQIP funding, making it by far the most requested program (Table 4.5).

H_O 4: *There will be **no** significant difference in survey respondents' participation among conservation programs.*

Program participation was intended to be a major focus of this study. However, the data on participation provided by the sample was limited and therefore hypothesis testing was not possible. Of the programs, only participation in EQIP was large enough for any sort of analysis. While 20% of the sample had participated in EQIP, no more than 3% had participated in any of the other five programs, which made comparative analysis of program participation unfeasible (Table 4.5).

H_O 5: *There will be **no** significant difference in survey respondents' application success rates among conservation programs.*

Although application rates were very low, application success rates were very high, ranging from 75% to 100%. This could be attributed to the small size of the sample, but it should be noted that EQIP, the program most applied for in the sample, had a success rate of 83%. If these results were to prove true across the farming population in NWA it would have important implications about program participation, namely that the likelihood of an individual being rejected is low enough that it should not be a large deterrent for application. The combination of high acceptance rates and low application rates implies that the conservation programs are either not very well known or not well perceived in the producer community (Table 4.5).

H_O 6: *There will be **no** significant difference in survey respondents' program awareness by Acres Owned, Acres Rented, Total Acreage or Years Operated.*

As reported in Table 4.7, t-test results found that there was a significant and positive relationship between almost every variable and the programs. The two exceptions were Years Operated for the program CREP and Acres Rented for the program NONPOINT. In both cases, the relationship was remained positive but was statistically insignificant. In all but the two specific cases, the null hypothesis was rejected, meaning that the conservation program awareness is positively affected by these variables.

The results of this testing are valuable for program administrators and confirm the results of previous studies (Asafu-Adjaye, 2008; Paudel, 2008; Gillespie, 2007; Gillespie et al., 2007). Because both size of operation and operator tenure are positively correlated with program awareness, those directing educational efforts about conservation programs could theoretically target newer farmers or those with less land and have a greater effect in terms of raising awareness.

H_O7: *There will be **no** significant difference in survey respondents' program awareness by County of Operation, Age of Principal Operator, On Farm Income or Education of Principal Operator.*

One analysis revealed that the null hypothesis for county of operation was rejected for all but one program because agricultural producers in Washington County are statistically more likely than producers in Benton County to know of every conservation program except LOAN (Table 4.8). One explanation for this difference is the educational outreach of each county's respective Cooperative Extension Service. The Washington County Extension Service has a close association with the Washington County Conservation District, the NRCS, and the University of Arkansas, the leading research institution in the state. This relationship has resulted in priority toward conservation education in the county (Pennington, 2010). With a smaller staff and a different direction, the Benton County Extension Service has been less focused on conservation program and nutrient management education (Seay, 2010). With these differences in mind, it makes sense that producers in Washington County would be more aware of conservation programs than their counterparts in Benton County.

Age of the principal operator was a positive but insignificant factor in program participation for all six tested programs, thus the null hypothesis was not rejected in this case (Table 4.10). Farm income, on the other hand, was significantly and positively correlated with program awareness for all six programs (Table 4.12). Farm income's significant and positive relationship to program awareness could be attributed to opportunity cost. If one can assume that higher agricultural income implies greater reliance on that income, information about farming opportunities becomes more valuable to those producers with higher income. As land is often agricultural producers' largest asset, soil loss and other forms of environmental degradation have a negative effect on the worth of any agricultural operation. Because conservation programs and the BMPs they introduce can slow or even reverse this damage in the long run, being unaware of these programs can represent some form of long-run opportunity cost, especially if these BMPs are profit-neutral.

Testing of principal operator education yielded interesting results that could be the basis for future research. While the relationship for half of the programs yielded expected positive signs, awareness of the conservation programs LOAN, APPLICATION and REMOVAL all bore negative relationships with education (Table 4.14). All of the correlation, positive or negative, was statistically insignificant, meaning that the null hypothesis was not rejected. The sample size and skew of educational distribution in the sample could account for discrepancies in the measured relationship between education and program awareness, but if the results prove accurate upon further research they are compelling, as educational attainment has been consistently positively linked to program awareness in other research (Gan et al., 2009; Ghazalian et al., 2009; Ward et al., 2008). One plausible explanation is the cultural difference behind agriculture in NWA when compared to other geographic regions of the county. Whereas agriculture is widely accepted as an industrial enterprise in other regions within the United States, agriculture is in many cases viewed as a pastime or lifestyle decision in NWA. These 'hobby-farmers' often rely primarily on off-farm income, have education that does not pertain directly to agriculture, and have less invested in their agricultural operation. If this is the case, the opportunity cost associated with being unaware of conservation programs is lower for 'hobby-farmers' than agriculturalists who rely heavily on agricultural production.

Although there is evidence that educational attainment in producers matches fairly directly with the general population throughout the nation (Appendix E), it is impossible to know if this is accurate in NWA because this data does not exist. There is, however, a clear discrepancy between county level education data generated by the U.S. Census Bureau and the survey. This discrepancy could be indicative of some form of statistical inaccuracy in the sample and could have a number of different causes; participant self-selection, participant lack of understanding of the question, or participant misrepresentation. Self-selection bias would likely be present if individuals who had graduate or professional education were somehow more likely to fill out the survey than those with less formal education, perhaps because they were more sympathetic to the difficulties of research and thus more willing to take the time to complete the survey. This notion is corroborated when one considers information that was delivered through the introductory letter (Appendix B) included with every survey and the colored insert included in the latter portion of delivered surveys (Appendix C), in which participants were informed that this research was being conducted in order to complete a master's degree.

H_O 8: *There will be **no** significant difference in survey respondents' program awareness given participation in a different program.*

This analysis was limited by the low amount of survey participants who had taken part in one or more of the conservation programs, and the null hypothesis could not be tested in most cases. Because of the limited data, this analysis was only executed comparing EQIP participation to knowledge of the other five programs (Table 4.15). For all of the programs except NONPOINT, participation in EQIP was a positive and significant indicator of other program knowledge.

EQIP participation tested as a significant and positive indicator of knowledge of other conservation programs, which resulted in the rejection of the null hypothesis that there would be no relationship between participation in one program and knowledge of others. This result makes sense, as contact with conservationists is necessary for program participation and conservationists are likely to pass on knowledge of other programs to the participating individual.

H_O 9: *The demographic and choice variables Acres, Years Operated, County, Income, Age, Education, Operation Type, Long Term Farm Plans and Information Source will have **no** significant effect on the likelihood of program **awareness**.*

In the initial specification, an MLE could not be correctly created due to quasi-complete separation of the data, which meant that the data behind some of the explanatory variables was inappropriate for modeling. A second specification with the sources of data separation (Age and all but the most significant information source per program) removed, was executed. Under this specification, the results did not suffer from quasi-complete data separation and yielded results.

Although the second specification was a valid test of the global null hypothesis, the individual effects of the explanatory variables were weak, with only LOAN having more than one significant independent variable (Table 4.19 and 4.20). With this in mind, a third round of logit models using a further trimmed-down selection of independent variables was estimated. The explanatory variables used in this estimation were: (1) Total Acres, (2) County of Operation, (3) On-Farm Income, and (4) Animal Agriculture. In this case, all six models were able to yield valid estimates for explanatory variables.

The end results of logit modeling are presented in Table 4.21, with the null hypothesis being rejected in some cases and upheld in others. In the final specification, program awareness was determined by a unique set of explanatory variables for every program. For four of the six programs, awareness was at least partially determined by Income and three of the six were at least partially determined by Information Source (Table 4.22).

Table 4.22: Explanatory Variables Used in Specification 3

	EQIP	CREP	LOAN	NONPOINT	APPLI-CATION	REMOVAL
Acres	No	No	No	No	No	No
Years Operated	Yes	No	No	No	No	No
County	Yes	No	No	Yes	No	No
Income	Yes	Yes	Yes	No	No	Yes
Age	No	No	No	No	No	No
Education	Yes	Yes	No	No	No	No
Operation Type	Yes	No	No	No	No	No
Continue Operation	No	No	No	No	No	No
Information Source	No	Yes	Yes	Yes	Yes	No

H_O 10: *The demographic and choice variables Acres, Years Operated, County, Income, Age, Education, Operation Type, Long Term Farm Plans and Information Source will have **no** significant effect on the likelihood of program **application**.*

Logit estimation of program application was not possible due to lack of available data, thus the null hypothesis remained untested.

H_O 11: *The demographic and choice variables Acres, Years Operated, County, Income, Age, Education, Operation Type, Long Term Farm Plans and Information Source will have **no** significant effect on the likelihood of program **participation***

Logit estimation of program participation was not possible due to lack of available data, thus the null hypothesis remained untested.

Table 4.23: Summary of Hypothesis Testing Results

Null Hypothesis	Hypothesis Test Success	Hypothesis Rejected	Variables
H_O 1: Survey sample comparison with NASS data	Yes	Most	Total Acreage, Years Operated, Principal Operator Age, On-Farm Income, and five of the nine categories of Agricultural Operation
H_O 2: Significance testing for program awareness	No	N/A	-
H_O 3: Significance testing for program application	No	N/A	-
H_O 4: Significance testing for program participation	No	N/A	-
H_O 5: Significance testing for application success rates	No	N/A	-
H_O 6: Program awareness by continuous variables	Yes	Most	See Table 4.7
H_O 7: Program awareness by discrete variables	Yes	Some	County and Income
H_O 8: Program awareness given participation in one program	EQIP Participation Only	Most	CREP, LOAN, REMOVAL and APPLICATION
H_O 9: Modeling Awareness	Yes	Yes: Significant variables were different for each program	See Table 4.21
H_O 10: Modeling Application	No	N/A	-
H_O 11: Modeling Participation	No	N/A	-

Chapter 5. Conclusions

5.1. Policy Implications of Analysis

Modern agricultural production has become inextricably linked to the management and conservation of natural resources. In order to better shape this relationship, government agencies have developed a number of conservation programs for agricultural producers. It is in the interest of conservationists and those who develop conservation policy to understand what might encourage or discourage on-farm conservation behavior. Reviewed literature suggested that a number of demographic and behavioral attributes that might be connected to conservation program adoption (Ghazalian et al., 2009; Asafu-Adjaye, 2008; Kim, 2008; Paudel, 2008; Suter et al., 2008; Benham et al., 2007; Gillespie, 2007; Gillespie et al., 2007; Isik, 2004; Soule et al., 2000; Cooper, 1997).

As program participation is impossible without program knowledge, it would appear logical that research seeking to understand program adoption would have been preceded by a body of study examining program awareness. Interestingly, the literature regarding *awareness* of conservation programs seems to be much less developed, with only one article (McLean-Meyinsse et al., 1994) found that placed a significant emphasis on program awareness. It is hoped that this research can add further insight into the study of program awareness and the factors that influence awareness. Understanding the factors that contribute to program awareness could help policy makers and conservationists in at least two ways; first in targeting those groups that are more likely to be aware of the programs with specific information about application and the benefits of program participation, and second to target those less likely to be aware of conservation programs with more basic educational efforts to give those producers the foundational knowledge of conservation.

The profile of the average producer generated by the data set is significantly different from NASS data in several ways including farm income, farm size and operation type. This does not mean, however, that the data are without merit. Data analysis generated some valuable results that are useful for understanding the subset of farmers in NWA who completed the survey. This subset of highly educated, larger scale agricultural operators was fairly unaware of conservation programs, with no more than 48% knowledgeable of any one of the programs. Statistical testing allowed for analysis of explanatory variables that could be linked to conservation program awareness in this sample of individuals.

Although the results of analysis for this research should be tempered by the data issues, some general statements about conservation policy in Northwest Arkansas can be made. Chi-square testing revealed that program knowledge was positively related to a number of demographic and choice variables, including acreage, farm income, and awareness of at least one program. However, it should be taken under advisement that applying these results to producers in NWA should be done with caution, as there were not enough survey respondents to generate accurate population estimates.

Conservationists and policy developers should take care to note the factors that affect awareness in the implementation of agricultural conservation programs. If research finds that smaller operations generate a disproportionate amount of environmental externalities, emphasizing program adoption for these producers will be important. If further research can definitively state that negative environmental externalities are indeed positively related to operation size, however, focusing on larger operations might be more efficient for conservationists. Because this information is not readily available in NWA, it might be wise for educators to focus on spreading information to smaller farms in Critical Source Areas, as these operators will be less likely to be aware of the programs and the implementation of BMPs will likely have more positive effect.

The success rates of program application, a minimum of 75% in the sample, imply that *completing* the application process is less of a barrier than *initiating* the application process. If greater program participation is a goal of policy-makers and conservationists, it might be effective to examine alternative methods of conveying information about the program.

Measuring and understanding conservation program awareness is important in the context of access. Although *participation* by all agricultural producers in NWA might be an inefficient use of funding, especially if positive environmental outcomes are optimized by large farm adoption, *access* to the programs for all producers should be a goal for conservation authorities, especially since the programs are publicly funded. In this case, access to the programs would involve knowledge of the basic nature of the programs and the application process. With this in mind, it makes sense that increasing program awareness should be a policy goal for federal, state and local officials, even if increasing program participation isn't. An effective stance, in this case, might be to target those agricultural operators who are more likely to be aware of the programs with information about program application information and the more specific results of program adoption, and to target those who are likely unaware of the programs with basic education information about the existence of the programs and the general nature of government conservation efforts.

One suggested means of increasing program awareness is to foster greater collaboration between state and federal institutions. In this sample, the two most well-known programs were the federal efforts EQIP (48%) and CREP (48%), with the state regulation APPLICATION a close third (47%). The three voluntary state programs were all less well-known, implying that the means used to spread information about federal conservation programs are in some way more effective. State conservationists could try to tap into the same methods of information dispersal with a direct relationship to federal assistance. Federal conservationists should be eager to work more closely with state institutions, as the harmonious implementation of federal and state conservation programs should result in increased conservation effect and the reduction of potential redundancies in a given area.

5.2. Study Limitations

Although every effort was taken to generate a data set that could more effectively approach the many questions posed in this research, the response rate to the delivered survey was too low for truly representative results. There were many interesting insights generated by the data set and the lack of a representative sample does not necessarily mean the data is inaccurate, but analysis of the results of this research should be examined with care.

5.3. Suggestions for Future Research

In the particular case of this research, a more representative data set would improve the accuracy of statistical measurement and allow for more decisive conclusions. If completed, this data could be utilized to develop policies that would be effective in Northwest Arkansas.

Much research has been completed examining the factors that encourage conservation program adoption, but relatively little has studied the factors that determine program awareness. Increased study of conservation program awareness would lead to improved understanding of the characteristics that reflect an agricultural producer who is *aware* of conservation programs as well as the differences that separate that individual from one who *participates* in programs. If this body of literature were to become more developed the resulting information would likely make it easier for conservationists and program developers to target their educational efforts.

Chapter 6. References

Aigner, Dennis and Jeffrey Hopkins. 2003. “Beyond Compliance: Sustainable Business Practices and the Bottom Line.” *American Journal of Agricultural Economics* 85(5):1126-1139

Alberson, Robbie. 2010. Personal Communication. 4/27/2010

Allison, Paul D. 2008. “Convergence Failures in Logistic Regression.” Paper 360—2008. Presented at the SAS Global Forum, 2008.

Amacher, Gregory S. and Peter M. Feather. 1997. “Testing Producer Perceptions of Jointly Beneficial Best Management Practices for Improved Water Quality.” *Journal of Applied Economics* 29: 153-159

ANRC (Arkansas Natural Resources Commission), 2005. “Rules Governing the Arkansas Soil Nutrient and Poultry Litter Application Management Program: Title XXII.”

ANRC, 2007. “The Surplus Poultry Litter Removal Incentives Cost Share Program: Title XI.”

ANRC 2010. “Arkansas Natural Resources Commission.” Last accessed July, 2010. http://www.anrc.arkansas.gov/

ANRC 2010b. “Nonpoint Source Management Programs.” Last accessed July, 2010. http://www.anrc.arkansas.gov/Nonpoint.html

Arkansas Natural Resources Conservation Service. 2009. “2009 Environmental Quality Incentives Program: Arkansas Eligible Conservation Practices.” http://www.ar.nrcs.usda.gov/programs/eqip/eqip_practices_list_2009.html

Asafu-Adjaye, John. 2008. “Factors Affecting the Adoption of Soil Conservation Measures: A Case Study of Fijian Cane Farmers.” *Journal of Agricultural and Resource Economics* 33(1):99-117.

Baber, Adrian. 2004. “Poultry Rules.” ANRC presentation using Microsoft PowerPoint. http://www.awag.org/2004%20Conference/Track%201/Baber_Poultry_Rules.pdf

Basarir, A. 2002. “Multidimensional Goals of Farmers in the Beef Cattle and Dairy Industries.” Unpublished Ph.D. Dissertation, Louisiana State University, Baton Rouge.

Batie, Sandra. 2008. “Wicked Problems and Applied Economics.” *American Journal of Agricultural Economics* 90(5):1176-1191.

Batie, Sandra. 2005. “Green Payments and the Next Farm Bill.” Paper prepared for the Farm Foundation Bennett Round Table Meeting.

Batie, Sandra. 1998. “Green Payments as Foreshadowed by EQIP.” Staff paper 99-45, Department of Agricultural Economics, Michigan State University. East Lansing, Michigan 48824.

Benham, B.L., A. Braccia, S. Mostaghimi, J.B. Lowery, P.W. McClellan. 2007. “Comparison of Best Management Practice Adoption Between Virginia’s Chesapeake Bay Basin and Southern Rivers Watersheds.” *Journal of Extension* 45, April.

Bouwman, P. Batjes NH, Bridges EM. 1992. “Methodology and Data Used to Estimate Natural N20 Emissions.” Presented at the International Workshop on World Inventory of Soil Emission Potentials, August 24-27, Wageningen.

Carpenter, S.R., N.F. Caraco, D.L. Correll, R.W. Howarth, A.N. Sharpley, and V.H. Smith. 1998. “Nonpoint Pollution of Surface Waters with Phosphorous and Nitrogen.” *Ecological Applications*, 8(3) pp. 559-568.

Carson, Rachel. 1962. Silent Spring. Boston; Houghton Mifflin.

Cattaneo, Andrea. 2003. “The Pursuit of Efficiency and Its Unintended Consequences: Contract Withdrawals in the Environmental Quality Incentives Program.” *Review of Agricultural Economics* 25(2):449-469.

Chakravorty, Ujjayant, Donna K. Fisher and Chieko Umetsu. 2007. “Environmental Effects of Intensification of Agriculture: Livestock Production and Regulation.” *Environmental Economics and Policy Studies* 8:315-336.

Chandler, Mike. Personal Communication. 3/3/2009.

Claasen, Roger and Richard D. Horan. 2000. “Environmental Payments to Farmers: Issues of Program Design.” *Agricultural Outlook* June-July pp. 15-18.

Collins, Ted. 2010. Personal Communication. 4/13/2010.

Collins, Ted. 2010b. Personal Communication. 9/13/2010.

Colvard, Diana. 2010. Personal Communication. 4/6/2010.

Cook, M.G., P.G. Hunt, K.C. Stone and J.H. Canterberry. 1996. "Reducing Diffuse Pollution Through Implementation of Agricultural Best Management Practices: A Case Study." *Wat. Sci. Tech*. 33:191-196.

Cooper, Joseph C. 1997. "Combining Actual and Contingent Behavior Data to Model Farmer Adoption of Water Quality Protection Practices." *Journal of Agricultural and Resource Economics* 22(1):30-43.

Daly, Herman E and Joshua Farley. 2004. <u>Ecological Economies: Principles and Applications</u>. Washington, D.C.; Island Press.

Davis, Scott F. and Rob Moritz. 2003. "Impasse is Over: Arkansas, Oklahoma Agree to Sign Water Quality Pact." *The Morning News*, 12/18/2003.

DeVuyst, Eric A. and Viju Ipe C. 1999. "A Group Incentive Contract to Promote Adoption of Best Management Practices." *Journal of Agricultural and Resource Economics* 24(2): 367-382.

Dillman, Don A. 2000. <u>Mail and Internet surveys--The tailored design method</u>. New York : John Wiley & Sons, Inc.

Dillman, Don A., Jolene D. Smyth, Leah Melani Christian. 2009. <u>Internet, Mail and Mixed-Mode Surveys: The Tailored Design Method</u>. Hoboken, New Jersey; John Wiley and Sons, Inc.

Dodge, Yadolah. 2003. <u>The Oxford Dictionary of Statistical Terms</u>. Oxford; New York: Oxford University Press, 2003.

Doering, Otto and Joe L. Outlaw. 2006. "The Evolution of the Rationale for Government Involvement in Agriculture." *Choices Magazine* 21(4):221-224.

Easton, Zachary M., M. Todd Walter and Tammo S. Steenhuis. 2008. "Combined Monitoring and Modeling Indicate the Most Effective Agricultural Best Management Practices." *Journal of Environmental Quality* 37:1798-1809.

Environmental Protection Agency (EPA). 2009. "National Water Quality Inventory: Report to Congress, 2004 Reporting Cycle: Findings."

Environmental Protection Agency (EPA), 2009b. This is from the "Final Rule Register" found here http://www.epa.gov/EPA-IMPACT/2009/January/Day-15/i530.htm

Fish, Robert, Susanne Seymour and Charles Watkins. 2006. "Sustainable Farmland Management as Political and Cultural Discourse." *The Geographical Journal* 172:183-189.

Foster, Rhonda. 2008. Personal Communication.

Frarey LC, Pratt SJ. 1995. “Environmental Regulation of Livestock Production Operations.” *Natural Resource and Environment* Winter 8-12

FSA, 2009. “Conservation Reserve Enhancement Program: Landowners and Conservationists.” USDA. Last accessed July, 2010. www.fsa.usda.gov/FSA/webapp?area=home&subject=lown&topic=cep

FSA, 2009b. “Fact Sheet: Arkansas Conservation Reserve Enhancement Program (CREP) Illinois River Watershed.” USDA. Accessed July, 2010. www.fsa.usda.gov/Internet/FSA_File/ark-irwcrep.pdf

Gan, Jainbang, Okwudili O. Onianwa, John Schelhas, Gerald C. Wheelock, and Mark R. Dubois. 2005. “Does Race Matter in Landowner’s Participation in Conservation Incentive Programs?” *Society and Natural Resources* 18:431-445.

Ghazalian, Pascal L., Bruno Larue, and Gale E. West. 2009. “Best Management Practices to Enhance Water Quality: Who is Adopting Them?” *Journal of Agricultural and Applied Economics* 41 (3):663-682.

Gillespie, Jeffrey, Seon-Ae Kim and Krishna Paudel. 2007. “Why Don’t Producers Adopt Best Management Practices? An Analysis of the Beef Cattle Industry.” *Agricultural Economics* 36:89-102.

Goodwin, H.L. Jr., Frank T. Jones, Susan E. Watkins, Janie S. Hipp. 2003. “New Arkansas Laws Regulate Use and Management of Poultry Litter and Other Nutrients.” University of Arkansas Cooperative Extension Service, FSA29.

Hamilton ND. 1997. “Reaping What We have Sown: Public Policy Consequences of Agricultural Industrialization and the Legal Implications of a Changing Production System.” *Drake Law Review* 45:289-310

Helmers, Matthew J., Thomas M. Isenhart, Catherine L. Kling, Thomas B. Moorman, William W. Simpkins and Mark Tomer. 2007. “Theme Overview: Agriculture and Water Quality in the Cornbelt: Overview of Issues and Approaches.” *Choices Magazine* 22(2):79-85.

Holleman, JT. 1992. “In Arkansas Which Comes First, the Chicken or the Environment?” *Tulane Environmental Law Journal* 6:21-60.

Houston, Jack E. and Henglun Sun. 1999. “Cost-Share Incentives and Best Management Practices in a Pilot Water Quality Program.” *Journal of Agricultural and Resource Economics* 24(1):239-252.

Isik, Murat. 2004. “Incentives for Technology Adoption Under Environmental Policy Uncertainty: Implications for Green Payments.” Environmental and Resource Economics 27:247-263.

James, J.M., R. Bolstein. 1992. “Large Monetary Incentives and Their Effect on Mail Survey Response Rates”. *The Public Opinion Quarterly*, Vol. 56, No. 4 (1992), 442-453.

Juozapavicius, Justin. 2009. Tulsa World http://www.tulsaworld.com/business/article.aspx?subjectid=47&articleid=20091118_47_0_Apoult408203&archive=yes

Kash, Jeffrey P. 2008. “Enemies to Allies: The Role of Policy-Design Adaptation in Facilitating a Famer-Environmentalist Alliance.” *The Policy Studies Journal* 36(1): 39-60.

Kim, Seo-Ae, Jeffrey M. Gillespie and Krishna P. Paudel. 2008. “Rotational Grazing Adoption in Cattle Production Under a Cost-Share Agreement: Does Uncertainty Have a Role in Conservation Technology Adoption?” *The Australian Journal of Agricultural and Resource Economics* 52:235-252.

Lambert, Dayton, Patrick Sullivan, Roger Claassen, and Linda Foreman. 2006. “Conservation-Compatible Practices and Programs: Who Participates?” February ERS Report #14.

Langpap, Christian. 2006. “Conservation of Endangered Species: Can Incentives Work for Private Landowners?” *Ecological Economics* 57:558-572.

Langpap, Christian and JunJie Wu. 2002. “Voluntary Conservation of Endangered Species: When Does No Regulatory Assurance Mean No Conservation?” *Journal of Environmental Economics and Management* 47:435-457.

Lichtenberg, Erik and Tony M. Penn. 2003. “Prevention Versus Treatment Under Precautionary Regulation: A Case Study of Groundwater Contamination Under Uncertainty.” *American Journal of Agricultural Economics* 85(1):44-58.

Lind, Douglas A., William G. Marchal, and Samuel A. Wathen. 2005. Statistical Techniques in Business and Economics. Twelfth Edition. McGraw-Hill Irwin, New York, New York.

Lubell, Mark. 2004. "Collaborative Watershed Management: A View from the Grassroots." *The Policy Studies Journal* 32:341-361.

Lynne, Gary D., J.S. Shonkwiler and Leandro R. Rola. 1988. "Attitudes and Farmer Conservation Behavior." *American Journal of Agricultural Economics* 70(1):12-19.

Maguire, Rory O., Gitte H. Rubæk, Brian E. Haggard, Bob H. Foy. 2009. "Critical Evaluation of the Implementation of Mitigation Options for Phosphorous from Field to Catchment Scales." *Journal of Environmental Quality* 38:1989-1997.

McLean-Meyinsse, Patricia, Jianguo Hui and Randolph Joseph, Jr. "An Empirical Analysis of Louisiana Small Farmers' Involvement in the Conservation Reserve Program." *Journal of Agricultural and Applied Economics* 26 (2) December, 1994. 379-385.

Mobley, Dennis. 2009. Personal Communication. 7/22/2009.

Moore, John L. 2005. "Lawsuit Fuels Concerns for Arkansas, Oklahoma Economy: Resort Owners may be Made Part of Lawsuit." *The Northwest Arkansas Morning News*, 6/19/2005

NASS (National Agricultural statistics Service), 2007. "Census of Agriculture."

NASS 2007b."Census of Agriculture: Ranking of Congressional Districts by Value of Sales: 2007. Poultry and Eggs." http://www.agcensus.usda.gov/Publications/2007/Online_Highlights/Congressional_District_Rankings/cdr_31.pdf

NRCS. 2010 "National Priorities Programmatic Fiscal Year 2006." http://www.nrcs.usda.gov/programs/natprgmpriorities/FY2006/natprgmprior.html#Environmental%20Quality%20Incentives%20Program

NRCS. May 2009. "Fact Sheet: Environmental Quality Incentives Program." http://www.nrcs.usda.gov/programs/farmbill/2008/pdfs/EQIP_factsheet.pdf

NRCS. May 2008. "At a Glance: Environmental Quality Incentives Program."

Obubuafo, Joyce, Jeffrey Gillespie, Krishna Paudel and Seon-Ae Kim. 2008. "Awareness of and Application to the Environmental Quality Incentives Program by Cow-Calf Producers." *Journal of Agricultural and Applied Economics* 40(1):357-368.

Pennington, John. 2008. Personal communication on 9/10/2008.

Pennington, John. 2010. Personal communication on 7/22/2010.

Perry, Janet, David Banker and Robert Green. “Broiler Farms. Organization, Management, and Performance.” Resource Economics Division, Economic Research Service, U.S. Department of Agriculture. Agriculture Information Bulletin No. 748.

Popp, J., N. Kemper, W. Miller, K. McGraw, and K. Karr. 2010. “Economic Contribution of the Agricultural Sector to the Arkansas Economy in 2008.” Arkansas Agriculture Experiment Station, University of Arkansas Division of Agriculture, Fayetteville, Forthcoming 2010.

Paudel, Krishna, Wayne M. Gathier, John V. Westra and Larry M. Hall. 2008. “Factors Influencing and Steps Leading to the Adoption of Best Management Practices by Louisiana Dairy Farmers” *Journal of Agricultural and Applied Economics* 40(1): 203-222.

Rahelizatovo, Noro C. and Jeffrey M. Gillespie. 2004. “Adoption of Best-Management Practices by Louisiana Dairy Producers.” *Journal of Agricultural and Applied Economics* 36(1): 229-240.

Raosoft. 2009. “Raosoft Sample Size Calculator” Last accessed 8/31/2010. http://www.raosoft.com/samplesize.html

Ramick, Tony. 2009. Personal Communication. 9/28/2009.

Rea, L. M., & Parker, R. A. 1992. Designing and Conducting Survey Research. San Francisco; Jossey-Bass.

Ribaudo, Marc, Andrea Cattaneo and Jean Agapoff. 2004. “Cost of Meeting manure Nutrient Application Standards in Hog Production: The Roles of EQIP and Fertilizer Offsets.” *Review of Agricultural Economics* 26(4):430-444.

Ribaudo, Marc, Richard Horan and Mark Smith. 1999. “Economics of Water Quality Protection from Nonpoint Sources: Theory and Practice” Agricultural Economic Report No. (AER782) 120 pp, Chpts 1, 3, 6 and 8 from “Economics of Water Quality Protection.” AER-782.

Rice, Mindy B., Warren B. Ballard, Ernest B. Fish, David B. Westler, and David Holdermann. 2007. “Predicting Private Landowner Support toward Recolonizing Black Bears in the Trans-Pecos Region of Texas.” *Human Dimensions of Wildlife* 12:405-415.

Richardson, C.W., D.A. Bucks, and E.J. Sadler. 2008. "The Conservation Assessment Project Benchmark Watersheds: Synthesis of Preliminary Findings." Journal of Soil and Water Conservation, Vol. 63, No. 6.

Sharpley, Andrew, Philip Moore, Karl VanDevender, Mike Daniels, Walter Delp, Brian Haggard, Tommy Daniel, Adrian Baber. 2010. "Arkansas Phosphorous Index." University of Arkansas Cooperative Extension Service FSA9531.

Soule, Meredith J., Abebayehu Tegene and Keith D. Wiebe. 2000. "Land Tenure and the Adoption of Conservation Practices." *American Journal of Agricultural Economics* 82(4):993-1005.

Steinfeld H, de Haan C, Blackburn H. 1997. "Options to Address Livestock-Environment Interactions." *World Animal Review* 88:15-20

Strauss, P., A. Leone, M.N. Ripa, N. Turpin, J.M. Lescot and R. Laplana. 2007. "Using Critical Source Areas for Targeting Cost-Effective Best Management Practices to Mitigate Phosphorous and Sediment Transfer at the Watershed Scale." *British Society of Soil Science* 23(1): 144-153.

Studenmund, A.H. 2001. Using Econometrics: A Practical Guide. Fourth Edition. Addison Wesley Longman.

Suter, Jordan F., Gregory L. Poe, and Nelson L. Bills. 2008. "Do Landowners Respond to Land Retirement Incentives? Evidence from the Conservation Reserve Enhancement Program." *Land Economics*. February 84 (1):17-30.

Thibault, J. W., & Kelley, H. H. 1952. The Social Psychology of Groups. New York; John Wiley & Sons.

Traore, Namatie, Rejean Landry and Nabil Amara. 1998. "On-Farm Adoption of Conservation Practices: The Role of Farm Characteristics, Perceptions and Health Hazards." *Land Economics* 74(1):114-127.

Troxel, Tom. 2007. "Best Management Practices for Small Beef Cow-Calf Herds." University of Arkansas Division of Agriculture Cooperative Extension Service.

USDA. 2008. "Conservation Reserve Program: Summary and Enrollment Statistics." Accessed July, 2010. http://www.apfo.usda.gov/Internet/FSA_File/annualsummary2008.pdf

U.S. Census Bureau, 2006. "2006-2008 American Community Survey." Last accessed June, 2010. http://factfinder.Census.gov.

U.S. Census Bureau, 2010. “State and County Quick Facts.” Last accessed June, 2010. http://quickfacts.census.gov/qfd/states/05/05007.html.

U.S. Water News Online. 2005. “Oklahoma Readies for Another Court Fight, Blaming River’s Decline on Poultry.” July, 2005. www.uswaternews.com/archives/arcrights/5oklaread7.html

Valentin, Luc, Daniel J. Bernardo and Terry L. Kastens. 2004. “Testing the Empirical Relationship between Best Management Practice Adoption and Farm Profitability.” *Review of Agricultural Economics* 26(4) 489-504.

Verheijen Lahm, Wiersema D., Hulshoff Pol LW, de Wit J. 1996. “Management of Waste From Animal Product Processing.” International Agricultural Center. Wageningen, The Netherlands.

Ward, Clement E, Mallory K. Vestal, Damona G. Doye, and David L. Lalman. 2008. “Factors Affecting Adoption of Cow-Calf Production Practices in Oklahoma.” *Journal of Agricultural and Applied Economics.* 40(3):851-863.

Weisstein, Eric W. 2010. "Logistic Distribution." From MathWorld--A Wolfram Web Resource. http://mathworld.wolfram.com/LogisticDistribution.html

Weisstein, Eric W. 2010b. "Maximum Likelihood." From MathWorld--A Wolfram Web Resource. http://mathworld.wolfram.com/MaximumLikelihood.html

Wu, JunJie, Richard M. Adams, Catherine L. Kling, and Katsuya Tanaka. 2004. “From Microlevel Decisions to Landscape Changes: An Assessment of Agricultural Conservation Policies.” *American Journal of Agricultural Economics* 86(1): 26-41.

Yates, Adam G., Robert C. Bailey, and John A. Schwindt. 2007. “Effectiveness of Best Management Practices in Improving Stream Ecosystem Quality.” *Hydrobiologia* 583:331-344.

Zinn, Jeffrey. 1998. “ (Aigner & Hopkins, 2003) (Amacher & Feather, 1997) (Arkansas NRCS)Environmental Quality Incentives Program (EQIP): Status and Issues.” CRS Report for Congress. http://ncseonline.org/NLE/crsreports/air/air-17.cfm

Chapter 7. Appendices

Appendix A: 2009 EQIP Arkansas Eligible Practices

Table A.1: 2009 EQIP Arkansas Eligible Practices

Practice Code	Practice Name	Cost Share (%)
560	Access Road	60
365	Anaerobic Digester/Ambient Temperation	60
366	Anaerobic Digester/Controlled Temperation	60
316	Animal Mortality Facility	60
591	Amendments for Treatment of Agricultural Waste	75
314	Brush Management	60
360	Closure of Waste Impoundment	60
317	Composting Facility	60
327	Conservation Cover	60
342	Critical Area Planting	60
356	Dike (Class III)	60
362	Diversion	60
382	Fence	60
386	Field Border	75
393	Filter Strip	60
394	Firebreak	60
490	Tree/Shrub Site Preparation	60
666	Forest Stand Improvement	60
655	Forest Trails & Landings	60
410	Grade Stabilization Structure	60
412	Grassed Waterway	60
561	Heavy Use Area Protection	60
464	Irrigation Land-leveling	60
552	Irrigation Regulating Reservoir	60
436	Irrigation Storage Reservoir	60
441	Irrigation System, Micro-irrigation	60
442	Irrigation System - Sprinkler	60
430DD	Irrigation Water Conveyance - Pipeline - High Pressure, Underground, Plastic	60
449	Irrigation Water Management	60
449	Irrigation Water Management (side inlet)	75
634	Manure Transfer (off-site transfer)	75
634	Manure Transfer (equipment)	60
484	Mulching	60
512	Pasture and Hayland Planting	60
516	Pipeline	60
449	Irrigation Water Management	60
449	Irrigation Water Management (side inlet)	75

Practice Code	Practice Name	Cost Share (%)
378	Pond	60
521A	Pond Sealing or Lining, Flexible Membrane	60
521B	Pond Sealing or Lining, Soil Dispersant	60
521C	Pond Sealing or Lining, Bentonite Sealant	60
521D	Pond Sealing or lining, Compacted Clay Treatment	60
338	Prescribed Burning	75
528	Prescribed Grazing - Wildlife	75
528	Prescribed Grazing	60
533	Pumping Plant	60
643	Restoration & Management of Declining Habitats	60
391	Riparian Forest Buffer	60
390	Riparian Herbaceous Cover	60
558	Roof Runoff Structure	60
646	Shallow Water Management for Wildlife	100
632	Solid/Liquid Waste Separation Facility	60
574	Spring Development	60
578	Stream Crossing	60
580	Streambank and Shoreline Protection	60
587	Structure for Water Control	60
612	Tree/Shrub Establishment	60
645	Upland Wildlife Habitat Management	60
367	Waste Facility Cover	60
313	Waste Storage Facility	60
359	Waste Treatment Lagoon	60
614	Water Facility	60
642	Water Well	75
644	Wetland Wildlife Habitat Management	60
380	Windbreak/Shelterbelt Establishment	60
431	Above Ground, Multi-Outlet Pipeline	75
447	Irrigation System, Tail-water Recovery	60
607	Surface Drainage, Field Ditch	60
608	Surface Drainage, Main or Lateral	60
340	Cover Crop	60
329B	Residue and Tillage Management - No-Till/Strip Till	75
106	Forest Management Plan	75
381	Silvopasture Establishment	60
384	Forest Slash Treatment	60

Source: http://www.ar.nrcs.usda.gov/programs/eqip/eqip_practices_list_2009.html

Appendix B: Survey

A Producer Survey: Do You Participate in Conservation Programs?

Dear Northwest Arkansas Agricultural Producers,

I want to better understand agricultural producers' views and use of state and federal conservation programs. Results of this survey will be used as the basis for my Master's thesis. All survey responses will be kept ***<u>confidential</u>*** and only ***<u>aggregated</u>*** responses across all participants will be released.

Completing the survey should take about 15 minutes. It is my hope that the information collected will help policy makers as they develop programs to best fit the needs of Arkansas' producers. (It will also help me fulfill my requirements for graduation!)

If you have any questions, please feel free to contact me by email at xxxx@xxxx.edu. You may also contact my thesis advisor, Dr. Jennie Popp, at 479-575-2279 or by email at jhpopp@uark.edu.

Sincerely,

Edison Froelich

Graduate Student, Agricultural Economics

Most of the survey is in a simple check-box format!

SECTION ONE: QUESTIONS ABOUT EQIP AND CREP

The **Environmental Quality Incentives Program (EQIP)** is a voluntary federal conservation program that promotes agricultural production and environmental sustainability as compatible goals.

The **Conservation Reserve Enhancement Program (CREP)** is a voluntary land retirement program that helps agricultural producers protect their land and water.

1. Please indicate **Yes** or **No** to the following statements about the Environmental Quality Incentives Program:

Statement	Yes	No
I knew about **EQIP** prior to this survey		
I have applied for **EQIP** funding at least once		
I have received **EQIP** funding at least once		

2. Please indicate **Yes** or **No** to the following statements about the Conservation Reserve Enhancement Program:

Statement	Yes	No
I knew about **CREP** prior to this survey		
I have applied for **CREP** funding at least once		
I have received **CREP** funding at least once		

3. From which of the following sources, if any, have you received information about EQIP and/or CREP?

Source	EQIP	CREP	No Info
Conservation District			
USDA National Resource Conservation Service			
USDA Farm Service Agency			
University extension/research personnel			
Other agricultural producers			
Other (please list):			
I have not received any information about EQIP or CREP			

4. For each of the practices listed below, please tell us whether you requested funding from EQIP or CREP. If requested please tell us whether it was accepted for funding and in what years:

Practice	Requested money for this practice			Was this practice funded?		Year(s) funded
	EQIP	CREP	Not requested	Yes	No	
Waste Storage						
Prescribed Grazing						
Fencing						
Composting Facility						
Water Management/Pipeline						
Other (please list):						

5. Are there any conservation practices that you would like to implement that EQIP does not fund? Please circle **Yes** or **No**.

   If ***Yes***, please list practice(s)

6. Are there any conservation practices that you would like to implement that CREP does not fund? Please circle **Yes** or **No**.

   If ***Yes***, please list practice(s)

SECTION TWO: STATE CONSERVATION PROGRAMS

The Arkansas Natural Resources Commission administers several programs aimed at land and water conservation for agricultural producers.

The **Arkansas Revolving Loan Program** (**LOAN**) is a state run program that works with local conservation districts to provide low interest loans to fund the implementation of certain agricultural conservation practices.

The **Arkansas Nonpoint Pollution Management Program** (**NONPOINT**) is a state administered program that funds projects associated with the reduction of nonpoint source pollution.

1. Please indicate **Yes** or **No** to the following statements about the Arkansas Revolving Loan Program:

Statement	Yes	No
I knew about **LOAN** prior to this survey		
I have applied for **LOAN** funding at least once		
I have received **LOAN** funding at least once		

2. Please indicate **Yes** or **No** to the following statements about the Arkansas Nonpoint Pollution Management Program:

Statement	Yes	No
I knew about **NONPOINT** prior to this survey		
I have applied for **NONPOINT** funding at least once		
I have received **NONPOINT** funding at least once		

3. From which of the following sources, if any, do you receive information about State Conservation Programs?

Source	LOAN	NONPOINT	No Info
Conservation District			
Arkansas Natural Resources Commission			
Arkansas Department of Environmental Quality			
University extension/research personnel			
USDA National Resource Conservation Service			
Other agricultural producers			
Other (please list):			
I have not received any information about these programs			

4. For each of the practices listed below, please tell us whether you requested funding from LOAN or NONPOINT. If requested please tell us whether it was accepted for funding and in what years:

Practice	Requested money for this practice			Was this practice funded?		Year(s) funded
	LOAN	NONPOINT	Not requested	Yes	No	
Poultry Stacking Shed						
Fencing						
Other (please list):						

SECTION THREE: POULTRY LITTER APPLICATION PROGRAMS

If your agricultural operation produces or uses poultry litter, please answer the following questions. If not, continue to Section 4.

The **Arkansas Soil Nutrient and Poultry Litter Application and Management Program** (**APPLICATION**) is a regulation that requires individuals who use litter or commercial fertilizer develop a nutrient management plan.

The **Surplus Poultry Litter Removal Incentives Cost Share Program** (**REMOVAL**) is a state run program that pays farmers to transport poultry litter from nutrient surplus areas to other parts of the state that can better use the litter.

1. Please indicate **Yes** or **No** to the following statements about the Arkansas Soil Nutrient and Poultry Litter Application and Management Program:

Statement	Yes	No
I knew about **APPLICATION** prior to this survey		
I have applied for **APPLICATION** funding at least once		
I have received **APPLICATION** funding at least once		

2. Please indicate **Yes** or **No** to the following statements about the Surplus Poultry Litter Removal Incentives Cost Share Program:

Statement	Yes	No
I knew about **REMOVAL** prior to this survey		
I have applied for **REMOVAL** funding at least once		
I have received **REMOVAL** funding at least once		

3. From which of the following sources, if any, do you receive information about Poultry Litter Programs?

Source	APPLICATION	REMOVAL	No Info
Conservation District			
Arkansas Natural Resources Commission			
Arkansas Department of Environmental Quality			
University extension/research personnel			
USDA National Resource Conservation Service			
Other agricultural producers			
Other (please list):			
I have not received any information about these programs			

SECTION FOUR: COMPARING STATE AND FEDERAL PROGRAMS

We recognize that there is a difference between agricultural producers using a program and actually *desiring* to use a program. Please answer the questions below to help us clarify those differences.

1. Based on your knowledge and experience, which conservation programs are **used the most and least** by agricultural producers in Washington and Benton Counties? Please write an **M** beside the program most used and **L** by the program least used.

____ EQIP

____ CREP

____ Arkansas Soil Nutrient and Poultry Litter Application and Management Program

____ Arkansas Revolving Loan Program

____ Arkansas Nonpoint Pollution Management Program

____ Surplus Poultry Litter Removal Incentives Cost Share Program

2. Based on your knowledge and experience, which conservation programs are **most and least desired** by agricultural producers in Washington and Benton Counties. Please write an **M** beside the program most desired and **L** by the program least desired.

____ EQIP

____ CREP

____ Arkansas Soil Nutrient and Poultry Litter Application and Management Program

____ Arkansas Revolving Loan Program

____ Arkansas Nonpoint Pollution Management Program

____ Surplus Poultry Litter Removal Incentives Cost Share Program

3. Which factors could encourage you to participate in these programs? Please check the boxes where the factor would encourage participation in that program. For each program, check all that apply.

Reason	**EQIP**	**CREP**	**NON - POINT**	**LOAN**	**APPLI-CATION**	**REMOV-AL**
I think programs like these are effective in promoting conservation						
I want to be an early adopter – I anticipate environmental regulations in the future						
Integrator requires or requests participation						
Participation would improve profitability of farm operations						
Others would view me as a good steward of the land						
I have participated in a conservation program in the past and have seen positive results						
Adoption of the program has been encouraged by government/extension/university						
Other (please specify):						
I don't know enough about this program to answer						

4. Which factors could discourage you to participate in these programs? Please check the boxes where the factor would discourage participation in that program. For each program, check all that apply.

Reason	**EQIP**	**CREP**	**NON POINT**	**LOAN**	**APPLI - CATION**	**REMOV -AL**
By participating in such programs, others will consider me a polluter						
Participation in conservation programs does not make business sense						
Programs like these require too much up front expense						
Conservation is not a primary concern on my operation						

Reason	EQIP	CREP	NON POINT	LOAN	APPLI CATION	REMOV AL
Participation would interfere with regular farm operations						
I lack knowledge regarding conservation programs.						
The paperwork and regulation associated with application for state conservation programs is too time consuming						
Contract period for improvements is too long						
I have participated in one or more conservation programs and saw no positive effects						
Other (please specify):						

5. Please indicate whether or not you would recommend each of these conservation programs to another producer whose production and conservation needs are similar to yours.

Program	Yes	No
Environmental Quality Incentives Program (EQIP)		
Conservation Reserve Enhancement Program (CREP)		
Arkansas Revolving Loan Program (LOAN)		
Arkansas Nonpoint Pollution Management Program (NONPOINT)		
Arkansas Soil Nutrient and Poultry Litter Application and Management Program (APPLICATION)		
Surplus Poultry Litter Removal Incentives Cost Share Program (REMOVAL)		

6. What do you think can be done to improve farmer participation in each of these programs? Check all that apply.

___ More communication between producers and state and local officials

___ A simpler application process

___ More producer involvement in the shaping of the programs

___ A change in covered practices

___ No improvement needed

___ Other_____________________

SECTION FIVE: OTHER PROGRAMS

The **Environmental Stewardship Program** is a program designed to recognize agricultural producers who have put effort into the conservation of natural resources.

The following refer to the Environmental Stewardship Program:

1. Have you ever heard of this program?

   Yes___ No___

2. Have you ever participated?

   Yes___ No___

3. Do you know someone who has participated?

   Yes___ No___

A **Local Led Work Group** is a group of leaders in agricultural production that gathers to review state natural resource priorities and make suggestions based on local conditions.

4. Have you ever participated in your county's Local Led Work Group?

   Yes_________

   No _________

A **Nutrient Management Plan** (NMP) is a plan for managing the amount, source, placement, form and timing of the application of nutrients and soil amendments. NMPs are developed by certified specialists and organized by the NRCS or ADEQ.

5. Please check the statement(s) that describe your situation.

   _____ I currently have a Nutrient Management Plan

   _____ I have never had a NMP

   _____ I am currently waiting to have a NMP developed

   _____ I am not familiar with NMPs

   _____ I would like to know more about NMPs

SECTION SIX: ABOUT YOUR OPERATION

1. In 2009, how many acres do you own that you use in production?

   __________acres

2. In 2009, how many acres do you rent for use in production?

   __________acres

3. Including 2009, for how many years have you operated a farm/ranch at your current location?
__________years

4. In which county is your agricultural operation located?

__________County

If multiple counties, in which county do you own most of your land used in production?

_________ County

In which county do you rent most of your land used in production?

_________ County

5. What is the age of the principle operator of the farm?

Under 25	____	35 to 44	____	55 to 64	____
25 to 34	____	45 to 54	____	65 and over	____

6. What type of activities did you engage in on your agricultural land in 2009? Please check all that apply.

_____ Broiler houses
_____ Other poultry (Please list.) ____________________
_____ Beef cattle
_____ Dairy
_____ Swine
_____ Other livestock (Please list.) ____________________
_____ Hay production
_____ Pasture production
_____ Tree farming/logging
_____ Vegetable production (Please list.) ____________________
_____ Fruit production (Please list.) ____________________
_____ Other agriculture (Please list.) ____________________

7. What is the highest level of education attained by the owner/operator of the agricultural operation?

____ Some High School ____ High School

____ Some College ____ Undergraduate

____ 2 Year College / Trade School Degree

____ Graduate/Professional

8. In your opinion, what is the best use for your farmland long term?

____Continued agricultural operation by you or your family

____Continued agricultural operation by another producer

____Retire land from production but keep the land in its current state

____Convert land for development

9. What was your gross income from agricultural activities in 2008? Please do NOT include any income earned off-farm.

______$1 to $4,999 ______$5,000 to $9,999

______$10,000 to $24,999 ______$25,000 to $49,999

______$50,000 to $99,999 ______$100,000 to $149,999

______$150,000 to $199,999 ______$200,000 to $249,999

______$250,000 to $299,999 ______$300,000 or more

THANK YOU FOR PARTICIPATING IN OUR SURVEY!

Please use the space below to add any comments.

Thank you again for participating in this research effort!

Please return your survey in the enclosed return reply envelope or mail directly to:

Mr. Edison Froelich c/o Dr. Jennie Popp

Department of Agricultural Economics and Agribusiness

217 Agriculture Building

1 University of Arkansas

Fayetteville, AR 72701

Appendix C: Survey Insert

Dear Agricultural Producer,

I'm enclosing another copy of my survey related to perceptions and use of agricultural conservation programs. If you've already completed it, please disregard this copy – and thank you!

To date I've received 50% of the responses I need in order to complete my thesis research. If you haven't yet completed one, with your help, I can complete research that will provide important information to agriculture policymakers – and important to me, I will be able to satisfy my graduate committee and graduate! So please take a few moments to complete this survey and return it in the postage paid envelope. If you have any questions, please contact me at 479-575-6038 or xxxxx@xxxx.edu.

Thank you,

Edison Froelich

Appendix D: Chi-Squared Testing, Census vs. Survey

Table D.1: Total Acres

	Benton County			Washington County			Both Counties		
Statistic	DF	Value	Prob	DF	Value	Prob	DF	Value	Prob
Chi - Square	5	9.9683	.0761	5	52.634	<.0001	5	44.919	<.0001
Likelihood Ratio Chi-Square	5	11.565	.0413	5	43.251	<.0001	5	41.164	<.0001
Phi - Coefficient	-	0.0667	-		0.1329	-	-	0.0927	-

Table D.2: Years Operated

	Benton County			Washington County			Both Counties		
Statistic	DF	Value	Prob	DF	Value	Prob	DF	Value	Prob
Chi - Square	3	3.983	0.2633	3	12.17	0.0068	3	12.344	0.0063
Likelihood Ratio Chi-Square	3	4.2889	0.2319	3	14.724	0.0021	3	13.781	0.0032
Phi - Coefficient	-	0.042	-		0.0639	-	-	0.0485	-

Table D.3: Principal Operator Age

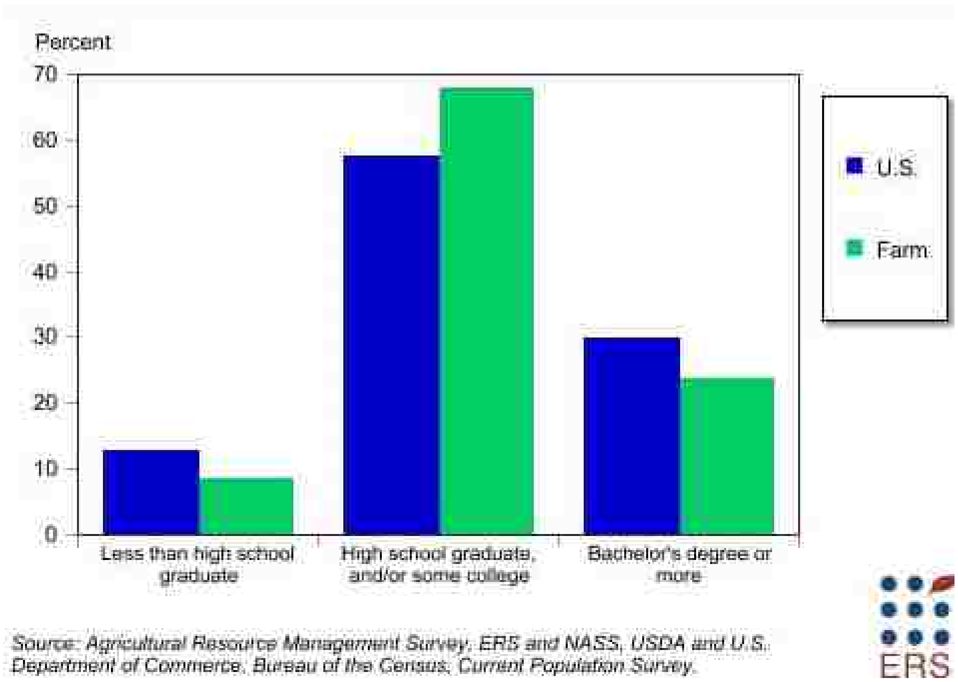
	Benton County			Washington County			Both Counties		
Statistic	DF	Value	Prob	DF	Value	Prob	DF	Value	Prob
Chi - Square	5	8.1354	0.1489	5	16.042	0.0067	5	20.949	0.0008
Likelihood Ratio Chi-Square	5	9.0322	0.1078	5	19.157	0.0018	5	23.464	0.0003
Phi - Coefficient	-	0.0601	-		0.0733	-	-	0.0632	-

Table D.4: On Farm Income

	Benton County			Washington County			Both Counties		
Statistic	DF	Value	Prob	DF	Value	Prob	DF	Value	Prob
Chi-Square	5	27.582	<.0001	5	46.968	<.0001	5	50.103	<.0001
Likelihood Ratio Chi-Square	5	19.301	0.0017	5	42.765	<.0001	5	39.083	<.0001
Phi - Coefficient	-	0.111	-	-	0.1256	-	-	0.0992	-

Appendix E: Educational Attainment of Householders, U.S. and Farm Operators

Table E.1: Educational Attainment of Householders, U.S. and Farm Operators



Appendix F: Operation Type Chi-Square Testing, Specifications and Results

Table F.1: Operation Type Chi-Square Testing, Variables

Variables	
Specification 1	**Specification 2**
Broiler Houses	Broiler Houses
Other Poultry	Beef Cattle
Beef Cattle	Pasture Production
Dairy	
Swine	
Other Livestock	
Pasture Production	
Vegetable Production	
Fruit Production	

Table F.2: Operation Type Chi-Square Testing, Specification 1

Operation Type Specification 1									
	Benton County			**Washington County**			**Combined Counties**		
Statistic	**DF**	**Value**	**p-value**	**DF**	**Value**	**p-value**	**DF**	**Value**	**p-value**
Chi-Square	8	46.757	<.0001	8	27.537	0.0006	8	42.182	<.0001
Likelihood Ratio Chi-Square	8	26.916	0.0007	8	21.29	0.0064	8	29.912	0.0002
Phi - Coefficient	-	0.1157	-	-	0.0796	-	-	0.0734	-

Table F.3: Operation Type Chi-Square Testing, Specification 2

Operation Type Specification 2									
	Benton County			Washington County			Combined Counties		
Statistic	**DF**	**Value**	**p-value**	**DF**	**Value**	**p-value**	**DF**	**Value**	**p-value**
Chi-Square	2	0.5256	0.7689	2	17.603	0.0002	2	5.5613	0.062
Likelihood Ratio Chi-Square	2	0.5434	0.7621	2	12.4015	0.002	2	4.8062	0.0904
Phi -Coefficient	-	0.0129	-	-	0.068	-	-	0.0283	-

Appendix G: Chi-Square and Fisher's Test Results for Type of Operation

Table G.1: Chi Square and Fisher's Test for Broiler Houses

Broiler Houses									
	Benton County			Washington County			Combined Counties		
Statistic	**DF**	**Value**	**Prob**	**DF**	**Value**	**Prob**	**DF**	**Value**	**Prob**
Chi - Square	1	0.5204	0.4707	1	31.4252	<.0001	1	77.0138	<.0001
Likelihood Ratio Chi-Square	1	0.5581	0.455	1	19.7744	<.0001	1	89.7194	<.0001
Phi - Coefficient	-	0.0152	-	-	-0.1027	-	-	0.0947	-
Fisher's Exact Test	-	-	0.1191	-	-	<.0001	-	-	0.0027

Table G.2: Chi Square and Fisher's Test for Other Poultry

Other Poultry									
	Benton County			Washington County			Combined Counties		
Statistic	**DF**	**Value**	**Prob**	**DF**	**Value**	**Prob**	**DF**	**Value**	**Prob**
Chi - Square	1	0.5204	0.4707	1	31.4252	<.0001	1	77.0138	<.0001
Likelihood Ratio Chi-Square	1	0.5581	0.455	1	19.7744	<.0001	1	89.7194	<.0001
Phi - Coefficient	-	0.0152	-	-	-0.1027	-	-	0.0947	-
Fisher's Exact Test	-	-	0.1191	-	-	<.0001	-	-	0.0027

Table G.3: Chi Square and Fisher's Test for Beef Cattle

Beef Cattle									
	Benton County			Washington County			Combined Counties		
Statistic	**DF**	**Value**	**Prob**	**DF**	**Value**	**Prob**	**DF**	**Value**	**Prob**
Chi - Square	1	0.5204	0.4707	1	31.4252	<.0001	1	77.0138	<.0001
Likelihood Ratio Chi-Square	1	0.5581	0.455	1	19.7744	<.0001	1	89.7194	<.0001
Phi - Coefficient	-	0.0152	-	-	-0.1027	-	-	0.0947	-
Fisher's Exact Test	-	-	0.1191	-	-	<.0001	-	-	0.0027

Table G.4: Chi Square and Fisher's Test for Dairy

Dairy									
	Benton County			Washington County			Combined Counties		
Statistic	**DF**	**Value**	**Prob**	**DF**	**Value**	**Prob**	**DF**	**Value**	**Prob**
Chi - Square	1	0.5204	0.4707	1	31.4252	<.0001	1	77.0138	<.0001
Likelihood Ratio Chi-Square	1	0.5581	0.455	1	19.7744	<.0001	1	89.7194	<.0001
Phi - Coefficient	-	0.0152	-	-	-0.1027	-	-	0.0947	-
Fisher's Exact Test	-	-	0.1191	-	-	<.0001	-	-	0.0027

Table G.5: Chi Square and Fisher's Test for Swine

Swine									
	Benton County			Washington County			Combined Counties		
Statistic	**DF**	**Value**	**Prob**	**DF**	**Value**	**Prob**	**DF**	**Value**	**Prob**
Chi - Square	1	0.5204	0.4707	1	31.4252	<.0001	1	77.0138	<.0001
Likelihood Ratio Chi-Square	1	0.5581	0.455	1	19.7744	<.0001	1	89.7194	<.0001
Phi - Coefficient	-	0.0152	-	-	-0.1027	-	-	0.0947	-
Fisher's Exact Test	-	-	0.1191	-	-	<.0001	-	-	0.0027

Table G.6: Chi Square and Fisher's Test for Other Livestock

Other Livestock									
	Benton County			Washington County			Combined Counties		
Statistic	**DF**	**Value**	**Prob**	**DF**	**Value**	**Prob**	**DF**	**Value**	**Prob**
Chi - Square	1	0.5204	0.4707	1	31.4252	<.0001	1	77.0138	<.0001
Likelihood Ratio Chi-Square	1	0.5581	0.455	1	19.7744	<.0001	1	89.7194	<.0001
Phi - Coefficient	-	0.0152	-	-	-0.1027	-	-	0.0947	-
Fisher's Exact Test	-	-	0.1191	-	-	<.0001	-	-	0.0027

Table G.7: Chi Square and Fisher's Test for Pasture

Pasture									
	Benton County			Washington County			Combined Counties		
Statistic	**DF**	**Value**	**Prob**	**DF**	**Value**	**Prob**	**DF**	**Value**	**Prob**
Chi - Square	1	0.5204	0.4707	1	31.4252	<.0001	1	77.0138	<.0001
Likelihood Ratio Chi-Square	1	0.5581	0.455	1	19.7744	<.0001	1	89.7194	<.0001
Phi - Coefficient	-	0.0152	-	-	-0.1027	-	-	0.0947	-
Fisher's Exact Test	-	-	0.1191	-	-	<.0001	-	-	0.0027

Table G.8: Chi Square and Fisher's Test for Vegetables

Vegetables									
	Benton County			Washington County			Combined Counties		
Statistic	**DF**	**Value**	**Prob**	**DF**	**Value**	**Prob**	**DF**	**Value**	**Prob**
Chi - Square	1	0.5204	0.4707	1	31.4252	<.0001	1	77.0138	<.0001
Likelihood Ratio Chi-Square	1	0.5581	0.455	1	19.7744	<.0001	1	89.7194	<.0001
Phi - Coefficient	-	0.0152	-	-	-0.1027	-	-	0.0947	-
Fisher's Exact Test	-	-	0.1191	-	-	<.0001	-	-	0.0027

Table G.9: Chi Square and Fisher's Test for Fruit

Fruit									
	Benton County			Washington County			Combined Counties		
Statistic	**DF**	**Value**	**Prob**	**DF**	**Value**	**Prob**	**DF**	**Value**	**Prob**
Chi - Square	1	0.5204	0.4707	1	31.4252	<.0001	1	77.0138	<.0001
Likelihood Ratio Chi-Square	1	0.5581	0.455	1	19.7744	<.0001	1	89.7194	<.0001
Phi - Coefficient	-	0.0152	-	-	-0.1027	-	-	0.0947	-
Fisher's Exact Test	-	-	0.1191	-	-	<.0001	-	-	0.0027

Appendix H: Logit Specification 1, MLE Results

Table H.1: Logit Results, Specification 1, EQIP

EQIP					
Analysis of Maximum Likelihood Estimates					
Parameter	**Measured**	**Estimate**	**Standard Error**	**Chi-Square**	**p-value**
Intercept		27.9112	79.7991	0.1223	0.7265
Acres	#	-0.0699	0.1852	0.1426	0.7057
Years Operated	#	0.3543	0.5149	0.4736	0.4913
County	Benton	-0.8044	7.8803	0.0104	0.9187
Income	$1 to $9,999	3.9749	71.9228	0.0031	0.9559
Income	$10,000 to $24,999	-7.0675	74.1625	0.0091	0.9241
Income	$25,000 to $49,999	-4.8977	145.3	0.0011	0.9731
Income	$50,000 to $99,999	-3.645	84.1477	0.0019	0.9654
College Ed	0	-1.114	8.8911	0.0157	0.9003
Animal Ag	0	-4.3511	14.3927	0.0914	0.7624
Under 55	0	1.8152	8.8869	0.0417	0.8382
Conservation District	0	-28.3663	22.8616	1.5395	0.2147
NRCS	0	-3.6985	112.3	0.0011	0.9737
FSA	0	-13.5287	23.3635	0.3353	0.5626
University Extension	0	-14.753	18.0864	0.6654	0.4147
Other Producers	0	11.6666	104.7	0.0124	0.9113
Long Term Plans	0	6.7898	8.8104	0.5939	0.4409

Table H.2: Logit Results, Specification 1, CREP

CREP					
Analysis of Maximum Likelihood Estimates					
Parameter	**Measured**	**Estimate**	**Standard Error**	**Chi-Square**	**p-value**
Intercept		27.0344	97.935	0.0762	0.7825
Acres	#	0.00316	0.00525	0.3615	0.5477
Years Operated	#	0.2632	0.1565	2.8286	0.0926
County	Benton	-0.7856	0.8226	0.9119	0.3396
Income	$1 to $9,999	-4.3917	40.3077	0.0119	0.9132
Income	$10,000 to $24,999	3.14	40.3066	0.0061	0.9379
Income	$25,000 to $49,999	18.6147	148.6	0.0157	0.9003
Income	$50,000 to $99,999	-17.0999	74.0321	0.0534	0.8173
College Ed	0	-4.2445	2.5644	2.7396	0.0979
Animal AG	0	0.1229	0.9378	0.0172	0.8957
Under 55	0	0.2084	0.75	0.0772	0.7811
Conservation District	0	-11.017	118.9	0.0086	0.9262
NRCS	0	-1.255	131.1	0.0001	0.9924
FSA	0	-5.8955	3.3212	3.1509	0.0759
University Extension	0	-10.2305	40.9024	0.0626	0.8025
Other Producers	0	-7.6082	65.4106	0.0135	0.9074
Long Term Plans	0	3.9113	2.2022	3.1545	0.0757

Table H.3: Logit Results, Specification 1, LOAN

LOAN					
Analysis of Maximum Likelihood Estimates					
Parameter	**Measured**	**Estimate**	**Standard Error**	**Chi-Square**	**p-value**
Intercept		5.9624	98.1304	0.0037	0.9516
Acres	#	0.00135	0.00326	0.1705	0.6797
Years Operated	#	-0.0486	0.0493	0.9726	0.324
County	Benton	0.9825	0.6814	2.0795	0.1493
Income	$1 to $9,999	-4.3173	16.8661	0.0655	0.798
Income	$10,000 to $24,999	4.6936	13.5717	0.1196	0.7295
Income	$25,000 to $49,999	5.9398	13.5887	0.1911	0.662
Income	$50,000 to $99,999	-11.0619	42.8207	0.0667	0.7962
College Ed	0	0.7986	0.6406	1.5541	0.2125
Animal Ag	0	4.7532	11.2382	0.1789	0.6723
Under 55	0	1.0448	0.7506	1.9379	0.1639
Conservation District	0	-6.5503	59.729	0.012	0.9127
ANRC	0	-14.0184	228.1	0.0038	0.951
ADEQ	0	20.8356	258	0.0065	0.9356
University Extension	0	-18.3519	69.388	0.07	0.7914
NRCS	0	11.1452	70.0016	0.0253	0.8735
Long Term Plans	0	0.4502	0.5977	0.5672	0.4514

Table H.4: Logit Results, Specification 1, NONPOINT

NONPOINT					
Analysis of Maximum Likelihood Estimates					
Parameter	**Measured**	**Estimate**	**Standard Error**	**Chi-Square**	**p-value**
Intercept		7.1111	160.1	0.002	0.9646
Acres	#	-0.00045	0.00147	0.0927	0.7608
Years Operated	#	-0.0115	0.0368	0.0978	0.7545
County	Benton	-0.4675	0.4333	1.1641	0.2806
Income	$1 to $9,999	-0.7341	0.836	0.7712	0.3799
Income	$10,000 to $24,999	-0.5812	0.8387	0.4802	0.4883
Income	$25,000 to $49,999	0.0346	0.8418	0.0017	0.9672
Income	$50,000 to $99,999	0.0903	0.9599	0.0089	0.925
College Ed	0	0.2091	0.5264	0.1577	0.6913
Animal Ag	0	0.8644	0.619	1.9502	0.1626
Under 55	0	0.0494	0.5031	0.0096	0.9218
Conservation District	0	-6.9223	143.8	0.0023	0.9616
ANRC	0	-0.0647	0.8228	0.0062	0.9373
ADEQ	0	-6.2034	160.1	0.0015	0.9691
University Extension	0	-0.1241	0.7447	0.0278	0.8677
NRCS	0	5.6807	143.8	0.0016	0.9685
Long Term Plans	0	0.652	0.4635	1.9783	0.1596

Table H.5: Logit Results, Specification 1, APPLICATION

APPLICATION					
Analysis of Maximum Likelihood Estimates					
Parameter	**Measured**	**Estimate**	**Standard Error**	**Chi-Square**	**p-value**
Intercept		9.086	79.2899	0.0131	0.9088
Acres	#	0.000208	0.00446	0.0022	0.9628
Years Operated	#	-0.0224	0.0354	0.3996	0.5273
County	Benton	-0.805	0.5329	2.282	0.1309
Income	$1 to $9,999	-0.0463	0.8956	0.0027	0.9587
Income	$10,000 to $24,999	-0.0203	1.0282	0.0004	0.9843
Income	$25,000 to $49,999	-0.2449	1.2554	0.038	0.8454
Income	$50,000 to $99,999	-1.5619	1.6009	0.9519	0.3292
College Ed	0	1.1184	0.6743	2.7509	0.0972
Animal Ag	0	-0.1381	0.642	0.0463	0.8297
Under 55	0	0.0802	0.483	0.0276	0.8681
Conservation District	0	-6.1456	84.1795	0.0053	0.9418
ANRC	0	6.2345	84.1894	0.0055	0.941
ADEQ	0	-5.3129	79.2672	0.0045	0.9466
University Extension	0	-1.2597	1.0162	1.5366	0.2151
NRCS	0	-1.3631	1.0058	1.8368	0.1753
Long Term Plans	0	1.0582	0.5808	3.3197	0.0685

Table H.6: Logit Results, Specification 1, REMOVAL

REMOVAL					
Analysis of Maximum Likelihood Estimates					
Parameter	**Measured**	**Estimate**	**Standard Error**	**Chi-Square**	**p-value**
Intercept		2.214	3.1466	0.4951	0.4817
Acres	#	0.000587	0.00291	0.0407	0.8401
Years Operated	#	0.000099	0.0284	0	0.9972
County	Benton	-0.6144	0.4495	1.8678	0.1717
Income	$1 to $9,999	-1.1647	0.8237	1.9992	0.1574
Income	$10,000 to $24,999	-0.5112	0.8188	0.3898	0.5324
Income	$25,000 to $49,999	1.0171	0.9331	1.1883	0.2757
Income	$50,000 to $99,999	-0.0225	1.2062	0.0003	0.9851
College Ed	0	0.9448	0.5411	3.0487	0.0808
Animal Ag	0	0.3858	0.6674	0.3341	0.5633
Under 55	0	0.2295	0.502	0.209	0.6475
Conservation District	0	-8.2915	108.6	0.0058	0.9391
ANRC	0	4.2227	86.2498	0.0024	0.961
ADEQ	0	1.121	2.8885	0.1506	0.698
University Extension	0	-1.6702	0.8017	4.3402	0.0372*
NRCS	0	3.0089	65.9711	0.0021	0.9636
Long Term Plans	0	1.3188	0.6241	4.465	0.0346*

Appendix I: Logit Specification 2, MLE Results

Table I.1: Logit Results, Specification 2, EQIP

EQIP					
Analysis of Maximum Likelihood Estimates					
Parameter	**Measured**	**Estimate**	**Std. Error**	**Chi-Square**	**p-value**
Intercept		4.9577	91.25	0.003	0.9567
Acres	#	0.00105	0.00227	0.2143	0.6434
Years Operated	#	0.0384	0.0198	3.7742	0.052
County	Benton	-0.4328	0.2764	2.452	0.1174
Income	$1 to $9,999	-0.8706	0.4883	3.1788	0.0746
Income	$10,000 to $24,999	-0.7611	0.5135	2.1968	0.1383
Income	$25,000 to $49,999	0.1864	0.6856	0.0739	0.7857
Income	$50,000 to $99,999	0.9746	0.6724	2.1007	0.1472
College Ed	0	-0.5934	0.3379	3.0831	0.0791
Animal Ag	0	-0.8264	0.4371	3.5755	0.0586
Long Term Plans	0	-0.0239	0.3686	0.0042	0.9482
Other Producers	0	-7.0549	91.2467	0.006	0.9384

Table I.2: Logit Results, Specification 2, CREP

CREP					
Analysis of Maximum Likelihood Estimates					
Parameter	**Measured**	**Estimate**	**Std. Error**	**Chi-Square**	**p-value**
Intercept		0.9334	0.9996	0.872	0.3504
Acres	#	0.00234	0.00195	1.4423	0.2298
Years Operated	#	-0.0133	0.0235	0.3211	0.571
County	Benton	-0.5004	0.2909	2.9589	0.0854
Income	$1 to $9,999	-1.1544	0.5943	3.7732	0.0521
Income	$10,000 to $24,999	-0.0369	0.5688	0.0042	0.9483
Income	$25,000 to $49,999	1.9014	1.1309	2.8269	0.0927
Income	$50,000 to $99,999	-0.5194	0.7588	0.4685	0.4937
College Ed	0	-0.8128	0.3526	5.3127	0.0212*
Animal Ag	0	-0.4722	0.4522	1.0904	0.2964
Long Term Plans	0	0.4475	0.3864	1.3413	0.2468
FSA	0	-1.2908	0.4279	9.1021	0.0026*

Table I.3: Logit Results, Specification 2, LOAN

LOAN					
Analysis of Maximum Likelihood Estimates					
Parameter	**Measured**	**Estimate**	**Std. Error**	**Chi-Square**	**p-value**
Intercept		0.4304	1.3144	0.1072	0.7433
Acres	#	0.00198	0.00203	0.9559	0.3282
Years Operated	#	-0.00043	0.0281	0.0002	0.9877
County	Benton	0.6567	0.4188	2.4585	0.1169
Income	$1 to $9,999	-2.058	1.0443	3.8835	0.0488*
Income	$10,000 to $24,999	0.0604	0.7737	0.0061	0.9378
Income	$25,000 to $49,999	1.4838	0.7114	4.3501	0.037*
Income	$50,000 to $99,999	0.6695	0.8773	0.5824	0.4454
College Ed	0	0.202	0.466	0.1879	0.6647
Animal Ag	0	0.7113	0.7903	0.8101	0.3681
Long Term Plans	0	0.1437	0.4831	0.0885	0.7662
University Extension	0	-1.995	0.6703	8.8587	0.0029*

Table I.4: Logit Results, Specification 2, NONPOINT

NONPOINT					
Analysis of Maximum Likelihood Estimates					
Parameter	**Measured**	**Estimate**	**Std. Error**	**Chi-Square**	**p-value**
Intercept		0.9565	1.0133	0.8909	0.3452
Acres	#	-0.0009	0.00121	0.6365	0.425
Years Operated	#	0.00456	0.0224	0.0416	0.8383
County	Benton	-0.5586	0.3247	2.9603	0.0853
Income	$1 to $9,999	-1.0597	0.7207	2.162	0.1415
Income	$10,000 to $24,999	-0.4694	0.6677	0.4942	0.482
Income	$25,000 to $49,999	-0.2604	0.6896	0.1426	0.7057
Income	$50,000 to $99,999	0.2986	0.7512	0.158	0.691
College Ed	0	0.00123	0.4033	0	0.9976
Animal Ag	0	0.8967	0.5168	3.0108	0.0827
Continue	0	0.3514	0.4006	0.7694	0.3804
ANRC	0	-1.3631	0.4576	8.8732	0.0029*

Table I.5: Logit Results, Specification 2, APPLICATION

APPLICATION					
Analysis of Maximum Likelihood Estimates					
Parameter	**Measured**	**Estimate**	**Standard Error**	**Chi-Square**	**p-value**
Intercept		0.8217	1.023	0.6451	0.4219
Acres	#	0.0012	0.00229	0.272	0.602
Years Operated	#	0.0145	0.0218	0.4402	0.507
County	Benton	-0.6497	0.3317	3.8359	0.0502
Income	$1 to $9,999	-0.0903	0.5853	0.0238	0.8774
Income	$10,000 to $24,999	-0.0861	0.6252	0.019	0.8905
Income	$25,000 to $49,999	-0.4421	0.7969	0.3077	0.5791
Income	$50,000 to $99,999	0.0279	0.7672	0.0013	0.971
College Ed	0	0.3729	0.4256	0.7677	0.3809
Animal Ag	0	-0.4447	0.4855	0.8391	0.3597
Long Term Plans	0	0.3997	0.3935	1.0319	0.3097
NRCS	0	-0.759	0.406	3.4951	0.0615

Table I.6: Logit Results, Specification 2, REMOVAL

REMOVAL					
Analysis of Maximum Likelihood Estimates					
Parameter	**Measured**	**Estimate**	**Std. Error**	**Chi-Square**	**p-value**
Intercept		0.9883	1.1316	0.7627	0.3825
Acres	#	0.000736	0.00124	0.3508	0.5536
Years Operated	#	0.012	0.0206	0.3397	0.56
County	Benton	-0.5396	0.3261	2.7377	0.098
Income	$1 to $9,999	-1.1207	0.6088	3.3885	0.0657
Income	$10,000 to $24,999	-0.3945	0.5982	0.4348	0.5096
Income	$25,000 to $49,999	1.1421	0.7496	2.3219	0.1276
Income	$50,000 to $99,999	0.2781	0.8028	0.12	0.729
College Ed	0	0.4685	0.4012	1.3636	0.2429
Animal Ag	0	-0.1011	0.5503	0.0338	0.8542
Long Term Plans	0	0.9659	0.4218	5.2448	0.022*
ADEQ	0	-0.6581	0.654	1.0126	0.3143

Appendix J: Logit Specification 3, MLE Results

Table J.1: Logit Results, Specification 3, EQIP

EQIP					
Analysis of Maximum Likelihood Estimates					
Parameter	**Measured**	**Estimate**	**Standard Error**	**Chi-Square**	**p-value**
Intercept		-1.0263	0.6258	2.6893	0.101
County	Benton	-0.4504	0.2188	4.2363	0.0396*
Income	$1 to $9,999	-1.4281	0.3694	14.948	0.0001*
Income	$10,000 to $24,999	-0.6319	0.3968	2.5358	0.1113
Income	$25,000 to $49,999	0.3225	0.5945	0.2943	0.5875
Income	$50,000 to $99,999	0.7889	0.5882	1.7992	0.1798
College Ed	0	-0.5558	0.2583	4.6296	0.0314*
Animal Ag	0	-0.8451	0.3404	6.1647	0.013*
Years of Operation	#	0.0366	0.0149	6.0202	0.0141*

Table J.2: Logit Results, Specification 3, CREP

CREP					
Analysis of Maximum Likelihood Estimates					
Parameter	**Measured**	**Estimate**	**Standard Error**	**Chi-Square**	**p-value**
Intercept		1.1806	0.4654	6.4356	0.0112*
Income	$1 to $9,999	-1.347	0.4519	8.8847	0.0029*
Income	$10,000 to $24,999	-0.1621	0.4979	0.1059	0.7448
Income	$25,000 to $49,999	1.4978	0.9791	2.3404	0.1261
Income	$50,000 to $99,999	-0.5605	0.6652	0.7101	0.3994
College Ed	0	-0.6027	0.2982	4.0843	0.0433*
FSA	0	-1.4238	0.406	12.3014	0.0005*

Table J.3: Logit Results, Specification 3, LOAN

LOAN					
Analysis of Maximum Likelihood Estimates					
Parameter	**Measured**	**Estimate**	**Standard Error**	**Chi-Square**	**p-value**
Intercept		0.4048	0.587	0.4757	0.4904
Income	$1 to $9,999	-1.608	0.7402	4.7194	0.0298*
Income	$10,000 to $24,999	-0.2333	0.6969	0.1121	0.7378
Income	$25,000 to $49,999	1.3838	0.6253	4.8972	0.0269*
Income	$50,000 to $99,999	0.5849	0.8384	0.4867	0.4854
University Extension	0	-2.1864	0.6029	13.152	0.0003*

Table J.4: Logit Results, Specification 3, NONPOINT

NONPOINT					
Analysis of Maximum Likelihood Estimates					
Parameter	**Measured**	**Estimate**	**Standard Error**	**Chi-Square**	**p-value**
Intercept		-0.165	0.3675	0.2016	0.6535
County	Benton	-0.6586	0.2739	5.7815	0.0162*
ANRC	0	-1.4915	0.3727	16.0177	<.0001*

Table J.5: Logit Results, Specification 3, APPLICATION

APPLICATION					
Analysis of Maximum Likelihood Estimates					
Parameter	**Measured**	**Estimate**	**Standard Error**	**Chi-Square**	**p-value**
Intercept		0.7114	0.4546	2.4486	0.1176
Animal Ag	0	-0.7192	0.3922	3.3622	0.0667*
University Extension	0	-1.2433	0.3376	13.5613	0.0002*

Table J.6: Logit Results, Specification 3, REMOVAL

REMOVAL					
Analysis of Maximum Likelihood Estimates					
Parameter	**Measured**	**Estimate**	**Error**	**Chi-Square**	**p-value**
Intercept		0.3035	0.2353	1.6646	0.197
Income	$1 to $9,999	-2.0953	0.4147	25.5227	<.0001*
Income	$10,000 to $24,999	-0.64	0.3977	2.5891	0.1076
Income	$25,000 to $49,999	0.9958	0.5567	3.1996	0.0737
Income	$50,000 to $99,999	0.7081	0.5098	1.9291	0.1649

Appendix K: SAS Program for Analyses

Program K.1: Data Manipulation

```
data conserve_adj (drop=q1_3_6_oth q1_4b_6_oth q1_4c_6_oth q1_5_2 q1_6_2
	q2_3_7_oth q2_4a_3_oth q3_3_7_oth q3_3_7_oth q4_3f_8_oth q4_4f_10_oth
q4_6_6_oth
	q6_6_2_oth q6_6_6_oth q6_6_10_oth q6_6_11_oth q6_6_12_oth comments
	i nfactor4_3 nfactor4_4 nimprove nnutrient nfarmact);
	/*Drop variables with open-ended responses & new counter variables*/
	set ef.conserve_pgm;

	/*Adjust value of one respondent to remove inconsistent answer*/
	If id='399' then q3_2_3=.;

/*This is to take care of the HORSE issue. The indicated surveys answered '1' to Q6_6_6
and wrote in horses.
	Horses are not to be included with 'Other Livestock' for this research, thus other
livestock is changed to no*/
	if id='234' then do;Q6_6_6=0;
	if id='301' then Q6_6_6=.0;
	if id='917' then Q6_6_6=0;
	if id='1173' then Q6_6_6=0;
	if id='1524' then Q6_6_6=0;
	if id='1726' then Q6_6_6=0;
	if id='2173' then Q6_6_6=0;
	if id='2411' then Q6_6_6=0;
	if id='2479' then Q6_6_6=0;
	if id='2579' then Q6_6_6=0;
	if id='3066' then Q6_6_6=0;
	if id='3252' then Q6_6_6=0;
	if id='3294' then Q6_6_6=0;
	end;

	/**************Convert blanks to zeros for some variables*************/

	/*Section 4, Question 3, Factors to encourage participation in programs*/
	array factorsa {54} q4_3a_1-q4_3a_9 q4_3b_1-q4_3b_9 q4_3c_1-q4_3c_9
q4_3d_1-q4_3d_9
					q4_3e_1-q4_3e_9 q4_3f_1-q4_3f_9;/*Place all
factor variables in an array*/

	nfactor4_3=sum (of q4_3a_1-q4_3a_9 q4_3b_1-q4_3b_9 q4_3c_1-q4_3c_9
q4_3d_1-q4_3d_9
					q4_3e_1-q4_3e_9 q4_3f_1-q4_3f_9);/*Sum the
number of factors checked*/
```

```
	if nfactor4_3>0 then do i=1 to 54;/*If at least one factor is checked, assume all non-checked are 'no'.
											If no factors are checked assume all non-checked are missing*/
		if factorsa{i}=. then factorsa{i}=0;
	end;

	/*Section 4, Question 4, Factors to discourage participation in programs*/
	array factorsb {54} q4_4a_1-q4_4a_9 q4_4b_1-q4_4b_9 q4_4c_1-q4_4c_9 q4_4d_1-q4_4d_9
						q4_4e_1-q4_4e_9 q4_4f_1-q4_4f_9;/*Place all factor variables in an array*/

	nfactor4_4=sum (of q4_4a_1-q4_4a_9 q4_4b_1-q4_4b_9 q4_4c_1-q4_4c_9 q4_4d_1-q4_4d_9
						q4_4e_1-q4_4e_9 q4_4f_1-q4_4f_9);/*Sum the number of factors checked*/

	if nfactor4_4>0 then do i=1 to 54;/*If at least one factor is checked, assume all non-checked are 'no'.
											If no factors are checked assume all non-checked are missing*/
		if factorsb{i}=. then factorsb{i}=0;
	end;

/*Section 4, Question 6, Ways to improve farmer participation*/
	array improve{6} q4_6_1-q4_6_6;

	nimprove=sum(of q4_6_1-q4_6_6);

	if nimprove>0 then do i=1 to 6;
		if improve{i}=. then improve{i}=0;
	end;

	/*Section 5, Question 5, Nutrient Plan statements*/
	array nutrient{5} q5_5_1-q5_5_5;
	nnutrient=sum (of q5_5_1-q5_5_5);
	if nnutrient>0 then do i=1 to 5;
		if nutrient{i}=. then nutrient{i}=0;
	end;

	/*Section 6, Question 6, Farming Activities*/
	array farmact{12} q6_6_1-q6_6_12;
```

```
	nfarmact=sum (of q6_6_1-q6_6_12);
	if nfarmact>0 then do i=1 to 12;
		if farmact{i}=. then farmact{i}=0;
	end;

	if q6_6_1=1 or q6_6_2=1 then poultry=1;/*Create new variable for whether have
poultry operation*/
		else if q6_6_1>. then poultry=0;
	if q6_6_3=1 or q6_6_4=1 then cattle=1;/*Create new variable for whether have
cattle (beef or dairy)*/
		else if q6_6_3>. then cattle=0;
	if poultry=1 or cattle=1 or q6_6_5=1 or q6_6_6=1 then animal=1;/*Create var for
whether have animal operation*/
		else if poultry>. then animal=0;
	if q6_6_9=1 or q6_6_10=1 or q6_6_11=1 then hort=1;/*Create var for whether
have trees, fruits and/or veggies*/
		else if q6_6_9>. then hort=0;
	if q6_6_7=1 or q6_6_8=1 then haypasture=1;
		else if q6_6_7>. then haypasture=0;
	if hort=1 or q6_6_7=1 or q6_6_8=1 then nonanimal=1;/*Create var for whether
have non-animal ag*/
		else if hort>. then nonanimal=0;


	acres=sum(q6_1,q6_2);/*Calculate total acres in operation*/
	if acres=0 then acres=.;/*Assuming they can't farm with zero acres owned or
rented*/

	/*If sum of acres is greater than zero and no acreage is reported for one of the
categories, owned or rented,
	  make that = zero*/
	if acres>0 then do;
		if q6_1=. then q6_1=0;
		if q6_2=. then q6_2=0;
	end;

	acresownpct=q6_1/acres*100;/*Calculate % of acres owned*/
	acresrentpct=q6_2/acres*100;/*Calculate % of acres rented*/


	/*Count the number of responses for factors to encourage*/
	q4_3a=sum(of q4_3a_1-q4_3a_8);/*EQIP*/
	q4_3b=sum(of q4_3b_1-q4_3b_8);/*CREP*/
	q4_3c=sum(of q4_3c_1-q4_3c_8);/*Non-Point*/
```

```
q4_3d=sum(of q4_3d_1-q4_3d_8);/*Loan*/
q4_3e=sum(of q4_3e_1-q4_3e_8);/*Application*/
q4_3f=sum(of q4_3f_1-q4_3f_8);/*Removal*/

/*Count the number of responses for factors to discourage*/
q4_4a=sum(of q4_4a_1-q4_4a_10);/*EQIP*/
q4_4b=sum(of q4_4b_1-q4_4b_10);/*CREP*/
q4_4c=sum(of q4_4c_1-q4_4c_10);/*Non-Point*/
q4_4d=sum(of q4_4d_1-q4_4d_10);/*Loan*/
q4_4e=sum(of q4_4e_1-q4_4e_10);/*Application*/
q4_4f=sum(of q4_4f_1-q4_4f_10);/*Removal*/

/*Count the number of improvements checked*/
q4_6=sum(of q4_6_1-q4_6_4);
label q1_1_1='Knew abt EQIP before Survey?'
q1_2_1='Knew abt CREP before Survey?'
q6_4_2='County of Rental'
q6_4_1='County of Residence'
q6_4_3='Primary County of Operation'
q6_5='Age of Principle Operator'
q6_7='Education'
q6_9='On-Farm Income'
;

Federal_Know_N=sum(q1_1_1,q1_2_1);
State_Know_N=sum(q2_1_1,q2_2_1);
Poultry_Know_N=sum(q3_1_1,q3_2_1);
EQIP_Know_N=sum(q1_1_1);
CREP_Know_N=sum(q1_2_1);
LOAN_Know_N=sum(q2_1_1);
NONPOINT_Know_N=sum(q2_2_1);
APPLICATION_Know_N=sum(q3_1_1);
REMOVAL_Know_N=sum(q3_2_1);


Federal_Know=Federal_Know_N;
If Federal_Know_N>1 then Federal_Know=1;

State_Know=State_Know_N;
If State_Know>1 then State_know=1;

Poultry_Know=Poultry_Know_N;
If Poultry_Know>1 then Poultry_know=1;
```

```
        EQIP_Know=EQIP_Know_N;
        if EQIP_Know>1 then EQIP_Know=1;

        CREP_Know=CREP_Know_N;
        if CREP_Know>1 then EQIP_Know=1;

        LOAN_Know=LOAN_Know_N;
        if LOAN_Know>1 then LOAN_Know=1;

        NONPOINT_Know=NONPOINT_Know_N;
        if NONPOINT_Know>1 then NONPOINT_Know=1;

        APPLICATION_Know=NONPOINT_Know_N;
        if APPLICATION_Know>1 then APPLICATION_Know=1;

        REMOVAL_Know=REMOVAL_Know_N;
        if REMOVAL_Know>1 then REMOVAL_Know=1;


/*Calculate variable for whether property will continue as farmland*/
        if q6_8 in(0,1) then continue=1;
        if q6_8 in(2,3) then continue=0;

        if Q6_5 in (0,1,2,3) then UnderFF=1;
        if Q6_5 in (4,5) then UnderFF=0;

        if q6_7 in (0,1) then CollegeEd=0;
        if q6_7 in (2,3,4,5) then CollegeEd=1;

/*Calculate variable for whether got info on EQIP by Source
         Set variable = to 1 if source is indicated*/

        if q1_3_1 in(1,3) then E_Conserve=1;

        if q1_3_2 in(1,3) then E_NRCS=1;

        if q1_3_3 in(1,3) then E_FSA=1;

        if q1_3_4 in(1,3) then E_CESRes=1;

        if q1_3_5 in(1,3) then E_Producers=1;

        If q1_3_6 in (1,3) then E_OtherSource=1;
```

```
        label E_Conserve='Info on EQIP from Conservation District'
        E_NRCS='Info on EQIP from NRCS'
        E_FSA='Info on EQIP from FSA'
        E_CESRes='Info on EQIP from Extension/Research'
        E_Producers='Info on EQIP from Other Producers'
        E_OtherSource='Info on EQIP from Another Source'
        ;

/*Calculate # of Information Sources for EQIP*/
        n_Eqip_Source=sum(E_Conserve,E_NRCS,E_FSA,E_CESRes,E_Producers);
        label n_Eqip_Source='# Information Sources on EQIP';

/*If the sum of sources is non-missing (i.e. at least one source was indicated, then sources
with no value entered were treated as No*/
        if n_eqip_source>0 then do;
                if E_Conserve=. then E_Conserve=0;
                if E_NRCS=. then E_NRCS=0;
                if E_FSA=. then E_FSA=0;
                if E_CESRes =. then E_CESRes=0;
                if E_Producers=. then E_Producers=0;
        end;

/*Calculate variable for whether got info on CREP by Source
         Set variable = to 1 if source is indicated*/

        if q1_3_1 in(2,3) then C_Conserve=1;

        if q1_3_2 in(2,3) then C_NRCS=1;

        if q1_3_3 in(2,3) then C_FSA=1;

        if q1_3_4 in(2,3) then C_CESRes=1;

        if q1_3_5 in(2,3) then C_Producers=1;

        label C_Conserve='Info on CREP from Conservation District'
        C_NRCS='Info on CREP from NRCS'
        C_FSA='Info on CREP from FSA'
        C_CESRes='Info on CREP from Extension/Research'
        C_Producers='Info on CREP from Other Producers';

/*Calculate # of Information Sources for CREP*/
        n_CREP_Source=sum(C_Conserve,C_NRCS,C_FSA,C_CESRes,C_Producers);
        label n_CREP_Source='# Information Sources on CREP';
```

```
/*If the sum of sources is non-missing (i.e. at least one source was indicated, then sources
with no value entered were treated as No*/
        if n_CREP_source>0 then do;
                if C_Conserve=. then C_Conserve=0;
                if C_NRCS=. then C_NRCS=0;
                if C_FSA=. then C_FSA=0;
                if C_CESRes =. then C_CESRes=0;
                if C_Producers=. then C_Producers=0;
        end;

/*Calculate variable for whether got info on LOAN by Source
         Set variable = to 1 if source is indicated*/

        if q2_3_1 in(1,3) then L_Conserve=1;

        if q2_3_2 in(1,3) then L_ANRC=1;

        if q2_3_3 in(1,3) then L_ADEQ=1;

        if q2_3_4 in(1,3) then L_CESRes=1;

        if q2_3_5 in(1,3) then L_NRCS=1;

        if q2_3_6 in(1,3) then L_producers=1;

        label L_Conserve='Info on LOAN from Conservation District'
        L_NRCS='Info on LOAN from NRCS'
        L_ANRC='Info on LOAN from ANRC'
        L_ADEQ='Info on LOAN from ANRC'
        L_CESRes='Info on LOAN from Extension/Research'
        L_Producers='Info on LOAN from Other Producers';

/*Calculate # of Information Sources for CREP*/

        n_LOAN_Source=sum(L_Conserve,L_NRCS,L_FSA,L_CESRes,L_Producers);
        label n_LOAN_Source='# Information Sources on LOAN';

/*If the sum of sources is non-missing (i.e. at least one source was indicated, then sources
with no value entered were treated as No*/

        if n_CREP_source>0 then do;
                if L_Conserve=. then L_Conserve=0;
                if L_NRCS=. then L_NRCS=0;
                if L_FSA=. then L_FSA=0;
```

```
		if L_CESRes =. then L_CESRes=0;
		if L_Producers=. then L_Producers=0;
	end;
run;

/*Create formats to group values and label values. These are applied to variables later to
make them "purdy"*/
proc format;
value yrsfarm 0-2='2 yr or less' 3-4='3-4 yrs' 5-9='5-9 yrs' 10-high='10 yr or more';
value county 4='Benton' 72='Washington';
value farmincome 0='1 to 4,999' 1='5,000 to 9,999' 2='10,000 to 24,999' 3='25,000 to
49,999' 4='50,000 to 99,999' 5='100,000 to 149,999' 6='150,000 to 199,999' 7='200,000
to 249,999' 8='250,000 to 299,999' 9='300,000 or more';
value inccomb 0,1='1 to 9,999' 2='10,000 to 24,999' 3='25,000 to 49,999' 4='50,000 to
99,999' 5,6,7,8,9='z100,000 or Greater';
/*Value inccomb 0,1='Less than 10,000' 2,3,4,5,6,7,8,9='More than 10,000';*/
value CollegeEd 0='No College' 1='College Education';
value UnderFF 1='PO is Under 55' 0='PO is 55 Years or Older';
/* think about creating a new grouping with age. Maybe even a dummy variable of >65*/
run;


data conserve2;
	set conserve_adj;
/*This is Info Source for EQIP*/
	if q1_3_1=1  then q1_3_1E=1;
	if q1_3_1=0  then q1_3_1E=0;
	if q1_3_1=2  then q1_3_1E=0;
	if q1_3_1=3  then q1_3_1E=1;

	if q1_3_2=1  then q1_3_2E=1;
	if q1_3_2=0  then q1_3_2E=0;
	if q1_3_2=2  then q1_3_2E=0;
	if q1_3_2=3  then q1_3_2E=1;

	if q1_3_3=1  then q1_3_3E=1;
	if q1_3_3=0  then q1_3_3E=0;
	if q1_3_3=2  then q1_3_3E=0;
	if q1_3_3=3  then q1_3_3E=1;

	if q1_3_4=1  then q1_3_4E=1;
	if q1_3_4=0  then q1_3_4E=0;
	if q1_3_4=2  then q1_3_4E=0;
	if q1_3_4=3  then q1_3_4E=1;
```

```
    if q1_3_5=1  then q1_3_5E=1;
    if q1_3_5=0  then q1_3_5E=0;
    if q1_3_5=2  then q1_3_5E=0;
    if q1_3_5=3  then q1_3_5E=1;

/*This is Info Source for CREP*/
    if q1_3_1=1  then q1_3_1C=0;
    if q1_3_1=0  then q1_3_1C=0;
    if q1_3_1=2  then q1_3_1C=1;
    if q1_3_1=3  then q1_3_1C=1;

    if q1_3_2=1  then q1_3_2C=0;
    if q1_3_2=0  then q1_3_2C=0;
    if q1_3_2=2  then q1_3_2C=1;
    if q1_3_2=3  then q1_3_2C=1;

    if q1_3_3=1  then q1_3_3C=0;
    if q1_3_3=0  then q1_3_3C=0;
    if q1_3_3=2  then q1_3_3C=1;
    if q1_3_3=3  then q1_3_3C=1;

    if q1_3_4=1  then q1_3_4C=0;
    if q1_3_4=0  then q1_3_4C=0;
    if q1_3_4=2  then q1_3_4C=1;
    if q1_3_4=3  then q1_3_4C=1;

    if q1_3_5=1  then q1_3_5C=0;
    if q1_3_5=0  then q1_3_5C=0;
    if q1_3_5=2  then q1_3_5C=1;
    if q1_3_5=3  then q1_3_5C=1;

/*This is Info Source for LOAN*/
    if q2_3_1=1  then q2_3_1L=1;
    if q2_3_1=0  then q2_3_1L=0;
    if q2_3_1=2  then q2_3_1L=0;
    if q2_3_1=3  then q2_3_1L=1;

    if q2_3_2=1  then q2_3_2L=1;
    if q2_3_2=0  then q2_3_2L=0;
    if q2_3_2=2  then q2_3_2L=0;
    if q2_3_2=3  then q2_3_2L=1;

    if q2_3_3=1  then q2_3_3L=1;
```

```
        if q2_3_3=0  then q2_3_3L=0;
        if q2_3_3=2  then q2_3_3L=0;
        if q2_3_3=3  then q2_3_3L=1;

        if q2_3_4=1  then q2_3_4L=1;
        if q2_3_4=0  then q2_3_4L=0;
        if q2_3_4=2  then q2_3_4L=0;
        if q2_3_4=3  then q2_3_4L=1;

        if q2_3_5=1  then q2_3_5L=1;
        if q2_3_5=0  then q2_3_5L=0;
        if q2_3_5=2  then q2_3_5L=0;
        if q2_3_5=3  then q2_3_5L=1;

        if q2_3_6=1  then q2_3_6L=1;
        if q2_3_6=0  then q2_3_6L=0;
        if q2_3_6=2  then q2_3_6L=0;
        if q2_3_6=3  then q2_3_6L=1;

/*This is for Info Source on NONPOINT*/
        if q2_3_1=1  then q2_3_1N=0;
        if q2_3_1=0  then q2_3_1N=0;
        if q2_3_1=2  then q2_3_1N=1;
        if q2_3_1=3  then q2_3_1N=1;

        if q2_3_2=1  then q2_3_2N=0;
        if q2_3_2=0  then q2_3_2N=0;
        if q2_3_2=2  then q2_3_2N=1;
        if q2_3_2=3  then q2_3_2N=1;

        if q2_3_3=1  then q2_3_3N=0;
        if q2_3_3=0  then q2_3_3N=0;
        if q2_3_3=2  then q2_3_3N=1;
        if q2_3_3=3  then q2_3_3N=1;

        if q2_3_4=1  then q2_3_4N=0;
        if q2_3_4=0  then q2_3_4N=0;
        if q2_3_4=2  then q2_3_4N=1;
        if q2_3_4=3  then q2_3_4N=1;

        if q2_3_5=1  then q2_3_5N=0;
        if q2_3_5=0  then q2_3_5N=0;
        if q2_3_5=2  then q2_3_5N=1;
        if q2_3_5=3  then q2_3_5N=1;
```

```
	if q2_3_6=1  then q2_3_6N=0;
	if q2_3_6=0  then q2_3_6N=0;
	if q2_3_6=2  then q2_3_6N=1;
	if q2_3_6=3  then q2_3_6N=1;

/*This is Info Source for APPLICATION*/
	if q3_3_1=1  then q3_3_1A=1;
	if q3_3_1=0  then q3_3_1A=0;
	if q3_3_1=2  then q3_3_1A=0;
	if q3_3_1=3  then q3_3_1A=1;

	if q3_3_2=1  then q3_3_2A=1;
	if q3_3_2=0  then q3_3_2A=0;
	if q3_3_2=2  then q3_3_2A=0;
	if q3_3_2=3  then q3_3_2A=1;

	if q3_3_3=1  then q3_3_3A=1;
	if q3_3_3=0  then q3_3_3A=0;
	if q3_3_3=2  then q3_3_3A=0;
	if q3_3_3=3  then q3_3_3A=1;

	if q3_3_4=1  then q3_3_4A=1;
	if q3_3_4=0  then q3_3_4A=0;
	if q3_3_4=2  then q3_3_4A=0;
	if q3_3_4=3  then q3_3_4A=1;

	if q3_3_5=1  then q3_3_5A=1;
	if q3_3_5=0  then q3_3_5A=0;
	if q3_3_5=2  then q3_3_5A=0;
	if q3_3_5=3  then q3_3_5A=1;

	if q3_3_6=1  then q3_3_6A=1;
	if q3_3_6=0  then q3_3_6A=0;
	if q3_3_6=2  then q3_3_6A=0;
	if q3_3_6=3  then q3_3_6A=1;

/*This is Info Source for REMOVAL*/
	if q3_3_1=1  then q3_3_1R=0;
	if q3_3_1=0  then q3_3_1R=0;
	if q3_3_1=2  then q3_3_1R=1;
	if q3_3_1=3  then q3_3_1R=1;

	if q3_3_2=1  then q3_3_2R=0;
```

```
	if q3_3_2=0  then q3_3_2R=0;
	if q3_3_2=2  then q3_3_2R=1;
	if q3_3_2=3  then q3_3_2R=1;

	if q3_3_3=1  then q3_3_3R=0;
	if q3_3_3=0  then q3_3_3R=0;
	if q3_3_3=2  then q3_3_3R=1;
	if q3_3_3=3  then q3_3_3R=1;

	if q3_3_4=1  then q3_3_4R=0;
	if q3_3_4=0  then q3_3_4R=0;
	if q3_3_4=2  then q3_3_4R=1;
	if q3_3_4=3  then q3_3_4R=1;

	if q3_3_5=1  then q3_3_5R=0;
	if q3_3_5=0  then q3_3_5R=0;
	if q3_3_5=2  then q3_3_5R=1;
	if q3_3_5=3  then q3_3_5R=1;

	if q3_3_6=1  then q3_3_6R=0;
	if q3_3_6=0  then q3_3_6R=0;
	if q3_3_6=2  then q3_3_6R=1;
	if q3_3_6=3  then q3_3_6R=1;
run;
```

Program K.2: Frequency Tables and T-Tests

```
proc contents data=conserve_adj position;
title 'Contents of adjusted dataset';
run;
Proc Sort Data=Conserve_Adj;
By Q6_4_1;
Run;
proc freq data=conserve_adj;
where q6_4_1 in(4,72);
title 'Frequency distribution of all variables in adjusted dataset';
run;
proc freq data=conserve_adj;
where q6_4_1 in(4,72);
by q6_4_1;
title 'Frequency distribution of all variables in adjusted dataset';
run;
```

```
proc freq data=conserve_adj;
/*Restrict data to those in Washington and Benton Counties*/
where q6_4_1 in(4,72);
by q6_4_1;
tables (Q1_1_1 q1_2_1 Q2_1_1 Q2_2_1 q3_1_1 q3_2_1)*q6_4_1/chisq;
title 'Chi-square tests for 2x2 tables with knowledge of programs';
run;

/* This measures County by Operation Type*/
proc freq data=conserve_adj;
where q6_4_1 in (4,72);
tables Q6_4_1*(Q6_6_1 Q6_6_2 Q6_6_3 Q6_6_4 Q6_6_5 Q6_6_6 Q6_6_7 Q6_6_8
Q6_6_9 Q6_6_10 Q6_6_11 Q6_6_12);
run;

proc freq data=conserve_adj;
/*Restrict data to those in Washington and Benton Counties*/
where q6_4_1 in(4,72);
by q6_4_1;
tables (q6_5 q6_9 q6_7)*(Q1_1_1 q1_2_1 Q2_1_1 Q2_2_1 q3_1_1 q3_2_1);
test measures;
title 'Ordinal tests of association with knowledge of programs';
run;

proc freq data=conserve_adj;
/*Restrict data to those in Washington and Benton Counties*/
where q6_4_1 in(4,72);
tables
Q1_1_3 *(q1_2_1 Q2_1_1 Q2_2_1 q3_1_1 q3_2_1)
q1_2_3 *(Q1_1_1 Q2_1_1 Q2_2_1 q3_1_1 q3_2_1)
q2_1_3 *(Q1_1_3 q1_2_1 Q2_2_1 q3_1_1 q3_2_1)
q2_2_3 *(Q1_1_3 q1_2_1 Q2_1_1 q3_1_1 q3_2_1)
q3_1_3 *(Q1_1_3 q1_2_1 Q2_1_1 q2_2_1 q3_2_1)
q3_2_3 *(Q1_1_3 q1_2_1 Q2_1_1 q2_2_1 q3_1_1)
/chisq;
title 'Chi-square tests for 2x2 tables of program participation with knowledge of other
programs';
run;

proc freq data=conserve_adj;
/*Restrict data to those in Washington and Benton Counties*/
where q6_4_1 in(4,72);
by q6_4_1;
tables
```

```
Q1_1_3 *(q1_2_3 Q2_1_3 Q2_2_3 q3_1_3 q3_2_3)
q1_2_3 *(Q2_1_3 Q2_2_3 q3_1_3 q3_2_3)
Q2_1_3 *(Q2_2_3 q3_1_3 q3_2_3)
Q2_2_3 *(q3_1_3 q3_2_3)
Q3_1_3*q3_2_3/chisq;
title 'Chi-square tests for 2x2 tables of program participation with other program
participation';
run;

proc freq data=conserve_adj;
/*Restrict data to those in Washington and Benton Counties*/
where q6_4_1 in(4,72);
tables (q1_1_1 q1_2_1)*(q1_3_1-q1_3_7) (q2_1_1 q2_2_1)*(q2_3_1-q2_3_8) (q3_1_1
q3_2_1)*(q3_3_1-q3_3_8);
title 'Source of information about programs by participation';
run;

proc freq data=conserve_adj;
/*Restrict data to those in Washington and Benton Counties*/
where q6_4_1 in(4,72);
        tables
        q1_1_3*(q4_3a q4_4a q4_5_1) q1_2_3*(q4_3b q4_4b q4_5_2)
        q2_1_3*(q4_3c q4_4c q4_5_3) q2_2_3*(q4_3d q4_4d q4_5_4)
        q3_1_3*(q4_3e q4_4e q4_5_5) q3_2_3*(q4_3f q4_4f q4_5_6);
title 'Program participation by # of encouraging factors, # discouraging
factors,recommendation';

proc freq data=conserve_adj;
/*Restrict data to those in Washington and Benton Counties*/
where q6_4_1 in(4,72);
        tables (Q1_1_3 q1_2_3 Q2_1_3 Q2_2_3 q3_1_3 q3_2_3)*(q4_1_1-q4_1_6
q4_6);
title 'Program participation by indication of Most and Least used conservation programs,
# improvements';

proc freq data=conserve_adj;
/*Restrict data to those in Washington and Benton Counties*/
where q6_4_1 in(4,72);
tables animal*nonanimal animal*hort (animal poultry cattle)*haypasture poultry*cattle
/chisq;
title 'Chi-square tests for 2x2 tables with type of agriculture';
run;
proc freq data=conserve_adj;
/*Restrict data to those in Washington and Benton Counties*/
```

```
where q6_4_1 in(4,72);
tables q6_8 continue;
title 'Plans for farmland';
run;
proc freq data=conserve_adj;
/*Restrict data to those in Washington and Benton Counties*/
where q6_4_1 in(4,72);
tables q6_7 q6_9;
title 'Education and Income';
run;

proc ttest data=conserve_adj;
/*Restrict data to those in Washington and Benton Counties*/
where q6_4_1 in(4,72);
class Q1_1_1 ;
var q6_1 q6_2 acres acresownpct acresrentpct q6_3;
title 'T-tests difference in mean acreage by knowledge of programs';
run;
proc ttest data=conserve_adj;
/*Restrict data to those in Washington and Benton Counties*/
where q6_4_1 in(4,72);
class q1_2_1 ;
var q6_1 q6_2 acres acresownpct acresrentpct q6_3;
title 'T-tests difference in mean acreage by knowledge of programs';
run;
proc ttest data=conserve_adj;
/*Restrict data to those in Washington and Benton Counties*/
where q6_4_1 in(4,72);
class Q2_1_1 ;
var q6_1 q6_2 acres acresownpct acresrentpct q6_3;
title 'T-tests difference in mean acreage by knowledge of programs';
run;
proc ttest data=conserve_adj;
/*Restrict data to those in Washington and Benton Counties*/
where q6_4_1 in(4,72);
class Q2_2_1 ;
var q6_1 q6_2 acres acresownpct acresrentpct q6_3;
title 'T-tests difference in mean acreage by knowledge of programs';
run;
proc ttest data=conserve_adj;
/*Restrict data to those in Washington and Benton Counties*/
where q6_4_1 in(4,72);
class Q3_1_1 ;
var q6_1 q6_2 acres acresownpct acresrentpct q6_3;
```

```
title 'T-tests difference in mean acreage by knowledge of programs';
run;
proc ttest data=conserve_adj;
/*Restrict data to those in Washington and Benton Counties*/
where q6_4_1 in(4,72);
class q3_2_1;
var q6_1 q6_2 acres acresownpct acresrentpct q6_3;
title 'T-tests difference in mean acreage by knowledge of programs';
run;
```

Program K.3: Logit Model Specification 1

```
/*EQIP KNOW*/
proc logistic data=conserve2;
/*Restrict data to those in Washington and Benton Counties*/
where Q6_4_1 in(4,72);
/*The mentioned variables are classification level data, note that 'acres' isn't included*/
class Q6_4_1 Q6_9 CollegeEd animal UnderFF continue q1_3_1E q1_3_2E q1_3_3E
q1_3_4E q1_3_5E;
/*These are all the explanatory variables to be used in this version of the logit model*/
model Q1_1_1(event='1')= acres Q6_3 Q6_4_1 Q6_9 CollegeEd animal UnderFF
q1_3_1E q1_3_2E q1_3_3E q1_3_4E q1_3_5E continue;
/*Event=1 changes it from modeling 'not knowing' to modeling 'knowing'*/
/*This format changes Q6_9 into a simplified version of income, where (0,1) and
(5,6,7,8,9) are collapsed into seperate groups*/
format Q6_9 inccomb.
q6_4_1 county.;
run;


/*CREP KNOW*/
proc logistic data=Conserve2;
/*Restrict data to those in Washington and Benton Counties*/
where Q6_4_1 in(4,72);
/*The mentioned variables are classification level data, note that 'acres' isn't included*/
class Q6_4_1 Q6_9 CollegeEd animal UnderFF continue poultry q1_3_1C q1_3_2C
q1_3_3C q1_3_4C q1_3_5C;
/*These are all the explanatory variables to be used in this version of the logit model*/
model Q1_2_1(event='1')=acres Q6_3 Q6_4_1 Q6_9 CollegeEd animal UnderFF
q1_3_1C q1_3_2C q1_3_3C q1_3_4C q1_3_5C continue;
/*Event=1 changes it from modeling 'not knowing' to modeling 'knowing'*/
/*This format changes Q6_9 into a simplified version of income, where (0,1) and
(5,6,7,8,9) are collapsed into seperate groups*/
format Q6_9 inccomb.
q6_4_1 county.;
run;

/*LOAN KNOW*/
proc logistic data=Conserve2;
/*Restrict data to those in Washington and Benton Counties*/
where Q6_4_1 in(4,72);
/*The mentioned variables are classification level data, note that 'acres' isn't included*/
class Q6_4_1 Q6_9 CollegeEd animal UnderFF continue poultry q2_3_1L q2_3_2L
q2_3_3L q2_3_4L q2_3_5L;
```

```
/*These are all the explanatory variables to be used in this version of the logit model*/
model Q2_1_1(event='1')=acres Q6_3 Q6_4_1 Q6_9 CollegeEd animal UnderFF
q2_3_1L q2_3_2L q2_3_3L q2_3_4L q2_3_5L continue;
/*Event=1 changes it from modeling 'not knowing' to modeling 'knowing'*/
/*This format changes Q6_9 into a simplified version of income, where (0,1) and
(5,6,7,8,9) are collapsed into seperate groups*/
format Q6_9 inccomb.
q6_4_1 county.;
run;

/*NONPOINT KNOW*/
proc logistic data=Conserve2;
/*Restrict data to those in Washington and Benton Counties*/
where Q6_4_1 in(4,72);
/*The mentioned variables are classification level data, note that 'acres' isn't included*/
class Q6_4_1 Q6_9 CollegeEd animal UnderFF continue poultry q2_3_1N q2_3_2N
q2_3_3N q2_3_4N q2_3_5N;
/*These are all the explanatory variables to be used in this version of the logit model*/
model Q2_2_1(event='1')=acres Q6_3 Q6_4_1 Q6_9 CollegeEd animal UnderFF
q2_3_1N q2_3_2N q2_3_3N q2_3_4N q2_3_5N continue;
/*Event=1 changes it from modeling 'not knowing' to modeling 'knowing'*/
/*This format changes Q6_9 into a simplified version of income, where (0,1) and
(5,6,7,8,9) are collapsed into seperate groups*/
format Q6_9 inccomb.
q6_4_1 county.;
run;


/*APPLICATION KNOW*/
proc logistic data=Conserve2;
/*Restrict data to those in Washington and Benton Counties*/
where Q6_4_1 in(4,72);
/*The mentioned variables are classification level data, note that 'acres' isn't included*/
class Q6_4_1 Q6_9 CollegeEd animal UnderFF continue poultry q3_3_1A q3_3_2A
q3_3_3A q3_3_4A q3_3_5A;
/*These are all the explanatory variables to be used in this version of the logit model*/
model Q3_1_1(event='1')=acres Q6_3 Q6_4_1 Q6_9 CollegeEd animal UnderFF
q3_3_1A q3_3_2A q3_3_3A q3_3_4A q3_3_5A continue;
/*Event=1 changes it from modeling 'not knowing' to modeling 'knowing'*/
/*This format changes Q6_9 into a simplified version of income, where (0,1) and
(5,6,7,8,9) are collapsed into seperate groups*/
format Q6_9 inccomb.
q6_4_1 county.;
run;
```

```
/*REMOVAL KNOW*/
proc logistic data=Conserve2;
/*Restrict data to those in Washington and Benton Counties*/
where Q6_4_1 in(4,72);
/*The mentioned variables are classification level data, note that 'acres' isn't included*/
class Q6_4_1 Q6_9 Q6_5 CollegeEd animal UnderFF continue poultry Q3_3_1R
q3_3_2R q3_3_3R q3_3_4R q3_3_5R;
/*These are all the explanatory variables to be used in this version of the logit model*/
model Q3_2_1(event='1')=acres Q6_3 Q6_4_1 Q6_9 CollegeEd animal UnderFF
Q3_3_1R q3_3_2R q3_3_3R q3_3_4R q3_3_5R continue;
/*Event=1 changes it from modeling 'not knowing' to modeling 'knowing'*/
/*This format changes Q6_9 into a simplified version of income, where (0,1) and
(5,6,7,8,9) are collapsed into seperate groups*/
format Q6_9 inccomb.
q6_4_1 county.;
run;
```

Program K.4: Logit Model Specification 2

```
/*EQIP KNOW*/
proc logistic data=conserve2;
/*Restrict data to those in Washington and Benton Counties*/
where Q6_4_1 in(4,72);
/*The mentioned variables are classification level data, note that 'acres' isn't included*/
class Q6_4_1 Q6_9 CollegeEd animal q1_3_1E continue;
/*These are all the explanatory variables to be used in this version of the logit model*/
model Q1_1_1(event='1')= acres q6_3 Q6_4_1 Q6_9 CollegeEd animal continue
q1_3_1E;
/*Event=1 changes it from modeling 'not knowing' to modeling 'knowing'*/
/*This format changes Q6_9 into a simplified version of income, where (0,1) and
(5,6,7,8,9) are collapsed into seperate groups*/
format Q6_9 inccomb.
q6_4_1 county.;
title 'EQIP Knowledge Logit';
run;


/*CREP KNOW*/
proc logistic data=Conserve2;
/*Restrict data to those in Washington and Benton Counties*/
where Q6_4_1 in(4,72);
/*The mentioned variables are classification level data, note that 'acres' isn't included*/
class Q6_4_1 Q6_9 CollegeEd animal q1_3_1E continue q1_3_3C;
/*These are all the explanatory variables to be used in this version of the logit model*/
model Q1_2_1(event='1')=acres q6_3 Q6_4_1 Q6_9 CollegeEd animal continue
q1_3_3C;
/*Event=1 changes it from modeling 'not knowing' to modeling 'knowing'*/
/*This format changes Q6_9 into a simplified version of income, where (0,1) and
(5,6,7,8,9) are collapsed into seperate groups*/
format Q6_9 inccomb.
q6_4_1 county.;
title 'CREP Knowledge Logit';
run;


/*LOAN KNOW*/
proc logistic data=Conserve2;
/*Restrict data to those in Washington and Benton Counties*/
where Q6_4_1 in(4,72);
/*The mentioned variables are classification level data, note that 'acres' isn't included*/
class Q6_4_1 Q6_9 CollegeEd animal q1_3_1E continue q2_3_4L;
```

```
/*These are all the explanatory variables to be used in this version of the logit model*/
model Q2_1_1(event='1')=acres q6_3 Q6_4_1 Q6_9 CollegeEd animal continue
q2_3_4L;
/*Event=1 changes it from modeling 'not knowing' to modeling 'knowing'*/
/*This format changes Q6_9 into a simplified version of income, where (0,1) and
(5,6,7,8,9) are collapsed into seperate groups*/
format Q6_9 inccomb.
q6_4_1 county.;
title 'LOAN Knowledge Logit';
run;


/*NONPOINT KNOW*/
proc logistic data=Conserve2;
/*Restrict data to those in Washington and Benton Counties*/
where Q6_4_1 in(4,72);
/*The mentioned variables are classification level data, note that 'acres' isn't included*/
class Q6_4_1 Q6_9 CollegeEd animal q1_3_1E continue q2_3_2N;
/*These are all the explanatory variables to be used in this version of the logit model*/
model Q2_2_1(event='1')=acres q6_3 Q6_4_1 Q6_9 CollegeEd animal continue
q2_3_2N;
/*Event=1 changes it from modeling 'not knowing' to modeling 'knowing'*/
/*This format changes Q6_9 into a simplified version of income, where (0,1) and
(5,6,7,8,9) are collapsed into seperate groups*/
format Q6_9 inccomb.
q6_4_1 county.;
title 'NONPOINT Knowledge Logit';
run;


/*APPLICATION KNOW*/
proc logistic data=Conserve2;
/*Restrict data to those in Washington and Benton Counties*/
where Q6_4_1 in(4,72);
/*The mentioned variables are classification level data, note that 'acres' isn't included*/
class Q6_4_1 Q6_9 CollegeEd animal q1_3_1E continue q3_3_5A;
/*These are all the explanatory variables to be used in this version of the logit model*/
model Q3_1_1(event='1')=acres q6_3 Q6_4_1 Q6_9 CollegeEd animal continue
q3_3_5A;
/*Event=1 changes it from modeling 'not knowing' to modeling 'knowing'*/
/*This format changes Q6_9 into a simplified version of income, where (0,1) and
(5,6,7,8,9) are collapsed into seperate groups*/
format Q6_9 inccomb.
q6_4_1 county.;
```

```
title 'APPLICATION Knowledge Logit';
run;


/*REMOVAL KNOW*/
proc logistic data=Conserve2;
/*Restrict data to those in Washington and Benton Counties*/
where Q6_4_1 in(4,72);
/*The mentioned variables are classification level data, note that 'acres' isn't included*/
class Q6_4_1 Q6_9 CollegeEd animal q1_3_1E continue q3_3_3R;
/*These are all the explanatory variables to be used in this version of the logit model*/
model Q3_2_1(event='1')=acres q6_3 Q6_4_1 Q6_9 CollegeEd animal continue
q3_3_3R;
/*Event=1 changes it from modeling 'not knowing' to modeling 'knowing'*/
/*This format changes Q6_9 into a simplified version of income, where (0,1) and
(5,6,7,8,9) are collapsed into seperate groups*/
format Q6_9 inccomb.
q6_4_1 county.;
title 'REMOVAL Knowledge Logit';
run;
```

Program K.5: Logit Model Specification 3

```
/*EQIP KNOW*/
proc logistic data=conserve2;
/*Restrict data to those in Washington and Benton Counties*/
where Q6_4_1 in(4,72);
/*The mentioned variables are classification level data, note that 'acres' isn't included*/
class Q6_4_1 Q6_9 CollegeEd animal ;
/*These are all the explanatory variables to be used in this version of the logit model*/
model Q1_1_1(event='1')= Q6_4_1 Q6_9 CollegeEd animal Q6_3;
/*Event=1 changes it from modeling 'not knowing' to modeling 'knowing'*/
/*This format changes Q6_9 into a simplified version of income, where (0,1) and
(5,6,7,8,9) are collapsed into seperate groups*/
format Q6_9 inccomb.
q6_4_1 county.;
title 'EQIP Knowledge Logit';
run;


/*CREP KNOW*/
proc logistic data=conserve2;
/*Restrict data to those in Washington and Benton Counties*/
where Q6_4_1 in(4,72);
/*The mentioned variables are classification level data, note that 'acres' isn't included*/
class Q6_9 CollegeEd q1_3_3C;
/*These are all the explanatory variables to be used in this version of the logit model*/
model Q1_2_1(event='1')=Q6_9 CollegeEd q1_3_3C;
/*Event=1 changes it from modeling 'not knowing' to modeling 'knowing'*/
/*This format changes Q6_9 into a simplified version of income, where (0,1) and
(5,6,7,8,9) are collapsed into seperate groups*/
format Q6_9 inccomb.
q6_4_1 county.;
title 'CREP Knowledge Logit';
run;


/*LOAN KNOW*/
proc logistic data=Conserve2;
/*Restrict data to those in Washington and Benton Counties*/
where Q6_4_1 in(4,72);
/*The mentioned variables are classification level data, note that 'acres' isn't included*/
class Q6_9 q2_3_4L;
/*These are all the explanatory variables to be used in this version of the logit model*/
model Q2_1_1(event='1')=Q6_9 q2_3_4L;
```

```
/*Event=1 changes it from modeling 'not knowing' to modeling 'knowing'*/
/*This format changes Q6_9 into a simplified version of income, where (0,1) and
(5,6,7,8,9) are collapsed into seperate groups*/
format Q6_9 inccomb.
q6_4_1 county.;
title 'LOAN Knowledge Logit';
run;


/*NONPOINT KNOW*/
proc logistic data=Conserve2;
/*Restrict data to those in Washington and Benton Counties*/
where Q6_4_1 in(4,72);
/*The mentioned variables are classification level data, note that 'acres' isn't included*/
class Q6_4_1 q2_3_2N;
/*These are all the explanatory variables to be used in this version of the logit model*/
model Q2_2_1(event='1')=Q6_4_1 q2_3_2N;
/*Event=1 changes it from modeling 'not knowing' to modeling 'knowing'*/
/*This format changes Q6_9 into a simplified version of income, where (0,1) and
(5,6,7,8,9) are collapsed into seperate groups*/
format Q6_9 inccomb.
q6_4_1 county.;
title 'NONPOINT Knowledge Logit';
run;


/*APPLICATION KNOW*/
proc logistic data=Conserve2;
/*Restrict data to those in Washington and Benton Counties*/
where Q6_4_1 in(4,72);
/*The mentioned variables are classification level data, note that 'acres' isn't included*/
class animal q3_3_4A;
/*These are all the explanatory variables to be used in this version of the logit model*/
model Q3_1_1(event='1')=animal q3_3_4A;
/*Event=1 changes it from modeling 'not knowing' to modeling 'knowing'*/
/*This format changes Q6_9 into a simplified version of income, where (0,1) and
(5,6,7,8,9) are collapsed into seperate groups*/
format Q6_9 inccomb.
q6_4_1 county.;
title 'APPLICATION Knowledge Logit';
run;
```

```
/*REMOVAL KNOW*/
proc logistic data=Conserve2;
/*Restrict data to those in Washington and Benton Counties*/
where Q6_4_1 in(4,72);
/*The mentioned variables are classification level data, note that 'acres' isn't included*/
class Q6_9;
/*These are all the explanatory variables to be used in this version of the logit model*/
model Q3_2_1(event='1')=Q6_9;
/*Event=1 changes it from modeling 'not knowing' to modeling 'knowing'*/
/*This format changes Q6_9 into a simplified version of income, where (0,1) and
(5,6,7,8,9) are collapsed into seperate groups*/
format Q6_9 inccomb.
q6_4_1 county.;
title 'REMOVAL Knowledge Logit';
run;
```