2007

Best Management Practices adoption rates and alternative land usage among Southwest Louisiana rice producers

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BEST MANAGEMENT PRACTICES ADOPTION RATES AND ALTERNATIVE LAND USAGE AMONG SOUTHWEST LOUISIANA RICE PRODUCERS

A Thesis
Submitted to the Graduate Faculty of the
Louisiana State University
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Master of Science

In

The Department of Agricultural Economics and Agribusiness

By
Heidi Landry
B.S. McNeese State University, 2005

December 2007

To all of those, especially my parents, who have supported me throughout this journey of graduate school. May God richly bless you.

ACKNOWLEDGMENTS

To God, for continually blessing me and answering prayers.

To mom and dad, for supporting me financially, emotionally, and physically during this process. Your love of me, encouragement to me, and commitment to the process was continuous. I know how proud this accomplishment makes y'all and I am equally as proud to dedicate this to the both of you. Thank you, Thank you, Thank you.

Jarod, my love and now my husband, for supporting me during school, I admire your faith and trust in me, you did not fully understand the process and you still encouraged and supported me every step of the way. Thank your for helping me get through this.

To MaMa and Mamie, the silent partners in this process. Thank y'all for everything y'all have done. I can not begin to imagine all of the hours y'all have spent saying prayers and offering up sacrifices on my behalf. Y'all are both truly inspirational women who have a tremendous amount of faith and love in me and in God. Y'all helped in the only way y'all knew, and I know that it is because of answered prayers that I will graduate.

Dr. Henning, thank you for your guidance and wisdom during my journey. Throughout this process you were my balance and you kept me grounded, always trusting that everything would come together and it DID.

Dr. Cramer and Dr. Paxton, for both of your never ending support and trust in me. Your support comforted me during the tough times and was always a positive light amid the darkness. Thank you both for always believing in me and never giving up on me. Dr. Salassi and Dr. Caffey thank you for you guidance during my research.

Sachin, thank you for all your help, you have been a wonderful friend to me. You were there to see me cry, laugh, rejoice, and struggle. Thank you for having enough trust and faith in me to never give up. Thank you also for attempting to learn and adopt this Cajun culture.

Pam and Q, y'all were both there to pick me up when I needed y'all most. Over the years I have leaned to love, trust, and look up to y'all as mothers away from home. Thank you for allowing me to be myself, providing support during the tough times, allowing me to move in, and providing an out from the stress of school that can become so overwhelming.

Debbie, thank you for all the comfort and support you have provided me. You and your quirky ways always know how to bring a smile to my face, even in the toughest of times.

My fellow graduate students, Brian, James, Tina, Tyler, Pawan, and Surkiti, thank y'all for the friendship and support. Y'all have made me feel welcomed, loved, and made my time here fly by.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

ABSTRACT

The EPA has identified agriculture to be a major contributor of nonpoint source water pollution. The production of rice poses two major water quality issues: the application of a large amount of water that is held on the field for long periods of time during the growing season and the disposal of that water at a later time in the production cycle.

Louisiana has developed the voluntary adoption of Best Management Practices (BMPs). These practices have been promoted through educational programs such as the Master Farmer program. This program, developed by the LSU AgCenter, targets conservation practices that are both environmentally and economically beneficial.

This study assessed the current adoption of 20 Best Management Practices (BMPs) in the Southwest Louisiana rice industry and provided policy recommendations based on the results. The practices were grouped into five management areas: erosion and sediment management, water management, nutrient management, pesticide management, and wildlife habitat management. A mail survey was conducted to determine producer awareness of water quality legislation, adoption of BMPs, participation in Natural Resource Conservation Service (NRCS) cost share programs, additional sources of on-farm revenue, environmental attitudes, and socioeconomic information.

The results show that the most significant variables include: awareness of the Coastal Nonpoint Pollution Control Act, educational programs and consultation with LCES personnel, attendance of grower meetings, farm size, intention to pass the farm to a family member, and the leasing of the majority of land to others. The recommendations of this study are to continue the promotion of educational programs and producer involvement with LCES agents.

CHAPTER 1
INTRODUCTION

Agriculture has been identified by the Environmental Protection Agency (EPA) as a major nonpoint source of water pollution in Louisiana. The policy dilemma for production agriculture is determining who is responsible for any given emission and how to effectively reduce or eliminate those emissions. In theory, individual producers could be held responsible for the cost of implementing emission reduction measures, regardless of evidence of responsibility. This creates a policy problem of concentrated costs and diffused benefits. Costs are concentrated on producers, while the benefits accrue to the public at large. A primary concern is that the cost to producers of implementing management measures that will effectively reduce agricultural pollution will be more than the benefits the individual farmer will gain. Benefits are diffused among all members of society, including producers. Under those circumstances, should society, through government, subsidize the cost of implementation?

1.1 Best Management Practices in Louisiana Rice Production

The best management practices (BMPs) provided by the Natural Resource Conservation Service (NRCS) outline a range of conservation practices to conserve, protect, and improve water and soil quality. In rice production, one of the main concerns is the quality and quantity of water used in the cultivation of the crop. In general, BMPs address: water quality, erosion and sediment control, wildlife habitat establishment and protection, nutrient management, and pesticide management. It has been well documented that the quality of water in the lakes, streams, rivers, and bayous located across south Louisiana is important to residents of the area. These conservation practices, currently adopted on a voluntary basis, are critical to the ability of production agriculture and the environment to coexist in harmony. In 2000, the LSU AgCenter produced a guide of recommended best management practices for rice producers titled Rice

Production BMPs 2000. This publication was put together by a panel of specialist within the LSU AgCenter to provide conservation practices that protect and conserve water and soil resources and control the movement of pollutants into groundwater and onto surfacewater.

1.2 Water Quality Legislation

1.2.1 Clean Water Act (CWA)

Water quality concerns have been around for decades. Congress passed the Federal Water Pollution Control Act in 1948 to ensure the preservation of the country's water sources for present and future use. (Clean Water Act. Summaries of Environmental Laws Administered by the EPA, 1998). In the Clean Water Act (CWA), passed in 1972, the main objective was to maintain and restore the chemical, physical, and biological integrity of the nation's waterways. Prior to 1987 the CWA targeted "point source" pollution, which is defined as:

> "…Any discernable, confined and discrete conveyance, including but not limited to any pipe, ditch, tunnel, conduit, well, discrete fissure, container, rolling stock, concentrated animal feeding operation, or vessel or other floating craft, from which pollutants are or may be discharged. This term does not include agricultural storm water discharges and return flows from irrigated agriculture."

The CWA controlled point source pollution through the National Pollutant Discharge Elimination System (NPDES) program. This program was successful in reducing the amount of discharged pollutants from point sources; however, water quality was still being derogated by "nonpoint sources" (Clean Water Act. Summaries of Environmental Laws Administered by the EPA, 1998).

In 1987, the CWA was amended to specifically address nonpoint sources of pollution. Nonpoint pollution was defined as any pollution not previously defined in the point source pollution definition and included activities such as land runoff, precipitation, atmospheric deposition, drainage, seepage, and hydrologic modification. Congress also enacted section 319 of the CWA, which established a national program to control nonpoint sources of pollution. Under this, state's addressed nonpoint pollution by assessing nonpoint source pollution problems and causes within the state, adopt management programs to control nonpoint pollution, and implement management programs that both complied with the act and were economically feasible. The EPA, in turn, would assist the states by issuing grants to help fund and implement such programs (Clean Water Act. Summaries of Environmental Laws Administered by the EPA, 1998).

1.2.2 Coastal Zone Management Act (CZMA)

The Coastal Zone Management Act, passed in 1972, states that "land uses in the coastal zone and the use of adjacent lands which drain into the coastal zone, may significantly affect the quality of coastal waters and habitats, and efforts to control coastal water pollution form land use activities must be improved" (CZMA, 1972; PL 101-508).

In 1990, the Coastal Zone Act Reauthorization Amendments (CZARA) were passed to address the impacts of nonpoint source pollution on coastal waters. Within section 6202 (a) Congress found, among other things, that "nonpoint source pollution is increasingly recognized as a significant factor in coastal water degradation. In urban areas, storm water and combined sewer overflow are linked to major coastal problems and rural areas, runoff from agricultural activities adds to coastal pollution" (Coastal Zone Management, 1998).

Section 6217 of the CZARA requires that the states develop a Coastal Nonpoint Pollution Control Programs to implement management measures that work toward the established goals within the legislation. In 1995, the Louisiana Department of Natural Resources (LADNR) submitted Louisiana's Coastal Nonpoint Pollution Control Program (LCNPCP), which used a voluntary approach to management practices in agriculture, to the National Oceanic and

Atmospheric Administration (NOAA) and the Environmental Protection Agency (EPA) for federal approval (Coastal Zone Management, 1998).

1.3 Rice Production in Louisiana

According to the Louisiana Summary of Agriculture and Natural Resources 2005, rice production acres planted in Louisiana was 524,936. This acreage was planted by 1,383 producers across the state. The southwestern region (Acadia, Allen, Calcasieu, Cameron, Evangeline, Jefferson Davis, St. Landry, and Vermilion parishes) produced 361,816 of the total acreage. The harvest had a farm value of $225 million.

1.4 Louisiana Master Farmer Program

In 2001, the LSU AgCenter developed the Louisiana Master Farmer program aimed at developing research and educational programs to make farmers more aware of environmental issues, agricultural and timber production, and farm management and marketing (Oldham and Castille 2003). This three stage program was begun to help farmers become better environmental stewards. Phase one is an eight hour environmental steward training program which presents material on environmental legislation and current conservation programs in the state. The program presents material on the Clean Water Act, national and state water quality standards, total maximum daily loads, nonpoint source pollution and it's affect on the Coastal Zone Management Act, responsibility of conservation districts, and programs sponsored by the National Resource Conservation Service. Phase two is a model farm field day and includes a visit to a commodity specific farm which demonstrates different BMP's. This provides a real life example of BMPs being used as well as videos and material on BMPs being developed. Phase three requires the farmer to build and execute a farm-specific plan for conservation of resources. This is achieved with the involvement of the National Resource Conservation Service(NRCS).

Upon completion of all three phases, the farmer will be certified as a Master Farmer and will be in compliance with Louisiana's soil and water conservation requirements.

1.5 Problem Statement

Unlike most commodities, rice production in Louisiana poses two water quality issues: 1) the application of a large amount of water that is held in the field for long periods of time during the growing season, and 2) disposal of that water at a later time in the production cycle.

Agricultural runoff is considered one of the most pervasive problems in water quality, but when preventive measures are not taken to reduce agricultural runoff, a serious threat to groundwater may develop as nutrients and pesticides infiltrate to the water table. The way water is used in the rice growing process creates water quality challenges that differ from more traditional row crops.

Louisiana has followed a strategy of education to promote voluntary adoption of best management practices. This strategy has resulted in the Master Farmer Program developed by the LSU AgCenter. In 2003, the Louisiana State Legislature designated the Master Farmer Program as the official certification program for conservation compliance in the state (*LSU AgCenter News*, May 2003). Since the implementation of this program, there has not been a study conducted in rice production to evaluate producer awareness and adoption rates to determine the effectiveness of the program.

To effectively implement and evaluate this strategy, a periodic analysis of the current state of BMP adoption and a comparison to previous periods is useful. Policy makers also need to determine how well producers understand current and proposed legislation that could affect their farming practices, as well as the factors that influence producers' willingness to adopt proposed best management practices. There is also a need for an evaluation of the economic and environmental effectiveness of alternative BMPs in Louisiana, and the appropriate incentives that may be needed to accomplish the goal of better water quality in the state. Economic subsidies, educational strategies, and technical assistance alternatives need to be evaluated.

1.6 Justification

Production agriculture in the U.S. has historically been considered a "good" steward of the soil. That view has been challenged in recent years as agriculture has been described as a major contributor to the deterioration of water quality. Several studies of BMP adoption in Louisiana since 1999 have found that BMPs with easily identifiable economic benefits have been readily adopted. The 1999 thesis by Zansler found that rice producers' adoption rates were influenced by a number of factors, including education, participation in cost-share programs, membership in producer organizations, and awareness of environmental regulation. Similar results were obtained in studies of sugarcane farming (Cardona, 1999; Zhong, 2003). However, since the introduction of the Master Farmer Program, no follow-up studies of BMP adoption or attitudes toward the environment have been conducted.

1.7 Study Area

The study area is limited to the Southwest Louisiana rice production area. This area includes the following eight parishes: Acadia, Allen, Calcasieu, Cameron, Evangeline, Jefferson Davis, St. Landry, and Vermilion. These parishes, in general, encompass rice production within the coastal zone area of Louisiana and contain 68.9% of the total rice grown in the state, according to the 2005 Louisiana rice acreage summary. Given the geographic location of the study area, questions relating to water quality issues as a result of the 2005 hurricane season and the consideration of alternative land use in the form of recreation habitat and commercial crawfish production will be included in the survey.

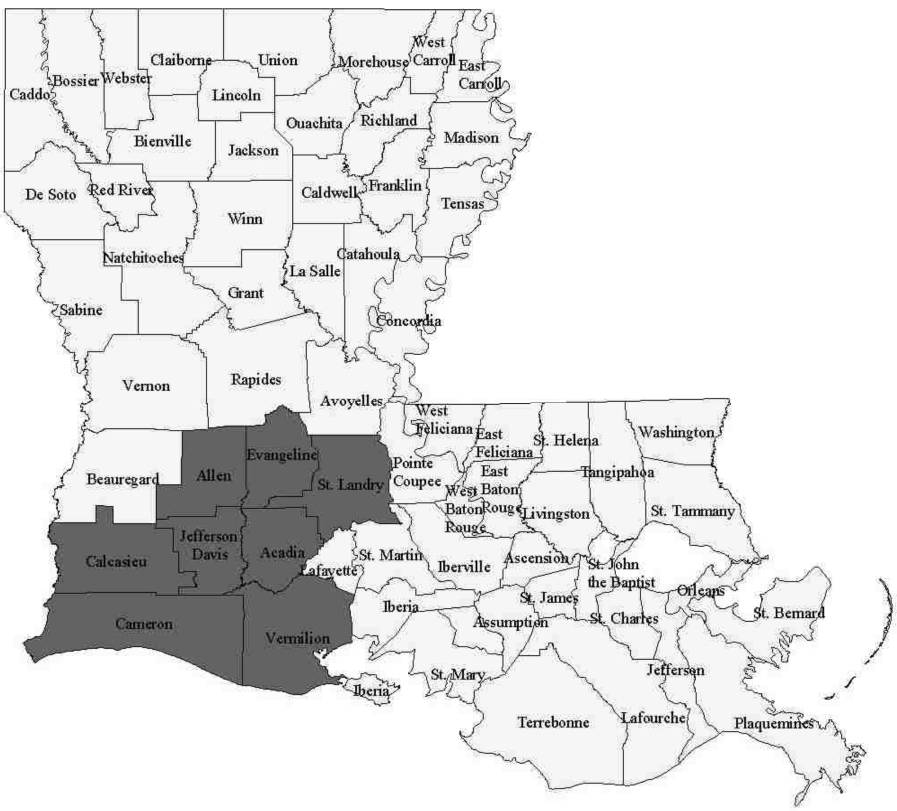

Figure 1.1- Rice Producing Parishes included in 2007 BMP Survey

1.8 Objectives

1.8.1 General Objective

The overall objectives of this study are to assess the current adoption rates of Best Management Practices (BMPs) by rice producers in southwest Louisiana, investigate other factors that may influence producer decisions, and provide policy recommendations based on the empirical results.

1.8.2 Specific Objectives

Specific objectives of this study are:

1) Identify and describe the current production and regulatory environment in rice production.

2) Develop a conceptual framework to explain the individual's behavioral choice to adopt BMPs among Louisiana rice producers.

3) Develop a qualitative choice model and test the relationship between hypothesized determinants of behavior with respect to BMP adoption among Louisiana rice producers.

4) Examine the relationship between rice production, water quality, and alternative land use choices.

5) Analyze the policy implications of the findings and suggest policy alternatives.

1.9 Research Procedures

1.9.1 Objective One

The first objective of this study will be accomplished through a comprehensive review of relevant literature to provide background on the current environment in the production of rice in south Louisiana. Crop budgets published by the LSU Department of Agricultural Economics and Agribusiness will be reviewed to determine actual production costs and production management practices currently implemented. Federal and state agency publications, as well as previous studies, will be reviewed to identify approved best management practices and environmental regulatory requirements. These findings will be compared to the most current regulations in the field office technical guides produced by the Natural Resource Conservation Service (NRCS). Specific regulatory issues related to the coastal zone and the Master Farmer program will be examined and described.

1.9.2 Objective Two

Objective two will be realized through a review of relevant literature on the use of behavioral variables and individuals' attitudes in predicting economic behavior. Previous studies by Cardona (1999), Zansler (1999), and Zhong (2003) will guide the development of the conceptual model. A comprehensive review of the literature will be completed to identify any relevant work accomplished since these studies.

1.9.3 Objective Three

Objective three of this study is to develop a qualitative choice model and test the relationship between hypothesized determinants of behavior with respect to BMP adoption among Louisiana rice producers. Qualitative choice modeling was selected because of the nature of the question being posed – will a producer adopt a best management practice and what influences that decision? The question posed has a discrete answer – either yes or no. Qualitative choice models (also known as discrete choice or qualitative response models) typically use maximum likelihood estimation procedures (Greene, 2003). In this study, LIMDEP econometric software will be used to estimate single probit and multivariate probit models, where the dependent variable is the adoption of a specified best management practice, and the independent variables are socioeconomic, institutional, and attitudinal characteristics describing producers.

A mail survey instrument will be designed and implemented to collect the needed data. A modified version of the Dillman method (Dillman, 1978; Dillman, 1991) will used to conduct a mail survey. Primary data collection will be attained by surveying a sample of the population of rice producers in the study area. The survey questionnaire will be designed to determine which BMPs (and in what proportion) are currently being used in rice production in Louisiana; the factors affecting farmer's willingness to adopt environmentally desirable BMPs; the educational and technical assistance needs to improve adoption rates and efficiency; and the impact of cost-sharing programs on the adoption of environmentally effective BMPs. The mailing list will be based on data provided by the USDA Farm Service Agency through a Freedom of Information Act request.

1.9.4 Objective Four

According to the 2006 Louisiana Summary of Agriculture and Natural Resources, rice acreage across the state decreased 33% in 2006, as a result of the 2005 hurricane season and because of the substantial increase in the prices of fuel and fertilizer costs. It is important to consider this natural disaster and evaluate its physical and economic impacts on the southwestern portion of the state. This will be initially assessed through a literature search of Hatch project research in the LSU AgCenter conducted by soil scientists, plus a search on the LSU Agcenter web site. The mail survey and will also include a section in the questionnaire to gather producer responses on how the 2005 hurricane season has influenced agriculture land use.

Multi-cropping, such as waterfowl hunting or crawfish harvesting on rice farms, serves as an alternative source of revenue for producers. In 2006, waterfowl hunting encompassed 1.7 million acres and had a gross farm value of $35.5 million (LA Ag Summary 2006). Also, crawfish harvesting was valued at $95.7 million, had 130,000 acres, and was the most valued aquaculture crop in Louisiana in 2006 (LA Ag Summary 2006). NRCS notes that both sources of income have some environmental benefit verses land left fallow. However, it is unknown how many producers are currently participating in these alternative sources of farm income.

1.9.5 Objective Five

Results generated from objectives one through four will be interpreted in line with expectations of the information needs of policy makers and sugarcane producers. Policy implementation will be discussed in terms of 1) achievement of environmentally desirable goals and 2) the aim of keeping agriculture as an economically viable activity. The objective is to recommend policies oriented toward compliance with required nonpoint pollution control programs, alternative tools that can be effectively used, and identifying new issues.

1.10 Thesis Outline

The first chapter of the thesis will outline an introduction for the overall project. This section will provide insight into the current issues surrounding rice production. Water quality regulation and educational programs such as the Master Farmer program will be discussed. This chapter will also outline the justification for the project, survey area, objectives, and research procedures to be used in the remaining chapters.

The second chapter will outline a literature review of previous studies conducted in best management practices in Louisiana including rice and sugarcane production and a review of research conducted on the Master Farmer program.

Chapters three and four will contain the conceptual framework for economic data analysis and empirical estimation of the data obtained from a producer survey to be mailed to residents in southwest Louisiana who received federal agricultural subsidy payments in 2006.

The survey will consist of ten sections: identifying the current situation in water quality concerns, awareness of existing legislation, knowledge and adoption of best management practices, evaluation of irrigation systems, participation in financial support and educational programs, implementation of additional farm revenue sources, outlook toward environmental concerns, socioeconomic information, and a comment section.

Chapter five will provide a summary to the study results. In this chapter we will outline the results obtained from previous chapters, provide conclusions based on analysis and list recommendations as well as future research needs in the research area.

CHAPTER 2
LITERATURE REVIEW

A review was completed on previous research within the topic area in order to determine factors influencing adoption rates and how government programs can effectively promote economically feasible best management practice adoption. In south Louisiana, rice production is both a heavy user of irrigation water and is in close proximity to coastal waters. This impact on adjacent coastal marshes and wetlands is one concern with nonpoint pollution from agriculture that is receiving increased attention from policy makers.

2.1 Previous Research

The first study, by Cardona, was completed in 1999. A mail survey was sent to sugarcane producers in southern Louisiana to determine the adoption rates of best management practices by producers. This survey serves as a basis to compare additional sugarcane producer adoption rates. This study supports the efforts of extension education to sugarcane producers and credits education with strongly increasing the awareness of best management practices. Adoption of BMPs are likely to increase if education to producers is made available. The study also found a positive relationship between government cost sharing programs and the BMP adoption rate by farmers even if those programs have not been established yet. The study warns that debt level and tenure are variables that future policy makers need to consider in future decisions.

The follow-up to this survey, by Zhong, was completed in 2003. The study looked at fifteen best management practices focused on soil erosion and sediment control, nutrient management, and pesticide management. Neoclassical economic principals of utility maximization were assumed to determine which practices were being adopted and in what proportions. It found that best management practices, which are used by farmers to comply with the state's coastal nonpoint pollution control program and Clean Water Act, have proven to be economically effective in the short run and have been readily adopted by producers. Some people question whether or not these practices have long term economic and environmental benefits. This study showed the adoption rate by farmers based on the number of BMP practices implemented at one time. The results showed that while there are a large number of producers adopting BMPs, the conservation practices are usually at a minimum standard and the adoption rate decreases as the number of practices required to be adopted increases per farm. This study stresses the importance of educational programs. The study warns that as future standards become more stringent, education levels will become more influential on adoption rates.

The third study, completed by Zansler and the only one focused on rice production, was completed in 1999. This study was part of a larger project focused on rice production costs. This study determined that adoption of water practices which are outlined in the Clean Water Act under Section 303(d) required effort in several areas for the practices to be attained. Concerns are reviewed on several factors practiced by Louisiana rice producers such as, production in watershed areas, flooding and water leveling of rice fields, and releasing of waters into local waterways. Implementation management practices were assessed under the utility maximization approach and included twenty-four best management practices in rice. Factors influencing BMP adoption included education, farm size, location of operation, participation in cost-share programs, debt levels, membership in producer organizations, and awareness of water quality legislation. The survey concluded that rice producers have largely adopted practices in soil and sediment conservation, including land leveling, retention of water, and grade stabilization structures. A logit analysis found that practice adoption is affected by farm size, percentage of land owned, farm debt level, and farm location. The presence and availability of cost share programs increase the adoption rates of practices.

A study completed in 2006, by Mendoza, evaluated the Master Farmer program. The Master Farmer program is the primary tool in Louisiana for promoting adoption of approved best management practices. The Master Farmer Program is offered by the LSU AgCenter and serves as the education arm of the adoption process. This program has been adopted by the state legislature as the requirement for a producer to be in compliance with nonpoint regulation in agriculture. This study looked at this environmental stewardship program as well as the Louisiana Master Logger Program and their influence on farmer's educational level and adoption rate of BMPs. This study looks at the behavioral factors affecting the implementation of stewardship programs. The study showed that industry support, from program development to program maintenance, is an important variable in the adoption rates.

The studies listed above will provide the general guidance for the project. In addition to this research, which we will concentrate on, there have been other studies conducted in recent years related to the topics of water quality and best management practices.

A study completed by Greenhalgh and Faeth (2001) states that agriculture contributes to the contamination of water quality through nutrient pollution. Nutrient pollution significantly impacts waterways and is a leading cause of dead zone. The dead zone is a hypoxic zone located in the northern Gulf of Mexico, from the mouth of the Mississippi River to beyond the Texas border. It is more commonly referred to as the Gulf of Mexico Dead Zone, because oxygen levels within the zone are too low to support marine life. The Dead Zone was first recorded in the early 1970's. It originally occurred every two to three years, but now occurs annually. In the summer of 1999 the dead zone reached its peak, encompassing 7,728 square miles, approximately the size of the state of New Jersey (Carlisle, 2000). By using a sectional model aimed at reducing agriculture's contribution to water pollution, the study compared policies such as conservation subsidies, nutrient trading, extensions of the conservation reserve program, sales of green house gases and carbon credits, and reducing the use of fertilizers. The model used also incorporates a number of environmental factors enriching the cost and benefits of nutrient reduction which identify policy options that incorporate cost minimization and maximum benefits.

In 2005, Kongchum and Manoch studied rice production and evaluated it as an agriculture commodity which uses large supplies of water for production. This study points to potential water conservation practices that may have a more positive impact on rice production. The water management practices of alternate flooding and drying versus continuous flooding were analyzed in the study.

Since 2002, there have been two studies completed with the Department of Agricultural Economics and Agribusiness at LSU evaluating BMPs within the cattle industry. The most recent, by Obobuafo (2005), evaluates the Environmental Quality Incentives Program (EQIP) adopted in the 1996 Farm Bill and how it affects legislation on Louisiana cattlemen. The study uses a sequential response model which measures the cattle operator's use of EQIP programs through cost-incentive practices and adoption rates of best management practices. The second study, by Rahelizatovo (2002), evaluated Louisiana dairy producers. These dairymen were studied on their involvement and implementation of site-specific best management practices. The dairy industry is plagued with pollutant problems such as sediments, nutrients, pesticides, salts, and pathogens which can contaminate surface or ground waters. The model applied to this survey pointed to the influences of size, productivity, and education as the main contributors to the adoption of BMPs.

A study by Barton (1999), evaluates agriculture's role on a national level and its contribution to water quality impairment across the US. Under the Clean Water Act, it is the individual state's responsibilities to execute statewide nonpoint source management programs based on the state's nonpoint source assessment. Since the program was developed in 1990, the states have sought funding from the public and Congress. The study concludes that additional research is needed in the areas of water quality data, better best management practices, education program effectiveness, voluntary approaches, and financial incentives to better grasp the problem of non point source pollution from agriculture and the efficiency of the Clean Water Action Plan.

A study completed in 1993 by Feagley et al, targeted the Mermentau River Basin as it is a major receiver of water runoff from rice fields in southern Louisiana. Water samples have shown there to be high levels of solids, pesticides and nutrients from the rice field overflow, which triggers the need for water quality improvement in the area. This study assesses prospective management practices to improve surface water quality.

Through the Clean Water Act, states were made accountable for controlling agricultural nonpoint source pollution. Feather and Cooper (1995) compared the use of voluntary and non voluntary incentives, the practice of using incentive payments, and implementing educational, technical and financial assistant programs. The study noted examples of successful incentive programs that are being used for the control of nonpoint source pollution. Participation in educational programs seemed to be more successful when teamed with cost incentive programs.

The 2005, the Louisiana nonpoint source annual report was produced by the Louisiana Department of Environmental Quality (LADEQ). It was directed toward the progression of the state's nonpoint source management plan. The annual report indicated progress despite the impacts of Hurricanes Katrina and Rita. The assessment of water bodies has been continued by the Louisiana Department of Environment Quality, as well as the development of the total maximum daily load (TMDL) practices, the implementation of plans for watersheds, implementation of best management practices, and continued education on nonpoint source issues. This study presented some of the challenges that Louisiana faces in 2006, including developing new water quality strategies, restoring our coast, and rebuilding devastated communities.

In 2002, Prud'homme and Greis evaluated forestry best management practices and their role in timber production across the South. This study shows that twelve of the thirteen southern states measured best management practice implementation, but with each state having unique approaches and varying results. Six of thirteen states have evaluated their management approaches through procedures designed by the Southern Group of State Foresters. The states showed an implementation rate of between 63 and 96% and the highest implementation rate was on public lands. Within Louisiana, as of the year 1999, the statewide qualitative implementation rate was 83% and the quantitative rate was 93%. Louisiana, through its voluntary program, has no formal process to handle water quality cases stemming from timber production. There exists no procedure for reprimanding forestry operations who impair water quality and there is no interdepartmental assistance from other state agencies outside the Department of Agriculture and Forestry.

2.2 BMPs Adopted in Louisiana Rice Industry

In 2000 the LSU AgCenter published a pamphlet on recommend best management practices that are economically feasible for rice production. Representatives from the LSU AgCenter worked with members of the Natural Resources Conservation Service (NRCS), Louisiana Department of Environmental Quality (LDEQ), the Louisiana Farm Bureau Federation

(LFBF), and the Louisiana Department of Agriculture and Forestry (LDAF). This pamphlet focused on five major areas of production: site selection, sediment management in surface water, pesticides and pest management, nutrient management, and general farm BMPs. For the current study, these general areas of concern were combined with conservation practices developed by the NRCS to develop a more complete list of BMPs. Through this process it was discovered that some of the practices were duplicated under both sources. The LSU AgCenter's pamphlet lent itself to a more general listing of BMP's while the NRCS provided a very technical record BMP's in their publication Field Office Technical Guide (FOTG), which contains practices for all crops produced.

2.2.1 Sediment and Erosion Control

This is the largest sector of conservation practices, covering each aspect of production from land preparation to crop residue. These conservation practices target the reduction of erosion and sediment runoff from water moving across the land. This sector is broken into smaller sections such as land preparation, water leveling, grade stabilization, water runoff, drainage, residue management, and planting. The available NRCS practice codes are identified in parenthesis. A complete list of BMPs is identified in Table 2.1.

- Land Preparation
  - Land Smoothing (Code 466)
  - Precision Land Forming (Code 462)
  - Irrigation Land Leveling (Code 464)

- Water Leveling
  - Suspended Soil Sediment Test Kit

- Grade Stabilization
  - Grade Stabilization Structure (Code 410)
  - Structure for Water Control (Code 587)
  - Controlled Drainage

- Water Runoff
    - Filter Strip (Code 393A)
    - Grassed Waterway (Code 412)
- Drainage
    - Surface Drainage- Field Ditch (Code 607)
    - Surface Drainage- Lateral (Code 608)
    - Open Channel (Code 582)
    - Drainage Management (Code 554)
    - Water and Sediment Control (Code 610)
    - Regulating Water Drainage System
    - Lined Waterway

- Residue Management
    - Pest Management (Code 595)
    - Nutrient Management (Code 590)
    - Residue and Tillage Management (Code 329)
        - No-Till Management (Code 329)
        - Mulch Till Management (Code 345)
        - Seasonal Till Management (Code 344)
- Planting
    - Field Border (Code 386)
    - Conservation Cover Crop (code 328)
    - Riparian Buffers (Code)
    - Residue and Tillage Management (Code 329)
        - No-Till Management (Code 329)
        - Mulch Till Management (Code 345)
    - Water Planting
        - Dry Seedbed
        - Flooded Seedbed
        - Spring Stale Seedbed
        - Fall Stale Seedbed
        - No-Till Seedbed
    - Dry Planting
        - Conventional Seedbed
        - Spring Stale Seedbed
        - Fall Stale Seedbed
        - No-Till Seedbed

2.2.2 Pesticide and Pest Management

These practices are targeted at selecting pesticides that deliver the best results, applying with precision equipment to reduce spray drift, and cleaning and maintaining sprayers and mixing facilities.

- Pest Management (Code 595)
  - Conservation Crop Rotation (Code 328)
  - Integrated Pest Management System (IPM)
  - Field Scouting
  - Precision Pesticide Application

2.2.3 Nutrient Management

The profitability of farming depends on the application of fertilizers and nutrients. These nutrients are susceptible to being carried away in water and sediment runoff, so it is important to consider practices that ensure the safe use of fertilizers.

- Nutrient Management (Code 590)
  - Cover or Green Manure Crop (Code 340)
  - Waste Utilization (Code 663)
  - Application Based on Soil Analysis

2.2.4 General Farm Management

These practices are grouped together to enhance water quality, water usage, and wildlife management.

Table 2.1
Comparison of Best Management Practices Between LSU AgCenter and NRCS
Louisiana Rice Best Management Practice Adoption Study

Agricultural Practice	NRCS Code	LSU Ag Center Code	Reason
Land Preparation	Land Smoothing (466)	Land Smoothing	Sediment & Erosion Control
Do you use any of the following practices to control runoff and drainage: land smoothing, precision leveling, and/or irrigation land leveling?	Precision Land Forming (462)	Precision Land Forming	
	Irrigation Land Leveling (464)	Irrigation Land Leveling	
Water Leveling		Suspended Sediment Test Kit	Sediment & Erosion Control
When water leveling, do you implement a suspended sediment test to control sediment runoff?			
Grade Stabilization	Grade Stabilization Structures (410)	Grade Stabilization	Sediment & Erosion Control
Do you implement some type of structure or control to reduce erosion resulting from field drainage?	Structure for Water Control (587)	Structure for Water Control	
		Controlled Drainage	
Water Runoff	Filter Strip (393A)	Filter Strip	Sediment & Erosion Control
Do you improve the quality of water runoff by implementing a filter strip or grassed waterway near the drainage site?	Grassed Waterway (412)	Grassed Waterway	

(table continued)

Agricultural Practice	NRCS Code	LSU Ag Center Code	Reason
Drainage	Surface Drainage- Field Ditch (607)	Regulating Water Drainage System	Sediment & Erosion Control
When removing water from the field, do you allow water to drain off on a surface body of water or do you channel the runoff through subsurface drainage? When releasing into a surface water body, do you line the waterway or establish a sediment control?	Surface Drainage- Lateral (608)	Surface Drainage- Field Ditch	
	Open Channel (582)	Open Channel	
	Drainage Management (554)	Lined Waterway	
	Water and Sediment Control (610)		
Crop Residue	Pest Management (595)		Sediment & Erosion Control
After harvesting the crop, do you plant a conservation crop or retain the residue on the field?	Nutrient Management (590)		
	Residue & Tillage Management (329)		
	No-Till (329)		
	Mulch Till (345)		
	Seasonal (344)		
Pest Management	Pest Management (595)	Integrated Pest Management (IPM) System	Pest Management
Do you base pesticide applications on economic thresholds as determined by field scouting? Do you use a containment facility for mixing, loading, and storage of pesticides? Do you calibrate spray equipment before each use? Do you implement any type of precision application equipment?	Conservation Crop Rotation (328)		
		Field Scouting	
		Precision Pesticide Application	

(table continued)

Agricultural Practice	NRCS Code	LSU Ag Center Code	Reason
Nutrient Management	Nutrient Management (590)	Application Based on Soil Analysis	Nutrient Management
Do you base fertilizer applications on soil testing and expected yields? Do you implement: split application of nutrients, animal waste, precision agriculture, and/or slow-release fertilizers?	Cover or Green Manure Crop (340)		
	Waste Utilization (633)		
Water Conservation	Tailwater Recovery (447)	Tailwater Recovery	Water Usage
	Irrigation Storage Reservoir (436)		
Irrigation	Irrigation Canal (320)	Irrigation Canal	Water Usage
Which of the following is the most common type of irrigation implemented on your farm? Do you make your irrigation system more efficient by installing flow meters, scheduler, and land leveling?	Irrigation Ditch (388)	Irrigation Ditch	
	Irrigation Water Pipeline (430)		
	Irrigation Regulation Reservoir (436)		
	Irrigation Water Management (449)		
Well Water	Well Water (642)	Well Water	Water Quality
Are you concerned with the quality of water coming from you irrigation well? Do you complete regular well water testing?	Well Water Testing (355)		
	Water Table Control (641)		
Wildlife	Wildlife Habitat (644)	Wildlife Habitat	Wildlife
Do you establish any type of wildlife habitat or wetland restoration on your land as an alterative source of income?	Wetland Restoration (657)		

(table continued)

Agricultural Practice	NRCS Code	LSU Ag Center Code	Reason
Planting	Field Border (386)	Water Planting: Dry Seedbed Flooded Seedbed Spring Stale Seedbed Fall Stale Seedbed No-Till Seedbed	Sediment & Erosion Control
	Conservation Cover Crop (328)		
	Riparian Buffers		
	Residue & Tillage Management (329)		
	No-Till (329)		
	Mulch Till (345)	Dry Planting: Conventional Seedbed Spring Stale Seedbed Fall Stale Seedbed No-Till Seedbed	

CHAPTER 3
CONCEPTUAL FRAMEWORK

3.1 Economic Approach to Human Behavior

Economics, a social science, has long been studied to understand and explain the decision making process of human behavior. Within the contemporary version of neoclassical microeconomics, the theory of the household is based on the logic of choice.

3.1.1 Individual Preference

Consumer's preferences result from a combination of a wide range of goods and services and a range in consumer tastes and preferences. Consumer behavior theory is explained using three assumptions. First, preferences are complete, meaning that the consumer is aware of all products and services available to him/her and will prefer one to another regardless of price. Second, preferences are transitive, implying that if a consumer prefers good A to good B and good B to good C, then the consumer would prefer good A to good C. Third, consumers always prefer more to less (Pindyck and Rubinfeld, 2001).

Consumer's gain utility from their chosen preferences. Utility is the level of satisfaction gained from consuming goods or using services. Utility is an essential concept because it defines the gratification associated with the choice rather than the perceived substandard choice. Human choice is perceived to be influenced by changes in economic incentives. If a consumer's utility increases, from choosing an option, they will be more likely to choose that option. However, if the costs associated with the choice increase, a person will be less likely to choose the option (Pindyck and Rubinfeld, 2001).

Rational consumers will select a combination of those goods and services which maximizes their utility. Those combinations can be grouped together with other consumers to construct a utilities possibilities frontier curve. Trading along the frontier will always make one person better off without making another worse off (Pindyck and Rubinfeld, 2001). Trading below the utilities possibilities frontier is inefficient because both parties would be better off trading to a position along the curve. Likewise, trading above the curve is infeasible because a sufficient level of utility is unattainable above the curve. It can be concluded that only the allocation of goods and services along the curve is an efficient allocation of resources (Pindyck and Rubinfeld, 2001).

3.2 Environmental Goods and Attitude

3.2.1 Environmental Goods

Environmental goods are often classified as public goods because of their nonexclusive and nonrival characteristics. A nonrival good is one that the marginal cost of its provision to an additional consumer is zero. A nonexclusive good is one which people can not be excluded from consuming, making it difficult to charge for its use (Pindyck and Rubinfeld, 2001).

3.2.2 Environmental Attitude

As the public has become aware environmental issues, researchers have been analyzing consumer's attitudes toward environmental issues. In 1978 a study conducted by Dunlap et al evaluated the extent to which the public accepts the "New Environmental Paradigm" (NEP). The study designed twelve different statements targeted at measuring the NEP or the relationship between the earth and human beings. The results of the study found that the public accepts the content of the emerging environmental paradigm more than researchers had expected. Since then, the NEP scale has become a widely used measure of pro-environmental orientation.

In 2000, a revised NEP scale was developed by Dunlap and Van Liere. This new scale, named the New Ecological Paradigm Scale, contains fifteen statements. The new scale was broadened to improve the balance between pro- and anti- NEP statements. The statements were worded in such a way that agreement with the eight odd-numbered items and disagreements with the seven-even numbered ones indicate a pro-ecological view. The revised scale also evaluated the five aspects of ecological view, namely: the reality of limits to growth, anti-anthropocentrism view, fragility of nature's balance, rejection of human exemptionalism, and the possibility of ecological crisis.

3.3 Theoretical Model

Following the neoclassical economic approach to human behavior and the analysis of environmental attitudes adopted by individuals, it is assumed that rice producers in Louisiana choose to adopt Best Management Practices to maximize their utility. This is consistent with the approach followed by Cardona (1999) and Zhong (2003). Both are similar studies in sugarcane BMP adoption in Louisiana. The general theoretical model is influenced by certain economic and socioeconomic factors and takes the following form:

Adoption of Best Management Practices = f(economic variables; socioeconomic variables; institutional variables; attitudinal variables)

3.3.1 Dependent Variable

The unobservable variable "Adoption of Best Management Practices" is the dependent variable and is evaluated through 20 management practices grouped into: Erosion and Sediment Management, Water Management, Nutrient Management, Pesticide Management, and Wildlife Management.

3.3.2 Independent Variables

The factors hypothesized to influence BMP adoption are grouped into three types: economic and socioeconomic variables, institutional variables, and attitudinal variables. The independent variables in the economic and socioeconomic variable group include: age, experience, gender, education level, gross income from farming, percent of household income from farming, debt level, passing of operation to another family member, active participation in operation, leasing majority of land to others, type and size of farm, percentage of acres owned, and risk attitudes. The independent variables in the institutional variable group include: number of contacts with extension personnel, attendance of grower meetings, awareness of BMP, awareness of CWA and CNPCP legislation, participation in the Master Farmer Program, certification through the Master Farmer Program, and participation in cost-sharing programs. The independent variables associated with attitudinal variables include: modification of behavior as result of knowledge of CWA or CNPCP, modified behavior as result of knowledge of the Master Farmer Program, attitude toward New the Ecological Paradigm and if agriculture reduces the quality of water coming off farmland.

3.3.2.1 Economic and Socioeconomic Variables

A farmer's age (AGE) is expected to have a negative relationship with the adoption of BMPs. Younger producers are more likely to adopt new management practices because they are usually better educated and more concerned with environmental issues. Older producers are assumed to be less likely to adopt new practices. Age is a continuous independent variable for the study.

Producer's experience (EXPER) is measured in years and is hypothesized to have a negative relationship with BMP adoption. Farmers who have engaged in rice production are less likely to transfer from the conventional practices than producers who have been farming for a short time. The number of years of farming is included as a continuous independent variable.

Producer's gender (GENDER) is expected to negatively impact BMP adoption. This is evaluated with a discrete choice variable in the study with a (1) representing male and a (0) representing female.

Producer's education (EDUC) is expected to be positively related with BMP adoption. More educated people are more likely to adopt new management practices because they are more learned on the benefits of BMPs on water quality and management. In this study the discrete variable in the survey questionnaire was set to a single dummy variable to represent if the producer had any education beyond a high school diploma.

The income variable (INCOME) will positively influence the adoption of BMPs. Higher levels of income are expected to reduce the financial pressure and allow for more opportunity to adopt new management practices. A dummy variable was developed to represent incomes over $100,000.

The percentage of gross income from farming (PGHIF) is expected to have a negative relationship with BMP adoption. Producers who have more that 50% of their income coming from on farm sources are more likely to implement management practices because they are more closely tied to the farm. Likewise, those producer's where the majority of income (less than 50%) comes from off farm sources are less likely to adopt BMPs. A dummy variable was developed for those respondents who receive more than 50% of income from farming.

Debt level (DEBT) is expected to have a negative relationship with BMP adoption. Producers with high debt level are more concerned with profit rather than adoption. A dummy variable was developed for farmers who have debt greater than 40% of total estimated value of farm business.

The intent to pass the operation to a family member (PASS) is expected to have a positive relationship with adoption. Producers who intend to pass the operation on are likely to be more concerned with environmental quality and sustainable development and would be more apt to adopt management practices (Norris and Bastie, 1987). A dummy variable is developed to represent producer's choice to pass the operation to a family member.

The active participation (PARTIC) in the farm operation is expected to have a positive relationship with adoption. Those producers who are actively involved with the operations are more likely to be aware of environmental issues and more likely to implement management practices to protect their natural endowment (land). A dummy variable was developed to determine if the producer was actively involved with the farm operation.

The leasing out of the majority of land owned to other operators (LEASE) is hypothesized to have a negative relationship with adoption. The larger the percentage of land leased out the higher the probability of not adopting BMPs. A dummy variable was developed to determine if the majority of their land was leased out to other operators.

Farm type (TYPE) is broken into individual operation, partnership, family corporation, or non-family corporation. Individual operation, because of environmental concern, is expected to have a positive relationship with adoption. A dummy variable was developed to determine if the farm was an individual operation or other.

Farm size (FSIZE) is a continuous variable expected to have a positive relationship with BMP adoption. The larger the farm size, the larger the yields, the more available funds to implement new management practices.

Percentage of acres owned (FSIZEAO) is hypothesized to have a positive relationship on adoption. The larger the number of acres owned by the operator, the more likely the possibility of adopting BMPs.

Risk attitude is estimated with two questions in the survey. The first question asks respondents to self describe risk attitude. Risk attitude is a positive and continuous variable (RISKP). This is achieved by choosing on a scale from 1 to 10 with 10 indicating maximum risk and 1 indicating minimum risk. The second question asks respondents to choose from four investment alternatives, each with different risks and benefits. A positive relationship is also expected for this variable (RISKB). This is a continuous independent variable.

3.3.2.2 Institutional Variables

The number of times producers attend meetings with the Louisiana Cooperative Extension Service (MEET) and grower meetings (ATTEND) is expected to be positively related to the adoption of BMPs. Educational programs targeted at producers are often presented by the extension service and other organizations, making growers more informed on environmental conditions and recommended conservation practices. It has been found that producers who are better informed will be more likely to adopt best management practices. Both variables are continuous for this study.

Awareness of legislation pertaining to water quality such as Clean Water Act (ACWA) and Coastal Zone Management Act (ACNPCP), awareness of best management practices (ABMP) and modification of behavior as a result of the Coastal Nonpoint Pollution Control Program are all hypothesized to positively influence BMP adoption.

The dichotomous variables: awareness of the Master Farmer program (AMFP), participation in the Master Farmer program (PMFP), received Master Farmer certification (CMFP), or modification of behavior as a result of what they have learned from the Master Farmer program (MMFP) are expected to positively influence the adoption of BMPs.

The relationship between the adoption of BMPs and participation in cost-share programs is examined through a dummy variable. This variable representing those producers who currently participate in at least one cost-share program is expected to positively influence the adoption of BMPs.

3.3.2.3 Attitudinal Variables

The score of the NEP will evaluate the producer's attitude toward ecology and is expected to have a positive relationship with adoption of best management practices. There are 15 statements for which a score from 1 to 5 is given. Using the total score (SNEP) a higher score reflects on increase concern for the environment.

Another attitude variable relates to whether or not the producer thinks agriculture reduces the quality of water coming off the farmland (AGRWQ). A positive relationship is expected between this variable and adoption.

3.4 Estimation Procedures

3.4.1 Discrete Choice Models

Objective 3 of the current study is to develop a qualitative choice model and test the relationship between the hypothesized independent variables described earlier in this chapter and the adoption of specified BMPs by Louisiana rice producers. Qualitative choice models (also known as discrete choice models) are econometric techniques that could be used to analyze the behavior of decision makers when facing a set of alternative choices rather than a continuous measure of some activity (Greene, 2003). These models "…relate the conditional probability of a particular choice to various attributes of the alternatives, which are specific to each individual, as well as the characteristics of the decision makers" (Judge *et al*., 1988).

In her thesis on BMP adoption among Louisiana sugarcane producers, Zhong (2003) provided a theoretical description of discrete choice models, which is presented below. The dependent variable in the current study is the individual specified BMPs applied to rice production in Southwest Louisiana. In this case, the rice producer's decision to adopt a BMP is equal to 1 if adopted, and 0 if not adopted.

The probability function for such dichotomous random variables is:

$$F(y) = P^{y} (1-P)^{1-y} \qquad y=0,1$$

Where P is the probability that a specific rice producer will choose to adopt a certain BMP practice and (1-P) is the probability that he or she will choose not to do so. The expected value is E(y) = P.

The models rely on the assumption that an individual decision maker will maximize his utility derived from such action. The unobservable variable of utility (U_{ij}) can be represented by explanatory variables in the following way:

$$U_{i1} = \overline{U}_{i1} + e_{i1} = z'_{i1}\,\delta + w'_{i}\,\gamma_1 + e_{i1}$$

$$U_{i0} = \overline{U}_{i0} + e_{i0} = z'_{i0}\,\delta + w'_{i}\,\gamma_0 + e_{i0}$$

Where U_{i1} represents average utility obtained by individual i from choosing the alternative; U_{i0} represents average utility obtained by individual i from not choosing the alternative; $\overline{U}_{i1}$, $\overline{U}_{i0}$ are average utilities of each choice; z'_{i1}, z'_{i0} represent vectors of the characteristics of the two choices; w'_{i} defines socioeconomic characteristics of the ith producer; e_{i1} and e_{i0} are random disturbances (Judge, *et al*., 1988).

The probability that an individual chooses one alternative versus the other is then determined by a latent random variable $y_i^* = U_{i1} - U_{i0}$. To be more specific, if $U_{i1} > U_{i0}$, the individual will choose the alternative and vice versa. It is noticed that the latent variable y_i^* is unobservable. However it can be linked to the observable binary variable y_i as follows:

$$y_i = \begin{cases} 1 & if \quad y_i^* > 0 \\ 0 & otherwise \end{cases}$$

The utility function, although unobservable, can be measured as:

$$
\begin{aligned}
y_i^* &= U_{i1} - U_{io} \\
&= (z_{i1} - z_{i0})'\delta + w_i'(\gamma_1 - \gamma_0) + (e_{i1} - e_{i0}) \\
&= [(z_{i1} - z_{i0})', w_i'] \begin{bmatrix} \delta \\ \gamma_1 - \gamma_0 \end{bmatrix} + e_i^* \\
&= x_i'\beta + e_i^*
\end{aligned}
$$

Where x_i' are explanatory variables; β represents unknown parameters; and e_i^* are random errors in the linear statistical model of y_i^* (Maddala, 1983).

The probability that an individual will choose the alternative (y_i=1) versus the probability of not choosing the alternative (y_i=0) can be expressed in the following equation:

$$P_i = \Pr[y_i = 1] = \Pr(y_i^* > 0) = \Pr[e_i^* > -x_i'\beta]$$

3.4.2. Probit Model

A first step in estimating discrete choice models is to select the probability distribution for the error term e_i^*. The two distributions most often chosen are the probit, or normal, and logistic (Judge, *et al*., 1988). The cumulative distribution function for the standard normal distribution is

$$f(t) = \int_{-\infty}^{t} (2\pi)^{-1/2} \exp\left\{-\frac{x^2}{2}\right\} dx$$

and the cumulative distribution function for the logistic distribution is

$$f(t) = \frac{1}{1 + \exp(-t)}$$

Both distributions are symmetrically bell-shaped with a zero mean. The logistical distribution is similar to the normal distribution except in the tails, which are considerably heavier (Greene, 2003). It is difficult to justify the choice of one distribution over the other on theoretical grounds. The question of which distribution to use is left to researchers. Probit distribution has been used successfully in previous studies of the same format done in sugarcane in the state. Based on that previous work, the probit distribution was selected to conduct this study.

Consequently, the probability P of choosing alternative A versus not to choose can be expressed by the probit model as following, in which the normal distribution has been used:

$$\Pr(Y = 1 \mid X) = \int_{-\infty}^{x'\beta} \Phi(t)dt = \Phi(x'\beta)$$

The function Φ is a commonly used notation for the standard normal distribution (Greene, 2003).

3.4.3. Multivariate Probit Model

A natural extension of the probit model allows more than one equation, with correlated disturbances, in the same spirit as the seemingly unrelated regressions model (Greene, 2003). The general formulation of a multi-equation model is defined as follows:

$y_1^* = x'_1\beta_1 + \varepsilon_1,\ y_1 = 1$ if $y_1^* > 0$, and 0 otherwise,

$y_2^* = x'_2\beta_2 + \varepsilon_2,\ y_2 = 1$ if $y_2^* > 0$, and 0 otherwise,

$E[\varepsilon_1 \mid x_1, x_2] = E[\varepsilon_2 \mid x_1, x_2] = \ldots = E[\varepsilon_M \mid x_1, x_2] = 0,$

$\mathrm{Var}[\varepsilon_1 \mid x_1, x_2] = \mathrm{Var}[\varepsilon_2 \mid x_1, x_2] = \mathrm{Var}[\varepsilon_M \mid x_1, x_2] = 1,$

The probabilities entering the likelihood function are:

Prob $(Y_{i1}, Y_{i2}, \ldots, Y_{im} / x_{i1}, xi_2, \ldots, x_{im})$ = MVN (TZ, TRT')

Where MVN represents multivariate normal distribution; T is a diagonal matrix with element $t_m = 2y_m - 1$; Z= a vector with elements $z_{iM} = \beta_M' x_{iM;}$ R=correlation matrix of the errors terms; and m=1,2,…, M. Although the evaluation of higher-ordered multivariate normal integrals is regarded as an obstacle in the multivariate model, recent research has provided improved methods to solve the problem.

CHAPTER 4
EMPIRICAL ESTIMATION

This chapter is consists of three parts. The first section will evaluate the survey design and implementation. The second section will provide a general description of rice producer respondents and descriptive statistics related to variables and econometric models. The third section will discuss the results from the univariate and multivariate probit analysis.

4.1 Survey Design and Implementation

4.1.1 Mail Survey

A mail survey was sent to a random sample 1,285 of rice producers in the southwestern portion of the state. The mailing list was obtained from the Farm Service Agency (FSA), under the Freedom of Information Act, and was based on those owner/operators and operators who received governmental payments in 2006. The survey was designed according to a modification of the Total Design Method (TDM) in order to generate a successful response rate (Dillman, 1978). The survey was produced by the Department of Agricultural Economics and Agribusiness at Louisiana State University and was conducted during July and August of 2007.

The original request of to the FSA was for mailing addresses of persons receiving direct payments and counter cyclical payments for rice production for the eight parishes in the study area. That search generated 26,557 records. Of that group, 3,346 records were for persons designated as owner-operators with Louisiana mailing addresses. In order to control the size of the mailing, only one-third of the subset were selected for the mail survey. After final adjustments were made, a total of 1,285 persons were included in the mail out.

The survey consisted of three separate mailings. The first mailing was completed on July 17, 2007 and consisted of an introduction letter, the survey questionnaire, and a postage paid return envelope. A postcard reminder was sent out a week later to those producers who did not respond to the questionnaire. On August 9, 2007 a second mailing was sent to those non-responding. This package included a second letter explaining the importance of their participation, a second copy of the survey, and a postage paid return envelope. A sample of the correspondence sent to producers is found in Appendix A.1.

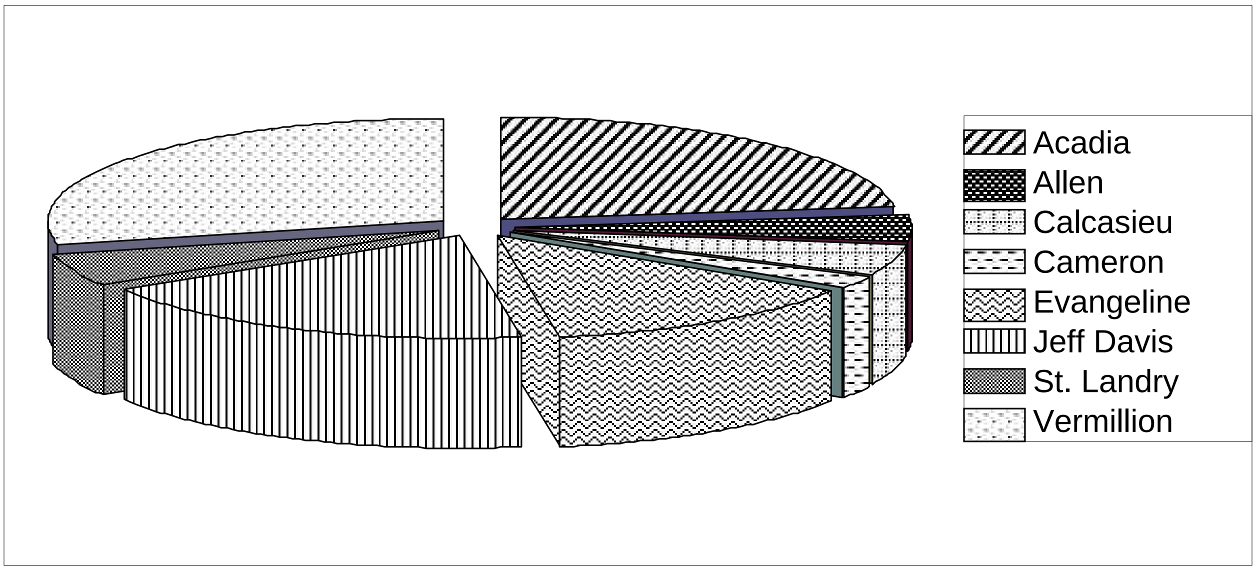

Figure 4.1 Percentage Sent to Each Parish, 2007 BMP Survey

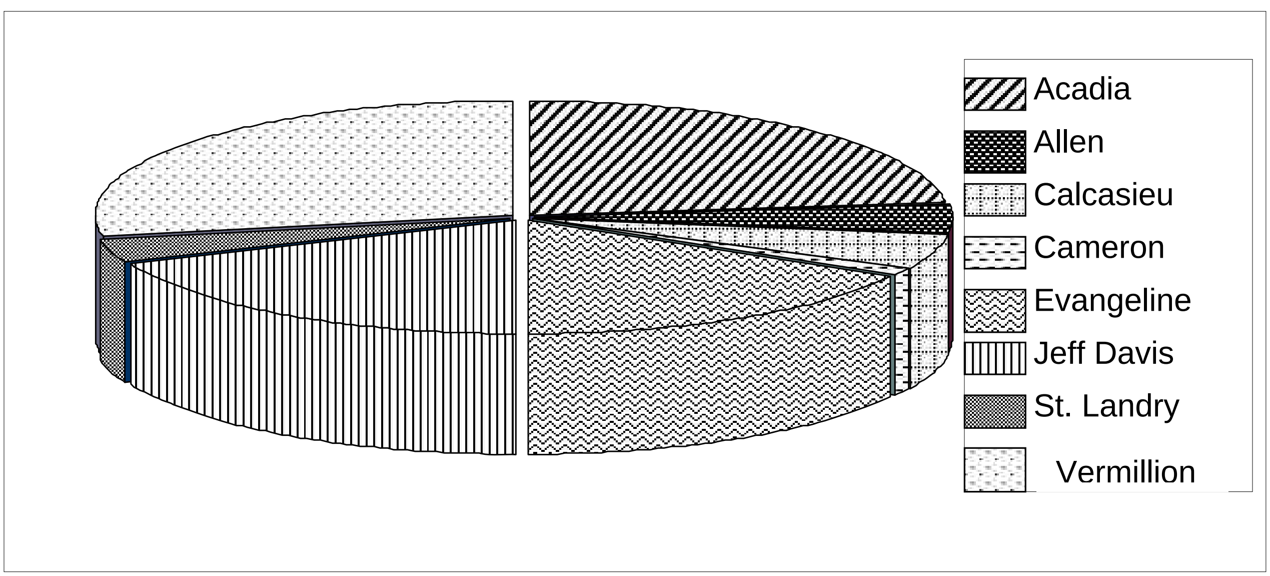

Figure 4.2 Percentage Responding From Each Parish, 2007 BMP Survey

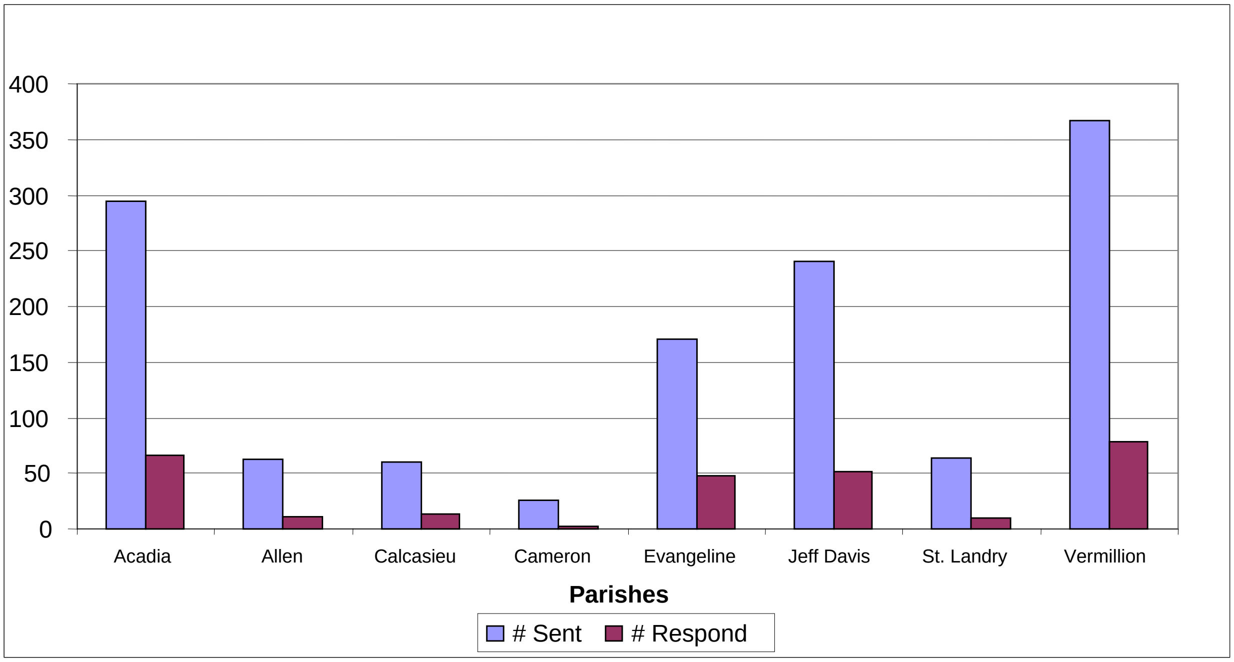

Figure 4.3 Number Responding Versus Number Sent, 2007 BMP Survey

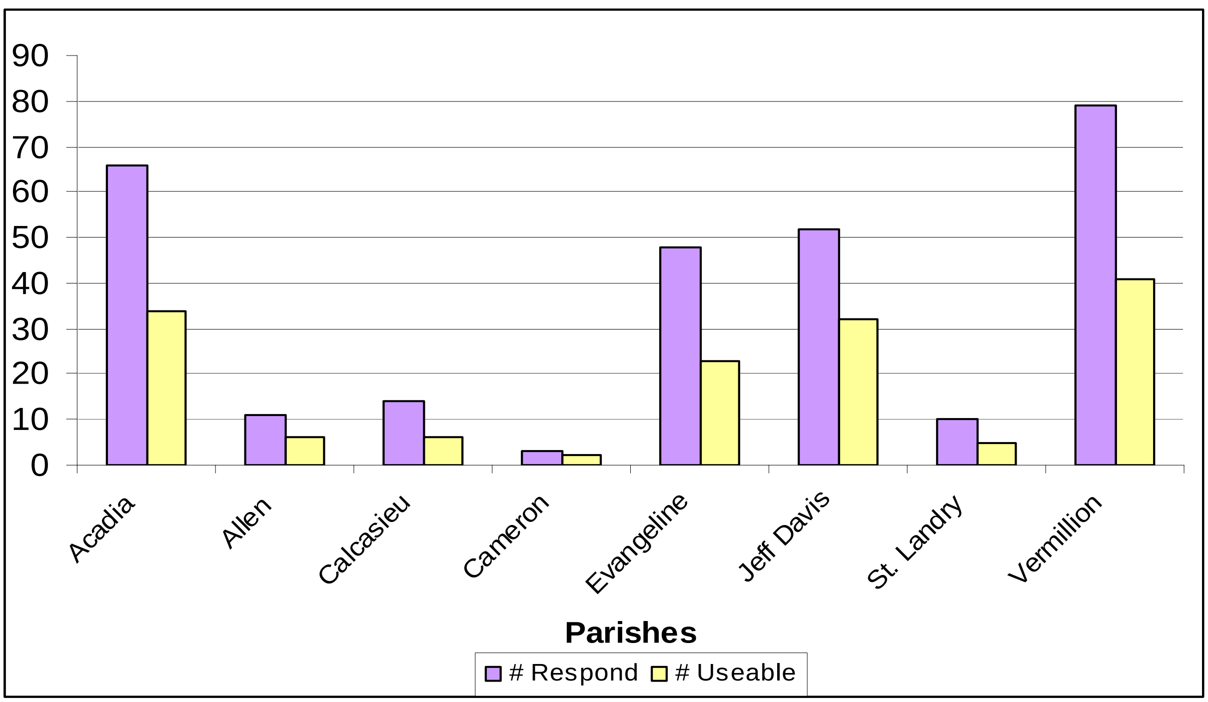

Figure 4.4 Number Responding Versus Number Useable, 2007 BMP Survey

Of the 1,285 surveys sent out, 295 were sent to Acadia parish (22.96%), 62 were sent to Allen parish (4.16%), 60 were sent to Calcasieu parish (4.67%), 26 were sent to Cameron parish (2.02%), 171 were sent to Evangeline parish (13.31%), 240 were sent to Jeff Davis parish (18.68%), 64 were sent to St. Landry parish (4.98%), and 376 were sent to Vermillion parish (28.56%). Those responding from each parish include: 66 from Acadia parish (23.31%), 11 from Allen parish (3.98%), 14 from Calcasieu parish (4.95%), 3 from Cameron parish (1.06%), 48 from Evangeline parish (16.96%), 52 from Jeff Davis parish (18.65%), 10 from St. Landry (3.53%), and 79 from Vermillion parish (27.92%). The percentage responding verses the percentage sent from each parish are, 11.53% from Acadia parish, 9.68% from Allen parish, 10% from Calcasieu parish, 7.69% from Cameron parish, 13.45% from Evangeline parish, 28.67% from Jeff Davis parish, 7.81% from St. Landry parish, and 11.17% from Vermillion parish.

Of those returned, the percentage useable was as follows: 34 from Acadia parish (22.82%), 6 from Allen parish (4.03%), 6 from Calcasieu parish (4.03%), 2 from Cameron parish (1.34%), 23 from Evangeline parish (15.44%), 31 from Jeff Davis parish (21.46%), 5 from St. Landry parish (3.36%), 41 from Vermillion parish (27.52%). This gives a total of 283 total responding and 149 useable responses. The most common response for not completing the survey was that the producers were no longer actively producing a crop on the land.

4.1.2 Survey Questions

The survey questionnaire consisted of ten sections. Section I identified the producer's knowledge of legislation related to improving water quality. Questions focused on the Clean Water Act and the Coastal Zone Management Act and also included questions about knowledge of nonpoint source pollution control programs, agricultural management practices, and source of information on water quality legislation.

Section II focused on knowledge of best management practices in agriculture. Questions included sources of information on BMPs, contact with extension personnel, and attendance at grower meetings. It also targeted the Master Farmer program, asking about awareness, participation, certification, and modification of behavior of rice producers. The section also targeted motivation for voluntary adoption and incorporation of additional practices.

In section III the listing of BMPs was presented in a chart asking the producer whether or not they are currently adopting a specific practice.

Section IV asked about current rice irrigation systems, this information was requested for a different study and was not included in this analysis.

Section V on farmer decision making analyzed if producers were currently participating in NRCS cost share programming for conservation practices. It also asked the percentage contribution by the producer for each program. It included a chart asking the producer to rank the importance of each practice according to environmental benefit. The last two questions focused on producer's risk preference level.

Section VI targeted additional on-farm revenue sources and included questions on crawfish production, waterfowl hunting leases, and next best alternative use of land. The geographic location of the study area lended itself to questions about on-farm income.

Section VII included Dunlap's New Ecological Paradigm Scale, which had fifteen questions targeting the relationship between humans and the environment. The second part of the section asks if the respondent thought that agriculture reduced water quality coming off the farm.

Section VIII was on the farm operation and included questions on location and size of farm, farm type, participation of owner in farming activities, leasing out of land to others, estimation of debt level, and impacts of 2005 hurricane season.

Section IX targeted socioeconomic information on the producer such as age, experience as farm operator, gender, education level, income level, and percentage income from farming.

Section X was an open ended question. Producers were free to comment on water quality, nonpoint source of pollution, and/or best management practices in rice production.

4.2 Summary of Descriptive Statistics

As outlined in chapter three, the adoption or non-adoption of management practices is assumed to be a function of economic and socioeconomic variables, institutional variables, and attitudinal variables. In the study, the dependent variables are identified by binary variables representing the decision to adopt a certain practices (1) or not adopting a practice (0). The right hand side of the model consists of the independent variables that are hypothesized to determine the producer's decision. There are 20 recommended best management practices for rice producers divided into four conservation management areas that were included in the survey. This is shown in table 4.1. The dependent variables and their expected affect on the dependent variables is outlined in table 4.2.

4.2.1 Current Adoption of BMPs

One of the specific objectives of the project was to describe and estimate the current level of BMP adoption by Louisiana rice producers. Results of the survey are presented in table 4.3. The percentage of producers adopting at least one management practice for: soil erosion and sediment management (93.79%), water management (92.41%), nutrient management (78.62%), pesticide management (75.86%), and wildlife habitat management (37.76%). These results are compared to the 1999 study: for field preparation (87.3%), planting methods (90.5%), pesticide management (88.5%), nutrient management (86.0%), and general farm management (22.9%).

Table 4.1
Binary Dependent Variables
Louisiana Rice Best Management Practices Study, 2007

CONSERVATION MANAGEMENT	MANAGEMENT PRACTICE	PRACTICE DESCRIPTION
Soil Erosion and Sediment Management	ESMP1	Use of land smoothing and precision leveling to control runoff and drainage
	ESMP2	Water leveling prior to January 1st of each year
	ESMP3	Implementation of suspended sediment test ot reduce sediment runoff by 50%
	ESMP4	Use of structure or control to reduce erosion from field drainage
	ESMP5	Use of residue management guidelines (no-till, mulch-till, seasonal-till)
	ESMP6	Use of filter strips and/or grassed waterways to improve quality of water runoff
	ESMP7	Use of cover crop
Water Management	WMP1	Use of irrigation water conveyance (irrigation canal, irrigation ditch, irrigation regulation reservoir, irrigation water pipeline)
	WMP2	Use of flow meters to improve irrigation efficiency
	WMP3	Implementation of precision leveling prior to irrigation to reduce quantity of water needed to cover field
	WMP4	Completion of regular water testing of well water
Nutrient Management	NMP1	Basing fertilizer applications on soil testing and expected yields
	NMP2	Implementation of split nutrient applications and/or slow-release fertilizers
	NMP3	Use of any precision equipment, such as variable rate applicator, to apply fertilizer to conserve amount used
	NMP4	Use of alternative sources of fertilizer, such as animal waste, instead of conventional sources
	NMP5	Calibration of spray equipment prior to each use
Pesticide Management	PMP1	Basing pesticide applications on economic thresholds as determined by field scouting
	PMP2	Use of a containment facility for mixing, loading, and storing pesticides
	PMP3	Calibration of spray equipment prior to each use
	PMP4	Use of precision application equipment
Wildlife Habitat Management	WHMP1	Establishment of wildlife habitat on land as an alternative source of income or recreational use

Table 4.2
Independent Variables and Expected Sign,
Louisiana Rice Best Management Practice Adoption Study, 2007

VARIABLE	DESCRIPTION	EXPECTED SIGN
ACNPCP	Awareness of Coastal Nonpoint Pollution Program as defined in Coastal Zone Management Act (1=yes, 0=no)	+
MCNPCP	Modified behavior as result understanding of Coastal Nonpoint Pollution Control Program (1=yes, 0=no)	+
ACWA	Awareness of efforts to control nonpoint source pollution through Clean Water Act (1=yes, 0=no)	+
MCWA	Modified behavior as result understanding of Clean Water Act (1=yes, 0=no)	+
ABMP	Awareness of Best Management Practices (1=yes, 0=no)	+
BMPIWQ	Best Management Practices will improve quality of water compared to conventional practices (1=yes, 0=no)	+
MEET	Times attended educational programs or receive consultation provided by Louisiana Cooperative Extension Services last year	+
ATTEND	Times attended grower meetings in the last year	+
AMFP	Awareness of Master Farmer Program in rice production (1=yes, 0=no)	+
PMFP	Participation in the Master Farmer Program certification training curriculum (1=yes, 0=no)	+
CMFP	Received Master Farmer certification (1=yes, 0=no)	+
MMFP	Modified production practices as result of instruction from Master Farmer Program (1=yes, 0=no)	+
SHARE	Participation in at least one of the NRCS cost-sharing programs (1=yes, 0=no)	+
RISKP	Continuous variable for self perception of risk attitude	+
RISKB	Risk attitude as measured by facing the respondent with investing in a specific farm venture	+
SNEP	Score of New Ecological Paradigm	+
AGRWQ	Think agriculture reduces the quality of water coming off farmland (1=yes, 0=no)	+
FSIZE	Farm size in acres	+
FSIZEAO	Ratio of acres owned and farm size (%)	-
TYPE	Binary variable for farm type (1= individual operation, 0= other)	+
PASS	Intent to pass operation on to an family member (1=yes, 0=no)	-
PARTIC	Actively participate in farming operations on owned land (1=yes, 0=no)	-
LEASE	Lease the majority of owned land to other operators (1=yes, 0=no)	-
DEBT	Estimated farm debt to be greater than 40% of total estimated value of farm (1=yes, 0=no)	-
AGE	Age of respondent in years	-
EXPER	Years experience as farm operator	-
GENDER	Binary variable for gender of respondent (1= male, 0= female)	-
EDUC	Education level equal to completion of a high school diploma (1=yes, 0=no)	+
INCOME	Gross farm income equal to $100,000 or higher (1=yes, 0=no)	+
PGHIF	Total family income from farming greater than 50% (1=yes, 0=no)	+

Further analysis of the practices found that the percentage of farmers implementing at least two practices listed was: soil erosion and sediment management (81.38%), water management (48.97%), nutrient management (69.66%), pesticide management (60%). The percentage of farmers implementing at least three conservation practices listed was: soil erosion and sediment management (64.83%), water management (8.28%), nutrient management (44.83%), pesticide management (39.31%). Percentage of farmers adopting all of the practices listed for soil erosion and sediment management (1.38%), water management (0%), nutrient management (2.76%), pesticide management (20.69%), and wildlife habitat management (37.76%).

4.2.2 Farm Characteristics

Table 4.4 exhibits those characteristics describing the type of farm, additional on-farm revenue sources, and impacts of the 2005 hurricane season. When asking farms what they intend to do with the acreage currently in rice production in 2007 the highest average of acres was for soybean acreage (127.20), followed by fallow acreage (88.62), crawfish acreage (61.12), other acreage (47.73), and cover crop acreage (2.33). The questions asking about crawfish production found that the average number of acres in crawfish only was 19.86, the average for rice acreage only was 74.97, and the acreage for rice and crawfish rotation was 60.11. The majority of respondents (87.40%) said they would not shorten the crawfish season to plant another crop. They also leave the land fallow following the end of crawfish season with 62.92 acres. Some said they plant soybeans (6.88 acres) or other (19.12 acres). Less than 1 % of respondents do not raise crawfish on their operation.

For those farmers leasing out their land to waterfowl hunting, the average acreage was 88.01 acres and the average price per acre was $3,192.71. When asked the next best alternative

Table 4.3
Percentage of Respondents Implementing Selected BMPs
Louisiana Rice Best Management Practices Adoption Study, 2007

CONSERVATION MANAGEMENT	MANAGEMENT PRACTICE	PERCENT ADOPTING	ADOPTING AT LEAST ONE PRACTICE	ADOPTING AT LEAST TWO PRACTICES	ADOPTING AT LEAST THREE PRACTICES	ADOPTING AT LEAST FOUR PRACTICES	ADOPTING AT LEAST FIVE PRACTICES	ADOPTING AT LEAST SIX PRACTICES	ADOPTING ALL PRACTICES
Soil Erosion and Sediment Management	ESMP1	51.19%	93.79%	81.38%	64.83%	51.72%	26.21%	6.90%	1.38%
	ESMP2	11.64%							
	ESMP3	34.51%							
	ESMP4	74.48%							
	ESMP5	84.62%							
	ESMP6	29.86%							
	ESMP7	36.99%							
Water Management	WMP1	34.53%	92.41%	48.97%	8.28%				0%
	WMP2	6.85%							
	WMP3	42.76%							
	WMP4	11.81%							
Nutrient Management	NMP1	65.51%	78.62%	69.66%	44.83%	15.86%			2.76%
	NMP2	20.14%							
	NMP3	20.14%							
	NMP4	9.59%							
	NMP5	58.22%							
Pesticide Management	PMP1	65.07%	75.86%	60%	39.31%				20.69%
	PMP2	39.04%							
	PMP3	58.22%							
	PMP4	32.14%							
Wildlife Habitat Management	WHMP1	37.76%							37.76%

Table 4.4
Frequency Distribution for Farm Characteristics
Louisiana Rice Best Management Practices Adoption Study, 2007

With the acreage currently in rice (2007), please indicate below what you intend to produce on that acreage beginning in the fall of 2007?	Average number of acres	Min.	Max.
Crawfish	61.12	0	1,000
Soybeans	127.2	0	12,000
Cover Crop (not soybeans)	2.33	0	150
Fallow	88.62	0	2,545
Other	47.73	0	1,400
How many acres do you currently have in each of the following:	Average number of acres	Min.	Max.
Crawfish (no rotation)	19.86	0	400
Rice (no rotation)	74.97	0	1,200
Rice and Crawfish (rotation)	60.11	0	1100
If you harvest rice and crawfish on the same acreage, do you shorten your crawfish harvest season to plant another crop?	Percent		
Yes	12.60%		
No	87.40%		
Which of the following practices follows the end of crawfish season?	Average number of acres	Min.	Max.
Leave the land fallow	62.92	0	2,700
Plant soybeans	6.88	0	600
Other	19.12	0	645
Do not raise crawfish (percentage)	0.38%	0	1
How many acres of rice do you annually lease out to others for waterfowl hunting?	Average number of acres	Min.	Max.
	88.01	0	3,200
In the most recent year, what was the dollar amount you received for the leased acres?	Dollar amount	Min	Max
	$3,192.71	0	200,000
If you stopped producing rice on the land you own, what would be your next best alternative use for the land?	Percent		
Do not own rice acreage	14.18%		
Non-agricultural use (selling or sub-dividing for real estate)	4.96%		
Federal conservation reserve program (CRP or WRP)	17.48%		
Manage habitat for commercial hunting in conjunction with federal programs	11.97%		
Produce energy producing crop (energy sugarcane, switchgrass, etc)	19.58%		
Livestock grazing	48.59%		
Other	9.97%		
Please indicate if the 2005 hurricane season affected your farming operation in any way.	Percent positive	Percent negative	
Labor Availability	2.65%	22%	
Yield Impact	7.29%	34.44%	
Planted Acreage	5.96%	24%	
Saltwater Intrusion	0%	23.18%	
Other	3.97%	45.33%	

of their rice land, most producers said they would convert the land to livestock grazing (48.59%); however 14.96% chose selling as real estate, 17.48% would enter a conservation reserve program, 11.97% would manage the land for commercial hunting, and 19.58% would produce an energy crop. Fourteen percent of respondents said they did not own any rice acreage. When evaluating the impact of the 2005 hurricane season some producers said their labor (2.65%), yield (7.28%), acreage (5.96%), and other (3.97%) were positively impacted. Other producers said their labor (22%), yield (34.44%), acreage (24%), saltwater intrusion (23.18%), and other (45.33%) were negatively impacted by the hurricane season.

4.2.3 Economic and Socioeconomic Variables

Tables 4.5 and 4.6 outline the questions asked about the individual farm operator. The majority of respondents (88.16%) were male 50 years of age or older. The highest percentage of respondents had experience either less than 10 years (21.43%) or more than 40 years (21.43%). The average age was 58.23 years and the average years of experience was 24.65 years. This was comparable to the 1999 study where the average age was 48.9 years old and 22.3 years of experience. The majority of respondents (46.98%) said that the highest level of education completed was high school, comparable to the 1999 study (46%). Most of the respondents (60.96%) stated that their gross farm income for 2006 was between $0 and $49,999. when this was compared to the 1999 study, where the majority (26%) responded to an income between $250,000 and $499,999 it becomes apparent that the two groups of respondents were different. A large percentage (63.94%) said that farming income accounted for less than 25 percent of their total income verses 8.3% in 1999. Most producers in the 1999 survey (63%) received 75% or more of there income from farming. The higher average age and lower reported income implies that this group were retired farmers, rather than active producers.

Table 4.5
Frequency Distribution for Farm Operator Characteristics
Louisiana Rice Best Management Practice Adoption Study, 2007

GENDER		Male	Female				
	Number	134	18				
	Percentage	88.16%	11.84%				
AGE		<=30	31-39	40-49	50-59	60-69	>=70
	Number	0	10	34	41	40	29
	Percentage	0%	6.49%	22.08%	26.62%	25.97%	18.88%
YEARS EXPERICNCE AS FARM OPERATOR		<=10	11-19	20-29	30-39	>=40	
	Number	33	19	30	24	33	
	Percentage	21.43%	12.33%	19.48%	15.58%	21.43%	
HIGHEST LEVEL OF EDUCATION COMPLETED		Grade school	High school	Trade school	Bachelor degree	Master degree	Doctorate degree
	Number	7	70	18	37	12	6
	Percentage	4.70%	46.98%	12.00%	24.76%	8.00%	4.00%
GROSS FARM INCOME FROM 2006		$0-$49,999	$50,000-$99,999	$100,000-$249-999	$250,000-$499,999	$500,000-OVER	
	Number	89	17	18	10	8	
	Percentage	60.96%	11.72%	12.33%	6.85%	5.48%	
PERCENTAGE TOTAL INCOME FROM FARMING		< 25%	25%-49%	50%-75%	>75%		
	Number	94	12	9	31		
	Percentage	63.94%	8.16%	6.12%	21.09%		
FARM TYPE		Individual operation	Partnership	Family corporation	Non-family corporation		
	Number	97	21	22	6		
	Percentage	65.99%	14.29%	14.97%	4.08%		
INTENTION TO PASS TO FAMILY MEMBER		Yes	No				
	Number	108	41				
	Percentage	72.48%	27.52%				
ACTIVE PARTICIPATION IN FARM OPERATIONS OF OWNED LAND		Yes	No				
	Number	101	49				
	Percentage	67.33%	32.67%				
		Yes	No				
LEASE MAJORITY OF OWNED LAND TO OTHER OPERATORS	Number	46	102				
	Percentage	31.08%	68.92%				
FARM DEBT GREATER THAN 40% OF FARM VALUE		Yes	No				
	Number	25	120				
	Percentage	17.24%	82.76%				

Table 4.6
Summary Statistics for Economic and Socioeconomic Variables
Louisiana Rice Best Management Practices Adoption Study, 2007

VARIABLE	DESCRIPTION	MEAN	ST.DEV	MIN	MAX	OBSERVATION
RISKP	Continuous variable for self perception of risk attitude (1=risk adverse, 10= risk taker)	5.06	2.542	0	10	109
RISKB	Risk attitude as measured by facing the respondent to investing in specific farm venture	1.68	0.861	0	4	116
DEBT	Estimated farm debt to be greater than 40% of total estimated value of farm (1=yes, 0=no)	0.17	0.379	0	1	145
AGE	Age of respondent in years	58.23	12.799	32	88	155
EXPER	Years experience as farm operator	24.65	15.734	0	67	139
GENDER	Binary variable for gender of respondent (1= male, 0= female)	0.88	0.324		1	152
EDUC	Education level equal to any schooling above competition of high school (1=yes, 0=no)	0.49	0.502	0	1	141
INCOME	Gross farm income equal to $100,000 or higher (1=yes, 0=no)	0.25	0.434	0	1	140
PGHIF	Total family income from farming greater than 50% (1=yes, 0=no)	0.29	0.454	0	1	139
PASS	Intent to pass operation on to an family member (1=yes, 0=no)	0.72	0.448	0	1	147
TYPE	Binary variable for farm type (1= individual operation, 0= other)	0.66	0.475	0	1	147
RAO	Rice acreage owned	78.41	132.931	0	900	145
OAO	Other crops acreage owned	33.61	157.8	0	1400	145
FAO	Fallow acreage owned	26.63	89.814	0	800	144
FCAO	Fallow Cattle acreage owned	47.47	200.689	0	2000	144
CAO	Crawfish acreage owned	31.49	92.62	0	739	144
HAO	Hunting lease acreage owned	40.39	168.363	0	1300	144
OWNED	Total acreage owned	240.13	487.492	0	4400	146
RAL	Rice acreage leased	166.79	424.036	0	3200	145
OAL	Other crops acreage leased	58.98	194.248	0	1300	145
FAL	Fallow acreage leased	38.79	163.939	0	1200	145
FCAL	Fallow cattle acreage leased	39.72	215.029	0	2000	145
CAL	Crawfish acreage leased	21.39	69.013	0	493	145
LEASED	Total acreage leased	355.96	834.504	0	6400	145
RICE	Total rice acreage (leased and owned)	230.14	437.792	0	3200	154

(table continued)

FSIZE	Farm size in acres	626.33	937.529	1	6400	135
FSIZEAO	Ratio of acres owned and farm size (%)	0.63	0.417	0	1	137
PARTIC	Actively participate in farming operations on owned land (1=yes, 0=no)	0.67	0.471	0	1	150
LEASE	Lease the majority of owned land to other operators (1=yes, 0=no)	0.31	0.464	0	1	148

Table 4.7
Summary Statistics for Institutional and Environmental Attitude Variables
Louisiana Rice Best Management Practices Adoption Study, 2007

VARIABLE	DESCRIPTION	MEAN	ST. DEV	MIN	MAX	OBSERVATION
ACNPCP	Awareness of Coastal Nonpoint Pollution Program as defined in Coastal Zone Management Act (1=yes, 0=no)	0.28	0.449	0	1	152
ACWA	Awareness of efforts to control nonpoint source pollution through Clean Water Act (1=yes, 0=no)	0.43	0.497	0	1	153
ABMP	Awareness of Best Management Practices (1=yes, 0=no)	0.63	0.486	0	1	152
BMPIWQ	Best Management Practices will improve quality of water compared to conventional practices (1=yes, 0=no)	0.76	0.429	0	1	150
MEET	Times attended educational programs or receive consultation provided by Louisiana Cooperative Extension Services last year	1.17	1.829	0	11	154
ATTEND	Times attended grower meetings in the last year	0.81	1.564	0	12	154
AMPF	Awareness of Master Farmer Program in rice production (1=yes, 0=no)	0.51	0.501	0	1	154
PMFP	Participation in the Master Farmer Program certification training curriculum (1=yes, 0=no)	0.18	0.385	0		150
CMPF	Received Master Farmer certification (1=yes, 0=no)	0.09	0.282	0	1	150

(table continued)

MMPF	Modified production practices as result of instruction from Master Farmer Program (1=yes, 0=no)	0.18	0.382	0	1	148
AGRWQ	Think agriculture reduces the quality of water coming off farmland (1=yes, 0=no)	0.29	0.457	0	1	146
SHARE	Participation in at least one of the NRCS cost-sharing programs (1=yes, 0=no)	0.57	0.496	0	1	134

Table 4.8
Summary Statistics for Institutional and Environmental Attitude Variables II
Louisiana Rice Best Management Practices Adoption Study, 2007

Are you aware of the Coastal Nonpoint Pollution Control Program as defined in the Coastal Zone Management Act?		Yes	No			
	Number	42	110			
	Percent	27.63%	72.24%			
Have you changed your agricultural management practices as a result of your understanding of the Coastal Nonpoint Pollution Control Program?		Yes	No			
	Number	35	115			
	Percent	23.24%	76.67%			
What is your primary source of information about the Coastal Nonpoint Pollution Control Program?		Louisiana Cooperative Extension Service	Media: TV, Radio, Magazines, or Internet	Other farmers, friends, relatives, neighbors	Farm organizations (Farm Bureau)	Governmental agencies (NRCS, DNR, DEQ)
	Number	34	7	4	8	23
	Percent	22.52%	4.64%	2.67%	5.30%	15.23%
Are you aware of federal efforts to control nonpoint sources of water pollution through the Clean Water Act?		Yes	No			
	Number	66	87			
	Percent	43.14%	56.86%			
Have you changed your agricultural management practices as a result of your understanding of the Clean Water Act?		Yes	No			
	Number	51	102			
	Percent	33.34%	66.67%			

(table continued)

What is your primary source of information about the Clean Water Act?		Louisiana Cooperative Extension Service	Media: TV, Radio, Magazines, or Internet	Other farmers, friends, relatives, neighbors	Farm organizations (Farm Bureau)	Governmental agencies (NRCS, DNR, DEQ)
	Number	43	10	8	14	34
	Percent	28.10%	6.54%	5.26%	9.15%	22.22%
Have you ever heard the term Best Management Practices?		Yes	No			
	Number	95	57			
	Percent	62.50%	37.50%			
What is your primary source of information about Best Management Practices?		Louisiana Cooperative Extension Service	Media: TV, Radio, Magazines, or Internet	Other farmers, friends, relatives, neighbors	Farm organizations (Farm Bureau)	Governmental agencies (NRCS, DNR, DEQ)
	Number	64	19	25	12	44
	Percent	42.38%	12.58%	16.67%	7.95%	29.14%
What do you consider your primary motivation for voluntarily adopting best management practices?		Improved productivity/ profitability	Improved water quality	Avoid mandated regulation	Conserve soil resources	Other
	Number	56	51	27	56	11
	Percent	37.58%	34.23%	18.12%	38.10%	7.38%
	Number	Percent				
Are you willing to implement additional and more stringent production practices as they become more effective in your operation?	57	39.58%				
Are you content with your current adoption rate of conservation practices?	69	47.92%				
Are you not interested in incorporating any additional conservation practices into your operation until mandated by federal or state government?	19	13.19%				

The majority in this survey (72.48%) and the 1999 survey (57%) stated that they would pass the operation onto a family member.

Also, the majority 65.99% (2007) and 56% (1999) of the farms in both surveys were individual operations. The studies both showed that most (82.76% in 2007 and 80% in 1999) of farmers have less than 40% debt level compared to farm value. Table 4.6 also shows the average rice acreage (including owned and leased) across farms was 245.20 acres and the average farm size was 626.33 acres. In 1999 the average farm size was 1,348.9 acres. The ratio of acres owned to farm size was 63%, versus 26% in 1999. In this survey, the average acres owned was 240.13 acres compared to 355.96 acres leased. This supports the conclusion that the represents to the 2007 survey were more likely to be retired from farming.

4.2.4 Institutional and Environmental Attitudinal Variable

Tables 4.7 and 4.8 outline the questions and responses that target the institutional and environmental attitude variables. In Table 4.7, when producers were asked about their awareness of Coastal Zone Management Act (72%) and Clean Water Act (57%), most were unaware of legislation. The majority (63%) have heard the term best management practices and are aware of the Master Farmer program in rice production (51%). However, only 18% are participating in training curriculum, only 9% have received Master Farm certification, and only 18% have modified their behavior as a result of training. This low level of participation may be related to the average age of the respondents. Twenty nine percent of the respondents believe that agriculture reduces the quality of water coming off the land. There was 57% of the respondents who had participated in at least one of the NRCS cost-sharing programs.

Table 4.8 showed that the primary source of information for legislative issues and best management practices is the Louisiana Cooperative Extension Service (22.52%), with

Governmental Agencies coming in second (15.23%). Most of the respondents (38.10%) consider conservation of soil resources to be the primary reason for adopting best management practices with improved productivity and profitability coming in second (37.58%). Forty eight percent say they are content with their current level of adoption, forty percent say they are willing to implement additional and more stringent practices as they become more effective, and only 13.19% say they are not interested in incorporating any additional conservation practices until mandated by the government

Table 4.9 showed the percentage of participation in cost-share programs sponsored by the Natural Resource Conservation Service (NRCS). Producer participation in these types of programs has increased from 18.47% to 57% since the 1999 survey.

Under the management group of erosion and sediment management there are four practices that cost-shared. Nine percent of respondents have participated in cost-sharing for filter strips, 32% have cost shared the implantation of grade stabilization structures, structures for water control, and/or critical area planting. Twelve percent of producers have cost-shared the use of filter strips to reduce the amount of sediment runoff. Residue management practices such as no-till, seasonal-till, or mulch-till have been cost-shared by 15% of farmers.

For water management, the NRCS has several practices, five of which were listed. The use of cost-sharing for irrigation land leveling was used by 41% of respondents and 48% used irrigation pipeline. Forty eight percent responded that they cost-share the implementation of irrigation regulating reservoir, tailwater recovery, and/or a pumping plant. Irrigation water management was cost-shared by 22% of respondents. Well decommissioning practices was cost-shared by nine percent of respondents. Nutrient management was cost-shared by 21% of respondents and pesticide management was cost-shared by 25% of respondents.

Table 4.9
Adoption of NRCS Cost Share Programs
Louisiana Rice Best Management Practices Adoption Study, 2007

Agricultural Practice	% Yes	% No	Your Share	
			%	# respond
1. Filter Strip	8.59	91.41	45.71	7
2. Grade Stabilization Structure, Structure for Water Control, and/or Critical Area Planting	32.31	67.67	53.26	23
3. Irrigation Land Leveling	41.04	58.96	59	25
4. Irrigation Pipeline	48.12	51.88	57.9	31
5. Irrigation Regulating Reservoir, Tailwater Recovery, and/or Pumping Plant	6.98	93.02	33.33	3
6. Nutrient Management	20.93	79.07	72.5	8
7. Pesticide Management	24.62	75.38	73	10
8. Field Border	11.72	88.28	45	4
9. Well Decommissioning	9.3	90.7	36.25	4
10. Irrigation Water Management	21.71	78.91	63.33	6
11. Residue Management- (No-Till)	14.62	85.38	40	3

4.2.5 New Ecological Paradigm Scale

Table 4.10 shows a summary of the distribution of the rice producer's responses to NEP statements. Agreement with the eight odd-number statements and disagreement with the seven even-numbered statements implies a pro-environmental view. Using a 1 to 5 scale, with 5 equaling strongly agreeing, a score can be calculated for each respondent. The maximum score of 75 indicates a strong pro-ecological position. The average score of respondents was 48.77; this indicates a neutral attitude toward ecological issues by Louisiana rice producers. This score can be compared to the average score of 45.61 from the 2003 sugarcane study.

Additional analysis revealed more about the range of attitudes among respondents by summing the reactions such as strongly agree (SA), mildly agree (MA), unsures (U), mildly disagree (MD, and strongly disagree (SD). Respondents agreed 60% or greater on questions which had a pro-ecological view. Question such as human interference with nature (3), humans subject to the laws of nature (9), and the balance of nature (13) show this. Approximately 87% of respondents agreed that despite our special abilities humans are still subject to the laws of nature (9) and 55.63% agreed that plants and animals have as much right as humans to exist (7).

Over 50% of respondents agreed with statements 4 and 6, indicating an anti-ecological view. Statement 4 states that human ingenuity will ensure that we do not make the earth unlivable, and statement 6 states that the earth has plenty of natural resources, if we just learn how to develop them. Statement 11, stating that the earth is like a spaceship with very limited room and resources, had a 34% positive response rate among those responding. Statements about the number of people the earth can support (1) (27%), the balance of nature to cope with industrial nations (8) (28%), and exaggerated view of ecological crisis facing humankind (10) (32%) had a higher percentages of unsure answers.

Table 4.10
Frequency Distribution Associated with the NEP Statements
Louisiana Rice Best Management Practices Adoption Study, 2007

STATEMENT	SA	MA	U	MD	SD
1. We are approaching the limit of the number of people the earth can support.	14.69%	17.48%	27.27%	19.58%	20.98%
2. Humans have the right to modify the natural environment to suit their needs.	9.79%	31.74%	14.69%	20.98%	23.78%
3. When humans interfere with nature it often produces disastrous consequences.	30.07%	31.25%	16.78%	15.28%	6.94%
4. Human ingenuity will ensure that we do NOT make the earth unlivable.	24.48%	31.47%	25.17%	11.19%	7.69%
5. Humans are severely abusing the environment.	20.48%	29.58%	14.79%	19.72%	14.08%
6. The earth has plenty of natural resources if we just learn how to develop them.	41.55%	37.32%	9.22%	7.04%	5.63%
7. Plants and animals have as much right as humans to exist.	27.46%	28.17%	9.86%	16.90%	16.90%
8. The balance of nature is strong enough to cope with the impacts of modern industrial nations.	9.86%	18.31%	28.17%	24.65%	19.01%
9. Despite our special abilities humans are still subject to the laws of nature.	49.30%	37.32%	9.93%	3.52%	0%
10. The so called “ecological crisis” facing humankind has been greatly exaggerated.	24.65%	27.46%	32.39%	7.75%	8.45%
11. The earth is like a spaceship with very limited room and resources.	14.18%	19.86%	24.11%	24.82%	17.02%
12. Humans were meant to rule over the rest of nature.	24.65%	25.35%	16.90%	14.79%	16.90%
13. The balance of nature is very delicate and easily upset.	28.87%	34.51%	16.90%	15.49%	3.52%
14. Humans will eventually learn enough about how nature works to be able to control it.	8.45%	25.35%	26.76%	21.83%	16.90%
15. If things continue on their present course, we will soon experience a major ecological catastrophe.	18.31%	19.01%	26.06%	19.72%	16.90%

4.3 Empirical Framework

Cardona (1999) developed an estimation procedure consisting of three phases. The first phase includes all independent variables in estimating single-probit models for each best management practice. A multi-correlation analysis was completed to eliminate redundant variables. The analysis indicated the degree of correlation between each variable. The independent variables used were previously listed and discussed in Table 4.2. Those variables with high degrees of correlation included: ACNPCP and MCNPCP, ACNPCP and MCWA, MCWA and MCNPCP, MCWA and ACWA, and FSIZE and INCOME. MCNPCP, MCWA, and INCOME variables were eliminated from our independent variable list.

The second phase constructed multivariate probit models from the results of single probit models estimated in the earlier phase. In phase II, those independent variables with at least 25% significance level in phase I were included in the models to ensure convergence and provide more efficient estimates (Hendry, 1995).

The third phase provided estimation under different scenarios. The first scenario required that at least two management practices be implemented for each management group. The second scenario required at least three management practices from each management group. The third scenario required at least four management practices from each management group. The fourth and fifth scenarios required at least five and at least six management practices from the erosion and sediment group, this was the only group with this large number of practices.

4.3.1 Phase I Estimation of Single Probit Models

A series of single probit models were constructed in the following manner:

BMPi = F (ACNPCP, ACWA, ABMP, MEET, ATTEND, CMFP, MMFP, SHARE, RISKP, RISKB, SNEP, AGRWQ, FSZE, FSIZEAO, TYPE, PASS, LEASE, DEBT, AGE, EXPER,

GENDER, EDUC, PGHIF, e_i*)

Where:

BMPi = 1 if the rice producer has adopted the ith BMP and 0 otherwise.

e_i*= error term

Twenty-one models were estimated using the LIMDEP 8.0 software program (Greene, 2003). The explanatory variables are defined in Table 4.2 and the results are Table 4.11, 4.12, 4.13, 4.14, and 4.15.

Table 4.11 illustrates the single-probit model screening for erosion and sediment management practices. The variables included in the chart that are significant at the 25% level for ESMP1 include: ATTEND, RISKP, FSIZE, FSIZEAO, LEASE, AGE, and GENDER. Significant variables at the 25% level for ESMP2 include: ACNPCP, ACWA, MMFP, RISKP, LEASE, DEBT, and AGE. For ESMP3 the significant variables are: ACNPCP, CMFP, MMFP, SHARE, FSIZE, FSIZEAO, GENDER, and EDUC. The significant variables for ESMP4 include: MEET, PASS, LEASE, and AGE. Those variables significant for ESMP5 are: MEET, ATTEND, RISKB, FSIZE, GENDER, and EDUC. For ESMP6 the significant variables include: ACWA, MMFP, SNEP, AGRWQ, AND PGHIF. Those significant variables for ESMP7 are: MEET, ATTEND, CMFP, RISKP, FISZE, FSIZEAO, and PGHIF. All of these variables were selected to enter phase II.

Table 4.12 illustrates the single-probit model screening for water management practices. Those variables significant at the 25% level for WMP1 include: FSIZE and FSIZEAO. The variables significant WMP2 are: ACWA and GENDER. For WMP3 the significant variables are: ATTEND, SHARE, AND EXPER. The significant variables for WMP4 include: CMFP, FSIZEAO, EXPER, GENDER, and EDUC. These variables were selected to enter into phase II.

Table 4.11
Single-Probit Model Screening for Erosion and Sediment Management
Louisiana Rice Best Management Practice Adoption Study, 2007

	ESMP1		ESMP2		ESMP3		ESMP4		ESMP5	
VARIABLE	Coeff	Std. Err	Coeff	Std. Err	Coeff	Std. Err	Coeff	Std. Err	Coeff	Std. Err
CONSTANT	*-1.2778	1.0710	-0.4925	1.3885	-1.1362	0.8396	1.3839	0.7694	-0.0132	0.2610
ACNPCP	0.1973	0.4110	***1.3929	0.6238	**0.6713	0.3898	-0.2159	0.3532	-0.1402	0.3090
ACWA	-0.1986	0.4109	**-0.8275	0.5618	0.0240	0.3586	0.2121	0.3532	0.1356	0.3074
ABMP	0.2423	0.3222	0.1800	0.5165	0.2245	0.3367	-0.0038	0.0464	-0.0002	0.0012
MEET	-0.0624	0.1360	0.1316	0.1165	0.0308	0.0887	***0.5756	0.1836	*-0.1287	0.1025
ATTEND	**0.5657	0.3449	0.0924	0.1164	0.0232	0.0883	-0.0596	0.1429	**0.5535	0.1995
CMFP	0.7251	0.7908	0.0000	0.0003	*0.0003	0.0003	0.0001	0.0003	0.0000	0.0003
MMFP	-0.7237	0.7907	***-0.0027	0.0012	*-0.0012	0.0010	0.0008	0.0011	0.0001	0.0008
SHARE	-0.0001	0.0005	-0.0003	0.0008	*-0.0009	0.0006	0.0001	0.0005	-0.0002	0.0005
RISKP	*0.0005	0.0004	***-0.0010	0.0005	0.0000	0.0004	0.0001	0.0004	-0.0002	0.0003
RISKB	0.0004	0.0004	-0.0003	0.0005	0.0000	0.0004	-0.0003	0.0004	*0.0005	0.0004
SNEP	-0.0004	0.0010	-0.0004	0.0008	-0.0002	0.0008	-0.0020	0.0020	-0.0002	0.0007
AGRWQ	-0.0003	0.0009	0.0007	0.0011	0.0069	0.0279	0.0005	0.0009	-0.0001	0.0007
FSIZE	**0.0011	0.0006	-0.0002	0.0002	*0.0002	0.0001	0.0000	0.0002	**0.0003	0.0002
FSIZEAO	*-0.0016	0.0011	0.0028	0.0124	*0.4087	0.3056	-0.0002	0.0010	0.0000	0.0008
TYPE	0.0312	0.0920	0.0018	0.0069	0.0016	0.0082	0.0026	0.0039	0.0690	0.0871
PASS	-0.1625	0.2853	-0.3449	0.4694	-0.3212	0.2918	***-0.5071	0.2421	-0.1387	0.2221
LEASE	*0.4421	0.3405	***1.2331	0.4785	0.0163	0.3146	***0.5052	0.2419	0.0696	0.2251
DEBT	-0.3095	0.3673	**0.6977	0.4334	-0.1095	0.2794	0.0015	0.0014	0.0003	0.0010
AGE	*0.0171	0.0143	***-0.0400	0.0206	0.0042	0.0137	*-0.0149	0.0119	0.0019	0.0026
EXPER	0.0005	0.0006	-0.0005	0.0009	0.0007	0.0008	0.0001	0.0006	0.0005	0.0005
GENDER	**0.7806	0.5063	0.2186	0.6385	**-0.351	0.2384	0.0100	0.0223	*-0.2774	0.2192
EDUC			0.1135	0.4052	**0.3415	0.2359	0.0007	0.0139	*0.2764	0.2194
PGHIF	-0.0004	0.0012	0.3348	0.5427	0.0055	0.0231	0.0000	0.0009	-0.0006	0.0010

(table continued)

	ESMP6		ESMP7	
VARIABLE	Coeff	Std. Err	Coeff	Std. Err
CONSTANT	***-1.3670	0.7060	-0.7181	0.8493
ACNPCP	-0.0453	0.3484	0.0025	0.0091
ACWA	**0.4812	0.3349	-0.0066	0.0117
ABMP	0.0051	0.0119	-0.0009	0.0012
MEET	0.0641	0.0821	**0.1285	0.0821
ATTEND	-0.0428	0.0899	**0.1563	0.1013
CMFP	0.0001	0.0002	*0.0003	0.0002
MMFP	*-0.0011	0.0009	0.0007	0.0010
SHARE	-0.0006	0.0005	-0.0005	0.0005
RISKP	-0.0003	0.0003	**0.0006	0.0003
RISKB	0.0003	0.0004	0.0000	0.0004
SNEP	**-0.0010	0.0006	-0.0006	0.0006
AGRWQ	*-0.0009	0.0007	-0.0002	0.0007
FSIZE	0.0001	0.0001	*0.0000	0.0001
FSIZEAO	-0.0006	0.0009	**0.0001	0.0010
TYPE	0.0017	0.0057	0.1294	0.1271
PASS	0.2394	0.2253	-0.4831	0.2162
LEASE	-0.2414	0.2253	0.3542	0.2130
DEBT	0.0025	0.0064	0.0002	0.0011
AGE	0.0039	0.0113	0.0050	0.0112
EXPER	-0.0003	0.0005	0.0004	0.0006
GENDER	-0.0073	0.0147	0.0274	0.4293
EDUC	0.0026	0.0082		
PGHIF	**-0.0015	0.0009	*-0.0012	0.0010

* Estimates significant at the 25% level
** Estimates significant at the 15% level
***Estimates significant at the 5% level

Table 4.12
Single-Probit Model Screening for Water Management
Louisiana Rice Best Management Practice Adoption Study, 2007

	WMP1		WMP2		WMP3		WMP4	
VARIABLE	Coeff	Std. Err	Coeff	Std. Err	Coeff	Std. Err	Coeff	Std. Err
CONSTANT	-0.3747	0.5856	-5.8289	17.9537	***-0.5895	0.2482	***-1.6863	0.4235
ACNPCP	0.0005	0.0112	0.7099	0.6288	0.0031	0.0128	-0.0055	0.1614
ACWA	0.0095	0.0351	*-0.7284	0.6320	0.0007	0.0231	0.2779	0.3939
ABMP	0.0003	0.0084	-0.0233	0.0328	0.0002	0.0012	0.0020	0.0100
MEET	0.3433	0.3071	-0.1292	0.2141	0.0859	0.0841	0.0462	0.1049
ATTEND	0.2808	0.6038	-0.1516	0.2383	***0.3144	0.1224	-0.0309	0.1433
CMFP	0.0011	0.0257	-0.0015	0.0098	0.0002	0.0002	**0.0004	0.0003
MMFP	-0.0012	0.0257	0.0046	0.0153	0.0007	0.0010	0.0020	0.0249
SHARE	0.0002	0.0006	0.0014	0.0049	*-0.0006	0.0005	-0.0002	0.0007
RISKP	-0.0004	0.0005	0.0032	0.0098	0.0003	0.0003	0.0001	0.0005
RISKB	-0.0004	0.0005	0.0029	0.0064	-0.0001	0.0004	-0.0002	0.0005
SNEP	0.0003	0.0010	0.0063	0.0263	-0.0007	0.0007	0.0017	0.0033
AGRWQ	0.0004	0.0009	-0.0002	0.0306	-0.0008	0.0007	0.0018	0.0097
FSIZE	***0.0050	0.0020	0.0003	0.0004	0.0001	0.0001	0.0002	0.0002
FSIZEAO	***-0.0050	0.0024	-0.0161	0.0192	0.0005	0.0009	*-0.0014	0.0011
TYPE	0.0038	0.0115	-0.0038	0.0189	0.0563	0.0676	0.0018	0.0212
PASS	-0.1857	0.3258	4.8862	16.8872	-0.1879	0.2001	0.3601	0.3856
LEASE	0.1845	0.3255			0.1370	0.2017	-0.3388	0.3603
DEBT	-0.0024	0.0149	-0.0046	0.0266	-0.0001	0.0011	0.0026	0.0167
AGE	0.0063	0.0075			0.0013	0.0025	-0.0003	0.0031
EXPER	-0.0001	0.0007	0.0138	0.0151	**-0.0008	0.0005	*-0.0010	0.0007
GENDER	-0.0077	0.0204	**-0.9393	0.7885	-0.0053	0.0259	*-0.5170	0.3911
EDUC	0.0002	0.0118	-0.0112	0.0225			**0.4927	0.3367
PGHIF	-0.0025	0.0059	-0.0024	0.0234	-0.0002	0.0010		

*Estimates significant at the 25% level
**Estimates significant at the 15% level
***Estimates significant at the 5% level

Table 4.13 illustrates the single-probit model screening for nutrient management practices. The significant variables for NMP1 include: ACNPCP, ACWA, MEET, SHARE, RISKP, RISKB, SNEP, FSIZE, FSIZEAO, PASS, and LEASE. For NMP2 the significant variables are: ACNPCP, ATTEND, RISKB, FSIZE, FSIZEAO, and EXPER. SHARE, RISKP, SNEP, FSIZE, PASS, and LEASE are all significant for NMP3. For NMP4 the significant variables are: RISKB, SNEP, AGRWQ, FSIZEAO, PASS, LEASE, AGE, and EXPER. Those variables significant for NMP5 include: ACNPCP, ACWA, MEET, RISKP, SNEP, FSIZE, FSIZEAO, and EXPER. All of these variables were selected to enter phase II.

In Table 4.14, the significant variables for PMP1 are: ACWA, MMFP, SHARE, RISKB, SNEP, and GENDER. For PMP2 the significant variables include: ACNPCP, ACWA, MEET, RISKP, FSIZE, FSIZEAO, and EXPER. Those variables significant for PMP3 include: ACNPCP, ABMP, SHARE, MEET, FSIZE, FSIZEAO, AGE, and GENDER. ACNPCP, ABMP, MEET, SHARE, FSIZE, FSIZEAO, AGE, and GENDER are all significant for PMP4. All of these variables were selected to enter phase II.

Table 4.15 illustrates single-probit screening for wildlife habitat management. For this variable, there is only one management practice. For this practice, the significant variables include: ACWA, ABMP, AGRWQ, and FSIZE. These variables are significant at least 25% level and qualify to enter phase II. This management group will be treated different from the other management groups, since it does not contain multiple practices that could be analyzed.

This management group is also different groups in that it is not directly tied to rice production but rather tied to alternative sources of on-farm income. This will become more apparent when evaluating the descriptive statistics looking at the percentage adopting of management practices.

Table 4.13
Single-Probit Model Screening for Nutrient Management
Louisiana Rice Best Management Practice Adoption Study, 2007

	NMP1		NMP2		NMP3		NMP4		NMP5	
VARIABLE	Coeff	Std. Err	Coeff	Std. Err	Coeff	Std. Err	Coeff	Std. Err	Coeff	Std. Err
CONSTANT	0.1083	0.5313	-0.1553	0.9097	***-2.5542	1.0769	-6.9024	159120.4800	-0.1308	0.4792
ACNPCP	**-0.5104	0.3465	***0.9053	0.4240	0.0021	0.0131	0.7004	0.6263	*-0.4041	0.3069
ACWA	**0.5073	0.3465	0.0706	0.3507	0.0000	0.0186	-0.3370	0.5729	*0.4010	0.3068
ABMP	-0.0006	0.0014	-0.0001	0.0035	-0.0012	0.0015	-0.0108	0.0098	-0.0003	0.0013
MEET	*0.2804	0.1237	-0.0498	0.1060	0.0611	0.0877	-0.0682	0.1446	**0.1539	0.1030
ATTEND	0.0607	0.0981	**0.3157	0.1687	-0.0771	0.1111	0.0054	0.1328	-0.0351	0.0917
CMFP	0.0002	0.0003	-0.0002	0.0003	0.0001	0.0003	-0.0016	0.0056	0.0000	0.0002
MMFP	0.0009	0.0009	0.0006	0.0008	0.0011	0.0013	0.0043	0.0088	0.0007	0.0008
SHARE	**-0.0010	0.0006	0.0002	0.0006	**-0.0010	0.0006	0.0016	0.0030	-0.0003	0.0005
RISKP	**0.0007	0.0004	0.0003	0.0004	*-0.0005	0.0004	0.0000	0.0006	*0.0004	0.0003
RISKB	**0.0007	0.0004	*0.0005	0.0004	0.0005	0.0004	**0.0023	0.0014	0.0002	0.0004
SNEP	*-0.0009	0.0007	-0.0036	0.0032	**-0.0010	0.0007	**-0.0015	0.0009	*-0.0009	0.0008
AGRWQ	-0.0008	0.0008	0.0001	0.0008	0.0005	0.0010	**-0.0022	0.0014	-0.0006	0.0007
FSIZE	***0.0005	0.0002	**0.0006	0.0003	**0.0003	0.0002	0.0002	0.0003	**0.0004	0.0002
FSIZEAO	*-0.0014	0.0010	**-0.0023	0.0012	-0.0009	0.0010	**-0.0084	0.0046	*-0.0012	0.0010
TYPE	0.0025	0.0065	0.0012	0.0048	0.0018	0.0118	0.0033	0.1233	0.0181	0.0661
PASS	*-0.3165	0.2654	0.0190	0.2376	**0.5920	0.3730	*0.8322	0.6267	-0.0626	0.2147
LEASE	**0.4867	0.2692	-0.0163	0.2376	***0.9462	0.3213	*-0.8359	0.6177	0.0464	0.2154
DEBT	-0.1700	0.2539	0.0008	0.0010	-0.0010	0.0011	0.0502	0.6142	0.0000	0.0009
AGE	0.0019	0.0028	0.0077	0.0123	0.0076	0.0135	*-0.0263	0.0202	0.0022	0.0071
EXPER	0.0004	0.0006	***0.0017	0.0008	0.0005	0.0007	**0.0087	0.0052	*0.0007	0.0006
GENDER	-0.1215	0.4640	-0.4603	0.4581	0.2849	0.5370	6.0675	159120.4800	-0.0129	0.0339
EDUC	-0.0003	0.0046	0.0020	0.0214	0.0042	0.0199	0.4734	0.4312	0.0046	0.0256
PGHIF	-0.0010	0.0014	-0.0013	0.0012	0.0037	0.0112	0.0253	0.0230	0.0002	0.0009

*Estimates significant at the 25% level
**Estimates significant at the 15%level
***Estimates significant at the 5% level

Table 4.14
Single-Probit Model Screening for Pesticide Management
Louisiana Rice Best Management Practices Adoption Study, 2007

	PMP1		PMP2		PMP3		PMP4	
VARIABLE	Coeff	Std. Err	Coeff	Std. Err	Coeff	Std. Err	Coeff	Std. Err
CONSTANT	-0.9768	0.3935	-0.3984	0.4102	-0.1308	0.4792	0.3698	0.7388
ACNPCP	-0.0805	0.4951	*-0.0036	0.0171	***-0.4041	0.3069	***0.8816	0.3568
ACWA	**0.7261	0.4181	*0.3902	0.2689	0.4010	0.3068	-0.0898	0.3369
ABMP	0.0013	0.0019	-0.0009	0.0013	*-0.0003	0.0013	*-0.0015	0.0013
MEET	-0.0300	0.1315	*-0.0055	0.0821	*0.1539	0.1030	*-0.1218	0.0969
ATTEND	0.3937	0.2899	0.0577	0.0836	-0.0351	0.0917	0.0445	0.0892
CMFP	0.0002	0.0004	0.0000	0.0002	0.0000	0.0002	-0.0001	0.0002
MMFP	**0.0002	0.0009	0.0016	0.0011	0.0007	0.0008	0.0010	0.0011
SHARE	***-0.0011	0.0005	-0.0020	0.0007	*-0.0003	0.0005	*-0.0008	0.0006
RISKP	0.0007	0.0004	*0.0004	0.0003	0.0004	0.0003	-0.0001	0.0003
RISKB	**0.0000	0.0004	0.0006	0.0004	0.0002	0.0004	0.0001	0.0004
SNEP	*-0.0012	0.0010	-0.0008	0.0006	-0.0009	0.0008	0.0000	0.0007
AGRWQ	-0.0004	0.0008	-0.0006	0.0008	-0.0006	0.0007	-0.0008	0.0008
FSIZE	0.0027	0.0008	**0.0000	0.0001	**0.0004	0.0002	**0.0003	0.0002
FSIZEAO	-0.0038	0.0015	*0.0006	0.0010	**-0.0012	0.0010	**-0.0015	0.0010
TYPE	0.3520	0.2926	0.1100	0.0978	0.0181	0.0661	0.0019	0.0059
PASS	0.0567	0.3126	-0.0759	0.2712	-0.0626	0.2147	0.0359	0.2749
LEASE	0.1237	0.2969	0.2671	0.2610	0.0464	0.2154	0.5799	0.2540
DEBT	-0.5303	0.3270	-0.0001	0.0010	0.0000	0.0009	-0.0001	0.0012
AGE	0.0015	0.0030	0.0039	0.0054	*0.0022	0.0071	*-0.0145	0.0118
EXPER	0.0003	0.0006	*-0.0001	0.0006	0.0007	0.0006	0.0006	0.0006
GENDER	**-0.0060	0.0108	-0.4705	0.2902	***-0.0129	0.0339	***-0.6234	0.2856
EDUC			0.1677	0.2411	0.0046	0.0256	0.0024	0.0091
PGHIF	-0.0008	0.0013	-0.0031	0.0045	0.0002	0.0009	0.0183	0.0205

*Estimates significant at the 25% level
**Estimates significant at the 15% level
***Estimates significant at the 5% level

Table 4.15
Single-Probit Model Screening for Wildlife Habitat Management
Louisiana Rice Best Management Practice Adoption Study, 2007

	WHMP1	
VARIABLE	Coeff	Std. Err
CONSTANT	-0.5790	0.7154
ACNPCP	-0.0032	0.0114
ACWA	**0.5370	0.2816
ABMP	*-0.0016	0.0012
MEET	-0.0731	0.0819
ATTEND	-0.0136	0.0915
CMFP	0.0002	0.0002
MMFP	0.0006	0.0008
SHARE	-0.0003	0.0006
RISKP	0.0002	0.0003
RISKB	-0.0002	0.0004
SNEP	0.0003	0.0007
AGRWQ	**-0.0013	0.0008
FSIZE	***0.0006	0.0002
FSIZEAO	0.0028	0.0070
TYPE	0.0018	0.0051
PASS	0.0274	0.2365
LEASE	-0.0328	0.2364
DEBT	-0.0006	0.0011
AGE	-0.0052	0.0113
EXPER	0.0127	0.0009
GENDER	-0.0106	0.2281
EDUC	0.0071	0.2282
PGHIF	0.0073	0.0137

*Estimates significant at the 25% level
**Estimates significant at the 15% level
***Estimates significant at the 5% level

4.3.2 Phase II Estimation of the Multivariate Probit Models

Phase I was completed to determine the significant variables need for the multivariate probit model for each set of management practices within the management groups. Tables 4.16, 4.17, 4.18, 4.19, and 4.20 present the results of the multivariate probit models for the management groups. While a 25% significance level was used in phase I to select variables for phase II, a more traditional statistical threshold of 10% is used in this stage of the analysis.

Within Table 4.16, no variables were significant at the 10% level for ESMP1, the use of land smoothing or precision leveling to control runoff or drainage; however, five variables (ATTEND, RISKP, FSIZE, FSIZEAO, and GENDER) had the expected sign and two variables (LEASE and AGE) had the opposite sign. For ESMP2, water leveling prior to January 1st, there were no significant variables at the 10% level; however, there were two variables (ACNPCP and LEASE) that had the expected sign and five variables (ACWA, MMFP, RISKP, DEBT, and AGE) had the opposite sign.

For ESMP3, implementation of suspended sediment test to reduce sediment runoff, ACNPCP, awareness of the coastal nonpoint pollution control program, was significant at the 5% level and had the expected positive sign. The implication is that the awareness of the program has a positive influence on the decision to adopt this practice. MEET was significant at the 10% level for ESMP4, the use of structure control to reduce erosion from field drainage, and had the expected positive sign. This implies that meeting with LCES personnel encouraged adoption of the management practice.

ESMP5, use of residue management guidelines, had no significant variables, but five variables (ATTEND, RISKB, FSIZEAO, GENDER, and EDUC) had the expected sign. MEET had the opposite sign. ESMP6, the use of filter strips or grassed waterways to improve quality of runoff, had no significant variables. Only ACWA had the expected sign while four variables (MMFP, SNEP, AGRWQ, and PGHIF) had the opposite sign. For ESMP7, use of cover crop, there were no significant variables at the 10% level, however six variables (MEET, ATTEND, CMFP, RISKP, PASS, and PGHIF) had the expected sign. Only PASS had the opposite sign.

Table 4.17 illustrated the multivariate probit model for water management. Both variables (FSIZEAO and TYPE) were significant at the 1% level and had the expected sign for WMP1, use of irrigation water conveyance. This suggest that a high ratio of owned acres to leased acres, and individual ownership, positively influenced adoption of this practice. WMP2, had no significant variables. No variables had the expected sign. The ACWA had a negative sign opposite of the expected sign. The GENDER variable also had the opposite sign with a positive sign opposite of the expected negative sign.

Implementation of precision leveling prior to irrigation, WMP3 had one variable (ACWA) significant and positive at the 1% level. Awareness of the Clean Water Act positively influenced the adoption of this practice. WMP4, completion of regular well water testing, had one variable (CMFP) significant and positive at 10% level. This result implies a link between certification in the Master Farmer program and the adoption of this practice.

Table 4.18 illustrates the multivariate probit modeling for nutrient management. Four variables are significant at 10% or less for NMP1, basing fertilizer applications on soil testing and expected yields they are MEET (5%), FSIZE, PASS, and LEASE (10%). LCES contact, farm size, intention to pass the farm to family, and leasing land to others had a positive influence the practice. NMP2, implementation of split nutrient application and/or slow release fertilizers, had one variable, FSIZE, which was significant at the 1% level and had the expected positive sign. This implies that larger farms were more likely to adopt the practice.

Table 4.16
Multivariate Probit for Soil Erosion and Sediment Management
Louisiana Rice Best Management Practice Adoption Study, 2007

Variable	Coefficient	Standard Error
Index Function for ESMP1		
CONSTANT	-0.368038	1.01639
ATTEND	0.443206	0.455653
RISKP	0.000572403	0.000387783
FSZIE	0.000656969	0.000775682
FSIZEAO	-0.00112841	0.00119076
LEASE	0.00135166	0.0181902
AGE	0.0138968	0.0126987
GENDER	-0.014107	0.402052
Index Function for ESMP2		
CONSTANT	-1.34208	0.946968
ACNPCP	0.9009	0.82262
ACWA	-0.652934	0.736561
MMFP	-0.00100329	0.00238553
RISKP	-0.000374808	0.000446939
LEASE	-0.0402341	0.545873
DEBT	0.16774	0.689854
AGE	4.50E-05	0.0178753
Index Function for ESMP3		
CONSTANT	-0.603558	0.523465
ACNPCP	**0.680978	0.347593
CMPF	0.000349004	0.000289529
MMFP	-0.000396262	0.00336431
SHARE	-0.000178772	0.000926048
FSIZE	0.000170845	0.000187145
FSIZEAO	0.000238965	0.00172283
GENDER	-0.463115	0.522807
EDUC	0.429025	0.306785
Index Function for ESMP4		
CONSTANT	*1.32872	0.785886
MEET	*0.514659	0.271156
PASS	-0.329838	0.286055
LEASE	0.329716	0.285538
AGE	-0.0160366	0.0127595

(table continued)

Variable	Coefficient	Standard Error
Index Function for ESMP5		
CONSTANT	0.127279	0.374342
MEET	-0.12285	0.150894
ATTEND	0.451008	0.319683
RISKB	0.000405011	0.000465888
FSIZE	0.000276526	0.000263374
GENDER	-0.21902	0.425255
EDUC	0.219553	0.304597
Index Function for ESMP6		
CONSTANT	***-0.901336	0.27655
ACWA	0.443768	0.347501
MMFP	-0.000583772	0.00162558
SNEP	-0.000162954	0.000610466
AGRWQ	-0.00110053	0.0010091
PGHIF	-0.00100099	0.00627252
Index Function for ESMP7		
CONSTANT	-0.313253	0.215217
MEET	0.0821493	0.0902744
ATTEND	0.115463	0.122518
CMFP	0.00018159	0.00029048
RISKP	0.000468859	0.000458647
PASS	-0.313986	0.245008
LEASE	0.314842	0.245461
PGHIF	0.000141935	0.00548585
Multivariate Probit Model: 7 equations Maximum Likelihood Estimates Dependent Variable: MVProbit Weighing Variable: NONE Number of observations: 145 Iterations completed: 101 Log likelihood function: -480.8703 Replications for simulated probs.= 100		

* Estimates significant at the 10% level
** Estimates significant at the 5% level
***Estimates significant at the 1% level

Table 4.17
Multivariate Probit for Water Management
Louisiana Rice Best Management Practice Adoption Study, 2007

Variable	Coefficient	Standard Error
Index Function for WMP1		
CONSTANT	***0.529025	0.160502
FSIZE	***0.00161399	0.000394899
FSIZEAO	***-0.00193348	0.000679628
Index Function for WMP2		
CONSTANT	**-1.85159	0.815257
ACWA	-0.220946	0.547019
GENDER	0.390497	0.768764
Index Function for WMP3		
CONSTANT	***-0.509377	0.146081
ATTEND	***0.329565	0.0944185
SHARE	-0.0005	0.000404043
EXPER	-0.000128361	0.000496745
Index Function for WMP4		
CONSTANT	***-1.15424	0.177711
CMFP	*0.000429023	0.000245005
FSIZEAO	4.51E-05	0.00132672
EXPER	-3.91E-05	0.00096144
GENDER	-0.458914	0.332554
EDUC	0.457839	0.33282

Multivariate Probit Model: 4 equations
Maximum Likelihood Estimates
Dependent Variable: MVProbit
Weighing Variable: NONE
Number of Observations: 145
Iterations completed: 101
Log Likelihood functions -209.3440
Replications for simulated probs.= 100

* Estimates significant at the 10% level
** Estimates significant at the 5% level
***Estimates significant at the 1% level

Table 4.18
Multivariate Probit for Nutrient Management
Louisiana Rice Best Management Practice Adoption Study, 2007

Variable	Coefficient	Standard Error
Index Function for NMP1		
CONSTANT	0.238235	0.3153
ACNPCP	-0.325171	0.475893
ACWA	0.179899	0.421369
MEET	**0.34482	0.177589
SHARE	-0.0006687	0.000876746
RISKP	0.000643221	0.000423835
RISKB	0.000516046	0.000546881
SNEP	-0.000421701	0.00296591
FISZE	*0.000453306	0.000272385
FSIZEAO	-0.00136171	0.0058257
PASS	*-0.507047	0.289614
LEASE	*0.508344	0.289046
Index Function for NMP2		
CONSTANT	-0.166712	0.212822
ACNPCP	0.530931	0.44912
ATTEND	0.143049	0.138134
RISKB	0.000653115	0.000464198
FSIZE	***0.000506059	0.000206
FSIZEAO	-0.0018216	0.00370571
EXPER	0.00120916	0.00113293
Index Function for NMP3		
CONSTANT	***-1.19854	0.450272
SHARE	-0.000378667	0.000754118
RISKP	-0.000285711	0.000406329
SNEP	-0.000408273	0.00292437
FSIZE	0.000204641	0.000137973
PASS	0.0705048	0.443
LEASE	0.28854	0.36128
Index Function for NMP4		
CONSTANT	***-1.75274	0.694542
RISKB	0.000864302	0.00445104
SNEP	-0.00183695	0.0024358
AGRWQ	-0.000858834	0.0019148
FSIZEAO	-0.00342222	0.0112713
PASS	0.582694	0.614753
LEASE	-0.287565	0.769258
AGE	-0.00170007	0.00975726
EXPER	0.00360528	0.017279

(table continued)

Variable	Coefficient	Standard Error
Index Function for NMP5		
CONSTANT	-0.0699805	0.231537
ACNPCP	-0.474748	0.344316
ACWA	0.472176	0.338569
MEET	*0.163234	0.0886718
RISKP	0.000272883	0.000312542
SNEP	-0.000598533	0.00284457
FSIZE	0.00020524	0.000220711
EXPER	0.000488661	0.000753997
Multivariate Probit Model: 5 equations Maximum Likelihood Estimates Dependent Variable: MVProbit Weighing Variable: NONE Number of Observations: 145 Iterations completed: 101 Log Likelihood functions -295.2994 Replications for simulated probs.= 100		

* Estimates significant at the 10% level
** Estimates significant at the 5% level
***Estimates significant at the 1% level

Table 4.19
Multivariate Probit for Pesticide Management
Louisiana Rice Best Management Practice Adoption Study

Variable	Coefficient	Standard Error
Index Function for PMP1		
CONSTANT	-0.423339	0.328425
ACWA	0.291545	0.342344
ATTEND	0.249598	0.309118
SHARE	-0.00072829	0.000449291
RISKP	0.000416488	0.000396706
SNEP	-9.26E-05	0.00138574
FSIZE	***0.00210539	0.000733389
FSIZEAO	-0.00238476	0.00226432
DEBT	-0.000511702	0.00125916

(table continued)

Variable	Coefficient	Standard Error
Index Function for PMP2		
CONSTANT	-0.250932	0.300854
ACWA	0.0668371	0.241368
MMFP	0.000512843	0.00146273
SHARE	-0.00101374	0.00096117
RISKB	0.000655155	0.000473934
SNEP	-0.000134828	0.000464309
GENDER	0.000591287	0.271997
Index Function for PMP3		
CONSTANT	-0.00689234	0.158818
ACNPCP	-0.384426	0.257638
ACWA	0.381664	0.258784
MEET	0.109888	0.0746082
RISKP	0.000258754	0.000274842
SNEP	-0.000723223	0.000457767
FSIZE	0.000253283	0.000182622
EXPER	0.000321738	0.000831257
Index Function for PMP4		
CONSTANT	-0.519915	0.70073
ACNPCP	0.328329	0.344779
ABMP	-0.000472533	0.002072
MEET	-0.0805087	0.0994021
SHARE	-0.000283103	0.00062702
FSIZE	**0.000305519	0.000149354
FSIZEAO	-0.00122647	0.00206196
LEASE	0.306671	0.256719
AGE	0.00032416	0.0065145
GENDER	-0.306189	0.564153

Multivariate Probit Model: 4 equations
Maximum Likelihood Estimates
Dependent Variable: MVProbit
Weighing Variable: NONE
Number of Observations: 145
Iterations completed: 101
Log Likelihood functions -261.2255
Replications for simulated probs.= 100

* Estimates significant at the 10% level
** Estimates significant at the 5% level
***Estimates significant at the 1% level

Table 4.20
Binomial Probit for Wildlife Habitat Management
Louisiana Rice Best Management Practice Adoption Study, 2007

Variable	Coefficient	Standard Error
CONSTANT	***-0.861245	0.175059
ACWA	**0.510237	0.235832
ABMP	-0.000664782	0.000906008
AGRWQ	-0.000802727	0.000566278
FSIZE	***0.000520067	0.000152545
EXPER	0.000190202	0.00047682

Binomial Probit Model
Maximum Likelihood Estimates
Dependent variable Q320Y
Weighting variable None
Number of observations 145
Iterations completed 10
Log likelihood function -81.33254
Restricted log likelihood -95.73304
Chi squared 28.80100
Degrees of freedom 5
Prob[ChiSqd > value] = .2536703E-04
Hosmer-Lemeshow chi-squared = 13.00343
P-value= .11173 with deg.fr. = 8

* Estimates significant at the 10% level
** Estimates significant at the 5% level
***Estimates significant at the 1% level

NMP3 is the use of any precision equipment to apply fertilizers to conserve the amount used, had no independent variable that was significant. Only FSIZE had the expected positive sign. The other variables, SHARE, RISKP, SNEP, PASS, and LEASE, had the opposite expected sign. NMP4, use of alternative sources of fertilizers, had no significant variables at the 10% level or less. RISKB, FSIZEAO, LEASE, and AGE variables had the expected sign. SNEP, AGRWQ, PASS, and EXPER variables all had the opposite sign than was expected. MEET was the only variable significant at the 10% level for NMP5, calibration of spray equipment prior to each use. This implies that contacts with LCES agents promote the adoption of this practice within the nutrient management group.

Table 4.19 showed the four variables associated with pesticide management. For PMP1, basing pesticide applications on economic thresholds as determined by field scouting had one variable, FSIZE, significant at the 1% level. The implication is that larger farms are more likely to use field scouting. Using a containment facility to mix, store, and load pesticide, PMP2, had no significant variables; however, three variables (ACWA, MMFP, and RISKB) had the expected sign. SHARE, SNEP, and EXPER variables had the opposite sign. There were no significant variables for PMP3, calibration of spray equipment prior to each use. Four variables (ACWA, MEET, RISKP, and FSIZE) are exhibiting the expected sign; while ACNPCP, SNEP, and EXPER variables have the opposite sign. Only FSIZE was significant at the 5% level for PMP4, the use of precision application equipment. Again, farm size positively influences the adoption of more expensive technology.

Table 4.20 showed the wildlife habitat management variable with two significant independent variables, ACWA 5% level and FSIZE 1 % level and both had the expected sign. Both awareness of the CWA and larger farm size positively influences wildlife habitat management.

4.3.3 Phase III Estimation of Different Scenarios

The same single probit models were established to prepare for the multivariate model analysis under five scenarios: compliance for adoption of at least two, three, four, five, and six management practices. Only those variables that were significant at the 25% significance level or better were selected to go onto the next phase (Table 4.21, 4.22, 4.23, 4.24, and 4.25).

Table 4.21 showed the compliance of adopting at least two management practices per management group. For ESMP2P, erosion and sediment management, the significant variables are: MEET, ATTEND, CMFP, MMFP, SHARE, FSIZE, FSIZEAO, PASS, LEASE, and

EXPER. The variables significant for WMP2P, water management, include: ATTEND, CMFP, SHARE, AGRWQ, FSIZE, and FSIZEAO. Six variables were significant for NMP2P; they are MEET, MMFP, RISKB, SNEP, FSIZE, and FSIZEAO. PMP2P, pesticide management, had five significant variables which include: ACWA, SHARE, RISKB, AGRWQ, and FSIZE.

In Table 4.22 significant variables that will enter the next phase under the compliance of at least three management practices were presented.   For ESMP3P the significant variables are ACNPCP, ACWA, ABMP, MEET, ATTEND, CMFP, MMFP, FSIZE, FSIZEAO, LEASE, and DEBT. For WMP3P the variables ATTEND, CMFP, SHARE, FSIZE, and FSIZEAO were all significant. ACWA, SNEP, FSIZE, FIZEAO, and EXPER were all significant for NMP3P. PMP3P had eight significant variables including: ACWA, MMFP, SHARE, RISKP, SNEP, FSIZE, FSIZEAO, and GENDER.

The significant variables for the condition of adopting at least four management practices are shown in Table 4.23. For ESMP4P the variables ATTEND, CMFP, MMFP, FSIZE, PASS, LEASE, and EXPER were all significant. NMP4P had nine significant variables that included: RISKB, SNEP, FSIZE, FSIZEAO, LEASE, DEBT, AGE, EXPER, and PGHIF. ACWA, ABMP, LEASE, DEBT, EDUC, and PGHIF are all significant for PMP4P.

Table 4.24 had two management groups with complied to at least five management practices. ESMP5P had five significant variables MEET, ATTEND, PASS, and LEASE. ATTEND, SHARE, AGRWQ, and FSIZEAO were significant for NMP5P.

Table 4.25 only had one management group (soil erosion and sediment management) that enough variables to have adoption of at least six management practices within a given management group. The variables ACNPCP, MEET, MMFP, RISKP, DEBT, EXPER, and PGHIF were all significant at the 25% level and were selected to enter the next phase.

Table 4.21
Single-Probit Model Screening for all Management Practices, the Condition for Compliance to Adopting at least Two Management Practices
Louisiana Rice Best Management Practice Adoption Study, 2007

	ESMP2P		WMP2P		NMP2P		PMP2P	
Variable	Coeff	Std. Err.	Coeff	Std. Err.	Coeff	Std. Err.	Coeff	Std. Err.
CONSTANT	0.1049	0.5181	**-0.4157	0.2655	-0.7544	0.8483	-0.3171	0.5010
ACNPCP	-0.4790	0.6046	-0.1809	0.2923	-0.4319	0.4015	-0.0023	0.0101
ACWA	0.4769	0.6042	0.1845	0.2922	0.4316	0.4014	***0.7654	0.2817
ABMP	0.1699	0.4072	-0.0007	0.0012	0.0006	0.0014	-0.0007	0.0012
MEET	**0.5186	0.2955	0.0407	0.0936	**0.2592	0.1465	-0.0145	0.0881
ATTEND	*2.1360	1.6716	*0.2752	0.1227	-0.0740	0.1214	0.0322	0.0927
CMFP	***4.2099	2.1286	*0.0003	0.0003	-0.0002	0.0003	0.0002	0.0003
MMFP	***-4.2098	2.1286	0.0008	0.0010	*-0.0011	0.0009	0.0005	0.0008
SHARE	***-0.0015	0.0008	**-0.0008	0.0005	-0.0007	0.0005	**-0.0010	0.0005
RISKP	-0.0005	0.0005	0.0004	0.0003	0.0003	0.0004	0.0003	0.0003
RISKB	-0.0003	0.0006	0.0001	0.0004	*0.0006	0.0004	*0.0006	0.0004
SNEP	-0.0025	0.0044	0.0002	0.0006	*-0.0011	0.0009	-0.0002	0.0006
AGRWQ	0.0010	0.0012	*-0.0010	0.0007	-0.0005	0.0008	*-0.0010	0.0007
FSIZE	***0.0032	0.0012	**0.0003	0.0002	***0.0023	0.0007	**0.0004	0.0002
FSIZEAO	**-0.8406	0.4446	*-0.0011	0.0009	***-0.0029	0.0012	-0.0010	0.0010
TYPE	0.1371	0.2398	0.0549	0.0700	0.0011	0.0039	0.0383	0.0698
PASS	*-0.5881	0.4512	0.0040	0.2657	0.0689	0.2560	0.0757	0.2166
LEASE	***1.2946	0.4527	0.2427	0.2314	-0.0679	0.2559	-0.1128	0.2192
DEBT	-0.0026	0.0365	0.0000	0.0011	0.0003	0.0009	0.0003	0.0009
AGE	0.0026	0.0034	0.0006	0.0023	0.0113	0.0132	0.0023	0.0041
EXPER	**0.0014	0.0008	-0.0004	0.0005	0.0003	0.0006	0.0005	0.0006
GENDER	0.1248	0.2399	-0.2974	0.2735	-0.0665	0.2307	-0.0623	0.4079
EDUC	-0.1347	0.2397	-0.0028	0.0092	0.0494	0.2295		
PGHIF	0.0010	0.0022	0.0001	0.0010	-0.0008	0.0014	-0.0012	0.0012

* Estimates significant at the 25% level
**Estimates significant at the 15% level
***Estimates significant at the 5% level

Table 4.22
Single-Probit Model Screening for all Management Practices, the Condition for Compliance to Adopting at least Three Management Practices
Louisiana Rice Best Management Practice Adoption Study, 2007

	ESMP3P		WMP3P		NMP3P		PMP3P	
Variable	Coeff	Std. Err	Coeff	Std. Err	Coeff	Std. Err	Coeff	Std. Err
CONSTANT	***-0.9144	0.3911	-2.1052	1.2870	-0.2822	0.5017	*-0.3769	0.2888
ACNPCP	*-0.4783	0.3616	0.9416	0.5877	0.8101	0.3526	-0.0032	0.0091
ACWA	*0.4763	0.3616	-0.1192	0.5688	***0.0491	0.3315	**0.4155	0.2798
ABMP	**0.5259	0.2772	-0.0027	0.0016	-0.0011	0.0015	-0.0013	0.0013
MEET	*0.1625	0.1152	0.1035	0.1226	0.0672	0.0939	-0.0663	0.0893
ATTEND	*0.2060	0.1703	***0.0591	0.1288	-0.0176	0.0917	0.0214	0.0873
CMFP	**0.5291	0.2774	*0.0004	0.0003	-0.0002	0.0002	-0.0002	0.0002
MMFP	**-0.5283	0.2775	-0.0015	0.0013	0.0001	0.0008	*0.0015	0.0011
SHARE	-0.0001	0.0005	**0.0006	0.0012	0.0003	0.0006	**-0.0009	0.0005
RISKP	0.0002	0.0004	0.0006	0.0008	0.0002	0.0003	*0.0004	0.0003
RISKB	0.0003	0.0041	0.0005	0.0008	0.0002	0.0004	0.0002	0.0004
SNEP	-0.0008	0.0010	-0.0002	0.0011	**-0.0011	0.0007	*-0.0008	0.0007
AGRWQ	-0.0005	0.0008	0.0037	0.0089	-0.0002	0.0007	-0.0008	0.0008
FSIZE	***0.0009	0.0004	**0.0000	0.0002	***0.0005	0.0002	***0.0004	0.0002
FSIZEAO	**-0.0019	0.0010	*-0.0030	0.0016	**-0.0022	0.0012	*-0.0015	0.0011
TYPE	0.0986	0.0903	-0.0007	0.0099	0.0014	0.0049	0.1241	0.1145
PASS	0.1571	0.2661	0.4723	0.5264	-0.1426	0.2254	-0.0358	0.2742
LEASE	*0.3238	0.2550	-0.5629	0.5331	0.1427	0.2253	0.2615	0.2614
DEBT	***-0.5682	0.2892	0.5111	0.5242	0.0005	0.0010	-0.0006	0.0010
AGE	0.0022	0.0038	0.0049	0.0203	0.0013	0.0029	0.0003	0.0023
EXPER	0.0000	0.0006	-0.0012	0.0010	**0.0014	0.0008	0.0004	0.0006
GENDER	0.0006	0.0293	-1.2543	0.5763	-0.3726	0.4236	**-0.4607	0.2936
EDUC			0.8319	0.4584	0.0338	0.2496	0.1066	0.2446
PGHIF	-0.0009	0.0011	0.0005	0.0226	-0.0002	0.0009	0.0001	0.0009

* Estimates significant at the 25% level
**Estimates significant at the 15% level
***Estimates significant at the 5% level

Table 4.23
Single-Probit Model Screening for all Management Practices, the Condition for Compliance to Adopting at least Four Management Practices
Louisiana Rice Best Management Practice Adoption Study, 2007

	ESMP4P		NMP4P		PMP4P	
Variable	Coeff	Std. Err	Coeff	Std. Err	Coeff	Std. Err
CONSTANT	-0.6998	0.6767	-0.5704	1.4181	*-1.4250	1.0588
ACNPCP	0.0027	0.0083	0.5088	0.4572	0.3296	0.3675
ACWA	-0.0066	0.0113	0.3360	0.5044	*0.4505	0.3574
ABMP	0.0001	0.0014	-0.0075	0.0272	*-0.0016	0.0013
MEET	0.1036	0.0958	0.0795	0.1070	-0.0506	0.1061
ATTEND	***0.2500	0.1264	0.0443	0.1208	0.0441	0.0927
CMFP	*0.0003	0.0003	0.0001	0.0003	-0.0003	0.0003
MMFP	*0.0000	0.0008	0.0021	0.0134	0.0005	0.0011
SHARE	-0.0008	0.0005	0.0001	0.0025	-0.0002	0.0007
RISKP	0.0003	0.0003	-0.0003	0.0006	0.0003	0.0004
RISKB	0.0000	0.0004	**0.0046	0.0029	-0.0004	0.0004
SNEP	-0.0009	0.0008	**-0.0044	0.0026	0.0001	0.0007
AGRWQ	-0.0052	0.0007	-0.0008	0.0012	-0.0003	0.0007
FSIZE	*0.0002	0.0001	***0.0005	0.0002	0.0000	0.0002
FSIZEAO	0.0040	0.0095	***-0.0104	0.0048	-0.0008	0.0010
TYPE	0.0014	0.0044	-0.0037	0.0100	0.0016	0.0085
PASS	**-0.3992	0.2198	-0.0922	0.4816	0.2548	0.3480
LEASE	**0.3943	0.2196	***1.4866	0.5483	***0.7013	0.3393
DEBT	0.0007	0.0011	*-0.0014	0.0011	*-0.0014	0.0011
AGE	0.0084	0.0111	**-0.0344	0.0228	-0.0112	0.0135
EXPER	*0.0008	0.0006	**0.0087	0.0051	-0.0002	0.0007
GENDER	-0.0136	0.0224	-0.2091	0.6691	0.1627	0.5456
EDUC	0.0050	0.0188			*0.3716	0.3120
PGHIF	-0.0010	0.0011	*0.0336	0.0254	*0.4474	0.3854

* Estimates significant at the 25% level
**Estimates significant at the 15% level
***Estimates significant at the 5% level

Table 4.24
Single-Probit Model Screening for all Management Practices, the Condition for Compliance to Adopting at least Five Management Practices
Louisiana Rice Best Management Practice Adoption Study, 2007

	ESMP5P		NMP5P	
Variable	Coeff	Std. Err	Coeff	Std. Err
CONSTANT	***-1.0872	0.3226	-10.4913	148803
ACNPCP	0.3180	0.3758	-0.0006	0.0165
ACWA	-0.0877	0.3815	-0.0003	0.0266
ABMP	0.0047	0.0502	-0.0031	0.0064
MEET	**0.1465	0.0869	0.0659	0.2245
ATTEND	*0.1167	0.0869	*0.3988	0.3364
CMFP	0.0002	0.0002	-0.0006	0.0043
MMFP	-0.0009	0.0009	0.0012	0.0069
SHARE	-0.0006	0.0006	*-0.0038	0.0030
RISKP	0.0002	0.0004	-0.0018	0.0019
RISKB	0.0004	0.0005	0.0014	0.0019
SNEP	-0.0007	0.0007	-0.0008	0.0017
AGRWQ	0.0001	0.0008	*-0.0031	0.0026
FSIZE	0.0001	0.0001	0.0007	0.0006
FSIZEAO	0.0125	0.3096	*-0.0028	0.0023
TYPE	0.0013	0.0170	0.1911	0.3225
PASS	**-0.4631	0.2905	1.3140	2.1597
LEASE	**0.4457	0.2879		
DEBT	0.0037	0.0177		
AGE	0.0009	0.0027	-0.0072	0.0633
EXPER	-0.0004	0.0006		
GENDER	-0.0688	0.2466	4.3338	148803
EDUC	0.0684	0.2468		
PGHIF	-0.0002	0.0008	0.0048	0.0692

* Estimates significant at the 25% level
**Estimates significant at the 15% level
***Estimates significant at the 5% level

Table 4.25
Single-Probit Model Screening for all Management Practices, the Condition for Compliance to Adopting at least Six Management Practices
Louisiana Rice Best Management Practice Adoption Study, 2007

	ESMP6P	
Variable	Coefficient	Standard Error
CONSTANT	-3.75453	3.24675
ACNPCP	***3.92459	1.56397
ACWA	-0.84964	1.56397
ABMP	0.255598	1.04956
MEET	**0.267944	0.176761
ATTEND	-0.04137	0.175189
CMFP	0.000088	0.000489
MMFP	***-0.00784	0.003364
SHARE	-0.00014	0.001541
RISKP	**-0.00216	0.001185
RISKB	-0.00021	0.0011
SNEP	-0.00128	0.00119
AGRWQ	-0.00067	0.001482
FSIZE	-0.00035	0.000343
FSIZEAO	0.853804	1.12945
TYPE	0.000275	0.015905
PASS	1.24795	1.2096
LEASE	-0.60849	1.17216
DEBT	*1.42712	1.0222
AGE	**-0.10176	0.054044
EXPER	**-0.00427	0.002314
GENDER	1.57428	1.85284
EDUC	0.720283	0.844704
PGHIF	*1.71567	1.34184

* Estimates significant at the 25% level
**Estimates significant at the 15% level
***Estimates significant at the 5% level

4.3.3.1 Scenario One

Results of the multivariate model, under the situation that at least two management practices were adopted per management group were reported in Table 4.26. For ESM2P, FSIZE and LEASE were significant at the 10% level. Both variables had a positive sign. This was not expected for the LEASE variable. The original assumption was that eh number of acres leased ot other increased, it would negatively affect BMP adoption. This was based on the belief that lease land would be an indication of absentee ownership. However, the descriptive statistics of

Table 4.26
Multivariate Probit for All Management Practices, Condition for Compliance Being at Least Two Management Practices per Measure
Louisiana Rice Best Management Practice Study, 2007

Variable	Coefficient	Standard Error
Index function for ESMP2P		
CONSTANT	0.3675	0.2956
MEET	0.3614	0.2887
ATTEND	2.2513	4.5629
CMFP	3.0187	4.8251
MMFP	-3.0179	4.8248
SHARE	-0.0014	0.0012
FSIZE	*0.0023	0.0013
FSIZEAO	-0.5851	0.4791
PASS	-0.2102	0.4114
LEASE	*0.7935	0.4854
EXPER	0.0011	0.0009
Index function for WMP2P		
CONSTANT	**-0.4524	0.1887
ATTEND	**0.2600	0.1102
MMFP	0.0007	0.0013
SHARE	-0.0006	0.0005
AGRWQ	-0.0005	0.0009
FSIZE	0.0003	0.0002
FSIZEAO	0.0002	0.0006
Index function for NMP2P		
CONSTANT	0.0196	0.3097
MEET	0.0649	0.0660
MMFP	0.0002	0.0034
SHARE	-0.0003	0.0008
RISKB	0.0007	0.0006
SNEP	-0.0005	0.0007
FSIZE	***0.0019	0.0007
FSIZEAO	-0.0019	0.0013
Index function for PMP2P		
CONSTANT	-0.0244	0.2050
ACWA	0.3155	0.2404
SHARE	-0.0008	0.0009
RISKB	0.0006	0.0005
AGRWQ	-0.0006	0.0012
FSIZE	**0.0004	0.0002

(table continued)

Multivariate Probit Model: 4 equations. Maximum Likelihood Estimates Dependent variable MVProbit Weighting variable None Number of observations 145 Iterations completed 85 Log likelihood function -240.6611 Replications for simulated probs. = 100

* Estimates significant at the 10% level
** Estimates significant at the 5% level
*** Estimates significant at the 1% level

the respondents indicates that the owner may no longer be an active producer, but is not an absolute owner, and still influences cultural practices on the land. Larger farms and the decision to lease out owned acreage influence the decision to adopt at least two erosion and sediment control practices. ATTEND was significant at the 5% level for WMP2P. Attending grower meetings is interpreted to influence the adoption of at least two water management practices. FSIZE was significant at the 1% level for NMP2P and was significant at the 5% level for PMP2P. In this case, as farm size increases, it is more likely that two or more nutrient management or pesticide management practices were adopted, respectively.

4.3.3.2 Scenario Two

Table 4.27 shows the results of the multivariate model under the condition that at least three management practices should be adopted per management group. There were four variables significant for ESMP3P; they are ABMP, MEET, LEASE, and DEBT all of these variables were all significant at the 10% level. Awareness of BMPs, attending LCES programs or receiving consultations by LCES personnel, and leasing acres of owned land to other producers, were factors that positively influence the adoption of at least three sediment control practices. However, producers with higher debt ratios would be less likely to adopt the use of this practice. There were no significant variables for WMP3P. NMP3P had one variable significant at the 5% level ACNPCP, and FSIZE was significant at the 1% level. The significant variables imply that the awareness of the Coastal Nonpoint Pollution Control Program and increasing farm size influence the decision to adopt at least three nutrient management practices. For the variable PMP3P, the only significant independent variable was farm size (FSIZE). This variable was significant, at the 5% level and implies that farm size is a significant factor in adoption.

Table 4.27
Multivariate Probit for All Management Practices, Condition for Compliance Being at Least Three Management Practices per Measure
Louisiana Rice Best Management Practice Study, 2007

Variable	Coefficient	Standard Error
Index function for ESMP3P		
CONSTANT	***-0.7668	0.2643
ACNPCP	-0.5469	0.5419
ACWA	0.5444	0.4733
ABMP	*0.528262	0.3087
MEET	*0.186375	0.1000
ATTEND	0.1825	0.2124
CMFP	0.6863	0.7882
MMFP	-0.6859	0.7882
FSIZE	*0.0008	0.0005
FSIZEAO	-0.0013	0.0017
LEASE	*0.4249	0.2408
DEBT	*-0.4244	0.2410
Index function for WMP3P		
CONSTANT	***-1.6663	0.3810
ACNPCP	0.4527	0.5193
ABMP	-0.0014	0.0021
CMFP	0.0004	0.0003
MMFP	-0.0012	0.0050
FSIZEAO	-0.0004	0.0020
EXPER	-0.0007	0.0019
GENDER	-0.6559	0.5479
EDUC	0.6556	0.5482
Index function for NMP3P		
CONSTANT	***-0.5891	0.1829
ACNPCP	**0.5002	0.2467
SNEP	-0.0005	0.0006
FSIZE	***0.0005	0.0002
FSIZEAO	-0.0020	0.0015
EXPER	0.0009	0.0014

(table continued)

Index function for PMP3P		
CONSTANT	-0.5349	0.4957
ACWA	0.1647	0.2453
MMFP	0.0008	0.0035
SHARE	-0.0007	0.0005
RISKP	0.0002	0.0003
SNEP	-0.0003	0.0007
FSIZE	**0.0003	0.0002
FSIZEAO	-0.0003	0.0010
GENDER	-0.0033	0.4912

Multivariate Probit Model: 4 equations.
Maximum Likelihood Estimates
Dependent variable MVProbit
Weighting variable None
Number of observations 145
Iterations completed 101
Log likelihood function -245.4194
Replications for simulated probs. = 100

* Estimates significant at the 10% level
** Estimates significant at the 5% level
*** Estimates significant at the 1% level

4.3.3.3. Scenario Three

Presented in Table 4.28 was the multivariate probit model for the condition of adopting at least four management practices per management group. For ESMP4P, the variable ATTEND was significant at the 5% level. The variable FSIZE was also significant for this management group. It was significant at the 1% level. This implies that farmers who regularly attend grower meetings and farmers with larger farms are more likely to adopt at least four sediment control practices. Two variables, FSIZE and LEASE, were significant at the 10% level for NMP4P. Farm size is again listed as a significant influence on adoption of at least four nutrient management practices. The leasing of owned land to other producers is also influential in the adoption of at least four management practices. For PMP4P, LEASE was significant at the 10% level, implying that leasing land to others is significant for the adoption of at least four pesticide practices.

Table 4.28
Multivariate Probit for All Management Practices, Condition for Compliance Being at Least Four Management Practices per Measure
Louisiana Rice Best Management Practice Study, 2007

Variable	Coefficient	Standard Error
Index function for ESMP4P		
CONSTANT	**-0.3231	0.1683
ATTEND	**0.2514	0.1186
CMFP	0.0003	0.0003
SHARE	-0.0003	0.0004
SNEP	-0.0004	0.0009
FSIZE	***0.0003	0.0001
PASS	-0.2285	0.1950
LEASE	0.2286	0.1950
EXPER	0.0005	0.0005
Index function for NMP4P		
CONSTANT	-0.8083	1.7252
RISKB	0.0038	0.0224
SNEP	-0.0042	0.0216
FSIZE	*0.0005	0.0003
FSIZEAO	-0.0082	0.0266
LEASE	*1.1173	0.6074
DEBT	-0.0016	0.2135
AGE	-0.0192	0.0295
EXPER	0.0075	0.0189
PGHIF	0.0186	0.2615
Index function for PMP4P		
CONSTANT	***-1.5483	0.2983
ACWA	0.3457	0.3257
ABMP	-0.0012	0.0017
LEASE	*0.6212	0.3302
DEBT	-0.0007	0.1424
EDUC	0.4302	0.3236
PGHIF	0.3978	0.3329
Multivariate Probit Model: 3 equations. Maximum Likelihood Estimates Dependent variable MVProbit Weighting variable None Number of observations 145 Iterations completed 101 Log likelihood function 182.5628 Replications for simulated probs. = 100		

*Estimates significant at the 10% level
**Estimates significant at the 5% level
***Estimates significant at the 1% level

Table 4.29
Multivariate Probit for All Management Practices, Condition for Compliance Being at Least Five Management Practices per Measure
Louisiana Rice Best Management Practice Study, 2007

Variable	Coefficient	Standard Error
Index function for ESMP5P		
CONSTANT	***-1.03639	0.164947
MEET	0.100158	0.0702486
ATTEND	**0.164445	0.0743063
PASS	*-0.339601	0.197705
LEASE	*0.339257	0.197778

Binomial Probit Model
Maximum Likelihood Estimates
Dependent variable SED5P
Weighting variable None
Number of observations 145
Iterations completed 5
Log likelihood function -66.13837
Restricted log likelihood -72.55835
Chi squared 12.83997
Degrees of freedom 4
Prob[ChiSqd > value] = .1208479E-01
Hosmer-Lemeshow chi-squared = 5.41009
P-value= .71298 with deg.fr. = 8

*Estimates significant at the 10% level
**Estimates significant at the 5% level
***Estimates significant at the 1% level

4.3.3.4 Scenario Four

Table 4.29 reported the results from the multivariate probit model under the scenario that five management practices were adopted per management group. ESMP5P was the only management measure with five or more possible BMPs to be adopted. ATTEND at the 5%level, PASS at the 10% level, and LEASE at the 10% level were significant for the adoption of at least five management practices within a management group. The implication from these variables is that attending grower meetings, the intention to pass farming operation onto a family member, and the leasing of majority of land to other operators, all significantly influenced the adoption of at least five management practices.

4.3.3.5 Scenario Five

Table 4.30 presented the results of a binomial probit model for ESMP6P. AGE was significant at the 10% level, MMFP was significant at the 5% level, and ACNPCP was significant at the 1% level. Age had the expected negative sign, indicating that as the age of the producer increases, they are less likely to adopt as many as six sediment practices. MMFP, the modification of production practices as a result of instruction from Master Farmer Program, did not have the expected sign. Awareness of the Coastal Nonpoint Pollution Program was strongly related to the adoption of six sediment practices.

Table 4.30
Binomial Probit for All Management Practices, Condition for Compliance Being at Least Six Management Practices per Measure
Louisiana Rice Best Management Practice Study, 2007

Variable	Coefficient	Standard Error
Index function for ESMP6P		
CONSTANT	-1.04372	1.00893
ACNPCP	***1.52844	0.541218
MEET	0.144284	0.102118
MMFP	**-0.00214095	0.00088844
RISKP	-0.0006041	0.000475146
DEBT	0.397299	0.521126
AGE	*-0.033821	0.0202576
EXPER	-0.0012793	0.000836135
PGHIF	0.0371993	0.0371399

Binomial Probit Model
Maximum Likelihood Estimates
Dependent variable SED6P
Weighting variable None
Number of observations 145
Iterations completed 15
Log likelihood function -24.24875
Restricted log likelihood -33.73031
Chi squared 18.96312
Degrees of freedom 8
Prob[ChiSqd > value] = .1505814E-01
Hosmer-Lemeshow chi-squared = 9.89081
P-value= .27277 with deg.fr. = 8

*Estimates significant at the 10% level
**Estimates significant at the 5% level
***Estimates significant at the 1% level

CHAPTER 5
SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

For years, the agriculture industry has been regarded as a good steward of the environment. However, modern agriculture has been blamed for derogating water quality through nonpoint source water pollution. Unlike most commodities produced in Louisiana, rice production poses two major water quality issues: the application of a large amount of water that is held on the field for long periods of time during the growing season and the disposal of that water at a later time in the production cycle.

To combat the problem of nonpoint source pollution, various legislative actions have been undertaken at the Federal and State levels. In compliance with the water quality regulations, site-specific management practices known as best management practices (BMPs) have been designed and implemented in order to reduce the water pollution from agricultural activities. In Louisiana, the adoption of such practices have been voluntary and these practices have been promoted through educational programs such as the Master Farmer program. This program, developed by the LSU AgCenter, targets conservation practices that are both environmentally and economically beneficial. It has since been certified by the Louisiana State Legislature in 2003 as the official certification program for conservation compliance.

This study evaluated 20 recommend BMPs aimed at reducing the overall impact of rice production on the environment. The management groups included: erosion and sediment management, water management, nutrient management, pesticide management, and wildlife habitat management.

The overall objectives of this study were to assess the current rates of BMP adoption by Southwest Louisiana rice producers, investigate other factors that influence producer decisions, and provide policy recommendations based on empirical results.

The specific objectives of this study were: to identify and describe the current production and regulatory environment surrounding rice production in Louisiana; to develop a conceptual framework to explain the individual's behavioral choice to adopt BMPs among Louisiana rice producers; to develop a qualitative choice model and test the relationship between hypothesized determinants of behavior with respect to BMP adoption among Louisiana rice producers; to examine the relationship between rice production, water quality, and alternative land use choices; and to analyze the policy implications of the findings and suggest policy alternatives.

The first objective was achieved in Chapter one and two by extensively reviewing literature related to the study. Literature related to water quality legislation and regulations were presented. Various programs sponsored by the Federal and State government aiming at improving water quality were reviewed. Finally, a further discussion of the recommended BMP options for Louisiana rice production sector was presented.

The second objective was accomplished in Chapter three by reviewing economic principles, methods used to evaluate people's environmental attitude, and econometric models to analyze the behavior of decision makers when facing alternative choices. Based on the neoclassical economic principles of individual's utility maximization, the Louisiana rice producer's choice to adopt BMPs was described as a function of economic and socioeconomic variables, institutional variables, and attitudinal variables.

The development of qualitative models, objective three, was achieved by choosing discrete models to elicit and evaluate yes or no outcomes. We conducted the analysis with the assistance of the LIMDEP econometric software (Greene, 2003) in three phases. In phase I, a series of binary choice models were established for each management practice and served as the basis for the multivariate models. In phase II, the multivariate probit models were analyzed for each set of management practices within the management group. In phase III, five scenarios: adoption of at least two, three, four, five, and six management practices was evaluated. The results derived from each model were reported in chapter four.

Objective four was on alternative land usage, the survey used in the study included questions covering alternative revenue generating activities, specifically, raising crawfish and leasing land for waterfowl hunting. Respondents were also asked about the next best alternative use of the land.

Data for the study was colleted through a mail survey sent to a random sampling of the population of rice producers (1,285), following the Dillman method of survey design and was conducted in July-August 2007. The mail out included an initial mailing, a reminder postcard, and a second mailing to nonresponders. A total of 283 surveys returned and 149 were useable responses, achieving an effective rate of response of twelve percent.

The fifth objective was realized by comparing the results derived to a previous study completed by Zansler in 1999. The results will be presented in this chapter.

5.1 Summary of Results

Phase I and II were designed to identify factors that influenced the adoption of individual best management practices within five management groups – erosion and sediment, water, nutrient, pesticide, and wildlife habitat.

In phase I the following variables were identified: ACNPCP, ACWA, ABMP, MEET, ATTEND, CMFP, MMFP, SHARE, RISKP, RISKB, SNEP, AGRWQ, FSIZE, FSIZEAO, TYPE, PASS, LEASE, DEBT, AGE, EXPER, GENDER, EDUC, and PGHIF. The purpose of this phase was to reduce the total number of independent variables considered to those statistically significant at the 25% level. Variables meeting these criteria moved to phase II.

In phase II, the statistical significance criteria were a more restrictive 10% or better, which is a more typical analysis criterion. Individual models were run for each of the twenty best management practices considered in this study. For practices in the erosion and sediment measurement category only two practices, ESMP3 (the suspended sediment test) and ESMP4 (use of control structure) were influenced by the independent variables included in the analysis. ESMP3 had one variable, ACNPCP, significant at the five percent level. This implies that farmers aware of the Coastal Nonpoint Pollution Control program were more likely to adopt this practice. ESMP4 also had one significant variable, MEET. Farmers that attended LCES education programs are consulted with LCES agents were more likely to use control structures to reduce erosion from field drainage.

There were four water management practices considered in this study. The adoption of WMP1 (use of irrigation water conveyance) was influenced by FSIZE and TYPE, both significant at the 1% level. Farms that had individual ownership and were larger in size were more likely to adopt this practice. WMP3 had only one significant variable, ACWA, also at the 1% level. Awareness of Clean Water Act positively influenced adoption of precision land leveling to improve water use to flood fields. Regular well water testing, WMP4, had one significant variable, CMFP, at the 10% level. Completion of the Master Farmer Program is identified here as a positive influence on the adoption of this practice.

Five nutrient management practices were included in the study, NMP1, basing fertilizer applications on soil testing and expected yields, had four statistically significant variables, MEET at the 1% level, FSIZE, PASS, and LEASE, at the 10% level. The results indicate that farmers were more likely to adopt this practice if they have contact with LCES agents, have larger farms, intend to pass the farm to a family member, and if they lease the majority of their property to other farmers. Two other practices, NMP2 and NMP5, also had significant variables. The practice of splitting nutrient applications and/or using slow release fertilizers (NMP2), was more likely to be adopted by larger farms (FSIZE - 1% level of significance). The regular calibration of spray equipment (NMP5) was more likely to be adopted by farmers who attend LCES programs (MEET – 10% level of significance).

Four pesticide management practices were considered. Two, PMP1 (economic thresholds and field scouting) and PMP4 (use of precision application equipment) each had one significant variable. FSIZE was significant at the 1% level for the adoption of PMP1. The interpretation of this result is that owners of larger farms are more likely to adopt this practice. FSIZE was also significant for PMP4, implying that the use of precision applications became more likely as farm size increased.

Only one management practice represented wildlife habitat management. Establishing wildlife habitat as an alternative source of income or recreational use (WHMP1) had two significant variables that could influence adoption, ACWA and FSIZE, at the 5% and 10 % level of significance, respectively. Farmers were more likely to consider this practice if they were aware of the Clean Water Act and as farm size increased.

Phase III sought to identify the influences on the decision to adopt more than one of the identified practices within each management measure. Phase I included all possible independent variables. It identified which variables to use in Phase II by imposing a 25% significance level. As in Phase I, this step was taken in phase III to reduce the total number of independent variables to consider in the final analysis.

First, we considered the adoption of two practices within a management group. For erosion and sediment practices (ESMP2P), two independent variables were significant at the

10% level, FSIZE and LEASE. The implication is that as farm size increases, or as the number of owned acres leased increases, the land owner is more likely to have two of these practices implemented. These variables remain significant in the later stages of modeling. This is likely because two different populations were identified in the study. Those commercial farmers with large farm acreage and retired farmers leasing out the majority of their land are equally concerned with the land resources used in the production process. This is reemphasized in the descriptive statistics in Chapter 4.

Only one independent variable appeared to be associated with the adoption of two practices in each of the remaining management groups. ATTEND is significant at the 5% level for the adoption of two or more water management practices (WMP2P). This interpretation implies that the more often a farmer attends growers meetings, the more likely they are to adopt two water management practices. FSIZE is statistically significant at the 1% and 5% levels, for influencing the adoption of two nutrient management (NMP2P) or pesticide management (PMP2P) practices, respectively. As farm size increases, it is more likely that two practices in each management group will be adopted.

When the requirement is raised to adopting three practices per management group, several variables (ABMP, MEET, LEASE, and DEBT) are significant at the 10% level for the sediment management group (ESMP3P). Awareness of BMPs, attending LCES programs, leasing owned land to other farmers, and high debt levels all influenced the adoption of these sediment practices.

ACNPCP, awareness of the Coastal Nonpoint Pollution Control Program, was significant at the 5% level and FSIZE, farm size, was significant at the 1% level for nutrient management measures (NMP3P). More knowledge of Coastal Protection Programs and larger farm size contributes to the adoption of these practices.

Only one variable, FSIZE, was significant at the 5% level, for pesticide practices. As farm size becomes larger they are more likely to adopt the pesticide management practices.

Two variables, ATTEND (5%) and FSIZE (1%), were significant for the adoption of at least four practices within the erosion and sediment group (ESMP4P). The implication is that producers with larger farm sizes and those who regularly attend grower meetings are more likely to adopt sediment management practices.

NMP4P had two variables, FSIZE and LEASE, both significant at the 10% level. As previously stated, this implies that farmers with larger farm sizes and those who lease the majority of their land to other producers are more likely to adopt nutrient management practices.

Only LEASE was significant at the 10% level for PMP4P. This implies that producers who lease out the majority of their land to others are more likely to implement multiple pest management practices.

Only erosion and sediment management had multiple practice adoption for at least five and at least six management practices. For ESMP5P, ATTEND was significant at the 5% level and PASS and LEASE were significant at the 10% level. The implication is that farmers, who attend grower meetings, intend to pass the operation to a family member, and who lease out the majority of owned land to others adopt multiple practices. For ESMP6P, ACNPCP was significant and positive at the 1% level, MMFP was significant at the 5% level and AGE was significant and had the expected negative sign at the 10% level. MMFP, the producer has modified production practices because of the Master Farmer program, had an unexpected negative sign. This suggests that participation in the Master Farmer program discouraged the adoption of at least five of the sediment practices. As for the other two significant variables, farmers who are aware of Coastal Nonpoint Pollution Control Program, were more likely to adopt at least six management practices within the sediment management group, while others were less likely to do so.

Also highlighted in this study were alternative sources of own-farm income, such as, crawfish production and waterfowl hunting leases. The descriptive statistics showed that the average farm had 20 acres of crawfish, 75 acres of rice, and 60 acres of rice crawfish rotation. Most farmers did not shorten the length of crawfish season to plant another crop because the majority left the land fallow.

The average dollar amount received for water fowl hunting leases was $3,192.71 annually, with the average acres leased at 88 acres per farm. Both activities, crawfish an hunting leases, may offer alterative or additional sources of farm revenue.

Evaluation of the New Ecological Paradigm Scale showed average producer responses to be 49. This indicates a neutral ecological attitude on environmental issues by Louisiana rice producers, and is similar to the results in the 2003 sugarcane producer study by Zhong.

5.2 Conclusions

The results obtained in this study provided streamlined results in the study of best management practice adoption by Louisiana rice producers. Reviews of the descriptive statistics identifying the economic and socio-economic, institutional, and attitudinal variables are comparable to the results previously obtained in the 1999 study.

Those variables statistically significant for the multivariate probit models for the adoption of more than one practice within a management group include: FSIZE (5 models), MEET, (3 models), ACNPCP (1 model), FSIZEAO (1 model), ATTEND (1 model), CMFP (1 model), PASS (1 model), LEASE (1 model), and ACWA (1 model).

The significant variables for the multivariate probit models for the adoption of multiple management practices are: FSIZE (7 models), LEASE (4 models), ATTEND (2 models), ACNPCP (2 models), ABMP (1 model), MEET (1 model), DEBT (1 model), MMFP (1 model), and PASS (1 model).

One of the anticipated results was that certification in the Master Farmer Program would influence BMP adoption rates. The study did find this link for WMP4, well water testing, in phase II. But this relationship did not appear to the statistically significant in any other models. One explanation may be that the respondents to this survey were older and less likely to participate in the Master Farmer program because they were close to retirement. It may also be possible that the relative newness of the program has not had time to fully influence producers decisions.

On the other hand, the LEASE variable and FIZE variable appeared often in the multiple adoption scenarios. This may reflect two distinct groups of respondents. FSIZE represents larger commercial farms, with the capital resources available to adopt more practices. As the short-run economic benefits of BMP adoption becomes more difficult to identify, the more likely adopters will be larger farm operations that can spread capital costs across more acres. LEASE may represent retired or semi-neutral farmers who are concerned with protecting their natural resource and financial asset (land).

5.3 Recommendations

Several recommendations are made based on the outcomes and conclusions of this study, for the purpose of promoting BMP adoption by Louisiana rice producers:

1. Continue to utilize educational programs such as the Master Farmer Program to promote BMP adoption by Louisiana rice producers.

2. Implement additional cost share programs to encourage BMP adoption by smaller farm operations.
3. Continue to rely on the Louisiana Cooperative Extension Service and governmental agencies such as NRCS, LADEQ, EPA as the primary source of educational information.
4. Encourage producers to regularly attend grower meetings.
5. Investigate methods for promoting BMP adoption among older producers who have an interest in passing the farm to a younger generation.

5.4 Further Research

The current study was formed on the basis of a 1999 study and provided an updated understanding of BMP adoption in Louisiana rice production. The same survey format and research procedure could be used at certain time intervals in the future to conduct time series analysis. Survey techniques, such as a panel survey, could be adopted in the future to target the same producers over time.

Additional research should target what factors influence rice producer’s participation in completing surveys in order to increase the number of usable responses. Also, more data collection is needed to capture the environment surrounding alternative on-farm income sources. The linkage of crawfish production on rice farms is a growing practice among producers and better analysis of costs and benefits needs to be established for this unique crop rotation.

Waterfowl hunting leases provide additional revenue sources for rice farmers; however the season conflicts with the crawfish season. Currently, more farmers are harvesting crawfish but hunting leases could provide additional revenue for landowners who are environmentally and economically conscious.

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APPENDIX A
CORRESPONENCE SENT TO LOUISIANA RICE PRODUCERS

July 16, 2007

Mr. John Doe
345 North St
Lovely, LA 12345

Dear Mr. Doe:

Recent environmental policy has focused on reducing nonpoint sources of water pollution. Sediment, nutrient, and pesticide runoff from agricultural production have been found to significantly impact water quality. Federal and state agencies are currently implementing programs designed to monitor and reduce agricultural nonpoint source pollution.

Louisiana has adopted a strategy of identifying appropriate agricultural management practices that reduce nonpoint source pollution and implementing voluntary adoption of these recommended practices. The LSU AgCenter has developed recommended management practices and educational programs for individual commodities produced in the state.

The enclosed survey is being sent to a randomly selected group of landowners and operators growing rice in southwest Louisiana. The survey asks a series of questions concerning sources of information on water quality programs, current adoption of recommended practices, and their contribution to improved water quality.

The information collected in this survey will give researchers and policy makers a better understanding of the current level of practice adoption and reasons why practices have or have not been adopted. This information will be used to improve strategies for increasing the adoption rates of economically feasible practices.

Your participation in this study is vital in assuring that as many producers as possible are represented. All individual responses will be kept strictly confidential; no data on individual responses will ever be reported. Your participation is strictly voluntary and you will not be penalized for non-participation.

Thank you, in advance, for your participation. Please return the survey in the enclosed return envelope. If you have questions or comments, please feel free to contact us by telephone or email. A summary of the results of the survey will be sent to all persons returning completed surveys.

Sincerely,

Steven A. Henning
Associate Professor
tel: (225) 578-2718
e-mail: shenning@agctr.lsu.edu

Heidi Landry
Graduate Assistant
tel: (225) 578-8579
e-mail: hlandr7@lsu.edu

enclosures

August 3, 2007

Mr. John Doe
345 North St
Lovely, LA 12345

Dear Mr. Doe:

We recently wrote to you asking for your participation in a survey on the voluntary adoption of best management practices by Louisiana rice producers. As of today, we have not received a response from you.

If you have recently completed and mailed back the survey, please accept our thanks and disregard this letter. If you have not yet completed the survey, please take a moment to answer the enclosed questionnaire and return it in the business reply envelope provided.

The information gathered from this survey will be used in a study of adoption rates of best management practices recommended by the LSU AgCenter. The study will determine current adoption rates and provide policy incentives for future adoption. The survey asks a series of questions concerning sources of information on water quality programs, current use of recommended best management practices, and perceptions of their contribution to improved water quality. This information can then be used to improve strategies that promote voluntary adoption of economically feasible practices.

The study will only be as useful as the completed surveys we receive, so your participation is extremely important. All individual responses will be kept strictly confidential and will not be independently reported.

Thank you, in advance, for your cooperation. If you have questions or comments, please feel free to contact either of us. A summary of the survey results will be sent to all persons returning completed surveys.

Sincerely,

Steven A. Henning
Associate Professor
tel: (225) 578-2718
e-mail: shenning@agctr.lsu.edu

Heidi Landry
Graduate Assistant
tel: (225) 578- 8579
e-mail: hlandr7@.lsu.edu

enclosures

Dear Rice Producer:

We have recently sent out a survey questionnaire requesting information about best management practices in rice production. If you have already completed and returned the survey, please accept our thanks and disregard this reminder.

If you have not responded, please do so today. It is extremely important that the survey be completed and returned, so that the results of this study will be truly representative.

If you did not receive a survey, or if it was misplaced, please call or e-mail either of us and we will gladly mail another to you.

Sincerely,

Steven A. Henning
Associate Professor
(225) 578-2718
shenning@agctr.lsu.edu

Heidi Landry
Graduate Assistant
(225) 578-8579
hlandr7@lsu.edu

APPENDIX B
2007
LOUISIANA RICE PRODUCER SURVEY

BEST MANAGEMENT PRACTICES ADOPTION RATES TO IMPROVE WATER QUALITY

Department of Agricultural Economics and Agribusiness

LSU AgCenter Research & Extension

This survey is being conducted by the Department of Agricultural Economics and Agribusiness in the LSU AgCenter. The purpose of this research survey is to collect information on the adoption of practices designed to improve water quality by reducing nonpoint source pollution from sediments, nutrients, and pesticides.

Your participation is vital in assuring as many producers as possible are represented in this study. The reliability of the results from this survey depends on the participation of individuals such as you.

All individual responses will be kept strictly confidential. No data on individual responses will ever be reported. By participating in this survey, you are consenting to participation in the research project. Participation in this survey is voluntary and there is no penalty for non-participation.

Thank you, in advance, for your participation. A summary of the results of the survey will be sent to all persons returning completed surveys.

Please return the completed survey (in the enclosed postage-paid envelope) to:

Dr. Steve Henning
Department of Agricultural Economics and Agribusiness
101 Agricultural Administration Building
Louisiana State University
Baton Rouge, LA 70803-5604

If you have any questions about the survey, please contact Dr. Henning at (225) 578-2718 or by e-mail at shenning@agctr.lsu.edu. You may also contact Dr. David Morrison, the LSU AgCenter Institutional Representative for Research, at (225) 578-8236.

For more information about the Department of Agricultural Economics & Agribusiness, go to http://www.agecon.lsu.edu/.

For more information on the LSU AgCenter, go to http://www.lsuagcenter.com.

Section I: **WATER QUALITY LEGISLATION**
Please check the option that best reflects your knowledge about legislation related to improving water quality.

1. Are you aware of the Coastal Nonpoint Pollution Control Program as defined in the Coastal Zone Management Act?
   _______ yes
   _______ no (skip questions 2 and 3)

2. What is your primary source of information about the Coastal Nonpoint Pollution Control Program?
   ________ Louisiana Cooperative Extension Service
   ________ Media: TV, Radio, Magazines, or Internet
   ________ Other Farmers, Friends, Relatives or Neighbors
   ________ Farm Organizations (Farm Bureau, etc)
   ________ Governmental Agencies (NRCS, DNR, DEQ, etc)

3. Have you changed your agricultural management practices as a result of your understanding of the Coastal Nonpoint Pollution Control Program?
   ________ yes
   ________ no

4. Are you aware of federal efforts to control nonpoint sources of water pollution through the Clean Water Act?
   ________ yes
   ________ no (skip questions 5 and 6)

5. What is your primary source of information about the Clean Water Act?
   ________ Louisiana Cooperative Extension Service
   ________ Media: TV, Radio, Magazines, or Internet
   ________ Other Farmers, Friends, Relatives or Neighbors
   ________ Farm Organizations (Farm Bureau, etc)
   ________ Government Agencies (NRCS, DNR, DEQ, etc)

6. Have you changed your agricultural management practices as a result of your knowledge of the Clean Water Act?
   ________ yes
   ________ no

Section II: **AGRICULTURAL BEST MANAGEMENT PRACTICES**
Please check the option that best reflects your knowledge of Best Management Practices in agriculture.

1. Have you ever heard the term Best Management Practices?
   ________ yes
   ________ no

2. Do you feel that the use of Best Management Practices for rice production will improve the quality of water compared to conventional production practices?
   ________ yes
   ________ no

3. What is your primary source of information about Best Management Practices?
   ________ Louisiana Cooperative Extension Service
   ________ Media: TV, Radio, Magazines, or Internet
   ________ Other Farmers, Friends, Relatives or Neighbors
   ________ Farm Organizations (Farm Bureau, etc)
   ________ Government Agencies (NRCS, DNR, DEQ, etc)

4. During the past year, how many times did you attend educational programs and/or receive consultation provided by the Louisiana Cooperative Extension Service?

________ times

5. During the past year, how many times did you attend any grower meetings?

________ times

6. Are you aware of the Master Farmer Program for rice production as sponsored by the LSU AgCenter?

________ yes
________ no (skip questions 7, 8, and 9)

7. Having heard of the Master Farmer Program, have you participated in the certification training curriculum?

________ yes
________ no

8. Have you received Master Farmer certification? If yes, please indicate the year in which you received the certification.

________ year
________ no

9. Have you modified your production practices as a result of what you have learned through the Master Farmer Program?

________ yes
________ no

10 . What do you consider your primary motivation for voluntarily adopting best management practices?

________ Improved productivity/profitability of farm operation
________ Improved area water quality
________ To avoid mandated regulation of management practices
________ To conserve soil resources
________ Other (please list)____

11. Are you:

________ willing to implement additional and more stringent production practices as they become effective in your operation.
________ content with your current adoption rate of conservation practices.
________ not interested in incorporating any additional conservation practices into your operation until mandated by federal or state government.

Section III: **ADOPTION & IMPLEMENTATION OF BEST MANAGEMENT PRACTICES**

Please indicate whether you currently implement any of these practices. If the practice is being implemented in your rice operation, please put an X in the YES column. If you are not currently implementing the practice in your operation, please put an X in the NO column.

Conservation Practice Adoption	YES	NO
1. Do you use any of the following practices to control runoff and drainage?		
Land Smoothing		
Precision Leveling		
2. Do you water level prior to January 1st of each calendar year?		
3. When water leveling, do you implement a suspended sediment test to reduce sediment runoff by 50%?		
4. Do you use some type of structure or control (pipedrops) to reduce erosion resulting from field drainage?		
5. Do you follow any of the NRCS residue management guidelines listed below?		
No-Till- (no soil disturbing activities, minimum 30% residue remaining on soil surface year around)		
Mulch-Till- (minimum 30% residue remaining on soil surface year around following 1 pass of full-width tillage implement)		
Seasonal Till- (minimum 30% residue on soil surface from harvest until seedbed prep begins for next crop)		
6. Do you use filter strips and/or grassed waterways to improve the quality of water runoff from your farm?		
7. Do you use any of the following types of irrigation water conveyance on your farm?		
Irrigation Canal		
Irrigation Ditch		
Irrigation Regulation Reservoir		
Irrigation Water Pipeline		
8. Do you use flow meters to improve irrigation efficiency?		
9. Do you precision level prior to irrigation to reduce the quantity of water needed to cover the field?		
10. Do you complete regular water quality testing for your well water?		
11. After harvesting the crop, do you plant a cover crop or retain the residue on the field?		
12. Do you base fertilizer applications on soil testing and expected yields?		
13. Do you implement split application of nutrients and/or slow-release fertilizers?		
14. Do you utilize any precision ag equipment, such as a variable rate applicator, to apply fertilizer in order to conserve the amount used?		
15. Do you use an alternative source of fertilizer, such as animal waste, instead of conventional sources?		
16. Do you base pesticide applications on economic thresholds as determined by field scouting?		
17. Do you use a containment facility for mixing, loading, and storing pesticides?		
18. Do you calibrate spray equipment before each use?		
19. Do you use any type of precision application equipment?		
20. Have you established any type of wildlife habitat on your land as an alterative source of income or recreational use?		

Section IV: **RICE IRRIGATION SYSTEMS**

Please answer the following questions pertaining to your current irrigation system.

1. How many rice acres did you plant on your farm in 2007?
   ________ acres

2. Of the total 2007 rice acres on your farm, how many acres were irrigated by well and surface irrigation water?
   Well water: ________ acres
   Surface water: ________ acres

3. How many feet of underground irrigation pipe were utilized in irrigating your total rice acres in 2007?

Underground irrigation pipe: ________ feet
Pipe diameter: ________ inches

4. In the following table, please provide information on up to five specific rice irrigation systems used on your farm in 2007.

Rice Irrigation System	Rice Acres Irrigated with this system	Irrigation Water Source W = well S = surface	Well Depth (feet)	Pump Capacity (GPM)	Pump Age (years)	Power Unit Size (hp)	Power Unit Type 1/	Power Unit Age (years)
(1.)								
(2.)								
(3.)								
(4.)								
(5.)								

1/ Power unit type: D=diesel, E=electric, NG=natural gas, LP=propane/lp, or G=gasoline.

Section V: FARM DECISION MAKING

Please fill out the tables below concerning decisions on the farm.

1. Have you participated in any of the following NRCS cost-sharing programs?

Agricultural Practice	Yes	No	Your Share (%)
1. Filter Strip			
2. Grade Stabilization Structure, Structure for Water Control, and/or Critical Area Planting			
3. Irrigation Land Leveling			
4. Irrigation Pipeline			
5. Irrigation Regulating Reservoir, Tailwater Recovery, and/or Pumping Plant			
6. Nutrient Management			
7. Pesticide Management			
8. Field Border			
9. Well Decommissioning			
10. Irrigation Water Management			
11. Residue Management- (No-Till)			

2. For **<u>each</u>** of the following agricultural practices, please give a score from 0 to 10 according to your observation of their environmental benefit. (A score of 0 means no contribution and a score of 10 means maximum contribution. More than one practice may have the same score.)

Agricultural Practice	**Score (0-10)**
1. Land smoothing, precision leveling, and/or irrigation land leveling.	
2. Suspended sediment test used to reduce the sediment runoff by 50%.	
3. Drop pipes or other grade stabilization structures to reduce erosion.	
4. Residue management: No-till, Mulch-till, or Seasonal-till.	
5. Grassed waterways or filter strips around fields and along drainage sites.	
6. Irrigation water management: canals, ditches, or regulation reservoirs.	
7. Regular water quality testing of irrigation water wells.	
8. Tillage management or cover crop planting following harvest.	
9. Determine fertilizer applications based on soil testing and expected yields.	
10. Any of the following fertilization practices: split application of nutrients and/or slow-release fertilizers.	
11. Using precision ag equipment to conserve the quantity of fertilizer used.	
12. Use alternate sources of nutrients such as animal waste.	
13. Basing chemical applications (insecticides, herbicides) on economic thresholds as determined by field scouting.	
14. A containment facility for mixing, loading and storing farm chemicals.	
15. The calibration of spray equipment prior to each use.	
16. Precision equipment for the application of chemicals.	
17. The establishment of wildlife habitat on production acres.	

3. Please place an **X** on the line below to indicate your risk level concerning farming decisions. (Close to risk averse will indicate that you avoid risky decisions. On the other hand, close to risk taker will indicate that you seek out risky decisions.)

[**-----*-----*-----*-----*-----*-----*-----*-----*-----*-----**]

Risk Adverse Risk Neutral Risk Taker

4. If you have $100,000 for investment in a specific farm venture, will you invest it if: (check one)

________You have a 95% chance to recover it, plus a 10 % net profit.
________You have a 70% chance to recover it, plus a 30 % net profit.
________You have a 50% chance to recover it, plus a 40 % net profit.
________You have a 30% chance to recover it, plus a 50 % net profit.

<u>Section VI:</u> **ADDITIONAL FARM REVENUE SOURCES**

Please check the option that most closely reflects your sources of income generated on your farming operation.

1. With the acreage currently in rice (2007), please indicate below what you intend to produce on that acreage beginning in the fall of 2007?

   Crawfish ________ number of acres
   Soybeans ________ number of acres
   Cover Crop (not Soybeans) ________ number of acres
   Fallow ________ number of acres
   Other ____________________ ________ number of acres

2. How many acres do you currently have in each of the following?

   Crawfish (no rotation) ________ number of acres
   Rice (no rotation) ________ number of acres
   Rice and Crawfish (rotation) ________ number of acres

3. If you harvest rice and crawfish on the same acreage, do you shorten your crawfish harvest season to plant another crop?

   ________ yes
   ________ no

4. Which of the following practices follows the end of crawfish season?

   Leave the land fallow ________ number of acres
   Plant soybeans ________ number of acres
   Other (please list) ______________ ________ number of acres
   Do not raise crawfish (circle)

5. How many acres of rice do you annually lease out to others for waterfowl hunting?

   ________ acres

6. In the most recent year, what was the dollar amount you received for the leased acres?

   $_______ total amount
   $_______ per acre ________ acres

7. If you stopped producing rice on the land you own, what would be your next best alternative use for the land?

   ________ Do not own any rice acreage
   ________ Non-agricultural use (selling or sub-dividing for real estate)
   ________ Federal conservation reserve program (CRP or WRP)
   ________ Manage habitat for commercial hunting in conjunction with federal programs
   ________ Produce energy producing crop (energy sugarcane, switchgrass, etc)
   ________ Livestock grazing
   ________ Other ____

<u>Section VII:</u> **ENVIRONMENTAL ATTITUDE**

1. Listed below are statements about the relationship between humans and the environment. For **<u>each</u>** one, please indicate (by marking the appropriate column) whether you STRONGLY AGREE (**SA**), MILDLY AGREE (**MA**), are UNSURE (**U**), MILDLY DISAGREE (**MD**) or STRONGLY DISAGREE (**SD**) with the statement.

STATEMENT	SA	MA	U	MD	SD
1. We are approaching the limit of the number of people the earth can support.					
2. Humans have the right to modify the natural environment to suit their needs.					
3. When humans interfere with nature it often produces disastrous consequences.					
4. Human ingenuity will ensure that we do NOT make the earth unlivable.					
5. Humans are severely abusing the environment.					
6. The earth has plenty of natural resources if we just learn how to develop them.					
7. Plants and animals have as much right as humans to exist.					
8. The balance of nature is strong enough to cope with the impacts of modern industrial nations.					
9. Despite our special abilities humans are still subject to the laws of nature.					
10. The so called "ecological crisis" facing humankind has been greatly exaggerated.					
11. The earth is like a spaceship with very limited room and resources.					
12. Humans were meant to rule over the rest of nature.					
13. The balance of nature is very delicate and easily upset.					
14. Humans will eventually learn enough about how nature works to be able to control it.					
15. If things continue on their present course, we will soon experience a major ecological catastrophe.					

2. Do you think agriculture reduces the quality of water coming off the farmland?

________ yes
________ no

Section VIII: FARM OPERATION INFORMATION
Please provide general information about your farm by answering the questions below.

1. Please indicate the parish where the majority of your farming operation is located?

________________ Parish

2. Within your operation, please indicate the current number of owned and leased acres:

Owned		**Leased**	
Rice (planted)	________ acres	Rice (planted)	________ acres
Other Crops	________ acres	Other Crops	________ acres
Fallow (no crop)	________ acres	Fallow (no crop)	________ acres
Fallow (cattle)	________ acres	Fallow (cattle)	________ acres
Crawfish	________ acres	Crawfish	________ acres
Hunting Lease/Use	________ acres		
TOTAL	________ acres	TOTAL	________ acres

3. Is this farm a(n):
   ________ Individual Operation
   ________ Partnership
   ________ Family Corporation
   ________ Non-Family Corporation

4. Do you intend to pass this farming operation on to a family member?
   ________ yes
   ________ no

5. Do you actively participate in the farming operations on the land you own?
   ________ yes
   ________ no

6. Do you lease the majority of your land to other farm operations/operators?
   ________ yes
   ________ no

7. Do you estimate your farm debt level to be more than 40% of the total estimated value of your farming operation?
   ________ yes
   ________ no

8. Please indicate if the 2005 hurricane season affected your farming operation in any way.

Positive	**Negative**
________ Labor Availability	________ Labor Availability
________ Yield Impact	________ Yield Impact
________ Planted Acreage	________ Planted Acreage
________ Other__________________	________ Salt-Water Intrusion
	________ Other ___________________

Section IX: SOCIOECONOMIC INFORMATION
Please provide information about yourself by answering the questions below. Please remember all answers will remain strictly confidential.

1. What is your current age?
   ________ years

2. How long have you been a farm operator?
   ________ years

3. What is your gender?
________ Male
________ Female

4. What is the highest level of education you have completed?
________ Grade school
________ High school or Equivalent
________ Trade or Technical school
________ College Degree (Bachelor's)
________ Graduate or Professional Degree (Master's)
________ Graduate or Professional Degree (Doctoral)

5. What is your total **gross** farm income, including governmental payments, as reported on you federal taxes for 2006?
________ $0- $49,999
________ $50,000 - $99,999
________ $100,000 - $249,999
________ $250,000- $499,999
________ $500,000 and over

6. Approximately what percentage of your total family income is from farming?
________ Less than 25%
________ 25% - 49%
________ 50% - 75%
________ 75% and over

<u>Section X:</u> COMMENTS

If you have any additional comments about water quality, nonpoint source of pollution, and/or Best Management Practices in the production of rice, please include them below or on the back page of the survey.

VITA

Being raised on a family farm by two agricultural graduates definitely influenced Heidi's decision to attend college and major in agriculture. Although school work never came easy to Heidi, she did complete high school in 2001 and college in 2005.

At 21 years old, Heidi was unsure what type of career she wanted, so she pursued the thought of attending graduate school. She explains that she was aware of some of the challenges of graduate school such as the writing of a thesis and graduate level work; however she later admits she was completely unaware of just how much stress could be involved. Her journey began at LSU in 2005, and she assumed it would be a short stay. After an adjustment of the first semester, her journey took a different path. After overcoming many obstacles, Heidi completed her course work in May 2007.

Heidi was supported through this journey by her parents and fiancé (Jarod) who she married during her last semester at LSU (October 12, 2007). Heidi, who never had a problem of meeting new friends says that looking back she enjoyed her time at LSU and sums up her graduate school journey as a "learning experience". Now, a more matured and married woman, Heidi is graduating and heading back to begin her new life with her husband in Creole, Louisiana. For her future, Heidi is still unsure of her career path, but does say she hopes to instill in her children some of the determination and faith she relied on to achieve this goal. She still credits her faith in God for helping her to finish and tries to remember the motto, "Life is too short to wake up in the morning with regrets, so love the people who treat you right, forget those who don't and believe that everything happens for a reason. If you get a chance take it. If it changes your life let it. Nobody said that it would be easy, they just promised it would be worth it.- unknown."