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The Role of Environmental Attitudes in Incentive-Based Environmental Management: The Case of the Wetland Reserve Program.

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THE ROLE OF ENVIRONMENTAL ATTITUDES IN INCENTIVE-BASED
ENVIRONMENTAL MANAGEMENT: THE CASE OF
THE WETLAND RESERVE PROGRAM

A Dissertation
Submitted to the Graduate Faculty of the
Louisiana State University and
Agricultural and Mechanical College
in partial fulfillment of the
requirements for the degree of
Doctor of Philosophy
in
The Department of Agricultural Economics and Agribusiness

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ABSTRACT

Environmental policy in the United States is increasingly relying on incentive-based mechanisms (IBM). Incentive-based mechanisms, are voluntary environmental management instruments based on free market environmentalism, a framework that attempts to harness market forces. A multi-disciplinary approach was developed to evaluate participation decisions in IBM’s such as the Wetland Reserve Program. This approach extended the traditional utility maximization approach to choice behavior by including alternative measures of environmental attitudes based on the theory of reasoned action or the New Environmental Paradigm. The addition of these psychological constructs conceptually improved the utility maximization by allowing the consideration of well established determinants of behavior.

Probit and Tobit models derived from the conceptual framework were empirically tested using primary data collected via a mail survey of Louisiana wetland owners. Results presented suggest that the acreage of wetlands owned, the level of information about the WRP, respondents’ involvement in environmental organizations, education level, income, the number of people living in the household, and attitudes were significant in explaining Louisiana wetland owners’ decision to offer to participate as well as the level of participation in the WRP.

The significance of attitude measures as explanatory factors suggests that a successful implementation of IBM programs depends, in addition to getting the economic incentive “right”, on properly addressing attitudinal concerns. Comparison between the
specific attitude measures derived from the theory of reasoned action and the general NEP-based environmental attitude was inconclusive. Therefore, until further evaluation, these alternative measures can be used interchangeably.
CHAPTER 1
INTRODUCTION

Since the mid-sixties, there has been an increasing concern for a variety of environmental issues and a greater demand for environmental amenities in the United States. Environmental amenities are desirable attributes of natural or environmental resources. Air and water quality, solid waste management, ozone depletion, and the preservation of endangered species and their habitat are among the major environmental concerns of citizens and regulators alike (Brown, 1993). The management of the environment is undergoing an evolution in response to the growing demand for environmental amenities and societal preferences for improved environmental quality. Agricultural environmental management is also evolving to reflect society's increased recognition of the detrimental role agriculture often plays in environmental degradation. For example, agriculture is now recognized as a major contributor to soil erosion, wetland conversion, and groundwater contamination (Batie, 1990).

Environmental Management

In the United States, environmental management has most recently been based on direct regulation (Nash, 1990). Under this regulatory approach, also known as command and control, rules, guidelines, and penalties are the main instruments used by regulatory agencies to protect and restore the environment (Dudek and Palmisano, 1988). Guidelines used under the command and control approach can be divided into two categories: technology-based and emission-based standards. Under a technology standard,
the regulatory agency imposes the technology to be used by a given polluter or for a given activity. The technology imposed is based on the best available technology (BAT) for the activity considered. A BAT regulation requires polluters to use the best available technology if it does not force the polluter to shut down (Ackerman and Stewart, 1988). The required installation of chimney scrubbers for utility companies is an example of a BAT regulation. For emission standards, the regulatory agency predetermines the maximum level of emission or discharge allowed to a given polluter or group of polluters in a given region. Ambient standards for criteria air pollutants set in the Clean Air Act of 1990 are an example of emission standards (Bryner, 1993).

Environmental management by direct regulation relies on the centralization of a diverse and large body of information within few regulators (Anderson and Leal, 1991). Unfortunately, this information is very costly and often impossible to gather for many current environmental problems (Anderson, Hofmann, and Rusin, 1990). Furthermore, compliance with environmental regulations is increasingly expensive. The Environmental Protection Agency (EPA) reports that the United States spends more than $100 billion annually to comply with environmental regulations (Stavins, 1991). Ineffectiveness in achieving improved environmental quality at affordable costs (Anderson, Hofmann, and Rusin, 1990), the lack of incentives for technological improvement (Anderson and Leal, 1991), and high costs of the command and control approach have led lawmakers and economists to consider alternative environmental management strategies.
Agricultural Environmental Management

Until recently, environment management in the U.S. has exempted agriculture. The agricultural sector has long benefitted from a tacit exemption from many environmental regulation and management strategies. Stemming from what has been described as a social contract with agriculture, society's primary concern was to guarantee and stabilize farmers' income through various commodity programs (Batie, 1990). As a result, the agricultural sector has enjoyed, until the Food Security Act (Farm Bill) of 1985, a self-regulating status.

In the 1980s, growing concern over environmental quality and evidence of the many adverse effects of agriculture on the environment prompted policy makers and society at large to question the self-regulating position granted to the agricultural sector. The Sodbuster, Swampbuster, and Conservation Compliance provisions of the Farm Bill of 1985 marked a shift in the social contract with agriculture (Batie, 1990). Under these cross-compliance programs, farmers' eligibility for U.S. Department of Agriculture (USDA) program benefits is tied to the adoption and implementation of approved conservation plans (Carlson, Zilberman, and Miranowski, 1993).

The implementation of incentive-based conservation programs constitutes another step in the evolution of agricultural environmental policy. The Conservation Reserve (CRP), the Water Bank (WBP), and the Wetlands Reserve (WRP) programs provide economic incentives to farmers willing to adopt conservation or restoration practices. For example, under the provisions of the CRP, USDA offers compensation to farmers willing
to retire highly erodible cropland from production. These incentive-based programs are also referred to as "green payments" (Hoag, Weber, and Duffy, 1995).

The search for environmental management tools able to efficiently address current environmental problems, including the destructive role often played by agriculture has resulted in increased consideration of alternative management strategies in environmental policy. Free market environmentalism (Anderson and Leal, 1991) is the principal alternative approach suggested.

**Incentive-Based Mechanisms**

Free market environmentalism (Anderson and Leal, 1991) is an alternative environmental management framework advocated by legal scholars (Ackerman and Stewart, 1988), economists (Tietenberg, 1990; Stavins, 1988; Randall, 1987), and politicians (Heinz and Wirth, 1988). Contrary to command and control, which is often based on bureaucratic decisions, free market environmentalism relies on market forces for environmental management. Specific environmental management instruments used within this framework are called incentive-based mechanisms (IBM) or market-based incentives.

Incentive-based mechanisms can take various forms. They either rely on the "polluter pays" principle or provide economic compensation to elicit a targeted environmental behavior. Incentive-based environmental strategies influence the behavior of individuals, households and firms by creating a system of penalties and rewards. Incentive-based mechanisms require clearly defined property rights and make each resource user, owner, or trustee bear the full cost and/or reap the entire benefits of her
actions. It is argued that dollars spent to comply with environmental rules and regulations would have a greater impact if used to provide economic incentives (Dudek and Palmisano, 1988; Stewart, 1988; Tietenberg, 1990). Incentive-based environmental strategies include green taxes, deposit-refund schemes, emission fees, and individual transferable quotas.

In agriculture, market-based environmental strategies have been mainly used to promote desirable behavior through the use of positive economic incentives. For example, in agricultural land policy, conservation and restoration practices are increasingly elicited through the transfer (TDR) or purchase of development rights (PDR). Under a PDR system, the private land owner "voluntarily sells the development rights and receives compensation for the development restrictions placed on the land" (Daniels, 1991, p.421). Development rights are also known as conservation easements. Under TDR arrangements, incentives are provided for temporary development restrictions. TDRs and PDRs were initially created to protect farmland against rapid urbanization and were mainly used as state and local land use policies. Provisions of the 1985 and 1990 Farm Bills revived and reoriented the focus of TDRs and PDRs from state level farmland protection to national conservation and restoration practices. For example, the Conservation Reserve Program provides compensation for temporary development rights restrictions on highly erodible agricultural land. On the other hand, the Wetlands Reserve Program purchases permanent easements on wetlands.

Despite the theoretical appeal of incentive-based mechanisms and the potential savings they can generate (Stavins and Whitehead, 1992), their effective application is
still very limited in the United States (Anderson, Hofmann, and Rusin, 1990). Special interests and the prevailing property rights regime have been identified as some of the limiting factors.

**Special Interests**

Several special interest groups are comfortable with the traditional command and control approach and favor a status quo (Dudek and Palmisano, 1988). The very existence of the environmental bureaucracy and its agency engineers is threatened by a wide application of incentive-based mechanisms. Moreover, lobbyists who have already learned to manipulate the regulatory system, and environmental groups which are antagonistic to business, strongly oppose changes in the current system (Stavins and Whitehead, 1992).

**Prevailing Property Rights Regimes**

Because free market environmentalism attempts to harness market forces (Stavins, 1988), the implementation and effectiveness of incentive-based environmental management programs rest on the existence and efficient functioning of markets. Factors hampering the existence or efficient functioning of markets will also affect the effectiveness of incentive-based mechanisms. Fully defined, transferable, and enforceable property rights are a prerequisite to the existence of efficient markets. Property rights are constituted of separable and independent elements referring to the privileges held by the resource owner. In a sense, property rights are comparable to a bundle of sticks, with each stick representing a specific right that can be used or transferred individually (Daniels, 1991). For example a private landowner's set of rights can be divided into the
right to sell, to use, development rights, and so forth (Daniels, 1991). However, for most natural resources, prevailing property rights lack one or often many of the attributes mentioned above (Randall, 1987).

Property rights are not fully defined for a great majority of environmental resources. For natural resources, open access is the dominant property rights regime. Ambient air and ocean fishing grounds are among the many examples of natural resources operating under open access. Inefficiencies attached to this form of property rights regime are illustrated by Harding (1968) and by Gordon (1954). A mathematical treatment of the inefficient use of resources resulting from an open access regime is provided by Cheung (1970).

Rights to several environmental resources, although clearly defined, are often not transferable. For example, under the riparian doctrine, water rights are fully defined but not transferable. Lack of transferable rights does not allow resources to flow to their highest valued use, resulting in an inefficient allocation. Due to the non rivalry in consumption and/or the non exclusiveness of most natural resources, property rights are either very difficult or impossible to enforce. A resource is non rival if consumption by one individual does not decrease the amount available to remaining consumers. A resource is non exclusive when it is impossible to exclude individuals from using the resource (Randall, 1987). This enforcement difficulty may be the result of physical attributes of the resource (non rivalry) or societal preferences, or both (non-exclusiveness). However, property rights structures are not static. They are dynamic in
nature and develop with technical changes and society's evolution (Anderson and Leal, 1991).

Research Problem: Acceptability of IBM Programs

In addition to the factors aforementioned, the acceptance of a given incentive-based program is critical to its success. Due to the voluntary nature of incentive-based programs, acceptance and thus participation in these programs is not automatic. The resistance to the use of markets as an environmental management tool may hamper the implementation of incentive-based programs. Reasons for the unwillingness to allow market forces in environmental resource management may stem from the strong ideological and political attachment to regulation existing in the U.S. (Stewart, 1988) or from a mistrust of market forces (Kelman, 1981). Thus, attitudes towards the use of markets in environmental management may play a determining role in the effective implementation of incentive-based management programs.

A dominant part of the social psychology literature focused on behavioral research has established the role of attitudes as predictors of behavior (Ajzen and Fishbein, 1980; Ajzen, 1988; Fazio, Powel, and Williams, 1989; Heberlein, 1989; Upmeyer and Six, 1989). Environmental attitudes should therefore serve as predictors of participation in a given incentive-based environmental management program. A better understanding of environmental attitudes, their formation, and translation into participation in a given market-based management program could facilitate a successful implementation of incentive-based mechanisms as alternative environment management strategies in agriculture.
Objectives

The overall objective of this study is to assess the role of attitudes in the decision-making process of economic agents facing incentive-based environmental policies and programs.

This study has five specific objectives:

1. Develop a conceptual framework which extends the neoclassical economic approach to choice behavior by including psychological constructs;

2. To propose an appropriate behavioral model for the explanation of economic agents' decision to participate or not in incentive-based environment management programs;

3. To empirically test the model proposed, using the Wetland Reserve Program (WRP) in Louisiana;

4. To evaluate the relative effectiveness of two alternative attitude measurement approaches; and

5. Based on the conclusions of this study, to provide information to policy makers and environmental regulatory agencies who wish to use incentive-based mechanisms as an effective environmental management instrument to address other environmental issues in agriculture.

Justification

In addition to the economic incentives provided, noneconomic factors such as environmental attitudes may play a determining role in explaining participation in a given incentive-based management program. For example, Green and Hefferman (1986) suggest that there is a consensus among social scientists on the importance of noneconomic factors that farmers consider in adoption decisions for soil conservation practices. Similarly, landowners' acceptance has been identified as one of the key
determinants of the effectiveness of the Wetland Reserve Program (Danielson and Leitch, 1995).

Assessments of the relative efficiency of environmental attitude measurement and the predictive power of behavioral models based on alternative attitude measurement approaches have not been conducted. Furthermore, this research has not been conducted in the framework of participation in incentive-based environmental programs. This study will evaluate the measurement issues surrounding the two approaches proposed.

The Wetlands Reserve Program, which will constitute the basis for the empirical part of this study, is still in its early stages of implementation. The proposed behavioral model could provide a valuable tool to evaluate the main determinants of landowners decision to participate in WRP. In addition, considering the growing popularity of incentive-based mechanisms, implications of the model proposed could be extended to other incentive-based management strategies.

Procedures

The realization of the first objective of this study will rely on a review of the relevant and current aspects of the literature on incentive-based environmental management, and the role and measurement of attitudes as predictors of economic behavior. This study will then assess the role of attitudes in participation decisions in incentive-based programs by establishing a link between the bodies of literature reviewed.

To achieve the second objective of this study, a predictive behavioral model which includes an attitudinal component in a qualitative response model will be
developed. Qualitative response or discrete choice models are the appropriate class of econometric models to use when the dependent variable is discrete and refers to a choice between several alternatives such as a participation choice (Greene, 1993; Judge et al, 1985; and Amemiya, 1981). Discrete choice models have been used to describe and predict a wide assortment of purchasing and voting behavior, and participation decisions (Judge et al, 1985; Greene, 1993). The recent upsurge in the use of qualitative choice modeling in economic applications is due to the existence of many naturally discrete variables (Amemiya, 1981). Economic agents are often making choices between different activities rather than only making choices involving levels of participation in markets.

Qualitative response models are derived from random utility models (Greene, 1993; Judge et al, 1982, 1988). Consider the following random utility model:

\[
U_{ij} = E(U_{ij}) + e_{ij} = \bar{U}_{ij} + e_{ij}
\]

(1)

For each individual i, the utility level corresponding to the choice of alternative j is divided into two components. \(E(U_{ij})\) is the expected value of the utility level associated with the choice of the jth alternative by the ith individual and \(e_{ij}\) is a random error term.

Assuming a dichotomous choice model, the utility \(U_{io}\) and \(U_{il}\) can be expressed as (Judge, et al., 1988):

\[
U_{io} = \bar{U}_{io} + e_{io} = z_{io}'\delta + w_{io}'\gamma_{o} + e_{io}
\]

(2)
Utility levels derived from selecting alternative 0 or alternative 1 are $U_{i0}$ and $U_{i1}$, respectively. Vectors of alternative specific, or mode, variables are denoted by $z_{i0}'$ and $z_{i1}'$. Socio-economic characteristics of the $i$th choice maker are represented by $w_i'$. The unknown parameters are represented by $\delta$, $\gamma_0$, and $\gamma_1$. A rational (utility maximizing) individual will select alternative 1 if and only if $U_{i1} > U_{i0}$ or, if the latent variable $y_i^*$, representing the difference between the two utility levels, is positive:

$$y_i^* = (z_{i1} - z_{i0})' \delta + w_i' (\gamma_1 - \gamma_0) + (e_{i1} - e_{i0})$$  \hspace{1cm} (4)$$

$$y_i^* = [(z_{i1} - z_{i0})', w_i'] \begin{pmatrix} \delta \\ \gamma_1 - \gamma_0 \end{pmatrix} + e_i^* = x_i' \beta + e_i^*$$  \hspace{1cm} (5)$$

Thus, the probability of selecting alternative one is:

$$P_i = P[y_i = 1] = P[y_i^* > 0] = P[e_i^* > -x_i' \beta]$$  \hspace{1cm} (6)$$

For symmetric distributions, equation (6) can be written as:

$$P_i = 1 - P[e_i^* \leq -x_i' \beta] = 1 - F(-x_i' \beta) = F(x_i' \beta)$$  \hspace{1cm} (7)$$

Equation (7) is the basic equation for Probit dichotomous choice models. Assumptions made about the distribution of the error term determine the binary choice
model. Probit models assume normally distributed errors. $F$ is the cumulative distribution function of a standard Normal $(0,1)$ distribution.

Explanatory variables in the behavioral model proposed in this study will include economic variables relative to the opportunity cost of the wetland such as the average return per acre, relevant socio-economic factors such as income and education, wetland acreage owned, farm program participation, and alternative measures of environmental attitudes. In equations 2 to 5, economic variables and socio-economic factors are represented by $z_j$ (j equal to 1 or 2) and $w_i$, respectively.

To measure environmental attitudes, two alternative approaches will be considered in this study. First, environmental attitudes will be measured using Ajzen's theory of planned behavior (1988). For the second approach, attitude measurements will be based on the latest NEP Scale (Dunlap, Van Liere, Mertig, Caton, and Howell, 1992). The use of alternative methods to assess environmental attitudes will allow comparison of the relative efficiency of environmental attitude measurements and evaluation of the relative predictive power of behavioral models based on the two approaches.

The third objective constitutes the empirical part of this study. This study will use primary data collected by surveying private land owners meeting the eligibility criteria for participation in the Wetland Reserve Program in Louisiana. Government policies have shifted from giving economic incentives for wetland conversion to giving economic incentives for restoring and protecting wetlands. Enacted in 1990, the Wetland Reserve Program is the latest policy instrument aimed at preserving wetlands. Under the
provisions of the WRP, the government is authorized to "purchase easements from owners of eligible land who voluntarily agree to restore and protect farmed wetlands and eligible adjacent acres" (USDA, 1992).

Louisiana was one of the eight pilot states selected to participate in the first phase of the WRP, and one of 19 states participating in the second phase of WRP sign-ups. Under the WRP, USDA purchases permanent easements from participating wetlands owners offering farmed wetlands, prior converted wetlands, and riparian areas linking wetlands (Coreil, 1994 a). The USDA pays landowners a fair market value for the enrolled acreage and up to 75 percent of the costs of wetland restoration to approved wetland conditions. Under the supervision of the Agricultural Stabilization and Conservation Service (ASCS), the enrolled acreage must be kept in a permanent wetland condition in perpetuity (Coreil, 1994 b).

Because it relies on voluntary participation of landowners and offers economic incentives, i.e., cash payments, instead of setting regulatory standards, the WRP is an incentive-based environmental management program. Under the WRP, a portion of private property rights, i.e., the development rights are transferred from landowners to the government. In design, the WRP is similar to previous state level land use programs which separated use and development rights. Thus, the acceptance of this market-based program might be influenced by environmental attitudes, especially those towards property rights of natural resources.

Data for the estimation of the proposed empirical model will be obtained from a mail survey using a modification of the Dillman Total Design Method (Dillman, 1991).
The questionnaire will focus on eliciting the determinants of environmental attitudes relevant to participation in the Wetland Reserve Program. Names and addresses for the sample will be obtained from the Louisiana NRCS, which administers the Louisiana WRP and conducts WRP enrollment. A sample from the approximately 500 names of wetland owners who offered intentions during the two sign-up periods (1992, 1994, 1995) will be supplemented with a matching sample of wetland owners who did not offer wetlands for enrollment in the WRP, obtained from the Louisiana Cooperative Extension Service.

Objective four will be achieved by evaluating the relative predictive power of behavioral models containing an attitudinal component measured either via the NEP approach or via the social psychology approach. This evaluation will be done by comparing different goodness of fit criteria.

Objective five will be achieved through a generalization of findings resulting from the previous objectives to environmental management programs adopting an incentive-based approach. Results will be interpreted in light of the information needs of policy makers and wetlands owners. This research should shed needed light on the determinants of voluntary participation in incentive-based environmental management, as well as provide a better understanding of the role of environmental attitudes in that decision process.

Summary

In summary, this research proposes to evaluate the role of environmental attitudes in incentive-based environmental management programs in agriculture by developing a
predictive behavioral model which incorporates alternative attitudinal measures in a qualitative response model. Primary data collected through a mail survey of private wetland owners will be used to empirically test the model proposed. In addition, the relative predictive power of behavioral models based on the alternative attitude measurement approaches considered in the study will be evaluated.
CHAPTER 2
INCENTIVE-BASED MECHANISMS AND THE WETLAND RESERVE PROGRAM

Either as complements or as alternatives to the traditional command and control approach, incentive-based mechanisms are increasingly gaining recognition as suitable environmental management tools. Incentive-based strategies are also increasingly included in agriculture related environmental policies such as soil conservation programs and wetland preservation or restoration. Following a brief presentation of the theoretical basis and applications of incentive-based mechanisms, and an overview of the history of soil conservation in the United States, the Wetland Reserve Program will be characterized in terms of an incentive-based program.

Incentive-Based Mechanisms

Incentive-based mechanisms or market-based incentives are environmental management tools that rely on a system of economic rewards (positive incentives) or penalties (disincentives) to promote a desired behavior or discourage a given externality generating activity. For this reason, incentive-based mechanisms are also referred to as economic instruments which can direct private actions towards socially desirable behavior (Opschoor and Vos, 1989). Market forces, not bureaucratic decisions, are the driving elements in this form of environmental management. Though some authors suggest more detailed classifications (Opschoor and Vos, 1989; Fiorino, 1995), incentive-based mechanisms can be divided into two basic categories: transferable permits and taxes and subsidies (Field, 1994).
Transferable Permits

The concept of transferable or marketable permits is due to Dales (1968). Under a transferable permit system, the environmental regulatory agency first determines the maximum allowable level of the externality generating activity, i.e., sets standards, and then issues the corresponding amount of permits. This system creates a new type of property right (Field, 1994). The right to engage in the externality generating activity, which was initially accessible to all, becomes exclusive, completely specified, and transferable. The regulatory agency creates an artificial market for the trade of permits (Fiorino, 1995).

Initially, permits can be either distributed among participants in the externality generating activity or sold at an auction to the highest bidders (Freeman, 1994). The initial mode of permit distribution can affect the competitiveness of the industry responsible for the externality generating activity considered. By distributing the initial number of permits among the existing participants or firms, the regulatory agency makes it more difficult for future participants to enter the industry. In effect, this mode of distribution creates additional barriers to entry and thus, decreases the competitiveness of the industry. This problem can be avoided if the regulatory agency sets aside a certain portion of the permits for future participants in the activity or industry in question. Auctioning off the permits can give an unfair advantage to larger firms or participants with more financial resources. As a strategic plan, they can buy as many permits as possible in order to control the industry and gain market power by driving competitors away.
While the supply of permits is predetermined and independent of prices, the demand for permits is a function of the number of participants and of the marginal abatement curve of the damage resulting from the externality generating activity. Figure 1 illustrates the supply and demand for marketable permit systems, the effects on permit prices of new participants, and of a reduction in the number of permits. Because the quantity of permits (Q*) is predetermined, the supply of permits (S) is vertical. The optimal price of permits (P*) is determined by the equilibrium which is the intersection (E*) between the supply and the demand (D) curves. To improve environmental quality in a designated area, the regulatory agency can decrease the number of permits in circulation to Q' by buying back and retiring a given number of permits. Such a decision would lead to a shift in the supply of permits from S to S'. The resulting equilibrium and price are respectively E' and p'. If new participants were to enter the market for tradable permits, the demand curve would shift to D' and the new equilibrium and price would be E'' and p'', respectively. A reduction in the number of permits as well as an increase in the demand for permits will lead to an increase in permit prices.

Another way of gaining access to tradeable credits or authorizations for engaging in the externality generating activity is through reducing one’s level of externality generated below a preset threshold (Tietenberg, 1992). The only difference between these credits and the permits previously discussed is that the supply for these credits is price responsive. The higher the price of credits, the more incentives one has to reduce his own level of externality generated in order to sell the additional credits earned.
Figure 1. Tradable Permit System
Source: Pearce and Turner, 1990

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In the United States, air pollution control has so far constituted the most fertile domain of application of marketable permit systems. For example, the Emission Reduction Credit (ERC) Program, which allows limited emission permit trading for stationary sources, was authorized under provisions of the Clean Air Act of 1977. Offsets, bubbles, banking, and netting are the four specific subprograms that constitute the ERC program (Dudek and Palmisano, 1988). Overall, the ERC program has yielded significant compliance cost reductions estimated at over $10 billion (Tietenberg, 1992). Created by the Clean Air Act of 1990, the transferable discharge permit program (TDP) for sulfur dioxide emissions offers another example of the application of marketable permits to air pollution control (Fiorino, 1995). Fisheries management constitutes another domain of application of tradable permit systems. Individual transferable quotas (ITQs), which are well defined authorizations to catch a certain amount of fish under clearly specified conditions, have been used in managing several fishing grounds worldwide (Neher, Arnason, and Mollet, 1989). Other applications of tradable permit systems as environmental management instruments in the United States include the control of the lead content of gasoline and the trade of water pollution rights (Carlin, 1992).

Taxes and Subsidies

The use of taxes and subsidies as environmental management tools was first introduced more than 75 years ago by Pigou (1920) who suggested that taxes and subsidies were adequate means to curb or promote targeted activities. A Pigouvian tax is a corrective tax imposed to discourage activities creating negative externalities (Hahn and Stavins, 1992). The optimal Pigouvian tax (subsidy) corresponding to a given externality
generating activity has to be equal to the socially optimal marginal damage (benefit) level. In other terms, the optimal level of taxation is achieved when the tax is set where the marginal net benefit derived from the activity considered is equal to zero. For a given activity, the marginal net benefit is the difference between the marginal benefit and the marginal damage produced by the activity. The imposition of an optimal Pigouvian tax would result in a Pareto-efficient level of the externality generating activity (Baumol and Oates, 1992).

The graphical determination of the optimal level of a Pigouvian tax is illustrated in Figure 2. Socially optimal levels of the externality generating activity $Q^*$ and the corresponding Pigouvian tax are determined at the equilibrium $E$, which is the point of intersection between the marginal benefit and marginal damage curves. Total revenues raised by the government are represented by the area $O t^* E Q^*$. For a given environmental damage, the large number of externality generating activities involved and persons affected by the damage make the calculation of the money value of the marginal benefit and marginal damage schedules very difficult. Thus, the correct determination of the optimal Pigouvian tax is practically impossible (Dubgaard, 1994).

The pricing and standard approach offers a workable alternative to the optimal Pigouvian tax. This system is an hybrid between the direct regulatory and the incentive-based approaches. Under this system, acceptable levels of damages, i.e., quality standards, are initially determined by the regulatory agency. Then, an appropriate tax level is selected to meet the preset targets. Though this method will generally not result in a Pareto-optimal
Figure 2. Optimal Pigouvian Tax
Source: adapted from Fields, 1994.
level of the externality generating activity, it is the most efficient way to meet the predetermined environmental quality standards (Baumol and Oates, 1992).

Charges or taxes and subsidies have been applied to a wide variety of externality generating activities to modify behavior, raise revenues or both. According to a survey study conducted by Opschoor and Vos, revenue raising has been the primary objective of most environmental taxes (1989). Taxes can be applied either to inputs or raw materials or directly to the externality generated such as the pollutant or effluent. Taxes on fertilizers based on their nitrogen content constitute an example of environmental taxes applied to the externality generating inputs or equipment (Field, 1994). Taxes based on the level of externality generated, also referred to as effluent charges or emission taxes, have been mainly used in water pollution control and noise reduction strategies (Opschoor and Vos, 1989).

Incentive-based mechanisms that simultaneously use a tax and a subsidy are typified by deposit-refund schemes. Under such systems, a tax is initially levied when the product is purchased and a subsidy is paid when parts or the entire used product is returned at specified collection centers (Field, 1994). Returns are either recycled or properly disposed. Beverage and pesticide containers, lead acid batteries (Anderson, Hoffman, and Rusin, 1990), lubricating oil, and cars (Field, 1994) are among the many examples of deposit refund schemes currently used.

Despite their theoretical attractiveness, taxes are not widespread. The difficulty in accurately evaluating damage functions, the inherent resistance to change by regulators, and the uncertainty about the justice of Pigouvian taxes have been identified as factors
limiting the use of taxes as environmental management instruments (Pierce and Turner, 1990). Furthermore, there exists in the United States an inherent opposition to new taxes regardless of their objectives. The uniform taxation of every unit of externality generated results in total tax payments that are significantly larger than the damage caused. A corrective method suggested by Field (1994) calls for a two-part tax which would tax only a part of the externality generated.

**Soil Conservation and Land Use Policies in the United States**

The evolution of soil conservation and land use policies in the United States illustrates the pivotal role that economic compensation has always played and the unrecognized contribution of incentive-based programs. The following sections provide an historical overview of soil conservation and land use policies.

**History of Soil Conservation and Land Use Policies**

Earliest documented efforts to promote soil conservation in the United States were the result of localized actions of farmers or politicians such as Jefferson. The foundations for a national soil conservation program were set by Hugh H. Bennett, a USDA soil scientist who was the first individual to emphasize that soil erosion was not a localized concern of some isolated landowners but a national problem demanding national institutions and solutions (Rasmussen, 1982). Following Bennett's assessment of the scope of soil erosion in the U.S., the Soil Erosion Service (SES), which later became the Soil Conservation Service (SCS), was created in 1933. The Soil Conservation Service is known today as the Natural Resource Conservation Service (NRCS).
During the more than 60 years that conservation programs have been implemented, successes have been relatively limited. For example, only a fourth of the U.S. farmland was enrolled in approved soil conservation practices (Wittwer, 1978). The National Agricultural Research and Extension Users Advisory Board also noted the excessive rate of loss of agricultural lands and soils and suggested that USDA concentrated on improving the effectiveness of soil and land conservation programs (Rasmussen, 1982).

The objectives of soil conservation programs have evolved over time with changes in the political and economic environment and have included a variety of goals such as farmers' income support, mitigation of soil erosion, water quality amelioration, flood control, and general environmental quality improvement. Nevertheless, the design and structure of most current soil conservation policies are not fundamentally different from initial programs established in the early 1930's (Batie, 1985) which relied on a system of passive incentives.

Alternative Policy Approaches

The soil conservation programs and land use policies implemented to date have used one of three major approaches: self regulation, cross compliance programs, and incentive-based mechanisms. These different approaches to soil conservation mainly differ from one another by their selected enforcement means. Under the self regulatory approach to agricultural policy relative to soil conservation, unconditional support of farmers' income and productivity maintenance were the main goals of most programs and policies. Soil conservation solely relied on farmers' willingness to participate in proposed programs or adopt suggested practices. Without restrictions, farmers were able to enjoy all benefits
provided by income support and commodity programs. In contrast, cross compliance conservation strategies have provided income support conditional on participating in specific programs or adopting given practices. Incentive-based mechanisms have relied on a system of economic rewards and penalties to promote environment improvement.

**Self-Regulatory Approach**

The self-regulatory status granted to agriculture can be traced back to agricultural fundamentalists who believed that farmers and their lifestyle were one of the cornerstones of American society and thus, had to be protected at all cost. This approach relies on voluntarism which has constituted a fundamental principle of soil conservation in the U.S. (Crosson, 1984). Voluntarism encourages farmers to undertake soil conservation while maintaining a complete independence between conservation participation decisions and eligibility for government benefits. A farmer’s decision not to engage in conservation practices does not in anyway compromise his eligibility for government programs. Early legislative acts such as the Agricultural Adjustment Act of 1933 and programs derived from it provide examples of soil conservation programs based on voluntarism.

Although the Soil Conservation Act of 1935 clearly identified soil erosion as a national threat and recommended that farmers and government cooperate to mitigate soil erosion, supporting farmers’ income and maintaining farmland productivity were the primary goals of the early legislation passed and programs implemented. For example, while its declared goal was soil conservation, the support of farmers' income by reducing crop surpluses was the specific goal of the Soil Conservation and Domestic Allotment Act of 1936. Soil conservation was just an accessory used as a protective umbrella against the
Supreme Court which previously had ruled that plans to regulate agricultural production such as the Agricultural Adjustment Act of 1933 were unconstitutional (Rasmussen, 1982). Under the provisions of the Soil Conservation and Domestic Allotment Act, farmers were offered financial incentives through the Agricultural Conservation Program (ACP) to shift agricultural land from "soil depleting" to "soil conserving" crops. Soil depleting crops corresponded to crops for which surpluses existed (Batie, 1985).

Voluntarism was a justifiable approach while maintaining farmland's productivity and farmers' income were the primary goals of soil conservation policies (Crosson, 1984). However, it became an increasingly questionable conservation approach as society began to recognize the important role agriculture plays in environmental degradation. Furthermore, due to the continuing decline in political power of farmers and their representatives and the maturing of the environmental movement, agricultural policy, including soil conservation programs and land use policies, was under increased scrutiny (Batie, 1985). The following reevaluation of society's "contract with agriculture" resulted in a policy shift demanding more accountability from farmers receiving government benefits. More specifically, soil conservation policies evolved from unconditional maintenance of farmland productivity and unrestricted support of farmers' income to cross compliance programs.

**Cross-Compliance Approach**

Cross compliance programs, also referred to as carrot and stick methods, use either "green ticket" or "red ticket" approaches. The green ticket approach promises additional benefits such as higher price support payments to landowners who agree to implement
predetermined conservation practices. The red ticket approach threatens to deny benefits previously acquired to landowners who do not implement soil conservation practices (Kramer and Batie, 1985). The Soil Bank, Sodbuster and Swampbuster Programs constitute examples of programs relying on the cross compliance approach to soil conservation.

The Soil Bank Program, which was established by the Agricultural Act of 1956, offers an example of a conservation program mainly aimed at supporting farmers' income but with a cross compliance component (Kramer, and Batie; 1985). The Soil Bank Program was a short lived attempt to support farmers' income by withdrawing agricultural land from production. Acreage reserve and conservation reserve were the two components of the program. The acreage reserve component gave farmers incentives to decrease their total acreage of allotment crops which were wheat, corn, cotton, peanuts, tobacco, and rice. The conservation reserve element promoted conservation through providing incentives to withdraw land from production for up to 10 years (Rasmussen, 1985).

While the Soil Bank Program used a carrot or green ticket approach, the following generation of cross compliance programs such as the Sodbuster and Swampbuster relied on a stick or red ticket approach. Instead of offering benefits in exchange for participation in soil conservation programs, the Sodbuster and Swampbuster programs denied benefits to farmers who did not adopt suggested practices. Both programs were established under the conservation title or Title XII of the 1985 and 1990 Farm Bills.

The Sodbuster and Swampbuster Programs are attempts to correct some inconsistencies of federal agricultural policies. Through commodity programs, agricultural
policy has given farmers strong financial incentives to crop as many acres as they can, including highly erodible land and wetlands. Simultaneously, several programs promote soil conservation and the preservation of the same highly erodible land and wetlands.

Under the provisions of the Sodbuster, a farmer loses all commodity program benefits if he crops highly erodible land which was not cropped before 1985. For highly erodible land that has been in production before 1985, the adoption and implementation of adequate conservation practices are required from farmers wanting to remain eligible for federal programs (National Wildlife Federation, 1994).

Besides the fact that it is aimed at wetland preservation and restoration, the Swampbuster Program is similar in design to the Sodbuster Program. Provisions of the initial Swampbuster deny a series of federal benefits to farmers who drain wetlands and transform them into agricultural land. The list of federal benefits denied includes price supports, farm storage facility loans, disaster payments, and commodity credit payments. Subsequently, the Swampbuster provisions of the 1990 Farm Bill denied benefits to farmers who drain wetlands regardless of the projected use of the land (National Wildlife Federation, 1994). Since its inception, the Swampbuster has significantly participated in slowing down the rate of wetland conversions to agriculture. However, the effectiveness of the Swampbuster provisions has been somewhat limited by the excessive number of exemptions granted (McElfish and Adler, 1990).

Cross compliance programs constitute a marked improvement from the voluntarism-based approach that was prevailing earlier in soil conservation policy (Steiner, 1990). Nevertheless, the effectiveness of cross compliance programs is contingent on
farmers participation in federal income support and commodity programs. Furthermore, the cross compliance approach to soil conservation policy has shortcomings that are similar to those of the direct regulatory approach. For instance, enforcement and monitoring of compliance requirements are difficult and very expensive. The revived interest in the incentive-based approach has provided the next generation of policy instruments to further conservation goals and remedy some of the limitations of the previous approaches.

**Incentive-based Approach**

Historically, economic incentives have played a central role in U.S. land use and soil conservation policies. Nevertheless, few have recognized the different incentive-based mechanisms that have been used. In land use policies, examples of incentive-based mechanisms include state and local level management programs with transferable development rights (TDRs) or allowing the purchase of development rights (PDRs). The Conservation Reserve Program (CRP) and the Wetlands Reserve Program (WRP) meanwhile illustrate the use of market-based incentives in federal soil conservation policies.

**State and Local Level Programs**

Economic development and the rapid expansion of many cities have been exerting continuous pressures on agricultural land. It is estimated that every year, one million acres of prime agricultural farmland is lost to urbanization in the United States (Blewett and Lane, 1988). Public concerns over the steady decline in America's agricultural land prompted private environmental groups and state and local governments to consider several farmland retention and open space protection programs.
Five major techniques have been used to preserve farmland and open space. State and local governments have relied on zoning laws, the outright purchase of the land, the transference, and the purchase of development rights. Private groups such as land trusts and national environmental organizations have participated in farmland and open space preservation by acquiring development rights mainly through conservation easements which are landowners donations (Wright, 1994).

The simplest and most direct way to prevent farmland conversion is the fee simple purchase of the land considered. However, the expensiveness of this type of policy renders it in most cases difficult to implement. For example, Boulder and Boulder County, Colorado spent 85 million dollars to buy 50 thousands acres of farmland (Wright, 1993). Zoning laws, which are policy instruments for land use management by direct regulation, simply forbid agricultural land conversion in specified areas. Their inherent reversibility (Toner, 1984), perceived unfairness to landowners, and potential for litigation are identified as some of the shortcomings of zoning laws (Wright, 1994; Daniels, 1991). Transfers and purchases of development rights constitute alternative policy instruments to the regulatory approach of zoning laws and to the expensive cost of direct purchase of the land. The transference and purchase of development rights are based on the separability of the bundle of rights associated with land ownership (Luzar and Batie, 1986). Transfers and purchases of development rights are incentive-based instruments for long term farmland retention strategies which allow landowners' compensation for restrictions placed on their property.
Under a development right transfer system, "sending" and "receiving" areas for development rights are identified. Interested parties can buy development rights from landowners in designated conservation areas, i.e., sending areas, and use them in receiving areas or locations that have been pre-approved for development (Wright, 1994). Though they have been extensively discussed, transfers of development rights have not often been used in farmland retention programs (Roddenwig and Ingrahm, 1987). The total acreage of agricultural land conserved through development right transfer schemes has been estimated at 36 thousand acres (Wright, 1994). With 24 thousands acres of farmland protected via TDRs, Montgomery County in Maryland has developed the most important TDR program in the United States (Mantell, Harper, and Propst, 1990). TDRs have also been used for the conservation of ecologically sensitive areas, the provision of low cost housing, and the preservation of heritage items (Bindon, 1992). Development rights transfer programs have been found to be cumbersome to administrate and difficult to explain (Wright, 1994).

More straightforward than the transfer of development rights, purchase of development rights programs buy limited rights, which are called easements, to preserve agricultural land (Buist et al., 1995). A PDR program is a farmland retention technique that purchases, separately, the development rights of the land (Luzar and Batie, 1986). In the United States, the first county level PDR program was implemented in Suffolk County, New York (Daniels, 1991). Though there has not been a single PDR program in the southeastern part of the U.S. until 1985 (Luzar and Batie, 1986), the use of PDRs as a farmland retention policy has been growing in popularity in recent years. By 1991, PDRs
helped preserve 205,000 acres of agricultural farmland in 11 states at a cost of $400 million (Daniels, 1991). To date, 15 states or their counties have implemented PDR programs (Buist, et al., 1995). With approximately 80,000 acres protected, Maryland has been the leading state in establishing PDR systems. Because they provide economic compensation, and, in contrast to zoning laws, are voluntary in nature, PDRs are well accepted by landowners (Daniels, 1991). In keeping with the policy intent, development of an agricultural land under a PDR system is permanently restricted (Wright, 1994).

In summary, PDR programs provide fair compensation to landowners, are flexible, voluntary, and permanent. However, despite their potential benefits, the establishment of PDR programs is hampered by the high cost of purchasing development rights (Luzar and Batie, 1986; Daniels, 1991). For example, in King County, Washington, initial development rights purchases have cost up to $8,000 an acre (Daniels, 1991). With the exception of few counties such as King County, Washington and Suffolk County, New York, few localities can afford extensive PDR programs (Wright, 1994).

Federal Programs

With the 1985 and 1990 Farm Bills, the concept of purchasing development rights has been revived. PDRs evolved from state and local level policy instruments to federal environmental management tools. More specifically, the Conservation Reserve Program and the Wetlands Reserve Program are federal purchase of development right schemes aimed at preserving highly erodible lands and wetlands, respectively.

The Conservation Reserve Program was created in the Farm Bill of 1985 and offers compensation to farmers who refrain from planting on highly erodible land. A given land's
eligibility for enrollment in the CRP is determined by its erodibility index and soil loss
tolerance level (Shoemaker, 1989). The CRP also requires that contract holders establish
a permanent vegetative cover on the enrolled farmland. Fifty percent of the cost of
establishing the permanent cover is borne by the USDA (Luzar, 1988). The agreement
between the farmer and the former ASCS, which was administering the program, is
temporary and can last up to 10 years.

Since the creation of the CRP, a total of 36 million acres of farmland have been
enrolled. The Conservation Reserve Program has significantly participated in reducing
cropland erosion in the U.S. (Dodson and McElroy, 1995). In addition, the CRP has
resulted in a marked increase in the number of farmers concerned about soil conservation
(Zinn, 1993). The CRP has also yielded several benefits to farmers including higher
farmland prices (Shoemaker, 1989) and higher crop prices resulting from the acreage idled
(Dodson and McElroy, 1995).

As a policy instrument, the temporary feature of the CRP constitutes one of its
major drawbacks. Enrollment contracts for about 22 million acres will expire by 1997.
According to a 1993 survey conducted by the Soil and Water Conservation Society, 63
percent of contract holders plan to return their farmland to production once their contracts
have expired (Collins, 1995). Thus, more than 13 million acres of highly erodible land
will be returned to production in the next three years, creating the same problem the CRP
was initially supposed to solve. The Wetlands Reserve Program, which was designed at
a later date, accounted for this shortcoming.
Traditionally, wetlands have been considered either as a source of nuisance and disease (Carey, Heimlich, and Brazee, 1990) or as obstacles to more profitable uses of the land (Wiebe, and Heimlich, 1995). Better information on their multiple roles and assessments of the benefits they provide led to a shift in public attitudes towards wetlands and prompted changes in government policies (Heimlich, 1991). According to the Section 404 permit program and the Swampbuster provision, wetlands can be broadly defined as "hydric soil that normally supports water-loving (hydrophytic) vegetation" (Carey, Heimlich, and Brazee, 1990, p.2). However, what constitutes a wetland is still a controversial matter. So far, a consensus on a single definition has not been reached.

Benefits derived from wetlands include the provision of habitat for threatened and endangered species, water quality improvement, soil erosion reduction, and flood prevention. Wetlands also provide spawning grounds for 60 to 90 percent of the nation’s commercial fisheries catches. In Louisiana, where approximatively 40 percent of the nation’s coastal wetlands are located (Bergstrom and Stoll, 1990), wetlands also serve as the foundation for its marine fishery and related economic activities including finfish, oyster, and shrimp harvests. Moreover, as a multi-attribute resource, wetlands offer a wide assortment of recreational activities such as waterfowl hunting and saltwater fishing (Gan and Luzar, 1993).

From promoting wetland conversion and drainage, government policies have evolved to giving economic incentives for wetlands preservation and restoration (Buist, 1993, Hamilton, 1994). The Wetland Reserve Program is the latest policy instrument directed towards wetlands protection. WRP adapts to wetlands the concept of purchase of

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development rights that has been used since the 1970s in farmland retention and open space preservation.

Although not commonly recognized as such, programs allowing the purchase of development rights and derived variations such as the Wetlands Reserve Program are incentive-based mechanisms. Under these systems, landowners are fully compensated for the restrictions placed on their resources. In addition, society, which constitutes the ultimate beneficiary of the imposed restrictions, is the one who pays for it. For programs such as WRP, the use of “conservation easements leaves the property in private ownership and available for other compatible economic uses while placing responsibility for funding on the public which reaps most of the benefits” (Hamilton 1994, p.118). The Wetland Reserve Program meets the criteria, identified by Opschoor and Vos (1989), that allow one to classify a policy instrument as an environmental incentive-based mechanism. The four criteria selected are "the existence of financial stimuli, the possibility of voluntary action, the involvement of government or related authorities, and, the intention of directly or indirectly preserving or improving environmental quality by applying the instrument" (Opschoor and Vos, 1989, p.14). Participation in the Wetland Reserve Program is voluntary, the government is involved through the soil conservation agencies that administer the program, the program offers financial compensation to landowners, and the goal of the program is to improve environmental quality by protecting and restoring wetlands.

Derived from county and state-level purchases of development rights, programs such as the Wetland Reserve Program are incentive-based environmental management
instruments. According to Coreil (1995), the WRP is a private landowner-oriented incentive-based program. Because they were not previously considered as such, incentive-based soil conservation policies like the Wetland Reserve Program do not readily fit in taxation (subsidization) schemes or tradeable permit systems, the two categories of incentive-based mechanisms defined earlier. However, the purchase of development rights and its recent extensions to soil conservation (CRP) and wetlands preservation and restoration (WRP) can be classified as incentive-based programs using tradable rights. In this broader class of incentive-based mechanisms, the rights to be privately owned and traded include all the marketable permits aforementioned (emission credits and permits, individual transferable quotas) and development rights whether used in a PDR scheme or traded for wetland conservation and restoration purposes. Therefore, the two broad categories of incentive-based mechanisms can be redefined as tradable rights and taxes and subsidies. Through the trading of development rights, conservation programs such as the WRP are incentive-based instruments because they "effectively create a market for remaining and restorable wetlands" (Wiebe, and Heimlich, 1995, p.13).

Summary

Incentive-based mechanisms do not constitute a panacea (Steward, 1988, Tietenberg, 1992) but they usually offer a workable alternative to efficiently control environmentally damaging activities. In many cases, the workable policy alternative is a combination of regulation and incentive-based mechanisms. Soil conservation and land use policies have evolved over time and have recently taken an incentive-based approach
to deal with issues such as agricultural farmland retention and wetland preservation and restoration.

Participation in voluntary programs may be influenced by a variety of factors, including traditional economic concerns, socio-economic characteristics, and psychographic factors. In the case of the WRP, because these programs are voluntary in nature, landowners' environmental attitudes might have an important role in explaining and predicting landowners' participation decisions. As a prerequisite to assessing the potential role of environmental attitudes in participation decisions, the following chapter will review alternative behavior evaluation approaches, including the traditional neoclassical economic and psychological economic frameworks.
CHAPTER 3

ALTERNATIVE BEHAVIOR EVALUATION APPROACHES

The evaluation, explanation, and prediction of human behavior have long been of prime interest to many scientists, especially social scientists. Depending on the discipline considered, individuals' decision making and behavior have been evaluated and predicted using a variety of paradigms and theories. Different social sciences rely on different sets of tools to analyze decision makers' behavior.

In economics, most individual decision making and behavior are explained within the neoclassical paradigm by some form of constrained optimization. Generally, profits or utility are the quantities to optimize under a given set of restrictions or constraints such as income. In a sense, economics considers decision makers as isolated maximizing (or minimizing) entities who base their decisions solely on economic considerations. Other social sciences rely on very different tools to explain and predict individual behavior. For example, disciplines like sociology, anthropology, and social psychology use means such as predispositions, socio-cultural environment, and attitudes towards the behavior considered as possible explanatory instruments.

Economics and psychology are among the main social sciences dealing with human behavior. Though economics and psychology have both originated from a common body of philosophical concepts (Hogarth and Reder, 1987), they evolved into very different disciplines following divergent paths. Differences between economics and psychology include the scope of the object of research, the data considered relevant (Hogarth and
Reder, 1987) and the investigative approach adopted (MacFayden and MacFayden, 1986). This study considers economic and social psychology approaches to evaluating and predicting behavior and proposes a synthesis of the two approaches via the inclusion of psychological variables in qualitative choice economic models.

The following section summarize the principal economic approach to behavior evaluation. Next, alternative economic approaches are reviewed. Finally, required characteristics of the social psychology perspective selected for the behavioral model of participation in conservation programs such as the Wetland Reserve Program are presented.

Economic Approaches to Behavior

Neoclassical Approach

The neoclassical economics paradigm, which is the dominant paradigm in contemporary economics, considers each individual decision maker as a "bundle of motivating preferences, combined with some procedures to translate these preferences into social acts" (Bausor, 1988, p.12). Decision makers are assumed to be rational, isolated, and maximizing individuals. In this context, decisions are viewed as resulting from a careful evaluation process during which all the available relevant information is analyzed.

Economic Rationality

Rationality is a key concept in neoclassical economics but its definition is subjected to different interpretations. Some authors suggest that economics attaches different meanings to the concept of rationality. For example, Hogarth and Reder (1987) argue that neoclassical economics offers two complementary definitions of the concept of rationality.
The first approach provides a broad definition of rationality and is extensively discussed in most consumer theory and microeconomics treatises. From this perspective, rationality is defined as a conceptual framework. This conceptual framework is generally referred to as the "rational choice paradigm." For economists, an individual decision maker's behavior is consistent with the rational choice paradigm if and only if her behavior "is in accordance with a systematic set of preferences" (Green, 1978, p.22).

Rational economic behavior is assumed to rest on three fundamental axioms. The axioms are mathematical translations of the assumptions made about how people behave (Robinson et al, 1984). Axiom one is often referred to as the completeness axiom. The completeness axiom establishes that there is a preference ordering for any pair of alternatives A and B drawn from a given set of alternatives. In other words, the decision maker prefers A to B, or B to A, or is indifferent between them (Green, 1978). The transitivity axiom is the second axiom on which the rational behavior paradigm rests. It deals with the consistency of the decision maker's preference ordering of more than two alternatives. The transitivity axiom ensures that, given three alternatives A, B, and C, if A is preferred to B, and B is preferred to C, then A must be preferred to C (Green, 1978). The third axiom, or rational choice axiom, establishes that if A is selected from a set of alternatives, then A must be at least as good as any other alternative drawn from the same set. As Green (1978) points out, this axiom is incomplete because it does not allow us to determine how an alternative was selected from a set of equivalent choices.

For practical purposes and further analyses of individual decision making in economics, the rational choice paradigm is replaced with the more precise definition of
economic rationality that is provided by the utility maximization approach. Four additional axioms are necessary in order to use the utility maximization approach, and thus derive testable hypotheses about individual decision makers' choices. This narrower and more precise concept of economic rationality is centered around individuals' utility functions. The concept of utility, which is attributed to Bernoulli (1738), refers to the level of satisfaction derived by an individual from consuming a given bundle of goods or engaging in an activity (Pindick and Rubinfield, 1992). A utility function is a mathematical function that allows the ranking of different alternatives available to an individual. An important feature of utility functions is that they only allow ordinal ranking of alternatives, i.e., they are uniquely defined only up to an order-preserving or monotonic transformation (Nicholson, 1985).

The fourth axiom, or non-satiation axiom, can be simply stated as more is preferred to less. Remaining axioms deal with desirable mathematical properties of indifference curves and of the underlying utility function. Axiom five establishes the continuity of preferences. For any two alternatives $x$ and $x'$ on the boundary set $B(x)$, the decision maker is indifferent between $x$ and $x'$. Because each boundary set, or indifference curve, represents one and only one level of satisfaction or utility, boundary sets are parallel and thus, do not intersect. The sixth axiom refers to the strict convexity of boundary sets. Axiom six makes the assumption that indifference curves are smoothly convex to the origin (Green, 1978). The regular strict quasi-concavity of the underlying utility function is a sufficient condition for the fulfillment of axiom six. The seventh and last axiom deals with the smoothness of the indifference curves. It states that along any boundary set, the
marginal rate of substitution has to be uniquely defined. Presentations of the complete set of axioms, including formal statements of the axioms, graphical illustrations, and the derivation of relevant corollaries to these axioms are provided by Green (1978) and Varian (1992).

**Rational Economic Man**

The seven axioms required for the theory of utility maximization provide the foundation for the formulation of the concept of Rational Economic Man (REM) or *Homo economicus*. Rational economic man constitutes a central feature of most economic analyses. As defined by MacFayden (1986, p.25), REM is a "selfish utility maximizer who makes completely efficient use of available information in order to select the most highly valued position open to him/her." As Simon (1987) suggests, rational economic man always makes the decision that is objectively, or substantively, the most profitable for a given utility function. Traditional neoclassical economics also assumes that REM's pursuit of the highest level of satisfaction achievable to him takes place within given and static social and institutional frameworks (Wolff and Resnick, 1987).

The notion of rational economic man and its underlying theoretical foundation, i.e., the theory of utility maximization, have significantly contributed to the development of explanatory and predictive models of human decision making processes. Furthermore, the axiomatic basis of these concepts has provided economics with a methodological rigor and conceptual cohesiveness that is lacking in many other social sciences, including psychology and social psychology (Hey, 1987; Hogarth and Reder, 1987). The relative success of the utility maximization approach has led neoclassical economists to address behavior and
choices considered outside traditional economic issues (Becker, 1981, 1993; Boland 1981; Bergstrom and Bagnoli, 1993). For this reason neoclassical economics has been described as the most imperialistic of the social sciences (Boland, 1982). Neoclassical "economic imperialism" (Swedberg, 1991) is illustrated by Becker’s contention that the economic approach can be utilized to evaluate most aspects of human behavior (1976). This view was reinforced by Hirshfield (1985) who argued that economics will gradually take over other social sciences.

Criticalisms to the Neoclassical Approach

Despite its wide domain of application and its widespread acceptance by economists, the neoclassical approach to human behavior is not without shortcomings and has been criticized for a variety of reasons. The neoclassical approach to human behavior has been considered as amoral and unrealistic (Thurrow, 1983; Allvine and Tarpley, 1977; Wilber and Jameson, 1983) as well as simplistic and lacking structure (Sen, 1977; Hirschman, 1985). The neoclassical paradigm has also been criticized for its psychological naivete (Lutz and Lux, 1979). Neoclassical economics has also been scrutinized for its inability to offer a theoretical justification for the content or shape of the utility function (Simon, 1987). Simon (1963) also argues that, as a result of the information overload that the individual decision maker faces, it is impossible to truly maximize, i.e., select the very best alternative. He thus suggests that individuals select an alternative that yields a satisfactory, but not optimal, utility level. In other words, economic rationality, as viewed by Simon, is a bounded rationality.
Alternative Economic Approaches

Although the neoclassical paradigm is the dominant approach in modern economics, several other conceptual frameworks have been suggested. Alternative approaches to economics have sprung from criticisms directed to neoclassical economics. Contrary to neoclassical economics, which considers that decisions are made in an isolated, acultural, and ahistoric context, institutional economics takes into account past and present social and cultural influences. The institutional approach stresses the importance of the institutions within which a given decision maker is evolving (Cohen, 1991; Gruchy, 1987). The rational economic man is replaced by *Homo institutionalis* in this conceptual framework.

Paradigms such as the I-We paradigm (Etzioni, 1991) question the validity of an all-encompassing utility function and suggest that decision makers maximize at least two quantities, utility or pleasure (I-Utility) and morality (We-Utility). Socioeconomics, which is derived from the I-We paradigm, refutes the individualistic and utilitarian approach taken by neoclassical economics. Instead, Socioeconomics proposes an approach based on codetermination, i.e., the integration of a variety of factors ranging from societal factors to variables used by neoclassical economics (Etzioni, 1988; Etzioni and Lawrence, 1991). Socioeconomics is an emerging field in economics that combines conventional neoclassical economics with other social sciences.

Several social scientists from various disciplines have long argued that adopting a multi-disciplinary approach by integrating other social sciences would significantly improve the neoclassical approach to human behavior. For example, on the premise that
behavior is not only triggered by narrow selfishness, but also by a rich set of values and attitudes, neoclassical economists such as Becker (1976, 1991, 1993) have advocated the inclusion of constructs derived from other social sciences in economic evaluation of behavior. Leading socioeconomists (Etzioni, 1986) have suggested that economics would significantly benefit from fostering cooperation with sociologists and psychologists. Behavioral economists such as Simon (1987) compare economics without psychology to a very inefficient one-blade scissors. However, the transformation into the more effective two-blade scissors can be, it is argued, achieved by the integration of psychology to economics.

In attempting to improve the neoclassical approach to choice behavior by adding psychological constructs, the complementary psychological approach selected has to be easily integrated to the neoclassical paradigm without compromising the fundamental axioms upon which utility theory rests. In addition to providing an appropriate conceptual complement to the neoclassical approach to human behavior, the psychological theory selected has to be readily testable by allowing the economic formulation of verifiable hypotheses. The resulting combination has to preserve the conceptual integrity of both approaches. The improved analytical framework has to lend itself to empirical evaluation which constitutes the ultimate validation criterion of any meaningful economic theory.

The psychological approach considered should establish a clear relationship between attitudes and behavior. Although some social psychologists and psychologists have suggested that attitudes are not predictors of behavior (Wicker, 1969), a dominant part of the social psychology literature has established and empirically tested the
significant role that attitudes play as precursors of human behavior and choices (Ajzen and Fishbein, 1980; Ajzen, 1988; Fazio, Powell, and Williams, 1989; Heberlein, 1989; Upmeyer and Six, 1989).

The theory of reasoned action, which is a social psychological approach for evaluating and predicting human behavior, fulfills the conditions mentioned above and provides an adequate complement to the neoclassical approach to choice behavior (Ajzen and Fishbein, 1980). Prior to offering a behavioral model based on a multi-disciplinary approach integrating neoclassical economics and social psychology, the next section of this study highlights the main points of the theory of reasoned action.

A Social Psychology Approach to Behavior: The Theory of Reasoned Action

Fundamental to the social psychology literature connecting attitudes and behavior is the theory of reasoned action proposed by Ajzen and Fishbein (1980). The theory of reasoned action considers individuals as rational agents using at any given point in time the information available to them. The theory argues that an individual’s intention is the prime determinant of his behavior or action. Intentions are determined by an attitude toward the behavior and a subjective norm. Attitudes refer to "a person's judgement that performing the behavior is good or bad" (Ajzen and Fishbein, 1980, p.6). More formally, Ajzen and Fishbein (1980) define attitude as an individual’s assessment of a psychological object. A person's perception of social pressure exerted on him to perform a behavior constitutes his subjective norm (Ajzen and Fishbein, 1980). Beliefs associated with an individual’s attitude are his behavioral beliefs. Normative beliefs are defined as "beliefs underlying a person's subjective norm" (Ajzen and Fishbein, 1980, p.7). While one can
hold a multitude of beliefs about a given behavior, research suggests one typically can only concentrate on a limited number of beliefs, usually between five and nine (Miller, 1956; Ajzen, 1991). These few relevant beliefs are known as salient beliefs (Ajzen and Fishbein, 1988).

Figure 3 provides a schematic representation of the theory of reasoned action. As previously stated, behavioral intention, the precursor of actual behavior, is a function of the individual’s attitude towards the behavior as well as his subjective norm. One’s attitude towards a behavior is determined by two components which are his salient behavioral beliefs and the subjective evaluations of those beliefs (Ajzen, 1991). Similarly, one’s subjective norm is determined by his salient normative beliefs and his corresponding motivation to comply (Ajzen and Fishbein, 1988).

The model derived from the theory of reasoned action can be expressed as follows (Upmeyer and Six, 1988):

\[ B = w_1BI + (A_b)w_2 + (SN)w_3 \]  

where:

- \( B \) = Overt behavior
- \( BI \) = Behavior intention
- \( w_1 \) = Empirical weight attached to \( BI \)
- \( (A_b) \) = Attitude towards a behavior \( B \), defined as \( \sum B_i E_i \) where,
  - \( B_i \) = Belief that a behavior will lead to outcome \( I \)
  - \( E_i \) = Evaluation of expected outcome \( I \)
- \( w_2 \) = Empirical weight attached to \( A_b \)
Figure 3. Theory of Reasoned Action
Source: adapted from Madden, Hellen, and Ajzen, 1992
(SN) = Subjective norm, defined as $\sum Nb_i MC_i$ where,

\( Nb_i = \) Perceived expectation of referent I
\( MC_i = \) Motivation to comply with referent I
\( w_3 = \) Empirical weight attached to SN.

In this mathematical formulation of the theory of reasoned action, behavior is expressed as a linear function of behavioral intention, attitude towards the behavior considered, and subjective norm. Each of the explanatory variables is weighted by an empirically determined coefficient. However, nothing in the theory of reasoned action precludes one from selecting alternative functional forms, including non-linear functions, to describe the relationship between attitudes, behavioral intention, subjective norm, and observed behavior.

Extensions of the theory of reasoned action have been explored empirically and conceptually. For example, the theory of planned behavior (Ajzen, 1988) adds perceived behavioral control to the initial Fishbein-Ajzen model. Figure 4 provides a schematic representation of the theory of planned behavior. The theory of planned behavior allows a better evaluation of human behavior when individuals do not enjoy full volitional control. An individual enjoys full volitional control when participation decisions are voluntary and completely under his control. Perceived behavioral control refers to "beliefs regarding the possession of requisite resources and opportunities for performing a given behavior" (Madden, Ellen, and Ajzen, 1992, p.4). Because it allows the inclusion of additional explanatory variables (Beck and Ajzen, 1991), the theory of planned behavior is more flexible than the theory of reasoned action. For example, to account for
Figure 4. Theory of Planned Behavior
Source: Madden, Hellen, and Ajzen, 1992
the financial constraint of the decision maker, available financial resources can be included as a proxy for actual control (Beck and Ajzen, 1991).

The theory of reasoned action is not limited to a specific type of behavior and has been applied to a wide and diverse set of issues. Areas of application of the theory of reasoned action and its extensions include analyses and evaluation of leisure participation (Ajzen and Driver, 1991; 1992), dishonest behavior (Beck and Ajzen, 1991), job searching (van Ryn and Vinokur, 1990), voting choice (Watters, 1989, and class attendance (Ajzen and Madden, 1986).

Applications dealing with environmental attitudes have focused on adoption decisions. The evaluation of farmers adoption of soil conservation practices (Lynne and Rolla, 1988), and of water conservation techniques (Lynne, Casey, Hodges and Rahmani, 1994), are examples of the application of the theory of planned behavior in adoption analyses. In their study on adoption of water conservation techniques, Lynne et al. (1994) use the theory of planned behavior within a qualitative choice framework to assess Florida strawberry growers' willingness to invest in drip irrigation systems. The explanatory variables in this study included attitude, subjective norm, and perceived behavioral control measures. Interaction terms between these variables and farm size constituted the additional independent variables. The conceptual model was estimated using logit and tobit. While both models were significant, the tobit model, which used expenditures on drip irrigation as the dependent variable, yielded better results in terms of individual parameter significance. This study illustrates that with strong positive attitudes towards conservation practices, heavy influence of the community, and
perceived control in the participation choice, a farmer is more likely to adopt conservation practices.

In summary, the theory of reasoned action reviewed above considers one’s attitudes, behavioral intention, and subjective norm as the primary explanatory factors to one’s behavior. Utility maximization rests on axioms establishing desirable mathematical properties of indifference curves as well as the completeness, transitivity, and rationality of the decision maker’s preferences. Fishbein and Ajzen’s social psychological approach to behavior has been extensively tested and is compatible with the axioms upon which utility maximization rests. The neoclassical approach to behavior can be enhanced by the inclusion of psychological constructs derived from the Fishbein Azjen model. The next section will present a multi-disciplinary approach to choice behavior resulting from the integration of the theory of reasoned action and neoclassical economics.

An Economic Psychological Approach to Behavior Evaluation

Despite all of its complexities and different facets, human behavior constitutes a whole that can not be arbitrarily segmented into distinct behavior classes each studied by a separate social science. As MacFayden and MacFayden (1986, p.3) suggest, "any single theoretical approach to explaining and predicting human behavior is unduly limiting." Proponents of this perspective are at the origin of several multi-disciplinary approaches to studying and predicting human behavior. This study focuses on approaches integrating two disciplines whose ultimate goals are to predict and explain human behavior, i.e., economics and psychology.
The emerging discipline that deals with human behavior evaluation using economic and psychological methods has been referred to as behavioral economics, economic psychology, and psychological economics (Simon, 1963; MacFayden and MacFayden, 1986; Furnham and Lewis; 1986, Katona, 1980). Van Raaij (1986, p.9) offers a formal definition of behavioral economics and states that behavioral economics is "an interdisciplinary framework, within which the methods and theories from the disciplines of economics and psychology can be used to explain the economic behavior of individuals and groups." The definition applies either to economists supplementing their approach with psychological constructs or to psychologists complementing their theories with economic arguments and variables. The primary emphasis in this study is on supplementing economic analysis with psychological constructs.

Choice behavior has been suggested as constituting the major area of intersection between economics and psychology (Shapira, 1986). Because this study focuses on the evaluation of discrete choices such as technology adoption and participation decisions, the following analyses will be presented within a qualitative or discrete choice framework.

Discrete Choice Modeling

Qualitative choice modeling in economics is based on utility maximization and has traditionally considered two broad categories of explanatory variables. The first group of independent variables are the economic variables or decision variables. This group includes variables such as the different payoffs or benefits and opportunity costs associated with the alternative choices available. In the qualitative choice literature, this
first group of variables is often referred to as the alternative specific variables or mode characteristics (Amemiya, 1981), i.e., variables whose values depend on the alternative selected by the decision maker. The second group of explanatory factors are individual specific variables. Values taken by these variables are invariant to the alternative selected. These variables, which are commonly called socio-economic variables, represent distinctive features of the individual decision maker. These socio-economic factors include variables such as the age, income, gender, and education level of the individual decision maker.

In summary, within a qualitative choice framework, behavior and choice have been traditionally explained using the economic variables associated with the alternative options available and the socio-economic characteristics of decision makers. For example, in modeling the choice between alternative transportation modes, Domencich and McFadden (1975) included economic alternative specific variables such as transit walk time and auto parking charges plus operating costs, and variables like race and occupation as socio-economic factors. Attempts have been made to include additional classes of explanatory factors, including for example an environmental attitudinal measure (Luzar et al., 1995).

In this study, the evaluation of decision making and analysis of human behavior in social psychology are considered within the framework defined by the theory of reasoned action proposed by Fishbein and Ajzen (1980). The theory of reasoned action suggests that attitudes constitute the primary antecedents of behavioral intentions. Intentions are also influenced by the subjective norm, a measure of the effects of social
influences on the decision maker. Assuming that the decision maker enjoys total volitional control, behavioral intentions are in turn the principal precursors of actual behavior.

The neoclassical approach and the Fishbein-Ajzen model have been extensively used in economics and social psychology, respectively. Each approach considers a different set of relevant explanatory variables to evaluate and predict choice behavior. This study argues that a conceptually superior framework can be obtained by integrating the two approaches. By complementing traditional economic variables with psychological constructs such as attitudes, the behavioral approach proposed is expected to result in better modeling of choice behavior.

**Proposed Behavioral Model**

The overall framework proposed is illustrated by figure 5. The behavioral approach suggested combines the explanatory factors commonly used in economic modeling and independent variables used in social psychology to explain human behavior.

Neoclassical economic theory suggests that, following a careful evaluation of all the relevant information available, a decision maker will always select the alternative that allows him to maximize his economic benefits or utility. For this reason, potential economic benefits of alternative options available constitute a central explanatory factor in the behavioral approach that this study suggests. More specifically, potential net benefits, i.e., benefits minus all costs associated with a given action or choice are an important independent variable. Socio-economic characteristics of the decision maker are
Figure 5. Behavioral Model Integrating the Neoclassical Economic and Fishbein-Ajzen’s Social Psychological Approach
also included in the proposed behavioral approach because economic theory suggests that they affect the decision maker's perception of potential economic benefits. Additional explanatory variables included in this behavioral approach to human behavior are social psychological constructs derived from the theory of reasoned action.

According to the theory of reasoned action (Ajzen and Fishbein, 1980), one's attitudes and subjective norm are the main determinants of one's behavioral intention. The more positive a decision maker's attitude towards a behavior or an alternative, the more likely his intention to perform the behavior or select the alternative. One's behavioral intention is also influenced by the subjective norm, which accounts for the fact that decision makers are not isolated individuals, completely shielded from outside influence. Instead, as choice makers, decision makers are subject to social pressures and influences of family, friends, peers, cohorts, and many other groups or individuals whose opinions are valued.

Interactions between the different independent factors previously mentioned are also conceptually significant in explaining the decision making process. Explanatory variables may have positive or negative influences on one another. For example, the socio-economic characteristics of the decision maker might affect his attitude towards a given choice or behavior. Similarly, perceived potential benefits that can be derived from an alternative choice or behavior can either mitigate or reinforce the attitude towards the behavior in question. For instance, if one holds a positive attitude towards performing a given behavior, the larger the potential economic benefits associated to the behavior, the larger the inclination to perform the behavior. Alternatively, if one possesses a
negative attitude towards a given behavior, increased potential benefits may mitigate the impact of the attitude in the decision making process. While one might not readily agree to perform certain tasks, if adequately compensated, one might willingly change his opinion and do the task. The extent to which this mitigation effect of economic gains on one's negative attitude towards a behavior prevails has to be determined empirically. Regardless of how negative one's attitude towards a behavior, is there a threshold of economic benefits that will lead one to perform the behavior? Conversely, irrespective of the level of economic gains attached to a choice, is there a threshold of negative attitude, or disdain towards that behavior, that will prevent one from performing the behavior? These questions are asked to illustrate that potential economic benefits may significantly limit the weight attached to attitudes in a decision making process, and vice-versa. For the same reasons, the impact of the subjective norm on one's decision to engage in a behavior or make a choice can be amplified or restricted by potential economic gains. One's ethical inclination to do the "right thing" according to society or to persons whose opinion are valued is greatly reinforced if substantial economic gains are made in the process. In turn, behavioral intention is directly proportional to behavior. Provided that the individual decision maker enjoys complete volitional control, behavioral intention can be considered as a direct precursor to actual behavior.

In summary, the behavioral model proposed above draws from neoclassical economic theory and social psychology to consider four groups of explanatory variables. The socio-economic characteristics of the decision maker and the potential economic gains of the alternatives constitute two classes of explanatory factors that are traditionally
included in economic qualitative choice modeling. To assess the decision maker’s attitude towards the behavior considered and his subjective norm, two additional sets of explanatory variables suggested by the theory of reasoned action (Ajzen and Fishbein, 1980) are included in the behavioral model.

The explanatory ability and the predictive effectiveness of the behavioral model proposed above depend on accurate assessments of the different classes of independent variables including, decision makers’ attitudes and subjective norms. Attitude evaluation and measurement as well as behavior predictions based on the theory of reasoned action or its extensions require prior assessment of several variables. Because attitudes are defined as $A_a = \sum B_i E_i$, the behavioral beliefs ($B_i$) that a behavior will lead to outcome I and subjective evaluations ($E_i$) of expected outcome I have to be assessed prior to the computation of a given attitude ($A_a$) towards a behavior. Behavior predictions based on the theory of reasoned action must also include a measure of the subjective norm (SN). In turn, the evaluation of the normative beliefs and the associated motivations to comply are prerequisites for the assessment of the subjective norm. Additional variables are required if extensions of the theory of reasoned action are used. For the theory of planned behavior, a measure of the perceived behavioral control has to be included.

The evaluation of attitudes via the theory of reasoned action, albeit soundly grounded in the social psychology literature, requires an intensive and extensive survey format. Increased length and survey detail, in any format, might have a negative impact on the survey’s response rate and the quality of responses (Dillman, 1991). A unique survey has to be specifically designed for each and every behavior considered. To reduce
data requirements when evaluating environmental behavior, environmental attitudes suggested by the proposed conceptual model can be assessed using an alternative attitude evaluation framework and instrument which demand less information to compute and apply to a wider range of environmental behavior. The New Environmental Paradigm (NEP) and the NEP scale (Dunlap and Van Liere, 1978) offer such an alternative.

**New Environmental (Ecological) Paradigm**

The New Environmental Paradigm (NEP) proposed by Dunlap and Van Liere (1978) was prompted by a general and growing interest in public attitudes towards the environment. The NEP is based on the assumption that environmentalism implicitly challenges our essential views about nature and our relationship to it (Dunlap and Van Liere, 1978). Within the NEP framework, Van Liere and Dunlap developed 12 Likert items assessing the three belief domains of the paradigm, i.e., beliefs about our ability to disturb the balance of nature, limits to growth, and the proper role of humans in nature. The overall internal consistency and the predictive ability of the 12 Likert items allowed the authors to consider them as a single entity named the "New Environmental Paradigm Scale."

The measurement of attitudes towards the environment using NEP scales is relatively straightforward. After the administration of the survey, a score is computed for each respondent by direct summation. These scores are then evaluated using descriptive statistics, such as correlation coefficients, factor loadings, or $\alpha$ values.

Since its creation, the NEP scale has been extensively used to analyze and contrast environmental attitudes of different groups. Caron (1989) used the scale to
assess the environmental attitudes of African Americans and to compare them with those held by Caucasians. A similar study focusing on the Hispanic community has been conducted by Noe and Snow (1990). Hall's assessment of Soviets' environmental perceptions is another application of the NEP scale (1990).

The relationship between environmental attitudes and socio-economic variables constitutes another area of application of the NEP scale. In a survey paper, Van Liere and Dunlap (1980) reviewed the main social correlates of environmental attitudes hypothesized in the literature and analyzed the existing empirical evidence. They found that only education, age, and political ideology were consistently and significantly correlated with environmental attitudes. Education and age were respectively found to be positively and negatively correlated with environmental attitudes. A liberal ideology was also positively correlated with environmental attitudes. Evidence supporting correlation hypotheses between environmental attitudes and sex, occupation, or residence was not found.

The NEP scale has also been used to evaluate the relationship between environmental attitudes and environmental knowledge. Arcury (1990), for example, concluded that there is a weak but consistent positive correlation between attitudes and knowledge. The author also demonstrated that, at least for his sample, the prevailing level of environmental knowledge was very low.

Using an extended NEP scale, Kuhn and Jackson (1989) tested the temporal stability of the scales. Their study concluded that the scales were stable and could be used for inter-temporal comparisons and assessments of attitude changes over time.
Despite its usefulness and various applications, the NEP scale is not without critics. For example, its lack of grounding in the social psychology literature on attitudes has been criticized by Heberlein (1981). In addition, Albrecht, Bultena, Hoiberg, and Nowak (1982) and Geller and Lasley (1985) argue that the NEP scale is not a single entity but is instead a multidimensional construct. The multi-dimensionality of the scale is due to its initial design. All but four of the 12 Likert items were worded in a pro-environmental direction (Dunlap, Van Liere, Mertig, Catton, and Howell, 1992). This prompted researchers to use subsets of the original scale, identified in the literature as modified NEP scales (Edgell and Nowell, 1989; Arcury, Johnson, and Scollay, 1990; Luzar et al., 1995).

To correct the imbalance existing in the original scale and broaden its scope, a New Ecological Paradigm Scale was proposed by Dunlap, Van Liere, Mertig, Catton, and Howell (1992). This revised scale also gives respondents the option to answer "unsure". The revised NEP scale contains 15 questions. It was extended by including questions about exemptionalism, i.e., "the idea that humans—unlike other species—are exempt from the constraints of nature" (Dunlap et al, 1992, p.6).

Historically, environmental attitude assessment has been based on two approaches, the agreement scale (Likert) approach which gives an overall attitude measure based on a single scale, and a more conceptually grounded social psychological approach. The New Environmental (or Ecological) Paradigm and the social psychology literature on the relationship between attitudes and behavior provide alternative frameworks used to measure environmental attitudes. Attitudinal evaluation and
measurement fundamental to designing and implementing incentive-based programs may take either of the two forms, with trade-offs inherent to each. The extensive testing, documentation, and reliability of overall environmental attitudinal measures obtained through the NEP-type assessment are counterbalanced by the more data intensive but conceptually superior social psychology approach typified by the Fishbein-Ajzen approach.

Summary

This chapter has argued that traditional neoclassical economic modeling of choice behavior can be conceptually enhanced by the addition of psychological constructs such as attitudes. Behavioral economic models based on this multi-disciplinary approach include economic variables, socio-economic characteristics of decision makers, attitude and social norm measures. The derivation of attitudinal measures may either rely on the social psychological foundation offered by the theory of reasoned action or depend on a less specific but much easier measure offered by the New Environmental Paradigm scale.

The next chapter will empirically test the conceptual behavioral model presented. Following a description of the survey instrument used, the data sources and summary statistics will be presented. Then, estimation results of alternative formulations of the conceptual model presented will be reported and discussed.
CHAPTER 4

EMPIRICAL ANALYSIS

The previous chapter reviewed the neoclassical economic approach to choice behavior and proposed an alternative behavioral economic approach. The neoclassical economic approach discussed evaluates choice within the traditional utility maximization framework. The two classes of explanatory factors traditionally considered within this framework include economic factors such as benefits associated with different alternatives and socio-economic characteristics such as the decision maker’s income and age. The behavioral economic approach proposed here is multi-disciplinary, integrating neoclassical economics and social psychology. It conceptually supplements the traditional neoclassical economic approach by including psychological constructs as additional explanatory factors in the evaluation and prediction of choice behavior.

Following a presentation of a general conceptual model based on the theoretical framework proposed in the previous chapter, several empirical models are derived and discussed. Data collection procedures and instruments used, including the survey questionnaire, and sample properties are also presented. The description of the estimation techniques and the results of the empirical estimations are then presented and discussed.

**Theoretical Model**

This study evaluates wetlands owners’ voluntary decision to offer acres of wetlands for enrollment in the WRP. Within this framework, offer of participation and non-involvement in the program are the two alternative choices available to wetland
owners. Using the conceptual model developed in the previous chapter, the evaluation and prediction of discrete choice behavior such as offers of participation in the Wetland Reserve Program can be expressed in a general form as:

$$\text{Choice} = f (\text{Economic variables; Socio-economic variables; Psychological constructs})$$  \hspace{1cm} (10)

The dependent variable, choice, constitutes a measure of the participation decision or intention. The participation choice is expressed as a function of different classes of independent factors considered relevant in explaining choice behavior. Alternative expressions of the dependent variable result in different econometric modeling approaches. For example, a binary representation of the choice variable yields a dichotomous choice model. The expression of the choice dependent variable as a continuous, but restricted, variable requires the use of limited dependent modeling approaches.

The nature of the independent variables included in the model depends on the conceptual framework adopted. Within the traditional neoclassical economic approach to behavior, economic variables and socio-economic characteristics are typically two classes of explanatory variables considered. Modeling choice behavior within the expanded behavioral economic framework proposed in this study includes an additional class of independent variables, psychological constructs.
Data Collection

Survey Procedures

The primary data necessary for empirically evaluating the conceptual model presented in equation (10) were collected via a mail survey of Louisiana's wetland owners conducted by the Department of Agricultural Economics and Agribusiness of Louisiana State University in the spring of 1996. The design and implementation of the mail survey were consistent with Dillman's Total Design Method (TDM) (1991). The TDM guides questionnaire design and recommends successive mailings for improved response rates and response quality. The mail survey was composed of a combination of closed and open format questions. For the first mailing, a questionnaire, a postage-paid return envelope, and a letter identifying the purpose of the survey and intended uses of the data collected were sent to a sample of wetland owners. The second mailing consisted of a post card reemphasizing the importance of answering and returning the questionnaire. The third and final mailing targeted respondents who had not yet returned a completed survey. The correspondence sent to wetland owners in the survey process is attached in Appendix A.

The survey, which includes six major sections, is attached in Appendix A.2. The first section of the survey assessed the respondent's awareness and level of knowledge about the WRP. This section also identifies the respondent's sources of information concerning the Wetland Reserve Program. The next section elicited information about the respondent's land. Information requested in this section included the total acreage, the acreage of agricultural land, and wetlands owned by the respondent. Information on
the location and type of wetlands, the crops grown, labor, and per acre return on the
wetlands was requested.

The third section elicited information about the respondent's participation in the
Wetland Reserve Program. Questions pertaining to intentions and effective participation
in the WRP, as well as the number of acres of wetlands offered, and the per acre
compensation proposed or requested are included in this section. This section also
provided information on the major reasons for participation or non-involvement in the
WRP.

In the fourth section of the survey, the environmental attitudes of the respondents
were evaluated. Attitude assessments were either based on the New Ecological Paradigm
or the theory of reasoned action. The evaluation of environmental attitudes via the NEP
approach was done by using the standard 15 questions of the revised NEP scale. Within
the framework proposed by Ajzen and Fishbein (1980), environmental attitudes towards
participating in the WRP were measured via a series of questions eliciting behavioral
beliefs and the subjective evaluations of those beliefs. For the associated subjective norm,
normative beliefs, and the corresponding motivations to comply with these beliefs were
elicited by the remaining questions in this section. Questions about the respondents'
involvement in environmental and agricultural organizations were also included in this
section.

The fifth section of the survey gathered socio-economic information, including
respondents' age, income, gender, and level of education. A sixth and final open format
section was included in the survey to allow respondents to express their opinion, and
share their suggestions. In summary, the mail survey gathered data on the respondent’s land, level of information about the WRP, degree of participation in the WRP, environmental attitudes, and socio-economic characteristics.

Survey Sample

Three different sources provided the information necessary to build the mailing list used for this mail survey. A list of 127 Louisiana wetland owners currently active in the WRP was included. In addition, a list of 195 wetland owners who expressed to the NRCS their intention to participate in the WRP was compiled from the available WRP eligibility forms filed with the NRCS. The third component of the mailing list was provided by the Louisiana Cooperative Extension Service, which provided a list of 471 randomly selected wetland owners. Due to undeliverable addresses, 26 surveys were returned. A final mailing list of 767 wetland owners was used for the mail survey.

Survey Summary Statistics

Of the 767 surveys mailed, a total of 174 completed surveys were returned, for an overall response rate of 22.7 percent. About two-thirds of the respondents (or 133 respondents) offered to enroll in the WRP. However, only 73 respondents (or 42 percent) effectively enrolled wetlands in the WRP. Wetland owners who did not participate in the WRP represented 58 percent of the respondents. Due to item non-responses in 41 questionnaires, only 143 surveys were used in the empirical analysis, yielding an adjusted response rate of 18.64 percent. Out of these 143 respondents, only 28 (or 19.58 percent) did not offer to participate in the WRP. Frequency tables as well as a summary of descriptive statistics for the 174 surveys collected are presented in Appendix C.
Respondents to the mail survey were predominantly male (83.7 percent), owned on average, 1,118.28 acres of land, including 484.43 acres of wetlands, and were, on average 55.4 years old. The average size of wetlands offered and enrolled in the WRP were 130 acres and 72 acres, respectively. This sample is, by comparison to Louisiana’s landowners, slightly older and less male-dominated. Louisiana’s landowners are mostly male (92.7 percent) and on average are 53.5 years old (Census of Agriculture, 1992). In addition, respondents to this survey own more land than the average Louisiana farmer who in 1992, on average, owned 306 acres (Census of Agriculture, 1992). Individuals who responded to this survey are, on average, wealthier and more educated than Louisiana residents. While the average yearly income in Louisiana is $15,931 (University of New Orleans, 1994), 65 percent of the respondents reported an income equal to or greater than $45,000 a year. In Louisiana, 36.6 percent of the adult population has some college education or more. For the sample of respondents, this proportion reaches 73.7 percent (National Center for Education Statistics, 1995).

In the following sections, empirical models derived from the theoretical model previously discussed are presented. Estimation techniques used to evaluate wetland owners’ participation in the WRP in Louisiana, and empirical results are presented and discussed.

**Empirical Models**

In order to empirically evaluate the choice behavior relevant to WRP offers of participation, two approaches were considered. First, the dependent variable, choice, was expressed as a binary variable. Logit and Probit are the two appropriate econometric
approaches used in binary choice modeling. Because they essentially yield comparable results (Amemiya, 1981; Capps and Kramer, 1985; Maddala, 1991), the selection of one approach over the other is left to the discretion of the researcher. This study considered a Probit approach for the modeling of landowners’ decision to offer acres of wetlands for enrollment in the Wetland Reserve Program in Louisiana.

The second approach evaluates the level of participation of respondents. The choice dependent variable is thus represented by the number of acres of wetlands offered for enrollment by landowners willing to participate in the WRP. Acres of wetlands offered for enrollment were substituted for acres effectively enrolled in the Wetland Reserve Program following the evaluation of the characteristics of the program and the data collected. Due to budgetary constraints, several wetland owners were not afforded the opportunity to participate in the WRP. For example, out of the 174 completed surveys used in this study, one third of wetland owners who offered to participate in the WRP were denied enrollment.

Modeling landowners’ levels of participation requires another econometric approach when the dependent variable is represented by the number of acres of wetlands offered for enrollment. When a dependent variable is limited to values between zero and infinity, a censored regression, or Tobit model, constitutes the appropriate econometric approach (Amemiyia, 1994; Maddala, 1988). Because the values taken by the number of acres offered for enrollment in the WRP are restricted to the positive quadrant, zero included, landowners’ intention to participate in the WRP was modeled using a Tobit approach.
Decisions to offer participation as well as levels of participation in the WRP are conditional upon the dissemination of information. Because the Wetland Reserve Program is a well publicized federal program that has been promoted and discussed in print media, radio, television, specialized journals, and extension services, this study assumed that information pertaining to the WRP was completely disseminated. In fact, all 143 respondents used in the empirical analysis were aware of the Wetland Reserve Program (Q.1 of the survey). Thus, sample selection bias resulting from incomplete information dissemination, which is generally observed in emerging technology adoption decisions (Saha, Love, and Schwart; 1994), was not considered in this study.

Probit Models

Three alternative models of participation choices were estimated. First, an initial model including explanatory factors traditionally used in economic qualitative choice modeling was estimated. The second Probit model estimated added an overall attitudinal measure based on the New Environmental Paradigm to the initial model. The third participation choice model estimated supplemented the initial model with psychological constructs derived from the social psychological theory of reasoned action. For the three models considered in this section, the choice dependent variable was a binary variable equal to 1 if the wetland owner offered to participate in the WRP, 0 otherwise.

The estimation of the Probit models was accomplished using a maximum likelihood approach. Maximum likelihood estimators are consistent, asymptotically normally distributed, and asymptotically efficient (Judge, et al., 1988). As illustrated by the likelihood function, the estimation of Probit models via maximum likelihood
normalizes the variance to one for identification purposes (Windmeijer, 1995). Thus, a homoscedasticity assumption is not required for estimating Probit models via maximum likelihood (Aldrich and Nelson, 1984). The log likelihood function is:

\[ l = \sum_{i=1}^{T} y_i \ln F(x_i' \beta) + \sum_{i=1}^{T} (1-y_i) \ln [1 - F(x_i' \beta)] \tag{11} \]

The binary dependent variable, the explanatory variables, and the vector of parameters to estimate are represented by \( y_i \), \( x_i \), and \( \beta \), respectively. \( F \) is the standard normal cumulative distribution function (Judge, et al., 1988).

In addition to the parameter estimates, changes in probabilities, and their corresponding standard errors, a likelihood ratio test is presented for each model as a test of overall significance. The likelihood ratio test, which has a \( \chi^2 \) distribution, is derived from the maximum of the log likelihood function of the unrestricted model and the maximum of the log likelihood function of a restricted model, assuming that all the parameters except the intercept are equal to zero. The likelihood ratio is expressed as:

\[ \lambda = 2 \left[ L(\beta) - L(0) \right] \tag{12} \]

Maxima of the log likelihood functions of the unrestricted and restricted models are represented by \( L(\beta) \) and \( L(0) \), respectively (White, 1993).

Alternative \( R^2 \) measures are presented for each model. The \( R^2 \) measures reported include the Aldrich and Nelson (1984), McFadden (1974), and Veall and Zimmermann...
Formulas for these $R^2$ measures are given in equations (13) to (16). Aldrich and Nelson’s $R^2$ ($R^2_{AN}$) is computed as:

$$R^2_{AN} = \frac{\lambda}{\lambda+n}$$  (13)

The $R^2_{AN}$ is based on the likelihood ratio test statistic. However, it does not adjust for the degrees of freedom (Aldrich and Nelson, 1984). To achieve an upper limit of one, the $R^2_{vz}$ is calculated by multiplying the $R^2_{AN}$ by a correction factor (Windmeijer, 1995). Veall and Zimmermann’s $R^2$ ($R^2_{vz}$) is:

$$R^2_{vz} = \frac{\lambda}{\lambda+n} \frac{2L(0) - n}{2L(0)}$$  (14)

McFadden’s $R^2$ ($R^2_{MF}$), one of the most commonly used $R^2$ measures in qualitative choice models, is given by:

$$R^2_{MF} = 1 - \frac{L(\hat{\beta})}{L(0)}$$  (15)

When adjusted for degrees of freedom, McFadden’s $R^2$ ($R^2_{MF_A}$) is written:

$$R^2_{MF_A} = 1 - \frac{L(\hat{\beta})(n-k)}{L(0)(n-1)}$$  (16)

Although the $R^2_{MF}$ and $R^2_{MF_A}$ lie within the [0, 1] interval, they cannot be used as a measure of explained variation because, in addition to the second moments, they involve all the characteristics of the distribution (Laitila, 1993).
No one $R^2$ measure is universally accepted and used as a goodness-of-fit measure. The suggested approach is to base the evaluation of qualitative choice models on several measures when evaluating qualitative choice models (Amemiya, 1981; Laitila, 1993).

The Akaike information criterion (AIC), which is a simple way to compare nested models while adjusting for their respective degrees of freedom, is also reported. The model with the smallest AIC is preferred. The AIC is written as (Amemiya, 1981):

$$AIC = -L(\beta) + k$$

The sample size and number of parameters estimated are represented by $n$ and $k$, respectively.

Apart from indicating the direction of the influence of a variable on the participation choice, parameter estimates do not have any direct economic interpretation. Thus, the marginal changes in probabilities and their standard errors are also reported.

The changes in probabilities, as computed in Judge, et al., (1988) are the partial derivatives of the probability function evaluated at each independent variable's sample mean, are expressed as:

$$\frac{\partial P}{\partial X_j} = f(x'\beta) \beta_j$$

The probability distribution function of the standard normal, vectors of sample means and parameter estimates, and the coefficient corresponding to the independent variable considered are represented by $f$, $x$, $\beta$, and $\beta_j$, respectively. Standard errors reported for
the changes in probabilities were computed using a linear approximation. They were obtained by multiplying each parameter estimate by the value of $f(x\beta)$. A more precise approach to computing standard errors for the changes in probability would be to account for the nonlinearity of the relationship between parameter estimates and probability changes using bootstrapping techniques. (Krinsky and Robb 1986; Efron, 1987). A linear approximation can lead to a significant underestimation of the standard errors. As illustrated by Krinsky and Robb (1986), the linear estimates of the standard errors can be ten times smaller than bootstrap values.

**Neoclassical Economic Model**

The basic Probit model estimated to evaluate wetlands owners' participation choices expresses the choice dependent variable as a function of economic and socio-economic variables. This initial Probit model is given as:

\[
\text{OFFERWRP} = f(L\text{TOTAL}, L\text{WET}, \text{REVENUE}, \text{KNOWRP}, \text{INFOWRP}, \text{WETFARM}, \text{CROP}, \text{ENVORG}, \text{GENDER}, \text{EDUCATE}, \text{RESIDE}, \text{LAGE}, \text{DEPEND}, \text{INCOME}, \varepsilon)
\]

(19)

where:

- **OFFERWRP** = 1 if the wetland owner offered acres for enrollment in WRP; 0 otherwise
- **LTOTAL** (+) = Total acreage owned (expressed in log form)
- **LWET** (+) = Acres of wetlands owned (expressed in log form)
- **REVENUE** (-) = 1 if the respondent's yearly average net return per acre increased or stayed the same; 0 otherwise
KNOWRP (+) = 1 if the respondent learned about the WRP from the extension service; 0 otherwise

INFOWRP (+) = 1 if the respondent has at least a good knowledge about WRP; 0 otherwise

WETFARM (+) = 1 if the respondent owns farmed wetlands; 0 otherwise

CROP (+) = 1 if respondent grows soybeans; 0 otherwise

ENVORG (-) = 1 if the respondent does not belongs to an environmental organization; 0 otherwise

GENDER (+-) = Respondent's gender; 1 if male; 0 otherwise

EDUCATE (-) = Respondent’s education level; 1 if at least attended college; 0 otherwise

RESIDE (+-) = Respondent’s residence; 1 if respondent resides in a city of more than 10,000 people; 0 otherwise

LAGE (-) = Respondent’s age (expressed in log form)

DEPEND (-) = Number of persons living in respondent’s household

INCOME (+) = Respondent’s income; 1 if respondent’s annual income is greater or equal to $55,000; 0 otherwise

ε = Error term

A large dispersion, as measured by the standard error, was observed for the continuous variables included in this model. In order to control the variability of the continuous variables, i.e., stabilize their variance, a non-decreasing monotonic transformation was performed so that continuous variables were expressed in logarithmic form. For each explanatory variable, the hypothesized sign of the parameter estimate is indicated in parentheses above. LTOTAL, the variable measuring the total acreage owned by the respondent, was assumed to positively affect the participation decision. It
was hypothesized that the more land a wetland owner possesses, the greater his ability to adjust his land use options and thus, the greater his willingness to participate in conservation programs such as the WRP. The same reasoning underlies the positive sign hypothesized for the estimate associated with LWET, the variable expressing the acreage of wetlands owned.

A negative sign was hypothesized for the revenue variable, REVENUE. Increased or equal returns per acre of wetlands were hypothesized to negatively affect the inclination to participate in the WRP because they lower the opportunity costs of not getting involved in the WRP. Missing data on the returned questionnaires prevented the inclusion of marginal benefits and opportunity costs of the alternative participation choices.

To capture the effect of the quality and amount of information received by respondents, two information variables were included. Variables representing the source of information and the level of knowledge about the WRP were hypothesized to positively affect participation. A wetland owner who learned about the WRP via the Louisiana Cooperative Extension Service was hypothesized to have a clearer understanding of the nature of the program and the options it offers. KNOWRP, the variable representing the respondent's source of information about the WRP, was therefore hypothesized to have a positive sign. A positive sign was also hypothesized for INFOWRP, the variable expressing the respondent's self-assessed level of information. The greater a wetland owner's level of information about the program, it was hypothesized that he would be more likely to offer to participate in the WRP.
Due to the declining trend observed in the real prices of most of the major crops grown in Louisiana (Zapata and Frank, 1995), an individual owning farmed wetlands was assumed to be more inclined to offer wetlands for enrollment in the WRP than an individual owning other types of wetlands such as bottomland hardwood forests who might anticipate an economic return on the timber. A positive sign is thus hypothesized for the variable WETFARM, specified in this model as a dummy variable, equal to 1 if the respondent owns farmed wetlands, 0 otherwise.

No a priori sign hypothesis was formulated for CROP, the dummy variable representing the main crop grown by the respondents. Its inclusion in the model determined the relationship between participation in the WRP and soybeans, the main crop grown by wetland owners in this sample. The variable CROP was specified as a dummy variable equal to 1 if the main crop grown by respondents was soybeans, 0 otherwise.

A negative sign was hypothesized for ENVORG, the variable representing the respondent's non-involvement in an environmental organization. The variable ENVORG was specified as a dummy variable equal to 0 if the respondent belong to an environmental organization, 1 otherwise. The wetland owner's involvement in an environmental organization was expected to positively affect participation in perceived environment-improving conservation programs.

Negative signs were hypothesized for EDUCATE, LAGE, and DEPEND, the variables representing the level of education, the age, and the number of people in the household, respectively. It was hypothesized that due to their greater ability to
understand the intricacies of property rights limitations inherent to the WRP, more educated wetland owners would be less inclined to offer land for enrollment in the WRP. It was also hypothesized that age would be inversely related to the decision to offer wetlands for enrollment in the WRP. Older wetland owners were hypothesized to view the property rights restrictions attached to the permanent easement as a limitation on the property that could be passed on to their heirs. Thus, a negative sign was hypothesized for the parameter estimate associated with the variable LAGE.

Similarly, it was hypothesized that the more people living in a wetland owner's household, i.e., the more dependents or potential heirs, the less likely he would be to offer wetlands for enrollment in the WRP due to the additional restrictions that the perpetual easement would impose on his heirs. A negative sign was thus hypothesized for DEPEND, the variable representing the number of people living in a wetland owner's household. It was also hypothesized that wealthier wetland owners were more flexible to explore alternative options for their property. Therefore, INCOME, the variable representing the respondent's income level, was hypothesized to have a positive effect on the decision to offer wetlands for enrollment in the WRP. To reflect characteristics of this sample for which 65 percent of the wetland owners had an annual income of at least $55,000, INCOME was defined as a dummy variable equal to 1 if the respondent's yearly income was at least $55,000, 0 otherwise.

High intercorrelations between variables, i.e., multicollinearity, is often observed in socio-economic data. In order to test for the presence of multicollinearity which inflates the variances of the estimates, collinearity diagnostic tests based on condition
indexes were performed. Collinearity tests suggested that, for this sample, the explanatory factors selected to explain wetland owners' decision to offer to participate in the WRP were not correlated. The value of the largest condition index resulting from the principal components analysis performed was 3.54. As suggested by Belsley, Kuh, and Welsch (1980), condition indexes less than 10 indicate very mild collinearity between the variables considered. Condition indexes are listed in Appendix D.

The models were estimated using SAS (SAS Institute, 1993) and SHAZAM (White, 1993). Parameter estimates, asymptotic standard errors, changes in probabilities, the percentage of right predictions, and goodness-of-fit measures are reported in Table 4.1. The prediction success table is presented in Appendix B.1.

The likelihood ratio test (LR), which tests the null hypothesis that all the parameter estimates, except the one associated with the intercept, are different from zero, suggests that, overall, the model is significant. The value of the LR test is 46.26 with 14 degrees of freedom. At a 99 percent confidence level, the corresponding critical $\chi^2$ statistic is 29.14. The estimated model correctly predicted 84.61 percent of wetland owners' participation choices. However, while the model accurately predicted 94.7 percent of the choices for respondents who offered to participate in the WRP, it only correctly predicted 42.8 percent of the choices for wetland owners who did not offer participation. This uneven predictive ability may be due to the relatively low number of respondents who did not offer to participate in the WRP. Computed R$^2$ measures range from 0.244 for the Aldrich and Nelson's R$^2$ to 0.490 for the Veal and Zimmermann measure.
Parameter estimates for the variables LWET, INFOWRP, WETFARM, ENVORG, EDUCATE, DEPEND, and INCOME are significantly different from zero at a 90 percent confidence level. All signs on parameter estimates significantly different from zero support the a priori hypotheses previously discussed. The negative sign of the coefficients for the socio-economic variables EDUCATE and DEPEND suggests that the level of education and number of people in the household of the wetland owner adversely affect the propensity to offer wetlands for enrollment in the WRP.

The clearer understanding of the property right restrictions associated with the WRP that more educated individuals are likely to possess may help explain the negative effect of education. Similarly, wetland owners with a greater number of dependents may be less inclined to offer wetlands for enrollment due to the limitations that it would place on the land passed on to heirs. Income levels greater than $55,000 were found to positively influence offers of participation. The flexibility to explore alternative options for their land afforded to wetland owners by a high income may possibly allow them to better face the permanent and strict restrictions imposed under the WRP.

Parameter estimates were positive for LWET, INFOWRP, and WETFARM. The positive sign of the coefficients for the variables LWET, INFOWRP, and WETFARM suggests that, as hypothesized, greater acreage of wetland owned, more knowledge about the program, and the ownership of farmed wetlands have a positive effect on the decision to offer wetlands for enrollment in the WRP. The impact of permanent restrictions imposed on a portion of her land may be reduced by a respondent's ownership of larger acreage of wetlands. Declining crop prices and the opportunity to make knowledgeable
Table 4.1
Probit Maximum Likelihood Estimates for the Neoclassical Economic Model

<table>
<thead>
<tr>
<th>Variable</th>
<th>Parameter Estimates</th>
<th>Changes in Probabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Value</td>
<td>Standard Error</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>LTOTAL</td>
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<td>0.152</td>
</tr>
<tr>
<td>LWET</td>
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</tr>
<tr>
<td>REVENUE</td>
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<td>0.327</td>
</tr>
<tr>
<td>KNOWRP</td>
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<td>0.335</td>
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<td>INFOWRP</td>
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<td>0.327</td>
</tr>
<tr>
<td>WETFARM</td>
<td>0.686*</td>
<td>0.336</td>
</tr>
<tr>
<td>CROP</td>
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<td>0.315</td>
</tr>
<tr>
<td>ENVORG</td>
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</tr>
<tr>
<td>GENDER</td>
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</tr>
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<td>EDUCATE</td>
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<td>RESIDE</td>
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</tr>
<tr>
<td>CONSTANT</td>
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<td>3.275</td>
</tr>
</tbody>
</table>

N = 143    AIC = 62.587
Likelihood Ratio Test = 46.26 with 14 d.f.
Percentage of Right Predictions = 84.61 percent
R²AN = 0.244; R²MF = 0.327; R²MFA = 0.253; R²VZ = 0.490
*Estimates significant at a 90 percent confidence level (critical t-statistic = 1.645)
decisions may help explain the positive effect of the ownership of farmed wetlands and greater levels of information on participation offers.

Changes in probabilities reported in Table 4.1 provide information on the marginal effect of each independent variable on the decision to offer wetlands for enrollment in the WRP. For example, in the case of the dummy variable EDUCATE representing the respondent’s level of education, the probability that highly educated wetland owners will offer acres for enrollment in the WRP, ceteris paribus, is approximately 0.20 lower than if wetland owners did not attend college. For continuous variables, changes in probabilities are interpreted as the effect on the decision to offer wetlands for enrollment in the WRP associated with a one unit change of the explanatory factor considered. For example, a one unit increase in the variable DEPEND, which indicates the number of people living in the respondent’s household, will result in a 0.056 decrease in the probability to offer acres of wetlands for enrollment in the WRP.

Behavioral Model with NEP Measure

The second model estimated extended the neoclassical economic model presented in equation (19) by including a psychological construct developed to measure environmental attitudes. This specification used the NEP framework to derive the measure of environmental attitudes. In addition to the variables included in the neoclassical economic model, the behavioral model with the NEP measure uses an environmental attitudinal measure derived from the revised New Environmental Paradigm, or New Ecological Paradigm. The behavioral model with NEP can be formally expressed as:
OFFERWRP = $F(L\text{TOTAL}, L\text{WET}, R\text{EVENUE}, K\text{NOWRP}, I\text{NFL\text{OWRP}}, W\text{ETFARM}, C\text{ROP}, E\text{NVORG}, G\text{ENDER}, E\text{DUCATE}, R\text{ESIDE}, L\text{AGE}, D\text{EPEND}, I\text{NCOME}, L\text{NEP}, \epsilon) \quad (20)$

where:

OFFERWRP = 1 if the wetland owner offered acres for enrollment in WRP; 0 otherwise

$L\text{TOTAL} (+) =$ Total acreage owned (expressed in log form)

$L\text{WET} (+) =$ Acres of wetlands owned (expressed in log form)

$R\text{EVENUE} (-) =$ 1 if the respondent’s yearly average net return per acre increased or stayed the same; 0 otherwise

$K\text{NOWRP} (+) =$ 1 if the respondent learned about the WRP from an extension service; 0 otherwise

$I\text{NFL\text{OWRP}} (+) =$ 1 if the respondent has at least good knowledge about WRP; 0 otherwise

$W\text{ETFARM} (+) =$ 1 if the respondent owns farmed wetlands; 0 otherwise

$C\text{ROP} (+ -) =$ 1 if respondent grows soybeans; 0 otherwise

$E\text{NVORG} (-) =$ 1 if the respondent does not belongs to an environmental organization; 0 otherwise

$G\text{ENDER} (+ -) =$ Respondent’s gender; 1 if male; 0 otherwise

$E\text{DUCATE} (-) =$ Respondent’s education level; 1 if at least attended college; 0 otherwise

$R\text{ESIDE} (+ -) =$ Respondent’s residence; 1 if respondent resides in a city of more than 10,000 people; 0 otherwise

$L\text{AGE} (-) =$ Respondent’s age (expressed in log form)

$D\text{EPEND} (-) =$ Number of persons living in respondent’s household

$I\text{NCOME} (+) =$ Respondent’s income; 1 if respondent’s annual income is greater or equal to $55,000; 0 otherwise
LNEP (+) = Respondent's environmental attitude measured by the log value of the NEP score

ε = Error term

The variables and signs hypotheses for the original explanatory factors used in the neoclassical economic model are consistent with this model. LNEP, the variable expressing the environmental attitude of the wetland owner, as measured by the revised New Environmental Paradigm scale, is added in this model. The NEP scale contains a set of 15 questions formulated either in a pro-environmental fashion or in anti-environmental manner. Questions formulated in a pro-environmental fashion were scored using a 1 to 5 Likert scale, with 5 for "strongly agree", 4 for "agree", 3 for "uncertain", 2 for "disagree", and, 1 for "strongly disagree". As suggested by Lynne, et al. (1994) and Luzar, et al. (1995), the NEP score of individuals displaying positive environmental attitudes was maximized by reversing the Likert scale for the scoring of questions presented in an anti-environmental fashion. For each respondent, the NEP score was obtained by summing the 15 individual scores. The variable LNEP is the log value of the respondents' NEP-derived score. A positive sign was hypothesized for the parameter estimate corresponding to LNEP. Considering the proposed beneficial effect of the WRP on the environment, it was hypothesized that the more positive a wetland owner's overall environmental attitude as measured by the NEP, the more likely she is to offer wetlands for enrollment in the WRP. The largest condition index obtained from the principal component analysis performed was 3.625, suggesting that there was no
serious multicollinearity problem within the set of regressors used in this model. Condition indexes are listed in Appendix D.

Parameter estimates, standard errors, changes in probabilities, and the percentage of right predictions are presented in Table 4.2. The likelihood ratio test suggests that, overall, the model is significant. The value of the LR test is 53.6 with 15 degrees of freedom. At a 99 percent confidence level, the corresponding critical $\chi^2$ statistic is 30.58. Goodness-of-fit measures are also reported in Table 4.2, ranging from 0.273 for the Aldrich and Nelson's R$^2$, to 0.549 for the Veall and Zimmermann R$^2$ measure. This model specification correctly predicted 84.61 percent of the wetland owners' participation choices. As indicated by the prediction success table presented in Table B.2, participation choices for respondents who offered to enroll in the WRP were more accurately predicted than choices made by respondents who did not offer to participate in the program. The prediction success rates for participants and non-participants were 93.91 percent and 46.42 percent, respectively. These unbalanced success rates may be due to the limited number of respondents who did not offer to participate in the WRP.

At a 90 percent confidence level, parameter estimates for the variables LWET, INFOWRP, WETFARM, ENVORG, EDUCATE, DEPEND, INCOME, AND LNEP are significantly different from zero. Parameter estimates are consistent, in sign and magnitude, with the coefficients of the neoclassical economic model presented earlier. The positive signs of the estimates corresponding to the variables INFOWRP, WETFARM, and INCOME suggest that the level of information about the WRP, the ownership of farmed wetlands, and high levels of income have a positive effect on the
Table 4.2
Probit Maximum Likelihood Estimates for the Behavioral Model with NEP

<table>
<thead>
<tr>
<th>Variable</th>
<th>Parameter Estimates</th>
<th>Changes in Probabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Value</td>
<td>Standard Error</td>
</tr>
<tr>
<td>LTOTAL</td>
<td>-0.139</td>
<td>0.156</td>
</tr>
<tr>
<td>LWET</td>
<td>0.198*</td>
<td>0.115</td>
</tr>
<tr>
<td>REVENUE</td>
<td>0.126</td>
<td>0.345</td>
</tr>
<tr>
<td>KNOWRP</td>
<td>0.253</td>
<td>0.352</td>
</tr>
<tr>
<td>INFOWRP</td>
<td>1.207*</td>
<td>0.337</td>
</tr>
<tr>
<td>WETFARM</td>
<td>0.882*</td>
<td>0.362</td>
</tr>
<tr>
<td>CROP</td>
<td>0.056</td>
<td>0.325</td>
</tr>
<tr>
<td>ENVORG</td>
<td>-0.895*</td>
<td>0.432</td>
</tr>
<tr>
<td>GENDER</td>
<td>-0.754</td>
<td>0.594</td>
</tr>
<tr>
<td>EDUCATE</td>
<td>-1.186*</td>
<td>0.497</td>
</tr>
<tr>
<td>RESIDE</td>
<td>0.462</td>
<td>0.385</td>
</tr>
<tr>
<td>LAGE</td>
<td>-0.799</td>
<td>0.747</td>
</tr>
<tr>
<td>DEPEND</td>
<td>-0.331*</td>
<td>0.151</td>
</tr>
<tr>
<td>INCOME</td>
<td>1.009*</td>
<td>0.458</td>
</tr>
<tr>
<td>LNEP</td>
<td>2.243*</td>
<td>0.863</td>
</tr>
<tr>
<td>CONSTANT</td>
<td>-3.804</td>
<td>4.599</td>
</tr>
</tbody>
</table>

N = 143  AIC = 59.912
Likelihood Ratio Test = 53.61 with 15 d.f.
Percentage of Right Predictions = 84.61 %
$R^2_{AN} = 0.273; R^2_{MF} = 0.379; R^2_{MP} = 0.305; R^2_{VZ} = 0.549$
*Estimates significant at a 90% confidence level (critical t-statistic = 1.645)
decision to offer wetlands for enrollment in the WRP. Negative coefficients attached to the variables ENVORG, EDUCATE, and DEPEND indicate that individuals who do not belong to environmental organizations, highly educated respondents, and wetland owners with more people living in their household are less likely to offer acres of wetlands for enrollment in the WRP.

The estimated coefficient for LNEP, the variable measuring respondents’ environmental attitudes via the NEP scale, is positive and significantly different from zero. Thus, as hypothesized for this model specification, the NEP-derived attitudinal measure is a meaningful explanatory factor for the evaluation of respondents’ decision to offer acres of wetlands for enrollment in the WRP. The greater the NEP-based score, i.e., the more positive a respondent’s environmental attitude, the more inclined she is to offer to participate in the WRP.

Changes in probabilities, also reported in Table 4.3, were comparable to those computed for the initial model. For example, increases in the probability to offer to participate in the WRP due to a change in income levels were 0.166 and 0.163 for the initial model and model including an NEP-derived attitude, respectively.

Values of the Akaike information criterion for the model with an NEP measure and the model based on the neoclassical approach suggest that the model with NEP slightly outperforms the initial model in explaining respondents’ decisions to offer to participate in the WRP. Calculated values of the AIC for the initial model and the model with NEP are 62.587 and 59.912, respectively.
Behavioral Model with Attitude and Subjective Norm Measures

The third Probit model estimated complements the neoclassical economic approach by including psychological constructs derived from the social psychological theory of reasoned action. Instead of the general environmental attitude measure considered in the NEP-based approach, this model specification uses specific measures of attitudes and subjective norm towards offering acres of wetlands for enrollment in the WRP. The behavioral economic model including attitude and subjective norm measures is:

\[
\text{OFFERWRP} = F (\text{LTOTAL}, \text{LWET}, \text{REVENUE}, \text{KNOWRP}, \text{INFOWRP}, \text{WETFARM}, \text{CROP}, \text{ENVORG}, \text{GENDER}, \text{EDUCATE}, \text{RESIDE}, \text{AGE}, \text{DEPEND}, \text{INCOME}, \text{ATTITUDE}, \text{SUBNORM}, e)
\]

where:

- \( \text{OFFERWRP} \) = 1 if the wetland owner offered acres for enrollment in WRP; 0 otherwise
- \( \text{LTOTAL} \) (+) = Total acreage owned (expressed in log form)
- \( \text{LWET} \) (+) = Acres of wetlands owned (expressed in log form)
- \( \text{REVENUE} \) (-) = 1 if the respondent's yearly average net return per acre increased or stayed the same; 0 otherwise
- \( \text{KNOWRP} \) (+) = 1 if the respondent learned about the WRP from an extension service; 0 otherwise
- \( \text{INFOWRP} \) (+) = 1 if the respondent has at least good knowledge about WRP; 0 otherwise
- \( \text{WETFARM} \) (+) = 1 if the respondent owns farmed wetlands; 0 otherwise
- \( \text{CROP} \) (+-) = 1 if respondent grows soybeans; 0 otherwise
ENVORG ( - ) = 1 if the respondent does not belong to an environmental organization; 0 otherwise

GENDER ( + - ) = Respondent's gender; 1 if male; 0 otherwise

EDUCATE ( - ) = Respondent's education level; 1 if at least attended college; 0 otherwise

RESIDE ( + - ) = Respondent's residence; 1 if respondent resides in a city of more than 10,000 people; 0 otherwise

LAGE ( - ) = Respondent's age (expressed in log form)

DEPEND ( - ) = Number of persons living in respondent's household

INCOME ( - ) = Respondent's income; 1 if respondent's annual income is greater or equal to $55,000; 0 otherwise

ATTITUDE (+) = Respondent's attitude towards enrolling wetlands in the WRP

SUBNORM (+) = Respondent's subjective norm for enrolling wetlands in the WRP

\( \varepsilon \) = Error term

The explanatory factors and the corresponding sign hypotheses, indicated in parentheses above, are consistent with the previous model specifications. ATTITUDE, the variable representing respondents' attitudes towards enrolling wetlands in the WRP was computed based on respondents' behavioral beliefs and belief evaluations elicited in the mail survey. Similarly, the assessment of wetland owners' subjective norms was based on their normative beliefs and the associated motivations to comply with those beliefs. Questions eliciting behavioral and normative beliefs were scored using a 1 to 5 unipolar scale. As suggested by Ajzen (1991), questions eliciting belief evaluations and
motivations to comply were score based on a -2 to +2 bipolar scale. The attitudinal measure was obtained by summing the behavioral beliefs weighted by their associated evaluations. ATTITUDE, the variable included in this model, is the logged value of the attitudinal measure. The subjective norm variable, SUBNORM, was constructed via a weighted sum of normative beliefs and corresponding motivations to comply. The subjective norm variable was not logged because of the presence of a large number of negative values. Because all condition indexes obtained from the principal component analysis performed were inferior to 10, it was concluded that severe multicollinearity problems were not present within the variables used in this model. Condition numbers are reported in Appendix D.

It was hypothesized that positive attitudes towards enrolling wetlands in the WRP would significantly reinforce the decision to offer to participate in an environment-preserving program such as the Wetland Reserve Program. Thus, a positive sign was expected for ATTITUDE, the attitudinal variable. Due to the perceived beneficial effect of the WRP on wetlands preservation and restoration, a positive sign was also hypothesized for the measure of subjective norm, SUBNORM.

Estimation results, including coefficients, asymptotic standard errors, and changes in probabilities are presented in Table 4.3. The prediction success table is presented in Table B.3. The value of the calculated likelihood ratio test, 53.80 with 16 degrees of freedom, suggests that the model presented is, overall, significant at a 99 percent confidence level. The corresponding \( \chi^2 \) statistic is 32.0. The percentage of right predictions is 88.11 percent. As in previous model specifications, participation choices
for respondents who offered to enroll in the WRP were more accurately predicted. The respective prediction success rates for respondents who offered to participate and those who did not offer to enroll in the WRP were 96.52 percent and 53.57 percent, respectively. Alternative R² measures, also reported in Table 4.3, range from an Aldrich and Nelson R² of 0.273 to a Veall and Zimmermann R² of 0.549.

Coefficients for this model specification are consistent with parameter estimates obtained for the first two Probit models estimated. For example, the variables LWET, INFOWRP, WETFARM, ENVORG, EDUCATE, DEPEND, and INCOME are significantly different from zero at the 90 percent confidence level. The positive relationship between the variables LWET, INFOWRP, WETFARM, and INCOME, suggests that information about the WRP, ownership of farmed wetlands, as well as high levels of income positively affect wetland owners’ decisions to offer to participate in the WRP.

However, different from previous models, RESIDE, the variable representing the place of residence of the wetland owner, is positive and significantly different from zero. This result suggests that, for this sample, wetland owners residing in cities of more than 10,000 inhabitants are more likely to offer participation in the WRP than individuals residing in small towns. Although it did not affect the signs and order of magnitude of other significant parameters, the significance of the estimate for the variable RESIDE is problematic because it indicates the presence of model misspecification. The inclusion of economic variables such as benefits and opportunity costs associated with alternative
Table 4.3
Probit Maximum Likelihood Estimates for the Behavioral Model with Measures of Attitude and Subjective Norm Derived from the Theory of Reasoned Action

<table>
<thead>
<tr>
<th>Variable</th>
<th>Parameter Estimates</th>
<th>Changes in Probabilities</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Value</td>
<td>Standard Error</td>
</tr>
<tr>
<td>LTOTAL</td>
<td>-0.246</td>
<td>0.156</td>
</tr>
<tr>
<td>LWET</td>
<td>0.200*</td>
<td>0.122</td>
</tr>
<tr>
<td>REVENUE</td>
<td>0.356</td>
<td>0.352</td>
</tr>
<tr>
<td>KNOWRP</td>
<td>0.415</td>
<td>0.357</td>
</tr>
<tr>
<td>INFOWRP</td>
<td>1.380*</td>
<td>0.363</td>
</tr>
<tr>
<td>WETFARM</td>
<td>0.775*</td>
<td>0.357</td>
</tr>
<tr>
<td>CROP</td>
<td>-0.049</td>
<td>0.327</td>
</tr>
<tr>
<td>ENVORG</td>
<td>-0.877*</td>
<td>0.432</td>
</tr>
<tr>
<td>GENDER</td>
<td>-0.933</td>
<td>0.592</td>
</tr>
<tr>
<td>EDUCATE</td>
<td>-1.310*</td>
<td>0.508</td>
</tr>
<tr>
<td>RESIDE</td>
<td>0.669*</td>
<td>0.402</td>
</tr>
<tr>
<td>LAGE</td>
<td>-0.792</td>
<td>0.771</td>
</tr>
<tr>
<td>DEPEND</td>
<td>-0.357*</td>
<td>0.156</td>
</tr>
<tr>
<td>INCOME</td>
<td>0.905*</td>
<td>0.456</td>
</tr>
<tr>
<td>ATTITUDE</td>
<td>0.358*</td>
<td>0.179</td>
</tr>
<tr>
<td>SUBNORM</td>
<td>0.019</td>
<td>0.012</td>
</tr>
<tr>
<td>CONSTANT</td>
<td>4.912</td>
<td>3.479</td>
</tr>
</tbody>
</table>

N = 143   AIC = 60.815
Likelihood Ratio Test = 53.80 with 16 d.f.
Percentage of Right Predictions = 88.11 percent
$R^2_{AN} = 0.273; R^2_{MF} = 0.380; R^2_{MFA} = 0.301; R^2_{VZ} = 0.549$
 Estimates significant at a 95 percent confidence level (critical t-statistic = 1.64)
participation decisions may add the critical information omitted and resolve this issue. In this study, missing data precluded inclusion of this information in the models.

The parameter estimate for ATTITUDE, the variable measuring respondents' attitudes towards offering wetlands for enrollment in the WRP, is positive and significantly different from zero at a confidence level of 90 percent. Thus, as hypothesized, the more positive a respondent's attitude towards offering wetlands for enrollment in the WRP, the more likely she would be to offer to participate in the WRP. The parameter for the subjective norm associated with the attitude towards offering to participate in the WRP, although positive, is not significantly different from zero. The non-significance of the SUBNORM parameter estimate suggests that, despite the perceived environment-improving quality of the WRP, social pressure does not constitute a relevant explanatory factor for the evaluation of wetland owners' offers to participate in the WRP. The decision to offer wetlands for enrollment in the WRP appears for this sample to be a privately based decision.

Calculated AIC values for the neoclassical model and the model including measures of attitude and subjective norm are 62.587 and 60.815, respectively. The model with attitude and subjective norm is thus preferred to the initial model. However, based on different R² measures, the comparison of the two behavioral models estimated was inconclusive. The two models yielded comparable or equal R²'s depending on the measure considered. For example, the Aldrich and Nelson's and Veall and Zimmermann's R² measures were, for both models, 0.273 and 0.549, respectively.
The Probit model based on the neoclassical economic approach as well as the two behavioral economic models including alternative attitudinal measures, overall, significantly explained the decision to offer to participate in the WRP. In the model specifications presented, the sign and magnitude of parameter estimates for the original explanatory variables initially included in the neoclassical economic model were consistent. A positive relationship was found between the decision to offer wetlands for enrollment in the WRP and the level of information about the WRP, the ownership of farmed wetlands, and income. Education and the number of people living in the respondent’s household were found to negatively influence the decision to offer participation in the WRP. Sensitivity analyses performed for different values of income and education showed that the sign of the influence of higher levels of education and income were invariant to the threshold value selected.

The NEP-based general environmental attitude and the specific computed attitude towards offering enrollment in the WRP were both found to be significant explanatory factors in the evaluation of wetland owners’ decision to offer to participate in the WRP. However, the respective percentage of right predictions and alternative $R^2$ measures for the models presented suggest that the two models including attitudinal variables resulted in only a marginal improvement in the neoclassical model. The comparison between the behavioral economic model including psychological constructs derived from the theory of reasoned action and the model with the NEP measure was inconclusive because they yielded equivalent $R^2$ measures.
In following sections, a continuous representation of the participation decision variable is substituted for the initial dichotomous expression of the decision to offer wetlands for enrollment in the WRP. The econometric approach corresponding to this approach, and estimation results are presented and discussed.

Tobit Models

Offers to participate, the dependent variable, is expressed in this section as a continuous, but censored variable. The number of acres of wetlands offered for enrollment in the WRP is used as an indicator of respondents' level of participation in the WRP. Acres of wetlands offered constitutes a censored variable because it either equals zero for respondents who did not offer any wetlands for enrollment or takes positive values for respondents who offered to enroll in the WRP. Censored regression or Tobit models are the appropriate class of econometric models to consider when the dependent variable is censored (Amemiya, 1984; Hellerstein, 1992). Censored regressions provide more information than dichotomous choice models. Contrary to binary choice models which only evaluate the participation decisions, censored regressions evaluate the level at which respondents offered wetlands for enrollment in the WRP.

Maximum likelihood estimation techniques are used to estimate the three models in this section. The log likelihood function is (Judge, et al., 1988):

\[
L = \sum_o \ln (1-F) - \left( T/2 \right) \ln 2\pi - \left( T/2 \right) \ln \sigma^2 - \sum_t \left( y_t - x_t'\beta \right)^2 / 2\sigma^2
\]  

(22)
To allow comparison between parameter estimates, the normalized coefficients rather than the regression estimates are reported. Normalized coefficients are regression coefficients divided by the standard error of the estimate (White, 1993). A likelihood ratio test is also presented for each model. Expected values of marginal changes in the number of acres offered associated with changes in the explanatory factors are also reported. The expected value of the marginal effect of a regressor $X_i$ on the number of acres of wetlands offered is expressed as (McDonald and Moffit, 1980; Shapiro, Brorsen, and Doster, 1992):

$$\frac{\partial E(y)}{\partial X_i} = F(X \frac{\beta}{\sigma}) \beta_i$$

(23)

The cumulative distribution function of the standard normal, vectors of sample means and normalized coefficients, and the estimate for the ith regressor are represented by $F$, $X$, $\beta/\sigma$, and $\beta_i$, respectively. Standard errors associated with calculated marginal effects were obtained by linear approximation, i.e., via scaling the parameter estimates' standard errors by a factor equal to $F(X \beta/\sigma)$.

The pseudo-$R^2$ proposed for limited dependent variables by Laitila (1993) is offered as a goodness-of-fit measure due to its reliability for Tobit models (Windmeijer, 1995). Laitila's pseudo-$R^2$ measure is given by:

$$Pseudo\cdot R^2 = \frac{\beta' \sum_i \beta}{(\sigma^2 + \beta' \sum_i \beta)}$$

(24)
The vector of parameter estimates, sample covariance matrix of the regressors, and variance of the estimate are represented by $\beta$, $\Sigma$, and $\sigma^2$, respectively. The pseudo-$R^2$ can be interpreted as the proportion of explained variation of the dependent variable (Laitila, 1993) and thus, lies within the interval $[0, 1]$.

As in the previous section, three models were estimated. A neoclassical economic-based model, a behavioral economic model with an NEP-derived environmental attitude measure, and a behavioral economic model including measures of attitudes and subjective norm derived from the theory of reasoned action were estimated.

**Neoclassical Economic Model**

Within the neoclassical economic framework, the initial model specification evaluates the relationship between the number of acres offered by respondents for enrollment in the WRP and economic and socio-economic variables. The basic Tobit neoclassical model is:

$$
\text{LACWRP} = F(\text{LTOTAL}, \text{LWET}, \text{REVENUE}, \text{KNOWRP}, \text{INFOWRP}, \text{WETFARM}, \text{CROP}, \text{ENVORG}, \text{GENDER}, \text{EDUCATE}, \text{RESIDE}, \text{LAGE}, \text{DEPEND}, \text{INCOME}, \epsilon)
$$

(25)

where:

$\text{LACWRP} =$ Log of the number of acres of wetlands offered by the respondent for enrollment in the WRP

$\text{LTOTAL}$ $(+)$ = Total acreage owned (expressed in log form)

$\text{LWET}$ $(+)$ = Acres of wetlands owned (expressed in log form)

$\text{REVENUE}$ $(-)$ = 1 if the respondent’s yearly average net return per acre increased or stayed the same; 0 otherwise
KNOWRP  (+) = 1 if the respondent learned about the WRP from an extension service; 0 otherwise
INFOWRP  (+) = 1 if the respondent has at least a good knowledge about WRP; 0 otherwise
WETFARM  (+) = 1 if the respondent owns farmed wetlands; 0 otherwise
CROP ( + - ) = 1 if respondent grows soybeans; 0 otherwise
ENVORG ( - ) = 1 if the respondent does not belong to an environmental organization; 0 otherwise
GENDER ( + - ) = Respondent’s gender; 1 if male; 0 otherwise
EDUCATE ( - ) = Respondent’s education level; 1 if at least attended college; 0 otherwise
RESIDE ( + - ) = Respondent’s residence; 1 if respondent resides in a medium or large city of more than 10,000 people; 0 otherwise
LAGE ( - ) = Respondent’s age (expressed in log form)
DEPEND ( - ) = Number of persons living in respondent’s household
INCOME ( - ) = Respondent’s income; 1 if respondent’s annual income is greater or equal to $55,000; 0 otherwise
\( \epsilon \) = Error term

For this model specification, regressors, and hypothesized signs, indicated in parentheses, are consistent with the neoclassical Probit model. Estimation results, including the value of the likelihood ratio test, normalized coefficients, standard errors, and marginal effects are reported in Table 4.4.

The likelihood ratio test suggests that, at a level of confidence of 99 percent, the model estimated significantly explains the variation in the number of acres of wetlands
offered for enrollment in the WRP. The value of the LR test and the critical $\chi^2$ statistic are 177.12 with 14 degrees of freedom and 29.14, respectively. The pseudo-$R^2$, the calculated goodness-of-fit measure, indicates that this model explains 26.5 percent of the variation in the number of acres of wetlands offered for enrollment in the WRP.

At a 90 percent confidence level, parameter estimates for LWET, INFOWRP, WETFARM, and INCOME are significantly different from zero. Signs of significant estimates are consistent with the a priori hypotheses formulated. Positive coefficients are associated with the variables LWET, INFOWRP, WETFARM, and INCOME, representing the acreage of wetlands owned, the level of information about the WRP, the ownership of farmed wetlands, and income, respectively. Thus, the number of acres of wetlands offered for enrollment in the WRP increases with the acreage of wetlands owned, the level of information about the WRP, the ownership of farmed wetlands, and, the level of income. Changes in the number of acres of wetlands offered due to changes in the explanatory factors are also presented in Table 4.4. For example, the marginal effect on the number of acres offered of a unit change in LWET, the variable representing the acreage of wetlands owned, is 0.141.

**Behavioral Model with NEP Measure**

This model specification added an NEP-derived attitude measure to the basic Tobit model presented in equation (25). The behavioral model explaining the number of acres of wetlands offered for enrollment in the WRP using the NEP-based environmental attitude is:
Table 4.4
Tobit Maximum Likelihood Estimates for the Neoclassical Economic Model

<table>
<thead>
<tr>
<th>Variable</th>
<th>Normalized Coefficients</th>
<th>Marginal Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Value</td>
<td>Standard Error</td>
</tr>
<tr>
<td>LTOTAL</td>
<td>0.026</td>
<td>0.089</td>
</tr>
<tr>
<td>LWET</td>
<td>0.150*</td>
<td>0.078</td>
</tr>
<tr>
<td>REVENUE</td>
<td>0.188</td>
<td>0.191</td>
</tr>
<tr>
<td>KNWWRP</td>
<td>0.054</td>
<td>0.187</td>
</tr>
<tr>
<td>INFOWRP</td>
<td>0.559*</td>
<td>0.192</td>
</tr>
<tr>
<td>WETFARM</td>
<td>0.436*</td>
<td>0.196</td>
</tr>
<tr>
<td>CROP</td>
<td>0.156</td>
<td>0.185</td>
</tr>
<tr>
<td>ENVORG</td>
<td>-0.308</td>
<td>0.228</td>
</tr>
<tr>
<td>GENDER</td>
<td>-0.114</td>
<td>0.269</td>
</tr>
<tr>
<td>EDUCATE</td>
<td>-0.315</td>
<td>0.227</td>
</tr>
<tr>
<td>RESIDE</td>
<td>0.296</td>
<td>0.207</td>
</tr>
<tr>
<td>LAGE</td>
<td>-0.161</td>
<td>0.235</td>
</tr>
<tr>
<td>DEPEND</td>
<td>-0.099</td>
<td>0.082</td>
</tr>
<tr>
<td>INCOME</td>
<td>0.416*</td>
<td>0.238</td>
</tr>
<tr>
<td>CONSTANT</td>
<td>0.780</td>
<td>1.0964</td>
</tr>
</tbody>
</table>

N = 143
Likelihood Ratio Test = 177.12 with 14 d.f.
Pseudo-$R^2 = 0.265$
*Estimates significant at a 90 percent confidence level (critical t-statistic = 1.645)
LACWRP = F (LTOTAL, LWET, REVENUE, KNOWRP, INFOWRP, WETFARM, CROP, ENVORG, GENDER, EDUCATE, RESIDE, LAGE, DEPEND, INCOME, LNEP, ε)  \hspace{1cm} (26)

where:

- **LACWRP** = Log of the number of acres of wetlands offered by the respondent for enrollment in the WRP
- **LTOTAL (+)** = Total acreage owned (expressed in log form)
- **LWET (+)** = Acres of wetlands owned (expressed in log form)
- **REVENUE (-)** = 1 if the respondent’s yearly average net return per acre increased or stayed the same; 0 otherwise
- **KNOWRP (+)** = 1 if the respondent learned about the WRP from an extension service; 0 otherwise
- **INFOWRP (+)** = 1 if the respondent has at least a good knowledge about WRP; 0 otherwise
- **WETFARM (+)** = 1 if the respondent owns farmed wetlands; 0 otherwise
- **CROP (+-)** = 1 if respondent grows soybeans; 0 otherwise
- **ENVORG (-)** = 1 if the respondent does not belong to an environmental organization; 0 otherwise
- **GENDER (+-)** = Respondent’s gender; 1 if male; 0 otherwise
- **EDUCATE (-)** = Respondent’s education level; 1 if at least attended college; 0 otherwise
- **RESIDE (+-)** = Respondent’s residence; 1 if respondent resides in a city of more than 10,000 people; 0 otherwise
- **LAGE (-)** = Respondent’s age (expressed in log form)
- **DEPEND (-)** = Number of persons living in respondent’s household
- **INCOME (-)** = Respondent’s income; 1 if respondent’s annual income is greater or equal to $55,000; 0 otherwise
LNEP (+) = Respondent's environmental attitude measured by the log value of his NEP score

ε = Error term

Parameter estimates and the corresponding sign hypotheses are consistent with the model presented in equation (25). Normalized coefficients, asymptotic standard errors, and marginal changes in the number of acres of wetlands offered due to changes in the explanatory variables are reported in Table 4.5. Values of the likelihood ratio test and the critical χ² statistic, 186.76 with 15 degrees of freedom and 30.58, respectively, indicate that the model estimated is, overall, significant at a confidence level of 99 percent. The pseudo-R², with a value of 0.30, suggests that the model explains 30 percent of the variation in the number of acres of wetlands offered for enrollment.

Coefficients for LWET, INFOWRP, WETFARM, ENVORG, and LNEP, the variables representing the acreage of wetlands owned, level of information about the program, ownership of farmed wetlands, belonging to an environmental organization, and environmental attitude, respectively, are significantly different from zero at a 90 percent confidence level. For significant variables, signs of the normalized coefficients support hypotheses formulated about the influence of explanatory factors considered on the number of acres of wetlands offered for enrollment.

The positive sign of the parameter associated with LNEP, the variable measuring the NEP-based environmental attitude, supports the hypothesis that positive environmental attitudes have a significant and positive influence on the number of acres
offered. A unit increase in LNEP yields a 1.415 marginal increase in the number of acres offered for enrollment in the WRP.

**Behavioral Model with Attitudes and Subjective Norm Measures**

This model complements the specification based on the neoclassical economic approach, presented in equation (25), with psychological constructs derived from the theory of reasoned action. The Tobit model, including measures of respondents' attitude and subjective norm towards offering wetlands for enrollment in the WRP, is:

\[
LACWRP = F(LTOTAL, LWET, REVENUE, KNOWRP, INFOWRP, WETFARM, CROP, ENVORG, GENDER, EDUCATE, RESIDE, AGE, DEPEND, INCOME, ATTITUDE, SUBNORM, \epsilon) \tag{27}
\]

where:

\[
\begin{align*}
LACWRP & = \text{Log of the number of acres of wetlands offered by the respondent for enrollment in the WRP} \\
LTOTAL & = \text{Total acreage owned (expressed in log form)} \\
LWET & = \text{Acres of wetlands owned (expressed in log form)} \\
REVENUE & = 1 \text{ if the respondent's yearly average net return per acre increased or stayed the same; } 0 \text{ otherwise} \\
KNOWRP & = 1 \text{ if the respondent learned about the WRP from an extension service; } 0 \text{ otherwise} \\
INFOWRP & = 1 \text{ if the respondent has at least a good knowledge about the WRP; } 0 \text{ otherwise} \\
WETFARM & = 1 \text{ if the respondent owns farmed wetlands; } 0 \text{ otherwise} \\
CROP & = 1 \text{ if respondent grows soybeans; } 0 \text{ otherwise} \\
ENVORG & = 1 \text{ if the respondent does not belongs to an environmental organization; } 0 \text{ otherwise}
\end{align*}
\]

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Table 4.5
Tobit Maximum Likelihood Estimates for the Behavioral Model with NEP

<table>
<thead>
<tr>
<th>Variable</th>
<th>Normalized Coefficients</th>
<th>Marginal Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Value</td>
<td>Standard Error</td>
</tr>
<tr>
<td>LTOTAL</td>
<td>0.080</td>
<td>0.091</td>
</tr>
<tr>
<td>LWET</td>
<td>0.141*</td>
<td>0.078</td>
</tr>
<tr>
<td>REVENUE</td>
<td>0.158</td>
<td>0.198</td>
</tr>
<tr>
<td>KNOWRP</td>
<td>-0.027</td>
<td>0.190</td>
</tr>
<tr>
<td>INFOWRP</td>
<td>0.556*</td>
<td>0.192</td>
</tr>
<tr>
<td>WETFARM</td>
<td>0.519*</td>
<td>0.198</td>
</tr>
<tr>
<td>CROP</td>
<td>0.176</td>
<td>0.185</td>
</tr>
<tr>
<td>ENVORG</td>
<td>-0.406*</td>
<td>0.231</td>
</tr>
<tr>
<td>GENDER</td>
<td>-0.127</td>
<td>0.269</td>
</tr>
<tr>
<td>EDUCATE</td>
<td>-0.236</td>
<td>0.228</td>
</tr>
<tr>
<td>RESIDE</td>
<td>0.287</td>
<td>0.208</td>
</tr>
<tr>
<td>LAGE</td>
<td>-0.193</td>
<td>0.236</td>
</tr>
<tr>
<td>DEPEND</td>
<td>-0.090</td>
<td>0.082</td>
</tr>
<tr>
<td>INCOME</td>
<td>0.380</td>
<td>0.239</td>
</tr>
<tr>
<td>LNEP</td>
<td>1.462*</td>
<td>0.463</td>
</tr>
<tr>
<td>CONSTANT</td>
<td>-4.99</td>
<td>2.167</td>
</tr>
</tbody>
</table>

N = 143
Likelihood Ratio Test = 186.76
Pseudo-R² = 0.30
*Estimates significant at a 90 percent confidence level (critical t-statistic = 1.645)
GENDER  ( + - )  =  Respondent's gender; 1 if male; 0 otherwise
EDUCATE ( - )  =  Respondent's education level; 1 if at least attended college; 0 otherwise
RESIDE ( + - )  =  Respondent's residence; 1 if respondent resides in a city of more than 10,000 people; 0 otherwise
LAGE ( - )  =  Respondent's age (expressed in log form)
DEPEND ( - )  =  Number of persons living in respondent's household
INCOME ( + )  =  Respondent's income; 1 if respondent's annual income is greater or equal to $55,000; 0 otherwise
ATTITUDE ( + )  =  Respondent's attitude towards enrolling wetlands in the WRP
SUBNORM ( + )  =  Respondent's subjective norm for enrolling wetlands in the WRP
\( \epsilon \)  =  Error term

Regressors used in this specification and associated sign hypotheses are consistent with the model presented in equation (25). The calculated likelihood ratio test, pseudo-\( R^2 \) and estimation results, including normalized coefficients, standard errors, and marginal changes are reported in Table 4.6. The likelihood ratio test, with a calculated value of 179.84 with 16 degrees of freedom, indicates that, at a level of significance of 99 percent, the model presented is, overall significant. The corresponding critical \( \chi^2 \) statistic is 32.0. As suggested by a calculated pseudo-\( R^2 \) of 0.28, the model explains 28 percent of the variation in the number of acres offered for enrollment in the WRP.

At a 90 percent confidence level, normalized coefficients for LWET, INFOWRP, WETFARM, and RESIDE are significantly different from zero. This indicates that, for
Table 4.6
Tobit Maximum Likelihood Estimates for the Behavioral Model with Measures of Attitude and Subjective Norm Derived from the Theory of Reasoned Action

<table>
<thead>
<tr>
<th>Variable</th>
<th>Normalized Coefficients</th>
<th>Marginal Changes</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Value</td>
<td>Standard Error</td>
</tr>
<tr>
<td>LTOTAL</td>
<td>0.038</td>
<td>0.089</td>
</tr>
<tr>
<td>LWET</td>
<td>0.139*</td>
<td>0.078</td>
</tr>
<tr>
<td>REVENUE</td>
<td>0.211</td>
<td>0.192</td>
</tr>
<tr>
<td>KNOWRP</td>
<td>0.088</td>
<td>0.189</td>
</tr>
<tr>
<td>INFOWRP</td>
<td>0.590*</td>
<td>0.194</td>
</tr>
<tr>
<td>WETFARM</td>
<td>0.458*</td>
<td>0.199</td>
</tr>
<tr>
<td>CROP</td>
<td>0.128</td>
<td>0.185</td>
</tr>
<tr>
<td>ENVORG</td>
<td>-0.299</td>
<td>0.227</td>
</tr>
<tr>
<td>GENDER</td>
<td>-0.189</td>
<td>0.274</td>
</tr>
<tr>
<td>EDUCATE</td>
<td>-0.302</td>
<td>0.227</td>
</tr>
<tr>
<td>RESIDE</td>
<td>0.349*</td>
<td>0.210</td>
</tr>
<tr>
<td>LAGE</td>
<td>-0.106</td>
<td>0.238</td>
</tr>
<tr>
<td>DEPEND</td>
<td>-0.095</td>
<td>0.082</td>
</tr>
<tr>
<td>INCOME</td>
<td>0.346</td>
<td>0.242</td>
</tr>
<tr>
<td>ATTITUDE</td>
<td>0.127</td>
<td>0.102</td>
</tr>
<tr>
<td>SUBNORM</td>
<td>0.005</td>
<td>0.006</td>
</tr>
<tr>
<td>CONSTANT</td>
<td>0.306</td>
<td>1.133</td>
</tr>
</tbody>
</table>

N = 143
Likelihood Ratio Test = 179.84
Pseudo-R² = 0.28
* Estimates significant at a 90 percent confidence level (critical t-statistic = 1.645)
this model specification, variables representing the acreage of wetlands owned, the level of information about the WRP, the ownership of farmed wetlands, and the place of residence of the respondents are the only significant factors in explaining the extent to which wetland owners offer participation in the WRP. The positive sign of these parameter estimates implies that they have a positive influence on the number of acres offered for enrollment in the WRP.

Contrary to hypotheses formulated, parameter estimates for the psychological constructs included in this model, although positive, are not significantly different from zero. Thus, for this model, measures of attitude and subjective norm derived from the theory of reasoned action are not meaningful in explaining the level to which wetland owners offered to participate in the WRP.

**Summary**

This chapter has presented a general conceptual model based on the theoretical framework for the evaluation of choice behavior developed in Chapter 3. Data required to empirically evaluate the conceptual model were obtained through a mail survey of a sample of 767 Louisiana wetland owners. The mail survey, which was administered following guidelines suggested by Dillman's Total Design Method, gathered information on wetland owners' land, level of information about the WRP, degree of participation in the WRP, environmental attitudes, and socio-economic characteristics.

Three alternative formulations of the general conceptual model were derived to analyze wetland owners' decisions to offer to participate in the WRP or to explain the rate at which they offered to participate. Wetland owners' decisions to offer to participate
in the WRP were evaluated using a Probit approach. The rate at which wetland owners offered to participate in the WRP was explained via a Tobit, or censored regression, approach.

Maximum likelihood was used to estimate three empirical models evaluating wetland owners' decisions to offer to participate in the WRP. A model based on the neoclassical economic approach to choice behavior, i.e., a model considering economic variables and socio-economic characteristics of respondents was initially estimated. Two models, extending the initial model by including either an NEP-based environmental attitude measure or measures, derived from the theory of reasoned action, of attitudes and subjective norm towards offering wetlands for enrollment in the WRP were also estimated. At a 99 percent confidence level, the three Probit models estimated were, overall, significant in explaining the variation observed in wetland owners' decisions to offer to participate in the WRP.

Across the three specifications, t-ratios indicated that at a 90 percent confidence level, parameter estimates for variables representing the acreage of wetlands owned, the level of information about the WRP, the ownership of farmed wetlands, the respondents' involvement in environmental organizations, education level, income, and the number of people living in the household were significant factors in explaining the decision to offer enrollment in the WRP. Signs of the estimates suggested that, apart from the level of education and the number of people in the respondents' household which had a negative effect on the probability to offer participation in the WRP, significant factors positively influenced wetland owners' decisions to offer to participate in the WRP.
Changes in the threshold values for education and income did not affect the signs of the influence of these explanatory factors on the decision to offer to participate in the WRP.

Coefficients for variables representing the NEP-based environmental attitude as well as the calculated attitude towards offering to participate in the WRP were significant and positive. Consistent with hypotheses formulated, positive environmental attitudes increased the likelihood of offering to participate in the WRP.

The representation of the choice dependent variable as a continuous, but censored, variable warranted the use of a Tobit maximum likelihood estimation in evaluating the rate at which landowners offered to participate in the WRP. The substitution of the number of acres of wetlands offered for the binary variable expressing the offer to participate yielded three additional model specifications.

At a 99 percent confidence level, likelihood ratio tests suggested that, overall, the three Tobit models estimated were significant. As indicated by the pseudo-$R^2$, the model with an NEP-derived environmental attitude measure was the most effective in evaluating the observed variation in the number of acres of wetlands offered for enrollment in the WRP. The acreage of wetlands owned, the level of information about the program, and the ownership of farmed wetlands were consistently significant and positive explanatory factors across models. The positive influence of the respondents' income level on the number of acres of wetlands offered was only significant for the initial model based on the neoclassical economic approach.

The model including an NEP-derived environmental attitude measure supported the hypothesis that positive environmental attitudes significantly and positively influenced
the number of acres offered for participation. However, for the model with attitudinal measures derived from the theory of reasoned action, attitudes and subjective norm were not significant in evaluating the number of acres of wetlands offered for enrollment in the WRP.

Empirical results presented support the multi-disciplinary conceptual approach upon which the behavioral models estimated are based. These models, which include attitude measures as additional independent variables, were slightly more effective in explaining wetland owners' choice behavior. This marginal increase in the predictive ability of the neoclassical economic model suggests that, despite the significance of attitudinal variables, economic factors constitute the primary decision variables for potential participants in voluntary conservation programs such as the WRP.

However, results presented do not provide a conclusive answer to the comparison between the alternative attitude assessment approaches selected in this study. Although psychological constructs based on the theory of reasoned action are more soundly grounded in social psychology, the inconclusiveness in the comparison between the NEP-based general measure of environmental attitude and the specific measures derived from the theory of reasoned action may suggest that these alternative attitude measures could be used interchangeably when evaluating offers to participate in the WRP.

The final chapter provides a summary of this research and draws conclusions suggested by the empirical results obtained. The fifth chapter also offers policy recommendations based on the empirical results. In addition, suggestions for future research are discussed.
CHAPTER 5
SUMMARY AND CONCLUSIONS

Historically, environmental management in the United States has primarily used a direct regulatory, or command and control, approach. The two classes of instruments used under the regulatory approach include technology-based and performance-based standards. The gradual realization of the limitations of direct regulation, including enforcement difficulties, inherent inefficiencies, and the lack of incentives for technological improvement has led to the consideration of an alternative framework for environmental management. This search for alternative environmental management instruments has resulted in an increased interest in incentive-based mechanisms. The evolution of environmental management in agriculture followed a different course.

Until the 1985 Farm Bill, agriculture benefited from an implicit exemption from regulation. During this period, self-regulation constituted the main strategy adopted to mitigate environmental problems stemming from the agricultural sector. As a result of the growing awareness of agriculture-related damages to the environment, cross-compliance methods were substituted for the prevailing self-regulatory approach. Under the cross-compliance approach, regulators began to tie government benefits to the adoption of specific conservation and restoration programs such as the Sodbuster Program. In agriculture, incentive-based mechanisms formed the third generation of environmental management tools. Although they evolved following different paths over
time, environmental management in general and environmental policy in agriculture both currently rely on an increased utilization of incentive-based mechanisms.

**Incentive-based mechanisms**

Incentive-based mechanisms, or market-based incentive programs, are voluntary environmental management instruments based on free market environmentalism. Free market environmentalism is an alternative environmental management framework that attempts to harness market forces and uses them to address environmental problems. This market approach to environmental issues neither possesses the enforcement difficulties and inherent economic efficiencies of direct regulation nor requires the information centralization indispensable to the implementation of command and control guidelines. Theoretically, free market environmentalism is conducive to economically optimal solutions to environmental problems.

The wide array of incentive-based instruments can be classified into two broad categories, taxes (or subsidies), and tradable permits (or rights). Applications of incentive-based mechanisms include the control of air pollutants using tax incentives, the management of fishing grounds via individual transferable quotas, state and local farmland retention programs through transfers or purchases of development rights, and, federal soil conservation programs such as the Wetland Reserve Program (WRP). The WRP is a federal policy instrument directed towards wetlands protection. Conceptually similar to the purchase of development right programs, the WRP restores and preserves wetlands by offering a financial compensation, determined after appraisal of the wetland
value, to wetlands owners who are willing to place their property under a perpetual easement.

Applications of IBM’s to environmental management are still hampered. Due to the voluntary nature of incentive-based environmental programs, acceptance and thus participation in these programs are not automatic. Reasons for the limited use of IBM’s include a pervasive mistrust of market forces in dealing with environmental issues. Attitudes towards the use of market forces in environmental policy may therefore play a determining role in the successful implementation of incentive-based mechanisms. Based on the limited understanding of the influence of attitudes in market-based program participation, this research explored the role of environmental attitudes in incentive-based environmental management programs.

Objectives of the Study

The general objective of this study was to evaluate the role of attitudes in the decision to participate in incentive-based environmental management programs. This research was specifically designed to: (I) develop a conceptual framework which extends the neoclassical economic approach to choice behavior by including psychological constructs; (ii) propose a behavioral model to explain participation in incentive-based environmental management programs; (iii) empirically test the behavioral model proposed using the Wetland Reserve Program in Louisiana; and, (iv) offer policy recommendations for the improvement of future market-based programs. Procedures used to achieve these objectives and empirical results obtained are summarized in the following sections.
Conceptual Framework

The development of a multi-disciplinary framework for the evaluation of choice behavior was accomplished by complementing a traditional utility maximization approach used in neoclassical economics by adding psychological constructs. The two classes of explanatory factors used in the neoclassical economic approach to evaluating choice behavior are economic variables and socio-economic characteristics of the choice maker.

The theory of reasoned action and the New Environmental Paradigm (NEP) provided the theoretical foundations for the derivation of alternative attitudinal measures used to extend the basic neoclassical model. Constructs derived from the theory of reasoned action included specific measures of wetland owners’ attitude towards offering wetlands for enrollment in the WRP and the associated subjective norm. The subjective norm is, in this case, a measure of the social pressure exerted on the decision maker to enroll in the WRP. The NEP-derived attitude, a general indicator of wetland owners’ attitude towards the environment, was based on the standard NEP scale. The behavioral economic approach taken in developing the conceptual framework discussed in this research combined economic variables and socio-economic attributes of the decision makers with alternative attitudinal constructs.

Theoretical Model

A theoretical model was proposed based on the conceptual framework developed. In addition to economic variables and socio-economic characteristics of the decision maker, the two classes of explanatory factors traditionally used in choice behavior evaluation, the theoretical model included attitudinal measures as a third class of
explanatory factors. Representation of the choice dependent variable determined the econometric method used to specify empirical models. The dependent variable was either represented by a discrete or by a continuous, but restricted, variable.

**Empirical Tests**

Models in which the choice variable, representing landowners' decision to offer wetlands for enrollment in the WRP, was expressed as a dichotomous variable were estimated via the Probit maximum likelihood approach. An initial probit model based on the neoclassical approach to choice behavior, a model including an NEP-derived environmental attitude measure, and a model complementing the neoclassical approach with psychological constructs derived from the theory of reasoned action were the three probit models estimated.

In the second class of empirical models estimated, the dependent variable, expressing the extent to which landowners offered wetlands for enrollment in the WRP, was represented by the number of acres of wetlands offered for enrollment in the WRP. These models were specified as Tobit, or censored regressions and were estimated using a maximum likelihood approach. The substitution of the acreage of wetlands offered for enrollment in the WRP for the binary variable expressing wetland owners' decisions to offer participation in the WRP yielded three additional model specifications.

Data used to evaluate the six models specified were collected through a mail survey of Louisiana wetland owners. The mail survey was conducted in accordance with the guidelines of the Dillman's Total Design method. Out of the 767 surveys mailed, 174 completed surveys were returned, yielding an overall response rate of 22.7 percent.
However, due to item non-responses, only 143 surveys were used in the empirical analysis. The mail survey gathered data on wetland owners’ land, level of information about the Wetland Reserve Program, degree of participation in the WRP, environmental attitudes, and socio-economic attributes.

**Probit Models**

The three models estimated, overall, significantly explained wetland owners’ decisions to offer to participate in the WRP. While the three models correctly predicted over 90 percent of the participation decisions for wetland owners who offered to enroll in the WRP, they accurately predicted about 50 percent of the choices made by respondents who did not offer to participate. This low prediction success may be due to the limited number of respondents who did not offer acres of wetlands for enrollment in the WRP. As suggested by the respective Akaike information criteria, $R^2$ measures, and percentage of right predictions, the model including psychological constructs derived from the theory of reasoned action marginally improved the predictive ability of the basic model. The same performance criteria indicated that the model with the NEP-derived attitudinal measure only yielded a small increase in the predictive ability of the basic model. The model with the NEP-based attitudinal measure as well as the model including measures derived from the theory of reasoned action supported the hypothesis that pro-environmental, or positive, attitudes increase the probability to offer to enroll in the WRP. However, comparison between the two behavioral models presented was inconclusive.
Explanatory factors such as the acreage of wetlands owned, the level of information about the WRP, the ownership of farmed wetlands, respondents’ involvement in environmental organizations, and income had a significant and positive influence on the decision to offer participation in the WRP. Respondents’ education level, and number of people living in the household had an adverse effect on the likelihood to offer wetlands for enrollment in the WRP. Consistent with a priori hypotheses, positive environmental attitudes increased wetland owners’ propensity to offer participation in the Wetland Reserve Program.

**Tobit Models**

Likelihood ratio tests suggested that all three Tobit models estimated were, overall, significant in explaining the variation observed in the number of acres of wetlands offered by respondents for enrollment in the WRP. The specification which included an NEP-based environmental attitude measure was relatively more effective in explaining variations in the acreage of wetlands offered for enrollment in the WRP. Consistent with the Probit models discussed above, the acreage of wetlands owned, the level of information about the program, and the ownership of farmed wetlands were found to significantly increase respondents’ likelihood to offer wetlands for enrollment in the WRP. The model including an NEP-derived attitudinal measure supported the hypothesis that positive environmental attitudes significantly enhances the likelihood to offer participation in the WRP. However, for the model including attitudinal constructs based on the theory of reasoned action, neither the attitude nor the subjective norm...
measures were significant factors in explaining the rate at which wetland owners offered participation in the WRP.

**Conclusions**

Environmental management in the United States increasingly relies on the use of voluntary environmental management instruments such as incentive-based mechanisms. The growing interest in the use of incentive-based mechanisms offers a unique opportunity to efficiently correct agriculture-related environmental problems and bring agriculture in line with mainstream environmental management.

The multi-disciplinary framework proposed in this research to evaluate choice behavior including participation choices in IBM programs such as the Wetland Reserve Program suggests that neoclassical economics may benefit from the inclusion of instruments and concepts used in other social sciences like social psychology. The addition of psychological constructs may conceptually improve the traditional neoclassical economic approach to evaluating choice behavior by allowing the consideration of well established determinants of behavior such as attitudes.

Empirical evidence presented in this study suggests that environmental attitudes play a significant role in explaining wetland owners' decision to offer to participate in the WRP. Positive environmental attitudes were found to increase the likelihood to participate as well as the participation rate. However, behavioral model specifications including attitudinal measures only yielded marginal improvements in the predictive ability of the basic model based on the neoclassical economic approach. In designing mail surveys to evaluate participation in incentive-based programs, the trade-off between the
additional cost resulting from the collection of attitudinal variables and the marginal benefits they yield has to be considered. These marginal improvements in the predictive ability of the basic model may also imply that, for programs with widely disseminated information such as the WRP, the role of attitudes in the decision process becomes secondary. Conversely, for new or proposed programs with limited information available to potential participants, attitudes may play a more noticeable role in the decision process.

An important limitation of this study can be attributed to issues associated with the data. Out of the 174 surveys returned, only 143 observations were used in the empirical analysis due to item non-responses. In addition, 80.4 percent of the surveys used were collected from wetland owners who offered to participate in the WRP. This under representation of respondents who did not offer to participate in the WRP may have affected the prediction success rates of the models. Finally, missing values in the data collected precluded the use of economic variables such as benefits and opportunity costs of alternative participation choices as explanatory factors.

**Policy Implications**

The effective implementation and success of future incentive-based environmental management programs rest on getting all the incentives “right”, including economic incentives and attitudinal concerns. Policy makers may consider, in the early stages of an IBM, campaigns geared towards increasing environmental awareness or improving predisposition towards a specific environmental management program as an additional instrument to foster the successful implementation of incentive-based programs.
However, as information about the incentive-based program becomes more widespread, policy makers should only consider the provision of additional economic incentives to significantly increase participation. As a result of the recent modification of the easement period from permanent to thirty years, policy makers should concentrate their efforts on younger wetland owners to maximize the chances of contract renewal.

**Future Research**

Future evaluation of landowners' participation in an incentive-based program such as the WRP may include economic variables accurately measuring benefits and opportunity costs associated with respondents' decisions. The assessment of the influence of attitudes on participation decisions may be extended to other voluntary environmental programs. New incentive-based programs, for which information has not been fully disseminated to the potential participants, may offer interesting applications. Because the comparison between the alternative attitude measurement approaches considered was inconclusive, further evaluation of the relative effectiveness of these two approaches to assessing environmental attitudes is warranted. The use of a geographical information system to geo-reference plots enrolled in the Wetland Reserve Program and the consideration of spatial correlation in the analysis of participation decisions may also constitute an area of future research.
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APPENDIX A.1

Correspondence Sent to Wetland Owners
February 6, 1996

Dear Wetland Owner:

Louisiana's wetlands are one of our state's greatest resources. Protection of wetlands has become a priority at the state and national levels. One program recently initiated to help preserve wetlands is the Wetland Reserve Program. Louisiana was one of a select group of states chosen to participate in this wetland conservation program. Now that it has been in place as a pilot program for a few years, it is important to determine wetland owners' knowledge of the program and identify trends influencing participation in the program.

The Louisiana State University Department of Agricultural Economics and Agribusiness requests your assistance in examining the Wetland Reserve Program in Louisiana. You are among a selected group of Louisiana wetland owners chosen for participation in this study. For this study to be truly representative, it is important that this questionnaire be completed and returned by you.

You may be assured of complete confidentiality. The identification number that appears on the questionnaire is for mailing purposes only, allowing us to check your name off of the mailing list when your questionnaire is returned. You can receive a summary of the final results of this survey by writing "results requested" on the back of the return envelope and printing your name and address below it. Please do not put this information on the questionnaire.

We would be pleased to answer any questions you might have about the questionnaire. Additional information and answers to any question you might have can be obtained by calling the LSU research team at (504) 388-2763.

Thank you for your assistance.

Sincerely,

E. Jane Luzar
Professor
Dear Wetland Owner,

Recently a questionnaire seeking information about wetlands and the Wetland Reserve Program in Louisiana was mailed to you. This card is a reminder to please fill out the questionnaire. If you have already completed it and returned it to us, please accept our thanks. If not, please do so today. It is extremely important that your questionnaire be completed and returned by you so that the results of this study will be truly representative. If by some chance you did not receive the questionnaire or it has been misplaced, please call me at (504) 388-2763 and another will be sent to you immediately.

Sincerely,

Dr. E. Jane Luzar
Professor
March 6, 1996

Dear Wetland Owner:

About a month ago I mailed a questionnaire to you seeking information about your Louisiana wetlands. As of today, I have not received your completed questionnaire.

I am writing to you again because of the importance each questionnaire has to this research. Your name was chosen for this study through a process in which all wetland owners in Louisiana had a chance of being selected. In order for the results of this study to be truly representative, it is important that you complete and return the questionnaire.

Another copy of the Louisiana Wetlands Survey questionnaire has been enclosed in case your original copy has been misplaced. Your answers to the questionnaire will be held in complete confidence and used only for the purpose of this study.

If you have already completed and mailed your questionnaire, please disregard this reminder and accept our thanks for participating in this study.

Additional information and answers to any question you might have can be obtained by calling the LSU research team at (504) 388-2763.

Thank you for your assistance.

Sincerely,

E. Jane Luzar
Professor
APPENDIX A.2

Louisiana Wetlands Survey
Section I- INFORMATION ABOUT THE WETLAND RESERVE PROGRAM (WRP)

In this first section, we would like to learn about your knowledge of the Wetland Reserve Program (WRP).

Q-1 Are you aware of the Wetland Reserve Program (WRP)? (circle number)

1 Yes 2 No (If No, Please skip to Q-4)

Q-2 How did you learn about the WRP? (circle number)

1 Extension Service
2 Media: magazine, TV or radio
3 Neighbors, friends or family
4 Other (please specify) _________________

Q-3 How would you rank your knowledge about the WRP? (circle number)

1 Excellent 3 Fair
2 Good 4 Poor

Section II- INFORMATION ABOUT YOUR LAND

In this section, we would like to learn about your land and some of its uses.

Q-4 How many total acres of agricultural and non-agricultural land do you own?

__________________ acres

Q-5 How many acres of agricultural land do you own?

__________________ acres
Q-6 How many acres of wetlands (both natural and restored) do you own?

________________________ acres

Q-7 What type of wetlands do you own? (circle only one number)

1  bottomland hardwood forests
2  freshwater swamps
3  freshwater marsh
4  brackish marsh
5  farmed wetlands
6  other___________________

Q-8 In what parish(es) are your wetlands located?

______________________________

Q-9 How long have you owned the wetlands?

_________________________years

Q-10 How many acres of wetlands have you converted to agriculture in the last 15 years?

_________________________acres

Q-11 How many acres of wetlands have you converted to uses other than agriculture in the last 15 years?

_________________________acres

Q-12 What is the main crop that you grow on your agricultural land? (circle only one number)

1  Soybeans
2  Rice
3  Sorghum
4  Cotton
5  Corn
Q-13 What is the main crop that you grow on the wetlands you converted to agriculture? (circle only one number)

1 Soybeans
2 Rice
3 Sorghum
4 Cotton
5 Corn

Q-14 How many people help you in farming your land? (indicate the number)

1 Family members_____________ 2 Outside Hired labor____________

Q-15 What is the yearly average gross revenue per acre earned from your wetlands (converted and non-converted)?

_________________________

Q-16 What is the yearly average net revenue per acre earned from your wetlands (converted and non-converted)?

_________________________

Q-17 How would you characterize the changes in your yearly average net revenue per acre in the past five years? (circle number)

1 Increase 2 Same 3 Decrease

Q-18 What are your future plans overall for the wetlands you currently own? (circle number)

1 Develop the land 5 enroll in a government program
2 Sell at fair market value 6 Leave idle
3 Convert to agriculture 7 Pass on to family
4 Rent or lease 8 Other (Please specify)
Section III- PARTICIPATION IN THE WETLAND RESERVE PROGRAM

Your answers to this section will allow us to learn more about your decision process regarding participating in the Wetland Reserve Program (WRP).

Q-19 Did you offer to enroll any of your land in the Wetland Reserve Program? (circle one number)

1 Yes 2 No (if No, please skip to Q-29)

Q-20 How many acres did you offer to enroll in the WRP?

___________________ acres in 1992

___________________ acres in 1994

___________________ acres in 1995

Q-21 In your offer, how much did you bid (or have been offered after appraisal) per acre of wetland?

$___________________ per acre in 1992

$___________________ per acre in 1994

$___________________ per acre in 1995

Q-22 Did you enroll any of your wetlands in the Wetland Reserve Program as a result of any of the sign-ups? (circle number)

1 Yes 2 No (if No, please skip to Q-29)

Q-23 How many acres of wetlands did you enroll in the WRP?

Q-24 In what parish(es) are the enrolled acres of wetlands located?

_________________  __________________  ____________

Q-25 What is the main crop grown on the wetlands you offered or enrolled in WRP? (circle only one number)

1  Soybeans  4  Cotton
2  Rice  5  Corn
3  Sorghum

Q-26 If the number of acres offered is different from the number of acres you did enroll, how would you best explain the difference? (circle number)

1  All the acres were not eligible  3  I changed my mind
2  The payment was too low  4  Other______________

Q-27 How much money did you receive (or have been offered) per acre enrolled?

$_______________ per acre in 1992

$_______________ per acre in 1994

$_______________ per acre in 1995

Q-28 What was the primary factor that determined your decision to participate in the WRP? (circle one number)

1  Economic factors
2  Environmental factors
3  Economic and environmental factors
4  Other (please specify)______________

Q-29 What was the primary factor that made you decide not to participate in the WRP? (circle one number)

1  Not enough economic incentives
2  The permanent nature of the easement
3  Hesitation to sell development rights to the government
4  Other (please specify)__________________________
Section IV- ENVIRONMENTAL ATTITUDES ASSESSMENTS

In this section, we would like to learn about your attitudes towards the environment in general, as well as your attitudes towards programs such as the Wetland Reserve Program (WRP).

Q-30 Please indicate your agreement or disagreement with the following statements about the environment (mark the most appropriate column). SA = Strongly Agree, A = Agree, U = Uncertain, D = Disagree, SD = Strongly Disagree.

<table>
<thead>
<tr>
<th></th>
<th>SA</th>
<th>A</th>
<th>U</th>
<th>D</th>
<th>SD</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>6</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>7</td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>8</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>9</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
<tr>
<td>13</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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Humans will eventually learn enough about how nature works to be able to control it.

If things continue on their present course, we will soon experience a major ecological catastrophe.

Q-31 Please indicate your agreement or disagreement with the following statements. (mark the most appropriate column). SA= Strongly Agree, A=Agree, U=Uncertain, D=Disagree, SD=Strongly Disagree.

Participation in the WRP allows the government to interfere with the way I choose to use my land.

I believe that participating in the WRP benefits society at my expense.

I believe that participating in a conservation program like the WRP will improve environmental quality.

Participating in the WRP permanently limits my property rights.

I believe that participating in the WRP will not benefit future generations.

I will lose money if I participate in the WRP.

Participating in the WRP allows me to demonstrate the way I feel about the environment.

Q-32 Please evaluate the following statements and indicate your opinion. (mark the most appropriate column). VB = Very Bad, B = Bad, N = Neutral, G = Good, VG = Very Good.

Government involvement in the way I choose to use my land is:

Preventing society from taking advantage of me is:

Improving the environment by participating in conservation programs like the WRP is:
Permanent restrictions on my property rights are: 

Benefiting future generations is: 

Losing money due to enrolling in a conservation program like the WRP is: 

Backing up my feelings about the environment with real actions is: 

Q-33 Please evaluate the following statements and indicate your opinion (mark the most appropriate column). VL=Very Likely, L=Likely, N=Neutral, U=Unlikely, VU=Very Unlikely.

My family would view enrollment in the WRP favorably. 

My participation in the WRP is very important to other wetland owners in my parish. 

Farm leaders think that I should enroll in the WRP. 

The county agent thinks that I should enroll in the WRP. 

It is important to my friends that I participate in the WRP. 

Usually, I want to do what my family thinks I should do. 

Usually, I want to do what other wetland owners in my parish think I should do. 

Usually, I do what farm leaders think I should do. 

Usually, I want to do what the county agent thinks I should do. 

Usually, I want to do what most of my friends think I should do.
Q-34  Do you currently belong to an environmental or conservation organization? (circle number)

   1  Yes  2  No (if No, please skip to Q-36)

Q-35  If yes, how much were the yearly membership fees or the amount of the yearly donation?

$____________

Q-36  Do you currently belong to any farm organization? (circle number)

   1  Yes  2  No

Section V- SOCIO-ECONOMIC VARIABLES

The questions in this final section will help us learn about wetland owners in Louisiana. ALL the answers will remain strictly confidential.

Q-37  What is your sex? (circle number)

   1  Male  2  Female

Q-38  What is the highest level of education you have completed? (circle number)

   1  Some Grade School  4  Some College
   2  Some High School  5  Completed College
   3  Completed High School  6  Advanced Degree

Q-39  Which of the following best describes your area of residence? (circle a number)

   1  Rural Area or Small Town (less than 1,000 people)
   2  Small Town or Small City (1,000 to 10,000 people)
   3  Medium or Large City (more than 10,000 people)
Q-40 What is your present age? _______ years

Q-41 How many persons live in your household, including yourself? _____ persons

Q-42 Which of the following best describes your total household income for 1994? (circle number)

1 LESS Than $15,000  5 $45,000 to $54,999
2 $15,000 to $24,999  6 $55,000 to $64,000
3 $25,000 to $34,999  7 OVER $65,000
4 $35,000 to $44,999
Section VII - SUGGESTIONS

If you have any suggestions or comments about wetlands or the Wetlands Reserve Program, please indicate them in this section.
Table B.1
Prediction Success Table for the Probit Model Based on the Neoclassical Economic Approach

<table>
<thead>
<tr>
<th>Predicted</th>
<th>Actual</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>12</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>1</td>
<td>16</td>
<td>109</td>
</tr>
</tbody>
</table>

Table B.2
Prediction Success Table for the Behavioral Model with the NEP Attitude Measure

<table>
<thead>
<tr>
<th>Predicted</th>
<th>Actual</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>13</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>7</td>
</tr>
<tr>
<td>1</td>
<td>15</td>
<td>108</td>
</tr>
</tbody>
</table>

Table B.3
Prediction Success Table for the Behavioral Model with Measures of Attitude and Subjective Norm

<table>
<thead>
<tr>
<th>Predicted</th>
<th>Actual</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>0</td>
<td>15</td>
</tr>
<tr>
<td>0</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>1</td>
<td>13</td>
<td>111</td>
</tr>
</tbody>
</table>
Table C.1
Frequency Table for Respondents' Means of Information about the WRP

<table>
<thead>
<tr>
<th>How did you learn about WRP?</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extension Service</td>
<td>106</td>
<td>60.9</td>
</tr>
<tr>
<td>Media: Magazine, TV or Radio</td>
<td>20</td>
<td>11.5</td>
</tr>
<tr>
<td>Neighbors, Friends or Family</td>
<td>42</td>
<td>24.1</td>
</tr>
<tr>
<td>Other</td>
<td>6</td>
<td>3.4</td>
</tr>
</tbody>
</table>

Table C.2
Frequency Table for Respondents' Level of Information about the WRP

<table>
<thead>
<tr>
<th>How would you rank your knowledge about WRP? *</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Excellent</td>
<td>33</td>
<td>19.2</td>
</tr>
<tr>
<td>Good</td>
<td>70</td>
<td>40.7</td>
</tr>
<tr>
<td>Fair</td>
<td>51</td>
<td>29.7</td>
</tr>
<tr>
<td>Poor</td>
<td>18</td>
<td>10.5</td>
</tr>
</tbody>
</table>

* Frequency Missing = 2
Table C.3
Frequency Table for the Type of Wetlands Owned by the Respondents

<table>
<thead>
<tr>
<th>What type of wetlands do you own? *</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bottomland hardwood forest</td>
<td>55</td>
<td>32.0</td>
</tr>
<tr>
<td>Freshwater swamps</td>
<td>7</td>
<td>4.1</td>
</tr>
<tr>
<td>Freshwater marsh</td>
<td>4</td>
<td>2.3</td>
</tr>
<tr>
<td>Brackish marsh</td>
<td>5</td>
<td>2.9</td>
</tr>
<tr>
<td>Farmed wetlands</td>
<td>93</td>
<td>54.1</td>
</tr>
<tr>
<td>Other</td>
<td>8</td>
<td>4.7</td>
</tr>
</tbody>
</table>

* Frequency Missing = 2

Table C.4
Frequency Table for the Main Crop Grown on Respondents’ Agricultural Land

<table>
<thead>
<tr>
<th>What is the main crop grown on your agricultural land? *</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Soybeans</td>
<td>75</td>
<td>50.0</td>
</tr>
<tr>
<td>Rice</td>
<td>19</td>
<td>12.7</td>
</tr>
<tr>
<td>Sorghum</td>
<td>2</td>
<td>1.3</td>
</tr>
<tr>
<td>Cotton</td>
<td>42</td>
<td>28.0</td>
</tr>
<tr>
<td>Corn</td>
<td>12</td>
<td>8.0</td>
</tr>
</tbody>
</table>

* Frequency Missing = 24
Table C.5  
Frequency Table for the Evolution of the Yearly Net Average Return Per Acre of Wetland

<table>
<thead>
<tr>
<th>Changes in your average net revenue per acre in the past five years? *</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increase</td>
<td>18</td>
<td>11.0</td>
</tr>
<tr>
<td>Same</td>
<td>79</td>
<td>48.5</td>
</tr>
<tr>
<td>Decrease</td>
<td>66</td>
<td>40.5</td>
</tr>
</tbody>
</table>

* Frequency Missing = 11

Table C.6  
Frequency Table for the Respondent's Future Plans for the Wetlands Owned

<table>
<thead>
<tr>
<th>What are your future plans overall for the wetlands you currently own? *</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Develop the land</td>
<td>3</td>
<td>1.8</td>
</tr>
<tr>
<td>Sell at fair market value</td>
<td>7</td>
<td>4.1</td>
</tr>
<tr>
<td>Convert to agriculture</td>
<td>2</td>
<td>1.2</td>
</tr>
<tr>
<td>Rent or lease</td>
<td>18</td>
<td>10.6</td>
</tr>
<tr>
<td>Try to enroll in a government program</td>
<td>81</td>
<td>47.6</td>
</tr>
<tr>
<td>Leave idle</td>
<td>17</td>
<td>10.0</td>
</tr>
<tr>
<td>Pass on to family</td>
<td>34</td>
<td>20.0</td>
</tr>
<tr>
<td>Other</td>
<td>8</td>
<td>4.7</td>
</tr>
</tbody>
</table>

* Frequency Missing = 4

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Table C.7
Frequency Table for the Respondents' Offers to Participate in the Wetland Reserve Program

<table>
<thead>
<tr>
<th>Did you offer to enroll any of your wetlands in the WRP?*</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>133</td>
<td>76.9</td>
</tr>
<tr>
<td>No</td>
<td>40</td>
<td>23.1</td>
</tr>
</tbody>
</table>

* Frequency Missing = 1

Table C.8
Frequency Table for the Respondents' Enrollment in WRP

<table>
<thead>
<tr>
<th>Did you enroll any of your wetlands in the WRP as a result of any of the sign-ups?</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>73</td>
<td>42</td>
</tr>
<tr>
<td>No</td>
<td>101</td>
<td>58</td>
</tr>
</tbody>
</table>

Table C.9
Frequency Table for the Primary Factor Determining Participation in WRP

<table>
<thead>
<tr>
<th>What was the primary factor that determined your decision to participate in the WRP?*</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non participants</td>
<td>101</td>
<td>58.0</td>
</tr>
<tr>
<td>Economic factors</td>
<td>20</td>
<td>11.5</td>
</tr>
<tr>
<td>Environmental factors</td>
<td>5</td>
<td>2.9</td>
</tr>
<tr>
<td>Economic and environmental factors</td>
<td>43</td>
<td>24.7</td>
</tr>
<tr>
<td>Other</td>
<td>5</td>
<td>2.9</td>
</tr>
<tr>
<td>New Environmental Paradigm Scale</td>
<td>Percent</td>
<td></td>
</tr>
<tr>
<td>------------------------------------------------------------------------------------------------</td>
<td>------------------------------</td>
<td></td>
</tr>
<tr>
<td>We are approaching the limit of the number of people the earth can support</td>
<td>Strongly Agree: 16.1, Agree: 25.9, Uncertain: 20.7, Disagree: 31.0, Strongly Disagree: 6.3</td>
<td></td>
</tr>
<tr>
<td>Humans have the right to modify the natural environment to suit their needs</td>
<td>Strongly Agree: 5.7, Agree: 39.7, Uncertain: 16.1, Disagree: 31.0, Strongly Disagree: 7.5</td>
<td></td>
</tr>
<tr>
<td>When humans interfere with nature it often produces disastrous consequences</td>
<td>Strongly Agree: 21.3, Agree: 50.6, Uncertain: 12.1, Disagree: 10.9, Strongly Disagree: 5.2</td>
<td></td>
</tr>
<tr>
<td>Human ingenuity will ensure that we do not make the earth unlivable</td>
<td>Strongly Agree: 8.0, Agree: 31.6, Uncertain: 31.6, Disagree: 16.1, Strongly Disagree: 12.6</td>
<td></td>
</tr>
<tr>
<td>Humans are severely abusing the environment</td>
<td>Strongly Agree: 19.0, Agree: 43.7, Uncertain: 10.9, Disagree: 24.1, Strongly Disagree: 2.3</td>
<td></td>
</tr>
<tr>
<td>The earth has plenty of natural resources if we just learn how to develop them</td>
<td>Strongly Agree: 19.5, Agree: 58.6, Uncertain: 9.8, Disagree: 9.8, Strongly Disagree: 2.3</td>
<td></td>
</tr>
<tr>
<td>Plants and animals have as much right as humans to exist</td>
<td>Strongly Agree: 14.9, Agree: 28.7, Uncertain: 13.8, Disagree: 29.3, Strongly Disagree: 13.2</td>
<td></td>
</tr>
<tr>
<td>The balance of nature is strong enough to cope with the impacts of modern industrial nations</td>
<td>Strongly Agree: 1.1, Agree: 13.8, Uncertain: 22.4, Disagree: 44.8, Strongly Disagree: 17.8</td>
<td></td>
</tr>
<tr>
<td>Despite our special abilities, humans are still subject to the laws of nature</td>
<td>Strongly Agree: 22.4, Agree: 69.5, Uncertain: 4.6, Disagree: 2.9, Strongly Disagree: 0.6</td>
<td></td>
</tr>
<tr>
<td>The so-called &quot;ecological crisis&quot; facing humankind has been greatly exaggerated</td>
<td>Strongly Agree: 8.0, Agree: 25.3, Uncertain: 30.5, Disagree: 28.2, Strongly Disagree: 8.0</td>
<td></td>
</tr>
<tr>
<td>The earth is like a spaceship with very limited room and resources</td>
<td>Strongly Agree: 10.3, Agree: 50.6, Uncertain: 14.9, Disagree: 21.8, Strongly Disagree: 2.3</td>
<td></td>
</tr>
<tr>
<td>Humans were meant to rule over the rest of nature</td>
<td>Strongly Agree: 12.1, Agree: 48.9, Uncertain: 12.1, Disagree: 20.1, Strongly Disagree: 6.9</td>
<td></td>
</tr>
<tr>
<td>The balance of nature is delicate and easily upset</td>
<td>Strongly Agree: 22.4, Agree: 48.9, Uncertain: 14.4, Disagree: 13.8, Strongly Disagree: 0.6</td>
<td></td>
</tr>
<tr>
<td>Humans will eventually learn enough about how nature works to be able to control it</td>
<td>Strongly Agree: 4.0, Agree: 24.7, Uncertain: 21.8, Disagree: 41.4, Strongly Disagree: 8.0</td>
<td></td>
</tr>
<tr>
<td>If things continue on their present course, we will soon experience a major ecological catastrophe</td>
<td>Strongly Agree: 5.2, Agree: 25.9, Uncertain: 33.3, Disagree: 28.2, Strongly Disagree: 7.5</td>
<td></td>
</tr>
</tbody>
</table>
Table C.11
Frequency Table for the Respondents' Behavioral Beliefs

<table>
<thead>
<tr>
<th>Perception</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Strongly Agree</td>
</tr>
<tr>
<td>Participation in the WRP allows the government to interfere with the way I choose to use my land</td>
<td>8.0</td>
</tr>
<tr>
<td>I believe that participating in the WRP benefits society at my expense</td>
<td>2.9</td>
</tr>
<tr>
<td>I believe that participating in a conservation program like WRP will improve environmental quality</td>
<td>29.9</td>
</tr>
<tr>
<td>Participating in the WRP permanently limits my property rights</td>
<td>16.7</td>
</tr>
<tr>
<td>I believe that participating in the WRP will not benefit future generations</td>
<td>1.7</td>
</tr>
<tr>
<td>I will lose money if I participate in the WRP</td>
<td>5.7</td>
</tr>
<tr>
<td>Participating in the WRP allows me to demonstrate the way I feel about the environment</td>
<td>14.9</td>
</tr>
</tbody>
</table>

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### Table C.12
Frequency Table for the Respondents' Evaluation of the Behavioral Beliefs

<table>
<thead>
<tr>
<th></th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Very Bad</td>
</tr>
<tr>
<td>Government involvement in the way I choose to use my land is:</td>
<td>11.5</td>
</tr>
<tr>
<td>Preventing society from taking advantage of me is:</td>
<td>1.1</td>
</tr>
<tr>
<td>Improving the environment by participating in conservation programs like the WRP is:</td>
<td>1.7</td>
</tr>
<tr>
<td>Permanent restrictions on my property rights are:</td>
<td>21.8</td>
</tr>
<tr>
<td>Benefiting future generations is:</td>
<td>1.1</td>
</tr>
<tr>
<td>Losing money due to enrolling in a conservation program like the WRP is:</td>
<td>14.4</td>
</tr>
<tr>
<td>Backing up my feelings about the environment with real actions is:</td>
<td>1.1</td>
</tr>
</tbody>
</table>
Table C.13
Frequency Table for the Respondents’ Normative Beliefs and Motivations to Comply

<table>
<thead>
<tr>
<th>Comment</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>My family would view enrollment in the WRP favorably</td>
<td>41.4</td>
</tr>
<tr>
<td>My participation in the WRP is very important to other wetland owners</td>
<td>18.4</td>
</tr>
<tr>
<td>in my parish</td>
<td>28.7</td>
</tr>
<tr>
<td>Farm leaders think that I should enroll in the WRP</td>
<td>10.3</td>
</tr>
<tr>
<td>The county agent thinks that I should enroll in the WRP</td>
<td>14.9</td>
</tr>
<tr>
<td>It is important to my friends that I enroll in the WRP</td>
<td>8.0</td>
</tr>
<tr>
<td>Usually, I want to do what my family thinks I should do</td>
<td>13.2</td>
</tr>
<tr>
<td>Usually, I want to do what other wetland owners in my parish think I</td>
<td>2.9</td>
</tr>
<tr>
<td>should do</td>
<td>14.4</td>
</tr>
<tr>
<td>Usually, I do what farm leaders think I should do</td>
<td>2.3</td>
</tr>
<tr>
<td>Usually, I want to do what the county agent thinks I should do</td>
<td>6.3</td>
</tr>
<tr>
<td>Usually, I want to do what most of my friends think I should do</td>
<td>2.9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th></th>
<th>Very Likely</th>
<th>Likely</th>
<th>Neutral</th>
<th>Unlikely</th>
<th>Very Unlikely</th>
</tr>
</thead>
<tbody>
<tr>
<td>My family would view enrollment in the WRP favorably</td>
<td>41.4</td>
<td>31.0</td>
<td>17.8</td>
<td>7.5</td>
<td>2.3</td>
</tr>
<tr>
<td>My participation in the WRP is very important to other wetland owners in my parish</td>
<td>18.4</td>
<td>28.7</td>
<td>27.0</td>
<td>20.1</td>
<td>5.7</td>
</tr>
<tr>
<td>Farm leaders think that I should enroll in the WRP</td>
<td>10.3</td>
<td>23.0</td>
<td>46.6</td>
<td>14.4</td>
<td>5.7</td>
</tr>
<tr>
<td>The county agent thinks that I should enroll in the WRP</td>
<td>14.9</td>
<td>29.3</td>
<td>42.5</td>
<td>9.2</td>
<td>4.0</td>
</tr>
<tr>
<td>It is important to my friends that I enroll in the WRP</td>
<td>8.0</td>
<td>19.5</td>
<td>44.8</td>
<td>17.2</td>
<td>10.3</td>
</tr>
<tr>
<td>Usually, I want to do what my family thinks I should do</td>
<td>13.2</td>
<td>37.9</td>
<td>28.2</td>
<td>13.2</td>
<td>7.5</td>
</tr>
<tr>
<td>Usually, I want to do what other wetland owners in my parish think I should do</td>
<td>2.9</td>
<td>14.4</td>
<td>37.9</td>
<td>29.3</td>
<td>15.5</td>
</tr>
<tr>
<td>Usually, I do what farm leaders think I should do</td>
<td>2.3</td>
<td>16.7</td>
<td>38.5</td>
<td>29.3</td>
<td>13.2</td>
</tr>
<tr>
<td>Usually, I want to do what the county agent thinks I should do</td>
<td>6.3</td>
<td>21.8</td>
<td>37.9</td>
<td>23.0</td>
<td>10.9</td>
</tr>
<tr>
<td>Usually, I want to do what most of my friends think I should do</td>
<td>2.9</td>
<td>12.1</td>
<td>42.5</td>
<td>27.0</td>
<td>15.5</td>
</tr>
</tbody>
</table>
Table C.14
Frequency Table for Respondents’ Involvement in Environmental Organizations

<table>
<thead>
<tr>
<th>Do you currently belong to an environmental or conservation organization?*</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>57</td>
<td>33.3</td>
</tr>
<tr>
<td>No</td>
<td>114</td>
<td>66.7</td>
</tr>
</tbody>
</table>

*Frequency Missing = 3

Table C.15
Frequency Table for Respondents’ Involvement in Farm Organizations

<table>
<thead>
<tr>
<th>Do you currently belong to any farm organization?*</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>84</td>
<td>50.0</td>
</tr>
<tr>
<td>No</td>
<td>84</td>
<td>50.0</td>
</tr>
</tbody>
</table>

*Frequency Missing = 6

Table C.16
Frequency Table for Respondents’ Gender

<table>
<thead>
<tr>
<th>What is your sex?*</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>144</td>
<td>83.7</td>
</tr>
<tr>
<td>Female</td>
<td>28</td>
<td>16.3</td>
</tr>
</tbody>
</table>

*Frequency Missing = 2
Table C.17  
Frequency Table for Respondents’ Education Level

<table>
<thead>
<tr>
<th>Education Level</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Some Grade School</td>
<td>3</td>
<td>1.8</td>
</tr>
<tr>
<td>Some High School</td>
<td>6</td>
<td>3.5</td>
</tr>
<tr>
<td>Completed High School</td>
<td>36</td>
<td>21.1</td>
</tr>
<tr>
<td>Some College</td>
<td>42</td>
<td>24.6</td>
</tr>
<tr>
<td>Completed College</td>
<td>52</td>
<td>30.4</td>
</tr>
<tr>
<td>Advanced Degree</td>
<td>32</td>
<td>18.7</td>
</tr>
</tbody>
</table>

*Frequency Missing = 3

Table C.18  
Frequency Table for Respondents’ Area of Residence

<table>
<thead>
<tr>
<th>Area of Residence</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rural Area or Small Town (less than 1,000 people)</td>
<td>76</td>
<td>44.4</td>
</tr>
<tr>
<td>Small Town or Small City (1,000 to 10,000 people)</td>
<td>42</td>
<td>24.6</td>
</tr>
<tr>
<td>Medium or Large City (more than 10,000 people)</td>
<td>53</td>
<td>31.0</td>
</tr>
</tbody>
</table>

*Frequency Missing = 3
Table C.19

Frequency Table for Respondents’ Income Level

<table>
<thead>
<tr>
<th>Which of the following best describes your total household income for 1994?*</th>
<th>Frequency</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Less Than $15,000</td>
<td>9</td>
<td>5.6</td>
</tr>
<tr>
<td>$15,000 to $24,999</td>
<td>11</td>
<td>6.9</td>
</tr>
<tr>
<td>$25,000 to $34,999</td>
<td>23</td>
<td>14.4</td>
</tr>
<tr>
<td>$35,000 to $44,999</td>
<td>13</td>
<td>8.1</td>
</tr>
<tr>
<td>$45,000 to $54,999</td>
<td>12</td>
<td>7.5</td>
</tr>
<tr>
<td>$55,000 to $64,999</td>
<td>15</td>
<td>9.4</td>
</tr>
<tr>
<td>OVER $65,000</td>
<td>77</td>
<td>48.1</td>
</tr>
</tbody>
</table>

*Frequency Missing = 14
## Table C.20
Summary Statistics for the Continuous Variables of the Louisiana Wetland Survey

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mean</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Acres of Land Owned</td>
<td>1118.28</td>
<td>2.00</td>
<td>8800.00</td>
<td>1566.28</td>
</tr>
<tr>
<td>Acres of Agricultural Land Owned</td>
<td>856.64</td>
<td>0.00</td>
<td>8500.00</td>
<td>1428.82</td>
</tr>
<tr>
<td>Acres of Wetlands Owned</td>
<td>484.43</td>
<td>0.00</td>
<td>6400.00</td>
<td>858.06</td>
</tr>
<tr>
<td>How long have you owned the wetlands?</td>
<td>21.84</td>
<td>4.00</td>
<td>100.00</td>
<td>19.54</td>
</tr>
<tr>
<td>How many acres of wetlands have you converted to agriculture?</td>
<td>81.72</td>
<td>0.00</td>
<td>3500.00</td>
<td>331.79</td>
</tr>
<tr>
<td>How many acres of wetlands have you converted to other uses?</td>
<td>53.99</td>
<td>0.00</td>
<td>1500.00</td>
<td>195.78</td>
</tr>
<tr>
<td>Family labor</td>
<td>0.76</td>
<td>0.00</td>
<td>6.00</td>
<td>1.17</td>
</tr>
<tr>
<td>Outside Hired Labor</td>
<td>2.68</td>
<td>0.00</td>
<td>50.00</td>
<td>6.29</td>
</tr>
<tr>
<td>Yearly average gross revenue per acre</td>
<td>1367.90</td>
<td>0.00</td>
<td>35000.00</td>
<td>5799.53</td>
</tr>
<tr>
<td>Yearly average net revenue per acre</td>
<td>361.34</td>
<td>0.00</td>
<td>12500.00</td>
<td>1810.95</td>
</tr>
<tr>
<td>Acres offered for enrollment in the WRP in 92</td>
<td>100.50</td>
<td>0.00</td>
<td>1700.00</td>
<td>286.01</td>
</tr>
<tr>
<td>Acres offered for enrollment in the WRP in 94</td>
<td>147.31</td>
<td>0.00</td>
<td>5640.00</td>
<td>548.98</td>
</tr>
<tr>
<td>Acres offered for enrollment in the WRP in 95</td>
<td>143.48</td>
<td>0.00</td>
<td>1000.00</td>
<td>202.84</td>
</tr>
<tr>
<td>How much did you bid or have been offered per acre of wetlands in 1992?</td>
<td>128.08</td>
<td>0.00</td>
<td>1000.00</td>
<td>252.13</td>
</tr>
<tr>
<td>How much did you bid or have been offered per acre of wetlands in 1994?</td>
<td>131.11</td>
<td>0.00</td>
<td>1000.00</td>
<td>231.99</td>
</tr>
<tr>
<td>How much did you bid or have been offered per acre of wetlands in 1995?</td>
<td>239.79</td>
<td>0.00</td>
<td>1000.00</td>
<td>290.20</td>
</tr>
<tr>
<td>How many acres of wetlands did you enroll in the WRP in 92?</td>
<td>90</td>
<td>0.00</td>
<td>1200.00</td>
<td>238.52</td>
</tr>
<tr>
<td>How many acres of wetlands did you enroll in the WRP in 94?</td>
<td>169.27</td>
<td>0.00</td>
<td>5640.00</td>
<td>669.16</td>
</tr>
<tr>
<td>How many acres of wetlands did you enroll in the WRP in 95?</td>
<td>122.15</td>
<td>0.00</td>
<td>875.00</td>
<td>192.43</td>
</tr>
<tr>
<td>How much money did you receive (or have been offered) per acre enrolled in 1992?</td>
<td>137.30</td>
<td>0.00</td>
<td>800.00</td>
<td>246.56</td>
</tr>
<tr>
<td>How much money did you receive (or have been offered) per acre enrolled in 1994?</td>
<td>144.00</td>
<td>0.00</td>
<td>650.00</td>
<td>226.77</td>
</tr>
</tbody>
</table>

(table con’d.)

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<table>
<thead>
<tr>
<th>Question</th>
<th>Mean</th>
<th>Minimum</th>
<th>Maximum</th>
<th>Standard Error</th>
</tr>
</thead>
<tbody>
<tr>
<td>How much money did you receive (or have been offered) per acre enrolled in 1995?</td>
<td>267.00</td>
<td>0.00</td>
<td>800</td>
<td>279.27</td>
</tr>
<tr>
<td>Yearly membership fees for environmental organization?</td>
<td>103.01</td>
<td>0.00</td>
<td>5000</td>
<td>465.50</td>
</tr>
<tr>
<td>What is your present age?</td>
<td>55.41</td>
<td>23.00</td>
<td>83</td>
<td>13.59</td>
</tr>
<tr>
<td>How many persons live in your household?</td>
<td>2.68</td>
<td>1.00</td>
<td>7.00</td>
<td>1.27</td>
</tr>
</tbody>
</table>
APPENDIX D
EIGENVALUES, VARIANCE PROPORTIONS, AND CONDITION INDEXES CALCULATED FROM PRINCIPAL COMPONENT ANALYSES OF EXPLANATORY VARIABLES
Table D.1
Eigenvalues and Variance Proportions for Variables Used in the Neoclassical Economic Models

<table>
<thead>
<tr>
<th>Variables</th>
<th>Eigenvalue</th>
<th>Ltotal</th>
<th>Lwet</th>
<th>Revenue</th>
<th>Knowrp</th>
<th>Infowrp</th>
<th>Wetfarm</th>
<th>Crop</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.21</td>
<td>0.031</td>
<td>0.027</td>
<td>0.022</td>
<td>0.001</td>
<td>0.007</td>
<td>0.012</td>
<td>0.000</td>
</tr>
<tr>
<td>2</td>
<td>0.401</td>
<td>0.002</td>
<td>0.005</td>
<td>0.006</td>
<td>0.027</td>
<td>0.002</td>
<td>0.030</td>
<td>0.071</td>
</tr>
<tr>
<td>3</td>
<td>0.55</td>
<td>0.001</td>
<td>0.018</td>
<td>0.016</td>
<td>0.010</td>
<td>0.001</td>
<td>0.098</td>
<td>0.079</td>
</tr>
<tr>
<td>4</td>
<td>0.591</td>
<td>0.014</td>
<td>0.052</td>
<td>0.008</td>
<td>0.039</td>
<td>0.143</td>
<td>0.065</td>
<td>0.000</td>
</tr>
<tr>
<td>5</td>
<td>0.664</td>
<td>0.081</td>
<td>0.035</td>
<td>0.000</td>
<td>0.020</td>
<td>0.141</td>
<td>0.001</td>
<td>0.102</td>
</tr>
<tr>
<td>6</td>
<td>0.764</td>
<td>0.000</td>
<td>0.007</td>
<td>0.089</td>
<td>0.422</td>
<td>0.037</td>
<td>0.034</td>
<td>0.000</td>
</tr>
<tr>
<td>7</td>
<td>0.841</td>
<td>0.007</td>
<td>0.012</td>
<td>0.386</td>
<td>0.047</td>
<td>0.004</td>
<td>0.069</td>
<td>0.074</td>
</tr>
<tr>
<td>8</td>
<td>0.926</td>
<td>0.003</td>
<td>0.000</td>
<td>0.109</td>
<td>0.134</td>
<td>0.011</td>
<td>0.114</td>
<td>0.298</td>
</tr>
<tr>
<td>9</td>
<td>1.084</td>
<td>0.002</td>
<td>0.017</td>
<td>0.027</td>
<td>0.029</td>
<td>0.519</td>
<td>0.003</td>
<td>0.208</td>
</tr>
<tr>
<td>10</td>
<td>1.179</td>
<td>0.012</td>
<td>0.026</td>
<td>0.114</td>
<td>0.095</td>
<td>0.007</td>
<td>0.047</td>
<td>0.002</td>
</tr>
<tr>
<td>11</td>
<td>1.314</td>
<td>0.047</td>
<td>0.002</td>
<td>0.097</td>
<td>0.001</td>
<td>0.005</td>
<td>0.005</td>
<td>0.025</td>
</tr>
<tr>
<td>12</td>
<td>1.36</td>
<td>0.038</td>
<td>0.003</td>
<td>0.003</td>
<td>0.033</td>
<td>0.066</td>
<td>0.292</td>
<td>0.002</td>
</tr>
<tr>
<td>13</td>
<td>1.477</td>
<td>0.090</td>
<td>0.224</td>
<td>0.028</td>
<td>0.070</td>
<td>0.000</td>
<td>0.102</td>
<td>0.005</td>
</tr>
<tr>
<td>14</td>
<td>2.639</td>
<td>0.672</td>
<td>0.571</td>
<td>0.095</td>
<td>0.073</td>
<td>0.057</td>
<td>0.128</td>
<td>0.131</td>
</tr>
</tbody>
</table>

(table con’d.)
## Table D.2
Condition Indexes for Variables Used in the Neoclassical Economic Models

<table>
<thead>
<tr>
<th>Eigenval</th>
<th>Envor</th>
<th>Gender</th>
<th>Educate</th>
<th>Reside</th>
<th>Lage</th>
<th>Depend</th>
<th>Income</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.21</td>
<td>0.039</td>
<td>0.005</td>
<td>0.029</td>
<td>0.012</td>
<td>0.000</td>
<td>0.001</td>
</tr>
<tr>
<td>2</td>
<td>0.401</td>
<td>0.000</td>
<td>0.000</td>
<td>0.010</td>
<td>0.019</td>
<td>0.133</td>
<td>0.202</td>
</tr>
<tr>
<td>3</td>
<td>0.55</td>
<td>0.022</td>
<td>0.156</td>
<td>0.013</td>
<td>0.124</td>
<td>0.005</td>
<td>0.024</td>
</tr>
<tr>
<td>4</td>
<td>0.591</td>
<td>0.021</td>
<td>0.053</td>
<td>0.012</td>
<td>0.052</td>
<td>0.100</td>
<td>0.001</td>
</tr>
<tr>
<td>5</td>
<td>0.664</td>
<td>0.006</td>
<td>0.112</td>
<td>0.040</td>
<td>0.052</td>
<td>0.020</td>
<td>0.000</td>
</tr>
<tr>
<td>6</td>
<td>0.764</td>
<td>0.001</td>
<td>0.011</td>
<td>0.088</td>
<td>0.029</td>
<td>0.064</td>
<td>0.004</td>
</tr>
<tr>
<td>7</td>
<td>0.841</td>
<td>0.104</td>
<td>0.003</td>
<td>0.002</td>
<td>0.058</td>
<td>0.015</td>
<td>0.044</td>
</tr>
<tr>
<td>8</td>
<td>0.926</td>
<td>0.001</td>
<td>0.016</td>
<td>0.270</td>
<td>0.007</td>
<td>0.003</td>
<td>0.014</td>
</tr>
<tr>
<td>9</td>
<td>1.084</td>
<td>0.006</td>
<td>0.203</td>
<td>0.017</td>
<td>0.021</td>
<td>0.039</td>
<td>0.002</td>
</tr>
<tr>
<td>10</td>
<td>1.179</td>
<td>0.077</td>
<td>0.003</td>
<td>0.089</td>
<td>0.003</td>
<td>0.171</td>
<td>0.200</td>
</tr>
<tr>
<td>11</td>
<td>1.314</td>
<td>0.005</td>
<td>0.278</td>
<td>0.160</td>
<td>0.551</td>
<td>0.099</td>
<td>0.012</td>
</tr>
<tr>
<td>12</td>
<td>1.36</td>
<td>0.506</td>
<td>0.000</td>
<td>0.225</td>
<td>0.000</td>
<td>0.053</td>
<td>0.000</td>
</tr>
<tr>
<td>13</td>
<td>1.477</td>
<td>0.044</td>
<td>0.099</td>
<td>0.014</td>
<td>0.072</td>
<td>0.199</td>
<td>0.339</td>
</tr>
<tr>
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### Table D.3
Eigenvalues and Variance Proportions for Variables Used in the Behavioral Economic Models with NEP

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**Table D.4**

Condition Indexes for Variables Used in Models with NEP Measure

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Table D.5
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### Condition Indexes for Variables Used in Models with Measures of Attitudes and Subjective Norm Derived from the Theory of Reasoned Action

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**Table D.6**
Condition Indexes for Variables Used in Models with Measures of Attitudes and Subjective Norm Derived from the Theory of Reasoned Action

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VITA

Assane Diagne was born in Dakar, Senegal, on February 7, 1961. After graduating from high school in July 1978, he accepted a European Community Fellowship and attended the Faculté des Sciences Agronomiques de Gembloux in Belgium. Upon completion of his degree in Agronomy, he returned to Senegal in 1984 and worked as a research officer and as a national coordinator for a development project (Projet de Lutte contre les Nematodes). In 1990, he joined Louisiana State University to pursue graduate studies in Agricultural Economics. He earned a Master’s degree in Agricultural Economics in May 1992 and enrolled in the doctoral program in August of 1992.
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Major Field: Agricultural Economics

Title of Dissertation: The Role of Environmental Attitudes in Incentive-Based Environmental Management: The Case of the Wetland Reserve Program

Approved:

[Signatures]

Major Professor and Chairman

Dean of the Graduate School

EXAMINING COMMITTEE:

[Signatures]

Date of Examination: June 12, 1996