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ESTIMATING ECONOMIC VALUES FOR GREAT LAKES COASTAL WETLANDS PROTECTION PROGRAMS

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ESTIMATING ECONOMIC VALUES FOR GREAT LAKES COASTAL WETLANDS PROTECTION PROGRAMS

By

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ABSTRACT

ESTIMATING ECONOMIC VALUES FOR GREAT LAKES COASTAL WETLANDS PROTECTION PROGRAMS

By:

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Concerns about the loss of wetlands due to human activities have led to state and federal efforts to protect wetlands on both public and private property. In designing wetland protection programs, decisionmakers have to balance alternative program objectives, competing priorities, and limited resources. This thesis presents the results of a study on economic values related to programs for Great Lakes coastal wetlands conservation and restoration. A mail survey was administered to a random sample of Michigan residents and had a 40% response rate. The survey used the Attribute Based Referendum method, and asked respondents about coastal wetland conservation / restoration programs with attributes that varied across the sample. Program attributes included program focus or priorities, the percentage of mix between conservation and restoration involved, and alternative property acquisition mechanisms. Model estimates revealed that respondents significantly preferred coastal wetland programs focusing on providing: i) water quality and flood control, ii) biodiversity, and iii) waterfowl habitat, more than other possible priorities (e.g. fish habitat, open space). Respondents also preferred programs that directed more effort at wetland preservation than wetland restoration. The data analysis revealed a lower bound willingness to pay (WTP) for the coastal wetland programs of $163/hhd which is roughly equivalent to a value of $20,500/acre of coastal wetland. These results indicate that some individuals positively value wetland protection programs and that they are willing to pay for such programs.

To my beloved family and to my wife Delanie Kellon.

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CHAPTER 1: INTRODUCTION

The coastal wetlands of the Great Lakes are unique and important ecosystems whose functions provide diverse benefits to society and the surrounding environment. Wetlands provide benefits such as: habitat for a significant number of wildlife species; water quality improvements; flood and erosion control; aesthetic benefits; the reduction of contaminant concentrations; carbon dioxide sinks; and even climate stabilization at a global scale (Canadian Wildlife Service 2002, National Research Council 2001, Mitsch and Gosselink 2000, Lewis 1995, Keating 1995, Mitsch 1994, Harrington 1993, Brown 1990, Maltby 1986). Since 1900, more than half of the wetlands of the world have disappeared (Barbier 1993). In the United States, 117 million acres of the nation's original 221 million acres of wetlands have been lost (A National Program for Wetlands Restoration and Creation, cited by Keating 1995). The greatest percentage of wetland depletion in the United States has occurred in those states located along the eastern seaboard, in the South, California, and areas adjacent to the Great Lakes (Keating 1995). In the Great Lakes region, 70% of the area's original wetlands have been lost, resulting in a regional wetland loss that is significantly larger than the loss in the United States as a whole (Brown 1990).

Concerns about the loss of wetlands due to human activities have led to state and federal efforts, such as the "no net loss" goal, to protect wetlands on both public and private property (National Research Council 2001). Several attempts have been made to establish funds for Great Lakes ecological restoration including the restoration of coastal wetlands, and new legislative proposals such as the Great Lakes Collaboration Implementation Act,

the Great Lakes Environmental Protection and Restoration Programs Reauthorization Act and the Great Lakes Environmental Restoration Act are aimed to protect and restore coastal wetlands.

In the design of wetland conservation or restoration programs, decisionmakers have to balance alternative program objectives, competing priorities, and limited resources. For example, they may allocate resources to either protect existing wetlands or restore wetlands that had been impaired by human activity. In light of the necessity of such trade-offs, information on the public's preferences for different coastal wetland program characteristics would be helpful for developing wetland conservation policy. Furthermore, an understanding of the characteristics of programs supported by Michigan citizens, and an estimation of the public's willingness to pay for these programs and program characteristics would aid the design of wetland policy more likely to be supported by the public.

Most wetland legislation contains references to the societal values that motivate wetland protection since wetland functions support associated societal benefits (Lewis 1995). The benefits that society derives directly or indirectly from ecosystem functions may be considered ecosystem services (Costanza et al. 1998). However, private owners of wetlands may not realize the full extent of the services that wetlands provide to society, because private owners cannot easily profit directly from such large-scale and diffuse services (Heimlich 1998). The private economic benefits obtained by converting wetlands to other land uses can be realized directly by the owner of the land and such

economic benefits have often been perceived as greater than preserving intact wetlands. This condition can be interpreted as a private incentive to convert wetlands to other competing land uses, which in the long run can result in large losses in social benefits because of the loss of important wetland functions that provide services (Cwikiel 2003).

It is pertinent to point out that, although the value of a wetland is directly related to its functions, economic value is an estimate of the worth of those functions to humans (Canadian Wildlife Service 2002). Society does not necessarily assign value to all wetland functions, since values are associated only to those functions that are interpreted by individuals as services (Lewis 1995). Important wetland functions also provide indirect services crucial for sustaining life in the Great Lakes' region which may not be clearly valuated or explicitly included as priorities in conservation programs.

A difficulty of estimating values for ecosystem services associated with wetland functions is an absence of a market for them, despite the fact that society may consider them important (Krutilla 1967; Costanza, Farber and Maxwell 1989; Wilson and Carpenter 1999; Woodward and Wui 2001). Those ecosystem services without an explicit market may be categorized as non-market goods and some uncertainty surrounds their valuation and significance (Turner, Pearce and Bateman 1994).

There is an important gap in the literature concerning Great Lakes coastal wetland (GLCW) valuation. The available valuation literature for GLCW is limited to a handful of studies including those by Amacher et al. (1989) and Whitehead et al. (2006). A recent

effort by the International Lake Ontario-St. Lawrence River Study resulted in a report prepared by Werick, Lupi and Leger (2006). This report attempts to develop a crude indication of economic values of benefits associated with Great Lakes wetland services by compiling and comparing existing studies.

This thesis presents research results on public preferences for programs conserving and restoring Great Lakes Coastal Wetlands. The purpose of this research is not to determine whether Michigan residents demand protection of the state's wetlands, rather it is to understand what tradeoffs and preferences the public is willing to make for additional programs targeting coastal wetlands restoration and preservation. It is expected that the cost and characteristics of proposed wetland protection programs will influence the respondents' support of alternative programs. Simultaneously, the research examines how demographic characteristics of survey respondents are associated with their willingness to support coastal wetland protection programs.

This thesis presents the results of a state-wide contingent valuation survey that used an attribute-based referendum (Holmes and Boyle 2005) for a program to protect and restore Great Lakes coastal wetlands in Michigan. The attribute-based referendum (ABR) approach is a variant of the contingent valuation and stated choice methods in which individuals are presented with a referendum valuation question for a program whose attributes (characteristics, including price) are experimentally varied across the sample.

A main effects factorial design (Louviere et al. 2000) was utilized for the experimental design of the attribute-based referendum.

The attributes used in the survey's design are characteristics of proposed Great Lakes coastal wetland conservation-restoration programs. These attributes are explained to respondents in the survey booklet and are subsequently used in the valuation question. The attributes included: (i) ecosystem services that serve as the primary focus of the program (biodiversity, waterfowl habitat, fish habitat, non-game species, water quality and flood control, and open space near cities), (ii) a mix of program effort devoted to preservation of high quality wetlands and effort allocated to restoration of impaired wetlands, (iii) the method used to acquire land from voluntary private land-owners, and (iv) program cost in the form of a one-time statewide tax payment (seven levels ranging from $40 to $1,320). The referendum question presented respondents with one program with a set of attributes together with a specific price for the program's implementation. Respondents were asked to vote Yes / No to pay a one-time tax for the proposed program's implementation.

The coastal wetland questionnaire was designed using an iterative process of focus groups and individual interviews (Kaplowitz, Lupi and Hoehn 2004) to produce a survey booklet with wetland information, policy context, and valuation questions that were understood and seen as plausible by respondents. The mail survey was implemented in 2004 and distributed to a random sample of 1,505 licensed drivers and state identification card holders in Michigan. Using a Dillman "tailored design method" (Dillman 2000),

potential respondents received up to five contacts including as many as two replacement survey booklets. The response rate[1] for this statewide survey was slightly more than 40% (AAPOR 2006).

The survey data were analyzed using both non-parametric (Turnbull) and parametric (probit) methods. The Turnbull estimator was used to estimate a lower bound willingness to pay, while the parametric method (standard discrete choice econometric model) was used to infer the effect that each attribute had on the probability of voting for the program. The results and models developed in this thesis should aid decisionmakers in evaluating public preferences and support for policies and programs for protecting and restoring GLCW.

[1] The response rate presented here is Response Rate (RR2), which includes partial interviews (AAPOR 2006).

CHAPTER 2: WETLANDS AND ECONOMIC VALUATION

Wetlands around the World

Wetlands are among the most ecologically diverse and productive ecosystems in the world (Maltby 1986). The global extent of wetlands is estimated to be six percent of the world's land surface. Despite this, wetlands have become a focus of conservation efforts due to the alarming rates at which they are disappearing (Mitsch and Gosselink 2000). The importance of wetlands is so significant that it is the only ecosystem type that has prompted its own international convention, the Ramsar Convention of 1971, under which signatory countries agreed to include wetland conservation in their national planning and promote the wise use of these ecosystems (Mitsch and Gosselink 2000, Maltby et al. 1986).

Definitions of Wetlands

The definition of wetlands varies across the literature and is problematic. Most definitions revolve around the presence and interaction of the biotic and abiotic components of a wetland. Mitsch and Gosselink (2000) suggest three main components of the definition of a wetland:

1. Hydrology: the area is defined by the presence of surface or ground (root zone) water.
2. Physicochemical environment: the soils in the area often have unique characteristics related to wet conditions.
3. Biota: wetlands support vegetation, animals and microbes that are adapted to wet conditions.

The quality and interaction of these three components serve as the basis for these productive ecosystems to generate associated benefits to the surrounding environment and people.

A precise definition can help delimit these ecosystems for scientific understanding and for their proper management. The Committee on Characterization of Wetlands for the U. S. National Academy of Sciences (National Research Council 1995) gives another definition for U.S. wetlands. While recognized as the most comprehensive definition of wetlands (Mitsch and Gosselink 2000), NRC (1995) definition fails to stress the importance of key factors necessary for wetlands when it describes hydric soils and hydrophytic vegetation as "common diagnostic features".

> *"A wetland is an ecosystem that depends on constant or recurrent, shallow inundation or saturation at or near the surface of the substrate. The minimum essential characteristics of a wetland are recurrent, sustained inundation or saturation at or near the surface and the presence of physical, chemical, and biological features reflective of recurrent, sustained inundation or saturation. Common diagnostic features of wetlands are hydric soils and hydrophytic vegetation. These features will be present except where specific physicochemical, biotic, or anthropogenic factors have removed them or prevented their development."*

Definitions of wetlands vary across disciplines and purposes, and they are usually too broad to be specifically applied in regulatory practices without being accompanied by context-specific interpretation (Lewis 1995). For this thesis, wetlands are defined based on U.S. Army Corps of Engineers regulation and Michigan's legislation:

> *"Wetland means land characterized by the presence of water at a frequency and duration sufficient to support, and that under normal circumstances does support,*

wetland vegetation or aquatic life, and is commonly referred to as a bog, swamp, or marsh..."[2]

Why Are Wetlands Important?

Wetland ecosystems play an important role in sustaining life systems. They are known as "the kidneys of the landscape" because of the ecological functions they perform and as "biological supermarkets" because of the extensive food webs and rich biodiversity they support (Barbier, Acreman and Knowler 1997, Mitsch and Gosselink 2000). Wetlands are commonly compared to tropical rain forests and coral reefs because of the diversity of species that rely on wetlands for habitat (Dennison and Schmid 1997). Wetlands are also important components of watersheds because they are critical in the transition from terrestrial to aquatic environments (Amacher et. al 1989, Lewis 1995, Dennison and Schmid 1997).

Wetland Functions

Wetland functions can be defined broadly as all processes and manifestations of processes that occur in wetlands (Lewis 1995). Through these functions, wetlands are capable of providing a wide range of benefits that can be interpreted as services, such as: habitat for a significant number of wildlife species; water quality improvements; flood and erosion control; aesthetic functions; reduction of contaminant concentrations; carbon dioxide sinks; and even as climate stabilizers at a global scale (Canadian Wildlife Service 2002, National Research Council 2001, Mitsch and Gosselink 2000, Lewis 1995, Keating 1995, Mitsch 1994, Harrington 1993, Brown 1990, Maltby 1986). Specifically with

[2] www.legislature.mi.gov §324.30301

respect to wildlife habitat and biodiversity conservation, wetland ecosystems represent unique habitats for migratory and endemic species. Over one third of all bird species in North America rely on wetlands, which are also the preferred habitat for animals such as muskrat, beaver, otter, mink, and raccoon (Heimlich 1998). Wetlands can also provide goods and service for direct use by people such as recreation and water transport; and wetlands can be used for fishing, agriculture, wildlife products, wood products, and water supply (Barbier 1994).

Although wetlands provide people, directly and indirectly, with an enormous range of goods and services that have effects beyond the wetland boundary, people did not fully realize their value to human society until recently (Barbier 1994). Historically, wetlands have been converted to other land uses and are increasingly disappearing as a result of development decisions (Barbier 1993, Matlby 1986, Canadian Wildlife Service 2002).

Wetland Loss

When wetlands are lost or damaged, the many functions they provide to the surrounding environment are lost or compromised as well (Mitsch and Gosselink 2000). A considerable percentage of wetland ecosystems have been lost or impaired by draining, filling, dredging, excavating, building, polluting and other development activities (Brown 1990). Since 1900, more than half of the wetlands of the world have disappeared (Barbier 1993). In the United States alone, 117 million acres of the nation's original inventory of 221 million acres of wetlands have been lost (Keating 1995). There has been a loss of about 53% of the country's original wetlands, of which 87% has been lost

to agricultural development, 8% to urban development, and 5% to other conversions (Dahl 2000, Maltby 1986). The greatest percentage of wetland loss in the United States has occurred in those states located along the eastern seaboard, in the South, adjacent to the Great Lakes, and in California (Keating 1995). In the Great Lakes region, only 30% of the original wetland area remains intact, representing a regional wetland loss that is significantly larger than the loss throughout the United States as a whole. In Michigan, the remaining area covered by wetlands is also 30% of the original wetland area (Brown 1990).

In the past, the functions of wetlands were neither understood nor appreciated by the nation's citizens, and wetlands were drained and filled in the name of development decisions (Hey and Philippi 1999). In the early 1970s, interest in wetlands increased as scientists began to identify and quantify the significance of these ecosystems for the services they provide (Mitsch and Gosselink 2000). As awareness about wetland services grew, federal wetland programs evolved from offering incentives for wetland conversion, to regulatory programs for conservation and incentives that promote restoration and protection (Heimlich 1998). To prevent the loss of more wetland acreage, state, federal and local regulatory programs currently operate in combination to place conditions on wetland permits in an effort to avoid, reduce, and mitigate wetland loss.

The Legal Framework of Wetland Conservation in the U.S.

Most of the legislation dealing with wetlands contains references to the societal values that motivate wetland protection given that some wetland functions are associated with

societal benefits and values (Lewis 1995). Wetland laws attempt to determine where an individual's property rights end and where the public's interest in resource protection begins (Cwikiel 2003). Consequently, wetlands are the only ecosystem type to be comprehensively regulated across all public and private land within the United States (Lewis 1995).

Since 1899, several federal laws, directives and regulations have been implemented in the United States to protect wetlands. However, not until the 1970s did the federal government begins a more committed approach to carry out wetland protection through executive orders and legislation (Lewis 1995). The primary federal laws that regulate activities that impact wetlands are Section 401, Section 402 and most importantly, Section 404 of the Clean Water Act (33 U.S.C. 1344). Section 10 of the Rivers and Harbors Act (33 U.S.C. 403) also plays an important role in wetland regulation (Cwikiel 2003, Mitsch and Gosselink 2000, Dennison and Schmid 1997, Brinson and Rheinhardt 1996). The objective of the Clean Water Act (CWA) is to "restore and maintain the chemical, physical, and biological integrity of the Nation's waters" (NRC 2001). The CWA confers the U.S. Army Corps of Engineers or state with an Environmental Protection Agency (EPA)-approved program with the authority to implement and issue Section 404 permits (NRC 2001). It was not expected that the Section 404 would, by itself, completely prevent the loss of wetlands, however it was meant to guarantee the minimization of losses wherever possible (Hey and Philippi 1999).

The "No Net Loss" Policy

The U.S. EPA initiated a national wetlands policy development initiative in 1987 by requesting that the Conservation Foundation convene a National Wetlands Forum to investigate the use and management of wetlands across the nation. The members of this Forum formulated the following goal in 1998:

> "To achieve no overall loss of the nation's remaining wetlands base and to create and restore wetlands, where feasible, to increase the quantity and quality of the nation's wetland resource base" (Kean, National Wetlands Policy Forum and Conservation Foundation 1998).

The EPA, which is jointly responsible together with the Army Corps of Engineers for regulating the mitigation of damages to wetlands, requested that the National Research Council evaluate the mitigation practices that were being used to restore and maintain the quality of the Nation's waters as regulated under Section 404 of the CWA. Recognizing the importance of wetlands' functions and values under the "no net loss" policy established by the Bush administration in 1989 (National Research Council 2001), the Committee on Mitigating Wetlands reported that the CWA cannot be achieved if wetlands are lost. This is supported by the fact that one of the most important wetland contributions is the protection of water resource quality, which is directly linked to the quality of the environment surrounding the wetlands (Dennison and Schmid 1997).

Great Lakes Coastal Wetlands

There are approximately five million acres of inland and coastal wetlands in Michigan (with a greater concentration in the Upper Peninsula), an area that corresponds to 30

percent of the State's territory (Gaddie and Regens 2000). GLCW represent unique and biologically important ecosystems in the Great Lakes region (Canadian Wildlife Service 2002), they occur along the Great Lakes shoreline and in portions of tributary rivers and streams that are directly affected by Great Lakes water regimes (Albert 2003). Despite their ecological value, Great Lakes coastal resources are under increasing pressures from urban sprawl, coastal development, beach grooming, invasive species, hydrologic changes, and environmental degradation.

Evidence of the importance of coastal wetlands becomes more apparent when their functions are identified and quantified in the context of the surrounding environment they benefit. For example, of the approximately 200 fish species supported by the Great Lakes, 90% live in coastal wetlands during some part of their lives, and large numbers of geese, ducks and swans utilize the coastal marshes as a stationary feeding point during their annual migrations (Albert 2003). A sharp decline in fish and waterfowl populations was the first evidence of severe coastal wetland degradation, which eventually had a negative effect on the economy and recreation activities of local communities. The negative impact that chemical and physical degradation of the lakes' waters had on humans was an important factor that activated the clean-up of the Great Lakes, including their wetlands (Albert 2003).

Regulation for Wetland Protection in Michigan

In Michigan, the Michigan Department of Environmental Quality (MDEQ) and the U.S. Army Corps of Engineers share the responsibility of administering and enforcing the

federal wetlands regulatory program. The State's core legislation regulating this matter is Michigan's Wetland Regulatory Program, part 303, Wetland Protection of the Natural Resources and Environmental Protection (Act 451 of 1994). The State of Michigan through the MDEQ is one of the two states that have assumed the administration of Section 404 of the Clean Water Act (Cwikiel 2003). MDEQ uses the definition of wetlands as specified by Michigan's legislature in the Natural Resources and Environmental Protection Act, which applies to public and private lands regardless of zoning or ownership:

> *"Wetland means land characterized by the presence of water at a frequency and duration sufficient to support, and that under normal circumstances does support, wetland vegetation or aquatic life, and is commonly referred to as a bog, swamp, or marsh..."*[3]

Landowners and developers who wish to carry out activities on wetlands and consequently impair, damage or fill-in a wetland, are required to apply for permits with respect to federal, state and local laws and regulations. The CWA expects that the Corps of Engineers, in cooperation with Michigan's Wetland Protection Act, will consider the public interest consequences when considering whether or not to issue a permit. The determination of the impact on public interests is considered in the context of those wetland functions that can be negatively affected by the proposed activity (Cwikiel 2003).

[3] www.legislature.mi.gov §324.30301

If a permit is issued, project approval is conditional upon compensatory actions intended to avoid the loss of wetland area and functions. That is, if wetlands are impaired or destroyed, wetland mitigation is required by law. Mitigation refers to actions taken by the landowner or developer to recreate, restore, or protect wetlands of an equivalent type and function to those being impaired or destroyed (Dennison and Schmid 1997, Brinson and Rheinhardt 1996).

The Economic Value of Wetlands

For the services they provide to society, wetlands are resources that should be properly valued; however, private owners of wetlands cannot realize the full extent of the services wetlands provide to society at large, because private owners cannot profit directly from such large-scale services (Heimlich 1998). The private economic benefits obtained by converting wetlands to other land uses can be acquired directly by the owner of the land. This condition can be interpreted as a private incentive to convert wetlands to other competing land uses, which in the long run can result in larger economic losses to society from the loss of wetland services (Cwikiel 2003).

It must be pointed out that although the value of a wetland is directly related to its functions, value is an economic estimate of the worth of those functions to humans (Canadian Wildlife Service 2002). Society does not necessarily assign value to all wetland functions, since values are associated only to those functions that are interpreted as services (Lewis 1995). Important functions that provide indirect services are also crucial for sustaining life in the Great Lakes' region and still are not clearly valuated or

explicitly included as priorities in conservation programs. Carson and Mitchell (1983) developed a typology of benefits (Table 1) associated with freshwater ecosystems, which is intended to include all of the possible benefits of freshwater quality improvements.

Table 1. A typology of benefits associated with the improvement of freshwater quality for purposes of economic valuation (adapted from Mitchell and Carson 1989)

Benefit Class	Benefit Category	Benefit Subcategory
Use	In-stream	Recreational (water sports, fishing, boating, swimming)
		Commercial (fishing, navigation)
	Withdrawal	Municipal (drinking water, waste disposal)
		Agriculture (irrigation)
		Industrial/commercial (electricity)
	Aesthetic	Enhanced near-water recreation (hiking, picnic, photography)
		Enhanced routine viewing (commuting, office/home views)
	Ecosystem (functions)	Enhanced recreation support (waterfowl hunting)
		Enhanced general ecosystem support (food chain, habitat, flood control)
Existence (or non-use)	Vicarious Consumption	Significant other (relatives, close friends)
		Diffuse others (the nation / world public)
	Stewardship	Inherent (preserving remote wetlands)
		Bequest (family, future generations)

Use Benefits

Use benefits can be separated into direct and indirect uses. Direct benefits consist of those derived from people's direct interaction with the ecosystem and include consumptive uses of the resource. Indirect benefits are those provided by the wetlands' natural functions and fall under the "aesthetic" and "ecosystem" type of benefits. These benefits include the non-consumptive use of resources (Mitchell and Carson 1989,

Barbier 1993). The benefits that society derives directly or indirectly from ecosystem functions can be considered ecosystem services (Costanza et al. 1998).

Benefit measurement techniques that include the role played by the ecosystem can be utilized to derive the value of direct and indirect uses. For direct uses associated with commercial activities, the value can be assessed observing changes in the market prices of those activities (Mitchell and Carson 1989). For indirect uses, the values might accrue for ecosystem services that indirectly provide consumption goods or have an effect on consumption goods, for example: aesthetic benefits or flood control (Sterner 2003).

Existence benefits

The value of this type of benefit can be derived from the value that the individuals attach to the mere knowledge that a unique natural ecosystem exists, even if the individual does not contemplate ever being able to use of the resources in that ecosystem (Portney 1994, Wilson and Carpenter 1999). The values derived from this type of benefit are also called "existence values" or "passive values" (Mitchell and Carson 1989; Portney 1994).

Economic Valuation of Environmental Benefits

While economic valuation of environmental benefits was explicitly prohibited when environmental regulations where initially set (Cropper and Oates 1992), as regulation evolved, economic valuation became more important. Currently, wetland regulations such as the U.S. Clean Water Act require economic valuation of environmental benefits (Carpenter and Turner 2000). Thus, valuing a wetland now essentially requires valuing the ecosystem services.

While several dimensions of use values and existence values are plausibly distinguishable, and all enter into a consumer's utility function, they are likely to be very difficult to separate and measure individually (Mitchell and Carson 1989). In an economic sense, a wetland is not a generic economic commodity. Rather, a wetland is a multi-attribute bundle of benefits (Hoehn, Lupi and Kaplowitz 2003).

A difficulty of estimating values for many ecosystem services associated with wetland functions is that there is no market for them, despite the fact that society considers them important (Krutilla 1967, Costanza, Farber and Maxwell 1989, Wilson and Carpenter 1999, Woodward and Wui 2001). These goods are categorized as non-market goods and some uncertainty surrounds their true value and significance (Turner, Pearce and Bateman 1994).

The complication of not knowing the true value of wetland services is worsened when individuals and decisionmakers have to make choices and trade-offs concerning ecosystem services and development decisions. This trade-off situation implies and requires valuation, because in a cost-benefit structure, any choice between competing alternatives implies that the one chosen was more highly valued. In that sense, it is important to realize what is being traded (Turner, Pearce and Bateman 1994, Costanza 2000, Perman et al. 2003). An accurate valuation of environmental goods and services is becoming increasingly important as the ecosystems that provide them become more scarce (Farber and Costanza 1987).

Valuation methods

The economic value of a good or service is generally established in terms of what society is willing to pay for that commodity and deducting the production costs. In the case of natural resources that simply exist as "given" by nature. Where the public perceives that there is no cost in producing the environmental goods it is our willingness to pay for the good / service that establishes its value (Barbier, Acreman and Knowler 1997). Researchers use two basic approaches for benefit valuation: A) revealed preference methods and B) stated preferences methods (Freeman 2003). Among these two approaches, several methods are available to estimate environmental values.

Revealed preference methods are essentially those that reflect the actual behavior of the respondent when facing decisions about utility maximization subject to constraints. For example, if an individual is offered a fixed quantity of a good at a given price on a yes-no basis (as in referendum), the observation of the choice made by the individual reveals only whether the value of the offered good to the individual was greater than or less than the offering price (Freeman 2003). Examples of these methods are travel cost and hedonic pricing.

Stated preference methods differ from in that they draw the value from people's responses to hypothetical questions rather than from observations of the real world choices. In the simplest approach, stated preferences questions can present a hypothetical market and directly ask (carefully worded survey questions) people what value they place

on environmental amenities. If the market scenario is plausible and the responses truthful, the data elicited in the form of monetary amounts, choices, ratings, rankings, or other indication of preference are scaled following appropriate models of preference to yield a measure of value (Freeman 2003, Perman et al. 2003, Champ, Boyle and Brown 2003). While a variety of methods utilize this type of questioning, the most prevalent approach is contingent valuation (Freeman 2003).

Contingent valuation

Since the publication in 1979 of "Principles and Standards for Water and Related Land Resources Planning", contingent valuation (CV), along with the travel method and the unit day value method have been accepted as useful for determining project benefits (Mitchell and Carson, 1989). CV has also been recognized as an approved method for measuring benefits and damages under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (Superfund), according to the final rule promulgated by the Department of the Interior in 1986 (Portney 1994). The literature in CV is extensive (e.g., Cummigns et al. 1986, Mitchell and Carson 1989, Bromley 1995, Bateman and Willis 1999, Stavins 2000, Freeman 2003, Champ, Boyle and Brown 2003, Haab and McConell 2003). For this thesis only the most relevant aspects of CV are discussed.

CV was used in the reported research to elicit people's preferences for a wetland conservation or restoration program. Respondents were asked how they would vote for a wetland protection program at a given price. The approach aimed at eliciting the

citizen's willingness to pay (WTP) in dollar amounts for a GLCW conservation / restoration program.

The goal in designing a CV survey is to formulate the question and scenario around a specific "commodity" that captures what one seeks to value, yet is plausible and meaningful (Hanemann, 1994). This research works when it presents a scenario that seems real to respondents so that respondents answer truthfully while aware of their individual budget constraints and preferences (Mitchell and Carson 1989).

The basic procedure is to ask CV survey questions that lead directly to WTP, or provide information that may be used to estimate preferences (Haab and McConnell 2002). Some common elicitation methods include:

- **Open Ended CV**: A question in which respondents are asked to state an estimate of their WTP for the good provided.
- **Bidding Game**: Respondents are asked iteratively whether they would be willing to pay a certain amount. The amounts are changed (lowered or raised) depending on whether the respondent was or not willing to pay the first amount offered. The number of iterations varies depending on the variant of the method utilized.
- **Payment Cards**: A CV question format in which individuals are asked to choose a willingness to pay point estimate (or a range of estimates) from a list of values predetermined by the researchers, and shown to the respondent on a card.
- **Dichotomous or Discrete Choice**: A CV question format in which respondents are asked to respond yes or no to a predetermined amount.

The Dichotomous Choice approach has become quite widely adopted and a preferred method of elicitation for CV practitioners (Haab and McConnell 2002). More details on how the method was applied in this thesis are presented in Chapters 3 and 4.

Why valuation?

Valuation methods are important tools to assess and quantify values associated with environmental amenities that have important roles sustaining life and providing quality of life. A monetary expression of these benefits is one approach for judging the relative importance of the environment when facing trade-offs. However, the cost of regulation also plays a role in benefit and cost analysis. For example, Cropper and Oates (1992) used EPA data to list the major pieces of environmental regulation and estimated the costs of full compliance with all Federal regulations. For full implementation of the Clean Water Act (CWA) throughout the entire nation, a total of $38,823 million[4] would be required annually. These costs ought to be compared with the attainable values in health, recreation, water quality, and other ecosystem services in order to recognize the full impact of the trade off.

On the other hand, the implementation of environmental protection policies is costly. For instance, Jaffe et al. (1995), who also used EPA data, stated that the annual cost to the United States for complying with environmental regulation equals 2.1 percent of the gross domestic product, which in 1995 was approximately $125 billion. For the

[4] In 1986 Dollars

implementation of Section 404 of the CWA in 1984, the Michigan Government estimated that it would need to spend $462,041[5] annually and hire five additional staff members (Gaddie and Regens 2000).

Therefore, in the face of constant concerns about the cost of environmental regulation, the need for assessing the values of multiple environmental services becomes extremely important in evaluating alternatives. Although there is little evidence to support the hypothesis that environmental regulations have had a serious, adverse effect on the productivity of the country (Jaffe et al. 1995), in protecting or restoring wetlands, the extent to which public and private resources should be used is still subject to debate. Existing wetland laws do not fund wetland preservation and restoration. The mere existence of a market failure does not automatically warrant the implementation of a given policy because the costs of market failures must be weighed against the potential for "policy failures" (Sterner 2003).

Previous Wetland's Valuation Research

Research efforts to estimate the value of wetlands have been increasingly more frequent. An interesting example is the work of Farber and Costanza (1987) who used two methods to estimate values for an entire wetland system by aggregating value measures of different wetland services. Their WTP estimations for commercial fishing and trapping, recreation and storm protection was about $590 per acre. Using an energy analysis evaluation, their research estimated values in a range of $6,400 to $10,600 per acre. The

[5] In 1990 Dollars

authors considered the WTP estimation as undervaluing the wetland since several wetland services seemed to be excluded from the analysis. On the other hand, they believed that the energy analysis method overestimated the value of wetlands because it includes wetland goods and services that may not be economically valuable.

There is a lack of GLCW valuation studies especially those studies associated with restoration and preservation programs for GLCW. The literature available on valuation of GLCW is limited to a handful of studies carried out mostly by Amacher et al. (1989) and more recently by Whitehead et al. (2006) who estimated the economic values of Saginaw Bay coastal marshes with multiple methods. Using two samples (sportsmen and general public), the Whitehead et al.'s Saginaw Bay study used CV to estimate willingness to pay for a hypothetical "Saginaw Bay Coastal Marsh Protection Program", which involved the purchase of coastal marshes. This study found that an annual value of $113,000 for protecting 1,125 acres of coastal marshes, for recreation and other not specified values These authors are cautious in stating that this value may be too low considering that it only addresses part of the overall importance of the subject wetlands and does not include ecological services that might have additional values.

Werick, Lupi and Leger (2006) recently prepared a report for the International Lake Ontario-St. Lawrence River Study (LOSL). In this report, the authors attempt to develop an indication of the economic value of benefits associated to wetland services by compiling and comparing studies to evidence that wetland's benefits have economic value. Table 2, shows the main research results compiled by the authors of that report.

Table 2. Previous Research in Economic Valuation of Wetlands (adapted from LOSL Report prepared by Werick, Lupi and Leger 2006. Valuating Wetland Benefits Compared with Economic Benefits and Losses).

Study	Services	Reported Values Per Acres/ Yr. (Converted to 2006 $US)
Woodward and Wiu, 2001.	Flood	$595
	Quality	$632
	Quantity	$192
	Recreational fishing	$541
	Commercial fishing	$1,179
	Bird Hunting	$106
	Bird Watching	$1,836
	Amenity	$5
	Habitat	$464
	Storm	$359
Kazmierczak	Habitat and species protection	$287
Costanza et al	Hábitat/refugia	$235
	Recreation	$263
	Total ecosystem services	$10,482
Breunig	Total ecosystem services	$17,307
Olewiler	Total ecosystem services (Low)	$4,217
	Total ecosystem services (High)	$17,712

The authors of the LOSL Report offered the caveat that making generalizations about wetland values is difficult since different types of wetland provide very different services. Similarly, where a wetland is located in relation to people will affect its value. Moreover, the demographic characteristics and behavior of the people surveyed will affect the values they assign to wetlands. Consequently, and in contrast to some types of non-

market values, the wetland values per acre reported in the literature vary widely (Werick, Lupi and Leger 2006).

CHAPTER 3: SURVEY METHODS

Introduction

This chapter presents the methods used for constructing and implementing a CV study with state of the art survey design techniques. Fundamental elements of the survey questionnaire design are presented, followed by discussion of survey pre-testing, implementation procedures, data entry management and response rate estimation. Finally, demographic information of the respondents is compared to Michigan's general population

Survey Questionnaire Design

The order in which the information in the survey is presented and how the questions are arranged in the survey used in this thesis, reflect the suggestions of the NOAA Panel review on how to increase the effectiveness and reliability of CV instruments (Mitchell and Carson 1989; Portney 1994; Hanemann 1994; Diamond and Hausman 1994). According to Carson, Flores and Meade (2001), the general guidelines for a CV survey design include the following steps: i) an introductory section to set the general context for the decision to be made; ii) a detailed description of the good to be offered to the respondent; iii) the institutional setting regarding how the good will be provided; iv) the payment vehicle; v) the method to elicit the respondents' preferences with respect to the good; vi) debriefing questions about why respondents answered certain questions the way that they did; and vii) information about the respondents' characteristics including attitudes, demographic information and debriefing questions.

The self-administered questionnaire was designed in accordance with state of the art methods and was implemented following the Tailored Design Method (Dillman 2000). The questionnaire booklet was made to be as "user-friendly" as possible in order to make it easier for respondents to understand, follow and respond (see Appendix for the complete questionnaire). The final survey instrument consisted of 52 items, grouped under 24 headings, and separated into four sections that elicited the answers to the following questions: A) what do respondents know about wetlands and what do they do in wetlands; B) what kind of conservation program would they prefer; C) what is their willingness to pay for that program; and lastly, D) what are some characteristics and behaviors of the respondents.

A) What do Respondents Know

The first section of the survey gathered information on respondents' knowledge of and experience with Great Lakes coastal wetlands (GLCW). This section of the survey also included information for respondents on the types of program characteristics associated with wetland protection and restoration. The questionnaire offered scientific definitions and explanations of GLCW and functions and services. Color pictures were used to illustrate the concepts.

B) What Program (Stated Choice)

The second section consisted of a "stated choice" question, which was used to collect information on the public's preferences for conservation programs utilizing an attribute based method. For more information on this part of the research, see Gibson (2005).

C) Valuation Question (Contingent Valuation)

The third section of the questionnaire is the focus of this thesis: a CV question using an attribute based referendum format. This section is intended to gather information to detect what value respondents place on particular wetland program attributes. This question took one of the programs presented as an alternative program in the stated choice question and added a monetary value to it. The CV question then asked respondents if they would vote to approve the specified program, if they had to pay for it. The cost was presented as a one-time payment which would be added to citizens' taxes. The CV question was followed by a question that prompts respondents for input as to their reasoning behind their answer. The follow up question was used to gain insight into the respondents' decision making process and to test their understanding and acceptance of the contingent valuation scenario (Hanemann 2005).

D) Background

The last section asked for background information on the respondents (e.g. attitudes, behaviors, demographic characteristics). This information is valuable for evaluating how representative of the general population the respondents are, as well as for obtain data about respondents that might help explain the results.

Survey Questionnaire Pre-Testing

Presser (2004) recommends that high quality survey instruments need to be pre-tested as part of the design and development process[6]. Pre-testing helps to ensure that the questionnaire language is understandable and that the questions asked are realistic and meaningful. Also, through pre-testing, the researcher can find out what the instrument's questions mean to people (Hanemann 1994). For the GLCW survey, pre-testing was conducted in two stages: intercept interviews and debriefing interviews.

Intercept Interviews

The debriefing interviews were carried out by interviewing randomly selected participants in public venues. To do this, two different "food courts" at shopping malls were used as the pre-testing locations. Twenty of these pre-testing sessions were conducted. Researchers approached individuals and asked them if they would be interested in filling out and commenting on a "public policy survey". Potential participants were told they would receive an honorarium of ten dollars as an incentive for participating, which was paid at the beginning of the session. Participants were asked to fill out a draft of the survey questionnaire. Subsequently, an interview session was conducted covering a series of questions pertaining to the questionnaire, its design, and participants' opinion of it (see Table 3).

The questions asked by researchers during this stage of pre-testing were designed to determine whether or not respondents understood the information and questions in the

[6] See Kaplowitz, Lupi and Hoehn in Presser 2004, 503 -524 for further detail regarding Multiple Methods for Developing and Evaluating a Stated-Choice Questionnaire to Value Wetlands.

questionnaire, and to find out if the correct amount and type of information was provided to respondents. The pre-testing survey was also intended to evaluate whether or not the contingent valuation question was designed properly.

Table 3. Survey Discussion Guide

1. Overall impression of the questionnaire
    a) What did you think of the questionnaire?
    b) Was there any information in the questionnaire that seemed odd or awkward to you?
    c) Did the information that was provided help you to answer the questions? Describe how.
    d) Were there questions where you would have liked more information? What information?
    e) Were there any areas where too much information was provided?
2. Wetland program
    a) Now, I want to talk about the question near the end that asked how you would vote on the wetland program. Tell me about what went through you mind as you made your decision.
    b) In your own words, describe to me what the program would provide.
    c) How would coastal wetlands change if the program were implemented?
    d) How would the services provided by coastal wetlands change with the program?
    e) Talk me through the table describing the program. What does each of these mean to you?
    f) How would the program affect you?
    g) Was the program realistic to you?
3. Other

Debriefing Interview Sessions

In addition to intercept pre-testing, three debriefing interview sessions were conducted at Michigan State University's campus. Potential participants in mid-Michigan were contacted by telephone through a system of random dialing telephone numbers from local

phone directory (Hoehn, Lupi and Kaplowitz 2003). After a brief screening interview, participants were invited to campus for scheduled individual interviews and offered $20 to attend. The three sessions took place on November 20, December 4 and December 10, 2003. All together 23 debriefing interviews were conducted.

One week prior to each interview session, interviewers made telephone contact with randomly selected residents in mid-Michigan. Interviewers initially asked each potential interviewee their age, education level, and gender. Any calls for which the demographic characteristic had been filled was terminated at this point in order to avoid over sampling any particular group of individuals. For each debriefing session, only one person from the 18-25 year old age group was recruited, and no one with an education level of a master's degree or beyond was recruited for any of the sessions. Individuals who possessed a master's degree or beyond were not sampled because they were not a group of concern for respondent comprehension. The researchers also sought to achieve an even distribution of males and females in order to correspond to the almost equal ratio of males to females in the state's population.

On the evening of the debriefing interviews, invitee were told when they arrived that they were to complete a self administered survey questionnaire on public policy, and then individually discuss their answers with an interviewer. On average, the interviewees took about ten minutes to complete the questionnaire. Following the completion of the questionnaire, a 20-minute interview regarding their reaction to the survey instrument was conducted. Based on the results of these pre-testing interviews, modifications to the

survey questionnaire were made in order to make it clearer, and to improve its overall design.

Survey Implementation

Sample

The sample for the mail survey consisted of 1,505 individuals, who were randomly drawn from a list of names and addresses obtained from the Michigan Office of the Secretary of State. The sample list was made up of Michigan residents 21 years old or older who possess a valid driver's license or state identification card. The sample was stratified on the basis of strata that corresponded to the seven most populous counties in Michigan (Table 4). These strata ensured that specific counties with large percentages of Michigan's population were accurately represented, so as not to over or under-sample them. The number of individuals selected for each county directly corresponds to the percentage of the state's population that each county comprises. The eighth strata contained individuals from the remaining counties in Michigan and represented 43.21% of the sample. Because the sample strata proportions correspond to the actual proportions of the State's population, no weights are required in the analysis of the stratified sample data (i.e. the weights to adjust for the stratified sampling all equal one).

Table 4. Stratified Random Sample, Representing the Seven Most Populous Counties in Michigan

County	*County Number*	*% of State's Population*	*Stratified Sample Drawn*	*% of overall Sample*
Genesee	25	4.31	65	4.32
Ingham	33	2.91	44	2.92
Kent	41	5.61	85	5.65
Macomb	50	8.15	122	8.11
Oakland	63	12.17	183	12.16
Washtenaw	81	3.43	52	3.46
Wayne	82	20.20	304	20.20
All other counties		43.21	650	43.19
Total		100	1505	100

Tailored Design Method

The mail survey was implemented using a Tailored Design Method (TDM) to achieve the best response rate possible (Dillman 2000). The TDM includes the following components: a user-friendly questionnaire; business reply envelopes that respondents utilize to return the questionnaires; up to five contacts with each individual; personalized correspondence; and a token incentive that was sent along with the survey.

In following the Dillman (2000) TDM, the researchers personalized the contacts by: using envelopes and correspondence that were addressed directly to respondents, and hand signing the letters; printing the large format questionnaires in color on glossy paper; printing the letters on high quality watermarked paper; using only first class mail for

every contact; and in the first contact including three postage stamps as a token incentive to complete and return the questionnaire.

Advocates of the TDM contend that multiple contacts have been shown to be more effective than any other technique for increasing response to surveys by mail (Dillman 2000). Therefore, the researchers' mail survey consisted of the five contacts recommended by this method: i) a pre-notice letter; ii) a questionnaire; iii) a reminder postcard; iv) a replacement questionnaire; v) and a final contact with an additional replacement questionnaire.

Pre-notice Letter

The pre-notice letter was sent in order to let the respondent know that they would soon be receiving a questionnaire from Michigan State University. The personally addressed, hand-signed, pre-notice letters were mailed first-class on July 6, 2004.

First Survey Questionnaire

The second contact was a survey questionnaire packet, which consisted of a hand-signed cover letter, a questionnaire, a business reply envelope for respondents to return the questionnaire, and an incentive of three first class stamps. This second contact was mailed first class one week after the pre-notice letter, on July 12, 2004. The recommendation of the TDM is to send this mailing a few days after the first contact (Dillman 2000), however for the purpose of this research, the sending time was expanded

to seven days in order to give time for the undeliverable mail to be returned and addresses corrected when possible respondent's new contact information was returned.

Postcard

The third contact with respondents was a hand signed reminder postcard, which was mailed first-class to respondents on July 20, 2004. Following Dillman (2000) recommendation this contact was mailed a few days to a week after the questionnaire. The postcard asked to please fill out and return the questionnaire, and thanked them if they had already done so.

Second Survey Questionnaire

The fourth contact was mailed August 9, 2004. It consisted of a questionnaire, a business reply envelope, and a cover letter that was changed to reflect the fact that this was a "replacement survey questionnaire" in case they had misplaced their first copy. No incentive was included in this wave. In accordance with TDM, this wave was mailed two to four weeks after the third contact (Dillman 2000).

Third Survey Questionnaire

The fifth and final mailing was sent on September 7, 2004 and included a questionnaire, business reply envelope, and a cover letter indicating that this was the final contact. This wave was mailed within two to four weeks after the fourth contact (Dillman 2000).

Data Entry and Response Rate

Each of the five mailings was carefully documented, paying special attention to mailing dates, returned mail received dates and post-mark dates. For the determination of response rates (RR), information on returned mail and responses was recorded and coded based on the American Association for Public Opinion Research (AAPOR) standards (AAPOR 2004).

For the aggregate RR of this survey, the AAPOR – RR2 was used because partially responded questionnaires were also counted as valid responses[7]. A final disposition code was recorded for each individual in the survey sample. All categories, with the exception of 2.31, 2.32 and 3.19, were aggregated (see Table 5). The response coding indicating that an individual was deceased (2.31) was not considered as valid possible response. The minimum response rate is determined by the following formula:

$$RR2 = \frac{(I+P)}{(I+P)+(R+NC+O)+(UH+UO)}$$

Where response rate (AAPOR-RR2) is estimated using the number of complete interviews (I) and partial questionnaires (P), divided by the number of total questionnaires (complete plus partial), plus the number of non-interviews which include

[7] Partial responded questionnaires are those that had at least 50 percent of all applicable questions answered.

refusal to participate (R), plus others[8] (O), plus all cases of unknown eligibility to participate (UH, UO).

Table 5. Response Rate Codes for the Sample

	Response Coding	*# of Sample*
I	Complete interview (coded 1.1)	467
P	Partial Interview (coded 1.2)	0
R	Refusal and break-off (coded 2.1)	21
NC	Non-contact (coded 2.2)	0
O	Other (coded and using only 2.32, 2.33)	1
UH	Unknown if Household / occupied HU (coded 3.19)	669
UO	Unknown, other (coded 3.2)	6
	Invalid (coded 3.3, 3.4 or 4.1 including 2.31-the deceased)	341
	Total	**1505**

Of the 1,505 persons in the initial sample, 341 had invalid addresses. That meant that the researchers received at least one notification that the address was incorrect (e.g. undeliverable as addressed, moved-left no address). Removing these invalid addresses yielded a sample with 1,191 valid addresses. In total, 467 questionnaires were returned completed, yielding an overall response rate for the survey of 40.1%. Of the 467 questionnaires completed, one was lost in the process of data entering; hence results are based on 466 completed questionnaires. Table 6 details the estimated overall response rate, as well as the response rates for each individual mailing contact.

[8] Not counting deceased.

Table 6. Response Rate by Mailing Contacts

Mailing Contact	Units Mailed	Returned		Response Rate (%)
		Complete Questionnaires	Bad Address or Undeliverable	
1 Pre-notice letter	1,505	N/A	N/A	N/A
2 First questionnaire	1,505	355	310	30.4
3 Post Card	1,195	N/A	N/A	N/A
4 Second questionnaire	882	88	3	11.0
5 Third questionnaire	740	24	1	3.4
Overall		467	314	40.1

Demographic Characteristics of the Sample

This section presents the mean demographic characteristics of respondents and compares them to those of Michigan's general population. The information contained in Table 7 was generated with data from the returned questionnaires and from the U.S. Census Bureau (2000).

Table 7. Comparison Between Survey Respondents and Census Results for Michigan

	Survey Sample	State of Michigan
Average Household Size	2.77	2.56[9]
Average Age	50.62	46.4[10]
Household Median Income	$62,499	$46,986[11]
Education		
High School Graduate or Higher	63.5%	61.6%[12]
Bachelor's Degree or Higher	27.9%	21.8%
Ethnicity		
White	87.3%	82.1%[13]
African American	2.8%	13.1%
American Indian/Alaska Native	1.5%	0.5%
Hispanic, Latino or Spanish	1.3%	2.7%
Female	51.9%	51.8%[14]

[9] U.S. Census Bureau, Census 2000. Table DP-1 Profile of General Demographic Characteristics: 2000. Geographic area: Michigan.

[10] Computed from: U.S. Census Bureau, Population Estimates Branch, "Estimated Population of States by Age Group and Sex, 2000-2003" as released by Census Bureau on March 10, 2004; for population over 20 years.

[11] U.S. Department of Commerce, Economics and Statistics Administration. U.S. Census Bureau. Money Income in the United States: 2000, page 12; for population 25 years and over.

[12] U.S. Bureau of the Census, Census 2000. Table DP-2 Profile of Selected Social Characteristics: 2000. Geographic area: Michigan; for population 25 years and over.

[13] U.S. Bureau of the Census. Census 2000. Table PL4. Hispanic or Latino and Not Hispanic or Latino by Race for the population 18 years and over [73] - Universe: Total population 18 years and over. Data Set: Census 2000 Redistricting Data (Public Law 94-171) Summary File. http://factfinder.census.gov/.

Table 7 shows that the demographic characteristics of the survey sample are reasonably similar to those of Michigan's general population. Some differences seem apparent with respect to African American and Hispanic, Latino or Spanish ethnicities; average household size; average age; and household median income, which represented the highest discrepancy between survey respondents ($62,499) and the State's median ($46,986). This apparent income difference does not appear to influence the estimation of results and will be discussed later in the next chapter.

Additionally, with respect to educational attainment, a slightly higher percentage of individuals responding to the survey had a high school degree or higher, compared to Michigan's population (63.5% and 61.6% respectively), and a larger percentage of respondents held a Bachelor's Degree or higher (27.9%) than the state's average (21.8%). Most of the respondents identified themselves as 'white', followed by smaller percentages of respondents identified as 'African Americans', 'American Indian or Alaska native' and 'Hispanic, Latino or Spanish origin'. Other minority groups were, 'Hawaiian or other Pacific Islander' (0.2%), and 'Asian' (0.6%).

Behavioral Aspects of Respondents

The survey also asked some additional questions about respondent behavioral aspects related to wetlands. For example: 69% of respondents answered that they "have visited" a wetland, 26% of our respondents declared that they participated in environmental conservation groups. Fifty-three percent declared that they practice fishing and/or

[14] U.S. Bureau of the Census. Census 2000. Table DP-1. Profile of General Demographic Characteristics: 2000. Data Set: Census 2000 Summary File 4 (SF 4). Summary File. Geographic Area: Michigan. For population 18 years and over. http://factfinder.census.gov/

hunting, and 66% practice camping or hiking. The behavioral aspects captured by the survey were expected to be useful for explaining the respondents' willingness to pay for the proposed program. While some of those variables turned out to be unimportant as criterion for explaining why respondents voted yes or no to the contingent valuation scenario, others turned out to significantly influence respondents' votes as shown in the next chapter.

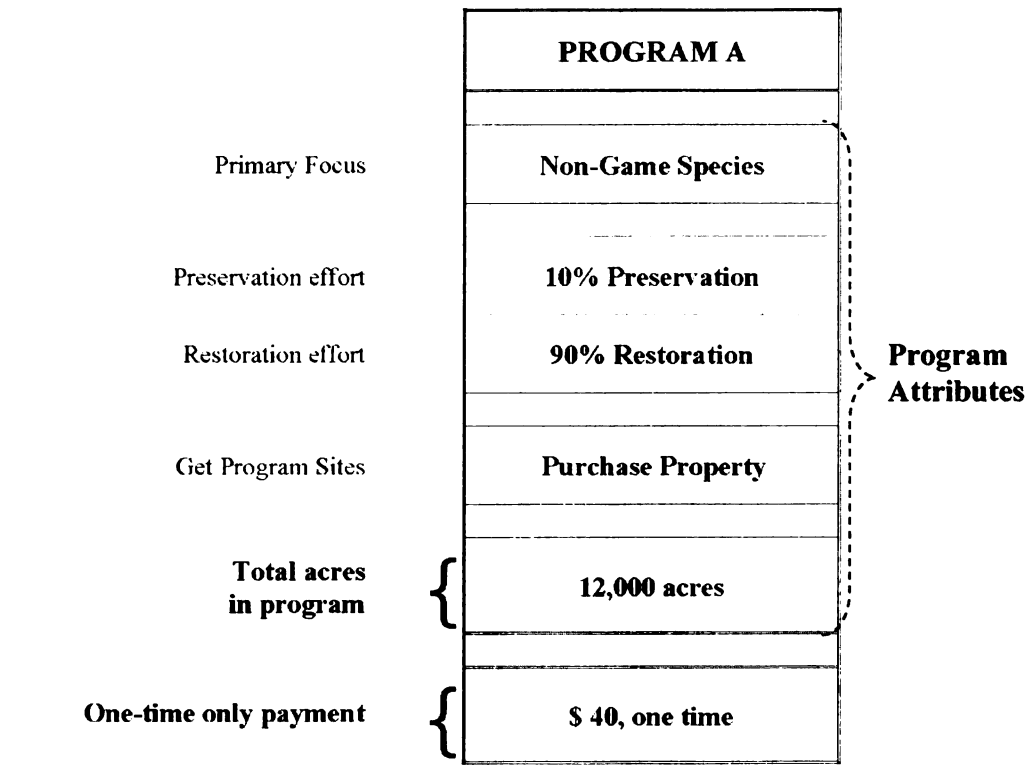
CHAPTER 4: MODELS FOR ESTIMATION OF VALUES AND RESULTS

Experimental Design

The third section of the questionnaire consisted of a CV question that uses the attribute based referendum format (Holmes and Boyle 2005) to elicit respondent's preference for program characteristics. Information gathered from this section of the questionnaire was used to estimate the value respondents placed on a proposed wetland program. The program to preserve or restore 12,000 acres of wetlands in Michigan was described in detail, including a one in a lifetime tax payment per household, the cost for implementing this program (Figure 1). The valuation question asked respondents if they would vote to approve the specified program if they had to pay for it.

The program's general characteristics are made up of three attributes and a "price". These attributes consisted of: A) the different ecological services that the program would focus on as a program "priority"; B) the "mix" of effort divided between preservation and restoration of coastal wetlands; C) the "tool" or mechanism used for land acquisition. The final characteristic is the price respondents were asked to pay for the implementation of the program. The attributes and the price are varied across the sample using an experimental design, the result of the combination of these characteristics were 49 versions of the questionnaire, the procedure to combine these characteristics is described further in the document.

PROPOSED COASTAL WETLAND PROGRAM AND COST



HOW WOULD YOU VOTE?

9. **Think of yourself in the voting booth. There are many things that the State can spend money on. Program A is one specific program. Suppose Program A is on the ballot. If it passes, Program A will be implemented and you pay the one-time, payment. If it does not pass, the program is not implemented and you do not pay for it.**

   With the information you have now, how would you cast your vote on Program A with a one-time cost to you of $40? (Mark ☒ one response)

	Definitely vote FOR it	Probably vote FOR it	Could vote either way	Probably vote AGAINST it	Definitely vote AGAINST it
For Program A I would...	☐	☐	☐	☐	☐

Figure 1. Actual page from the survey showing the program scenario given to respondents.

Program Characteristics

A) The "priority" included 1 of 6 possible ecosystem services that serve as the primary focus of the preservation or restoration program. Table 8 lists this attribute's levels. It was explained in the questionnaire that wetland protection programs must prioritize their efforts to accomplish their goals with limited funds by placing the highest priority on a particular feature.

Table 8. Priority: The Program's Primary Focus.

Levels
Non-Game Species
Open Space Near Cities
Water Quality & Flood Control
Fish Habitat
Waterfowl Habitat
Biodiversity

B) The program's "mix" is how the program's efforts are devoted to preservation of high quality wetlands versus restoration of impaired wetlands. This attribute had seven possible levels from 10% preservation, with the remainder allocated to restoration to 90% preservation and 10% restoration. This attribute is indicative of how the program's resources would be split between the two activities. The proposed program could take 1 of the seven levels listed in Table 9.

Table 9. Possible Levels of Combined Effort Devoted to Preservation and Restoration.

Mix Levels
10 % Preservation 90% Restoration
25 % Preservation 75% Restoration
40 % Preservation 60% Restoration
50 % Preservation 50% Restoration
60 % Preservation 40% Restoration
75 % Preservation 25% Restoration
90 % Preservation 10% Restoration

C) There were 3 levels for the "tool" attribute. Each level is a method itself to acquire land from voluntary private land-owners. The proposed program showed respondents only 1 method for acquiring the acreage for coastal wetland preservation or restoration.

Table 10. Tool: Land Acquisition Method.

Tool:
Purchase Property
Permanent Easements
Ten Year Contracts

D) The final characteristic is the program cost; the possible price (seven levels ranging from $40 to $1,320) that an alternative program can take are listed in Table 11. In the questionnaire, this cost was presented to respondents as a one-time statewide tax payment.

Table 11. Cost To Implement the Program

Price $
40
120
280
370
525
870
1320

Combination of Program's Attributes Levels and Price Levels: Main Effect Factorial Design

Main factorial design was used to combine the attribute levels and price levels into alternative scenarios to create sufficient variation among the program scenarios. One approach would be to use a full factorial design in which every level of every attribute is combined with every level of all other attributes (Louviere, Hensher and Swait. 2000). The experimental design of this research was made taking into consideration both the Contingent Valuation and the Stated Choice questions. According to the main factorial design method, to determine the number of combinations that would be necessary for a full factorial design in which the number of levels of each attribute are squared (to account for them being included in both programs A and B) and then multiplied by the other squared attribute level counts. The full factorial design for this study would result in $6^2x7^2\ x3^2$, or 15,876 combinations. Such a design results in far too many options for a sample (Louviere, et al., 2000). Because this number of combinations is far too large to manage, a main effects design was utilized. A main effects design ensured that the attributes, and their levels, are independent of each other. A main effects plan generates variables that are linearly independent, within and across alternatives. Using this design,

only the first order interactions among variables can be identified. The main effects design resulted in 49 pairs of alternative programs (49 questionnaire versions).

Estimation of Values

The CV question offered household respondents a scale to cast their vote for the attribute-based referendum, meaning that if they would vote to approve the program they would also be paying the proposed "price".

To reduce hypothetical bias and maintain a high level of certainty in the use of the responses, only "definitely yes" responses were considered as "YES" for the estimation of values, the rest of responses in the scale, including "probably vote for it", (Table 12) were considered as NO.

Table 12. Scale to vote for the program.

	Definitely vote FOR it	Probably vote FOR it	Could vote either way	Probably vote AGAINST it	Definitely vote AGAINST it
For Program A I would...	☐	☐	☐	☐	☐

Two methods were used to relate the votes to estimation of values: parametric model (probit) and the Turnbull Estimator as a non parametric model (Haab and McConnell 1997).

Parametric Model - Attribute Based Referenda

From the vote response, a utility function is inferred in order to calculate a monetary measure, such as WTP. The purpose is to link the change in utility of Michigan's Citizens

to a value measure, which might occur if a wetland's conservation and restoration program is implemented.

The Model's Theoretical foundation

In order to convert data from dichotomous choice responses into a monetary measure, a utility theoretic model of choice is necessary (Freeman, M. 1993). A key element is the individual optimization that relates the individual choice to the change in the quantity or quality of the environmental resource. For well described theory in deriving net income changes in individual preferences, see Freeman (1993) and Haab and McConell (2003). For this thesis, a succinct revision of the Random Utility Model (RUM) routine is described. RUM provides the theoretical framework for the valuation procedure that relates the change in the indirect utility function of the respondent. Also, RUM helps to understand how respondents will mimic actual behavior by making a choice in response to the proposed program, the price, and their individual constraints (Hanemann 1994; Champ, Boyle and Brown 2003, Haab and McConell 2003). An important assumption for RUM is that environmental services or environmental attributes relating to environmental services can be treated as arguments in well-behaved utility functions (Perman et al. 2003; Haab and McConnell 2003), so the indirect utility function of respondent j can be written as

$$u_{ij} = u_i(y_j, x_i, z_j, \varepsilon_{ij})$$

where $i = 1$ is the environmental condition acquired when the coastal wetland protection program is implemented, and $i = 0$ for the status quo. The determinants of utility are y_J,

the j^{th} respondent's discretionary income, x_i an argument about the attributes of the wetland conservation / restoration program, z_j a multi dimensional vector of household characteristics (demographics and behavioral aspects), and ε_{ij}, a component of preferences known to the individual respondent but not observed in this research. Based on this model, respondent j^{th} votes yes to a required payment (cost of the program) of t_j if the utility with the GLCW program exceeds the utility of the status quo,

$$u_1(y_j - t_j, x_1, z_j, \varepsilon_{1j}) > u_0(y_j, x_0, z_j, \varepsilon_{0j}).$$

Because it is not possible to know the random component of the preferences, only probability statements can be made with indirect utility function (v_i). The probability of a yes response depends upon respondent thinking that he or she is better off with the proposed program and paying for it, so that $v_1 > v_0$. For respondent j^{th} the probability of yes is,

$$\Pr(yes_j) = \Pr[v_1(y_j - t_i, x_1, z_j, \varepsilon_{1j}) > v_0(y_j, x_0, z_j, \varepsilon_{0j})].$$

At this point, this probability statement provides the basis for non-parametric analysis; however it's too general for parametric analysis.

$$\Pr(yes_j) = \Pr[v_1(y_j - t_i, x_1, z_j) + \varepsilon_{1j} > v_0(y_j, x_0, z_j) + \varepsilon_{0j}]$$

The random difference between the status quo and the CV scenario are still unidentifiable for the researcher. Haab and McConnel's procedure suggests rewriting the random term

from $\varepsilon_j \equiv \varepsilon_{1j} - \varepsilon_{0j}$ to a single random term. Let $F_\varepsilon(a)$ be the probability that the random variable ε is less than a. Therefore, the probability of yes can be expressed as follow:

$$\Pr(yes_j) = 1 - F_\varepsilon[-(v_1(y_j - t_j, x_1, z_j) - v_0(y_j, x_0, z_j))],$$

The Random Utility Model with a Linear Utility Function:

This thesis applies the RUM with a deterministic part of the preferences that is linear in function,

$$v_{ij}(y_j) = \delta_i x_i + \alpha_j z_j + \beta_j(y_j),$$

where y_J is the j^{th} respondent's discretionary income, x_i an argument about the attributes of the wetland conservation / restoration program, z_j a multi dimensional vector of household characteristics, ε_{ij} is a component of preferences known to the individual respondent but not observed in this research; and δ_i, α_j and β_j are multi dimensional vectors of parameters so that $\delta_i x_i = \sum_{k=1}^{m} \delta_{ik} x_{ik}$,

$\alpha_j z_j = \sum_{k=1}^{m} \alpha_{jk} z_{jk}$ and $\beta_j y_j = \sum_{k=1}^{m} \beta_{jk} y_{jk}$.

A Contingent Valuation question induces the respondent to make a choice between the current state and a proposed condition at a required payment t_j. In this case our research is proposing the scenario of improved conditions for wetlands due to the implementation

of conservation and restoration programs. The deterministic indirect utility under the proposed scenario would be:

$$v_{1j} - v_{0j} = (\delta_1 - \delta_0)x_i + (\alpha_1 - \alpha_0)z_j + \beta_1(y_j - t_j) - \beta_0 y_j,$$

where t_j is the price offered to the j^{th} respondent (citizen). It is assumed that the marginal utility of income is constant between the two Contingent Valuation states, therefore, $\beta_1 = \beta_0$ and the utility difference becomes:

$$v_{1j} - v_{0j} = \delta x_i + \alpha z_j + \beta t_j,$$

where $\alpha = \alpha_1 - \alpha_0$, so that $\alpha z_j = \sum_{k=1}^{m} \alpha_k z_{jk}$; and $\delta = \delta_1 - \delta_0$ sot that $\delta x_j = \sum_{k=1}^{m} \delta_k x_{jk}$. Once the deterministic part of the preferences is specified, the probability that the citizen responds 'yes' can be expressed as:

$$\Pr(yes_j) = \Pr(\delta x_i + \alpha z_j - \beta t_j + \varepsilon_j > 0).$$

The next step, in order to estimate the parameters of the utility difference, is to determine the nature of the random term. According to Haab and McConnell (2003) the assumption that ε_j are independently and identically distributed with mean zero describes most distributions used. The probability of yes response can be estimated as:

$$\Pr(\delta x_i + \alpha z_j - \beta t_j + \varepsilon_j > 0) = \Pr(-(\delta x_i + \alpha z_j - \beta t_j) < \varepsilon_j)$$

$$\Pr(\delta x_i + \alpha z_j - \beta t_j + \varepsilon_j > 0) = 1 - \Pr(-(\delta x_i + \alpha z_j - \beta t_j) > \varepsilon_j)$$

$$\Pr(\delta x_i + \alpha z_j - \beta t_j + \varepsilon_j > 0) = \Pr(\varepsilon_j < \delta x_i + \alpha z_j - \beta t_j)$$

The last equation utilizes the symmetry of the distribution. For symmetric distributions $F(x) = 1 - F(-x)$. Assuming that $\varepsilon_j \sim N(0,\sigma^2)$, the conversion to a standard normal ($N(0,1)$) variable is necessary to carry out the analysis with computer software. Let $\theta = \varepsilon / \sigma$. Then $\theta \sim N(0,1)$ and,

$$\Pr(\varepsilon_j < \delta x_i + \alpha z_j - \beta t_j) = \Pr(\theta < \frac{\delta x_i}{\sigma} + \frac{\alpha z_j}{\sigma} - \frac{\beta}{\sigma} t_j);$$

however in a probit model, it is assumed that ε_j is normally distributed and that there is no cost associated with maintaining the status quo therefore it bid (price) is zero.

$$\Pr(\varepsilon_j < \delta x_i + \alpha z_j - \beta t_j) = \Phi(\frac{\delta x_i}{\sigma} + \frac{\alpha z_j}{\sigma} - \frac{\beta}{\sigma} t_j),$$

Where $\Phi(x)$ is the cumulative standard normal distribution which is the probability that a unit normal variant is less than or equal to x. Probability now is in term of parameters divided by an unknown variance in a probit model. Since the model is using a dichotomous dependent variable taking a value of zero or one, the variance for this is unidentified and so is simply normalized to 1. The probit model developed statistical relationship between wetlands program characteristics, people's choices, and costs.

Results of the Parametric Model

The variables included in the probit regression are all listed in Table 13. The selection of variables used in the model was made on the basis of their relevance in explaining the probability of vote. From the survey data, 52 variables were initially generated, all of which were tested in the process of explaining the vote. Of the 52 variables, only 31 were selected as relevant.

Table 13. Variables Utilized in the Probit Model

Dependent variable	t_j	x_i	z_j
Definitely Vote for the Program (YES*)	Price (cost for the program)	Preservation continuous Non game species* Open space near cities* Water quality and flood control* Fish habitat* Waterfowl habitat* Biodiversity* Purchase property* Permanent easement* Ten year contracts*	Urban_res1* Suburban_res1* Rural_res1* Env_Group_Member_1* Fisher_Hunter_1* Camp_Hike_1* Imp_wet_there_1* Imp_wet_future_1* Age_resp Female_1* White_1* Democrats_1* Republican_1* Complete_College_1* Work_fulltime_1* Retired_1* Income_Above50K* Income_continuous Visited_Wetl_1*

*Equals 1 if true, 0 otherwise.

Table 14 shows the description of each of these selected variables. Sets of dummy variables were created for each block of attributes. For the program's "Priority", five dummy variables were created, leaving 'Biodiversity" as the excluded group. Same thing

for the "Tool" attribute, were 'Permanent easement' was used as the excluded group (baseline).

Table 14. Definition of Dependent Variables

	Variable	Variable Definition
	Q9_Yes	Dependent dummy variable indicating only "Definitely Yes" responses to the CV question.
Price t_j	*Price of the program*	A continuous variable indicating the cost of the conservation program to the respondent
"Priority" x_i	*Non Game Species*	Independent dummy variable indicating whether *Non Game Species* is the program's top priority.
	Water Quality and Flood Control	Independent dummy variable indicating whether *Water Quality and Flood Control* is the program's top priority.
	Fish Habitat	Independent dummy variable indicating whether *Fish Habitat* is the program's top priority.
	Waterfowl Habitat	Independent dummy variable indicating whether *Waterfowl Habitat* is the program's top priority.
	Biodiversity	Independent dummy variable indicating whether *Biodiversity* is the program's top priority.
	Open Space Near Cities	Independent dummy variable indicating whether *Open Space near Cities* is the program's top priority.
"Tool" x_i	*Purchase Property*	Independent dummy variable indicating whether or not *Purchase Property* was the approach used to acquire wetland acreage.
	Permanent Easements	Independent dummy variable indicating whether or not *Permanent Easements* was the approach used to acquire wetland acreage.
	Ten Year Contracts	Independent dummy variable indicating whether or not *Ten Year Contracts* was the approach used to acquire wetland acreage.
"Mix" x_i	*Percent Preservation*	A continuous variable representing the percentage of program effort devoted to preservation.
Household Characteristics z_j	*Urban_res1**	A dummy variable indicating if respondent lives in a Urban area
	*Suburban_res1**	A dummy variable indicating if respondent lives in a Sub-urban area
	*Rural_res1**	A dummy variable indicating if respondent lives in a Rural area
	*Env_Group_Member_1**	A dummy variable indicating if respondent contributes or is a member of an environmental group
	*Fisher_Hunter_1**	A dummy variable indicating if respondent go fishing and/or hunting
	*Camp_Hike_1**	A dummy variable indicating if respondent go camping and/or hiking

Table 14. (con't)

Household Characteristics Z_j	*Imp_wet_there_1**	A dummy variable indicating if respondent considers as extremely important wetland's existence
	*Imp_wet_future_1**	A dummy variable indicating if respondent considers as extremely important wetland's future existence
	Age_resp	A continuous variable indicating age of respondents
	*Female_1**	A dummy variable indicating if respondent is a female
	*White_1**	A dummy variable indicating if respondent considers herself as White (as ethnicity group)
	*Democrats_1**	A dummy variable indicating if respondent think of herself as a member of the Democratic party
	*Republican_1**	A dummy variable indicating if respondent think of herself as a member of the Republican party
	*Complete_College_1**	A dummy variable indicating if respondent has completed college at least.
	*Work_fulltime_1**	A dummy variable indicating if respondent works full time
	*Retired_1**	A dummy variable indicating if respondent is retired
	*Income_Above50K**	A dummy variable indicating if respondent's income is superior to fifty thousand dollars a year
	Income_continuous	A continuous variable for income
	*Visited_Wetl_1**	A dummy variable indicating if respondent has ever visited a wetland.

Specifications of the Model

In order to maintain consistency in comparing results across different specifications of the model, the data sets were filtered to include complete cases only. Complete cases were those observations where respondents had not skipped any questions that were determinant for the model. A total of 378 (81.1%) observations were selected.

The model was specified in six ways with the purpose of exploring the partial effect of the variables in the estimation of willingness to pay for the program at two levels of "Yes" response, i) Definitely yes, and ii) Definitely yes + Probably yes. However, only the three models referring to Definitely Yes vote are reported in this thesis. These three models utilize a set of variables arranged in the following manner: i) using price and the

program attributes; ii) using the price combined with the program attributes and respondents' characteristics; and iii) using only the price and respondents' characteristics.

To determine the relevance of the independent variables, numerous specifications of the model were estimated combining these variables in diverse arrangements, while observing their estimated coefficient's statistical significance. Variables that were not different from zero or not different from the excluded group (for the case of dummy variables) were dropped from the model. To select the best models, we assessed the performance of the probit models by observing the significant variables in each specification and comparing their Pseudo R^2. The same number of observations (378) was kept across the specifications for comparison purposes. Goodness of fit was also compared by calculating the correct prediction percentage of each model.

For all the specifications tested, 'Biodiversity' and 'Permanent Easements' were chosen as baselines for the set of dummy variables representing the program's 'priority' and 'tool' respectively. These baselines were chosen because they are the attributes that matter the most in the models, according to their significance in relation to the other variables in its respective sets (in all the possible iterations). After completing the procedure of choosing the best six models, only 16 variables were left to help explain the respondents' votes.

Table 15. Descriptive Statistics of Selected Variables

Variable	Mean	Std. Dev.	Min	Max
		N = 378		
Q9_yes	0.16	0.37	0	1
Q9_probyes	0.30	0.46	0	1
Yes_all	0.46	0.50	0	1
Price	489.39	423.58	40	1320
preserv_A_Cont	49.56	25.62	10	90
nongame_SpA	0.27	0.45	0	1
openSpace_A	0.15	0.36	0	1
watQ_FloodC_A	0.17	0.37	0	1
fishHab_A	0.14	0.35	0	1
waterfowlHab_A	0.13	0.33	0	1
biodiverst_A	0.14	0.35	0	1
purch_PropertyA	0.31	0.46	0	1
perm_EasmtA	0.42	0.49	0	1
tenY_ContractA	0.28	0.45	0	1
visited_wetl_1	0.71	0.45	0	1
suburban_res1	0.51	0.50	0	1
env_group_member_1	0.28	0.45	0	1
fisher_hunter_1	0.57	0.50	0	1
age_resp	49.48	13.61	22	71

General Results for Models 1 to 3

When regressing Definitely Yes with the program attributes and demographic characteristics, we found that the three models are statistically significant (Prob > chi2 = 0.00). The coefficients in the three models demonstrate that 'price' has a negative effect on the probability of vote, reflecting theoretical expectations that at a higher price, the probability of observing 'Yes' votes would decrease. The variable "price" is different from zero at a 99% confidence level for the three selected models. For model 1 and 2, the coefficient for preservation is also different than zero at 0 α level 0.01, and has a positive sign indicating that preservation increases the probability of vote. The estimated coefficients for these models are presented in Table 16.

Table 16. Parametric Results Models.

	Explaining Definitely Yes Vote					
	Model 1 (x_i)		Model 2($x_i + z_j$)		Model 3 (z_j)	
	Coef.	P>z	Coef.	P>z	Coef.	P>z
Price	-0.001	0.005	-0.001	0.001	-0.001	0.000
preserv_A_Cont	0.008	0.010	0.007	0.044		
Nongame_SpA	-0.686	0.006	-0.575	0.028		
openSpace_A	-0.812	0.007	-0.743	0.017		
watQ_FloodC_A	-0.339	0.200	-0.303	0.273		
fishHab_A	-0.731	0.014	-0.771	0.013		
waterfowlHab_A	-0.392	0.163	-0.236	0.438		
Purch_PropertyA	-0.138	0.476	-0.118	0.562		
tenY_ContractA	-0.143	0.476	-0.063	0.772		
Urban resident			-0.440	0.121	-0.392	0.145
Rural resident			-0.442	0.023	-0.481	0.011
Visited wetland			0.449	0.042	0.467	0.026
Env. Group Member			0.649	0.001	0.677	0.000
Constant	-0.582	0.036	-0.855	0.014	-1.013	0.000
Prob(Yes=1)	0.14		0.12		0.13	
Number of Obs. (n)	378		378		378	
LR chi^2	28.09		53.72		38.27	
Prob > chi^2	0.001		0.000		0.000	
Pseudo R^2	0.084		0.161		0.115	
Log likelihood	153.011		140.195		147.918	

Model 1 (x_i)

This model only includes the program's characteristics as explanatory variables (price and attributes). The regression coefficient of price is negative and highly significant (α level 0.01); preservation coefficient is positive and significant at α level 0.01. Implying that in the population price has a negative effect on the probability of vote, while preservation increases the probability.

Every coefficient for program's attributes provides evidence that with the exception of 'Water Quality and Flood Control' and 'Waterfowl Habitat', the other groups are statistically different then the excluded group "Biodiversity' at α level 0.01. This results are evidence that 'Biodiversity', 'Water quality and flood control' and 'Waterfowl habitat' have a larger effect on the probability of vote, from where we can deduce the preference of these priorities over other alternatives for the priority of the program.

The variables for the "tool" to acquire land from volunteers have coefficients that are not statistically significant; therefore we can't conclude that in the population the three different tools are not equal from each other in determining vote.

The expected willingness to pay for this model was calculated by dividing the sum of the attribute's coefficients times their means plus the constant's coefficient, by the negative of the price coefficient (Haab and McConnell 2003).

$$E_{\varepsilon}(WTP_j \mid \lambda, \delta, \beta, x_i, z) = \frac{\lambda + \delta x_i + \alpha z_j}{-(\beta)}$$

Results from this model render negative estimations of mean WTP for a program that would have multiple foci and a mean share of preservation – restoration. However, other interpretations of the coefficients are important for understanding how the attributes can affect the estimation of WTP. For example, for this model, if the program provides 100% preservation and Biodiversity as a priority, the expected WTP is $379.5.

Model 2 $(x_i + z_j)$

This is the more complete model since it includes the price, program attributes and respondents' characteristics as explanatory variables. In this model we obtained the highest pseudo R^2 (0.161) of the three models presented. As in Model 1 the coefficients for program's attributes provide evidence that only 'Water Quality and Flood Control' and 'Waterfowl Habitat' are statistically different then the excluded group "Biodiversity' at α level 0.01. This is again an indication of the preference of 'Biodiversity', 'Water quality and flood control' and 'Waterfowl habitat' over these other alternatives for the priority of the program.

In this regression, variables representing respondents that have visited wetlands and respondents belonging to environmental groups have coefficients that are positive and significant at α level 0.05. The average willingness to pay of the people who have visited a wetland and belong to environmental groups is higher than that for those whom these variables do not hold true.

For example, if the program provides 100% preservation, a wetland visitor that belongs to an environmental group will be willing to pay as much as $210.2 for the program, all else equal. On top of that, if the program provides Biodiversity as the priority, the same group of people will have an expected WTP of $1,061.5. On the other hand, for the average respondent (not member of an environmental group), for a program that provides 100% of preservation and 'biodiversity' as priority, the expected WTP is approximately $47.

Model 3 (Z_j)

In this model, only individual's characteristics were used in trying to explain the vote. Surprisingly, most of the characteristics such as political affiliation, ethnicity, level of income, age, level of education, gender, and individuals that hunt, fish, or camp and hike, did not matter for the model. Variables related to site of residence indicated urban residents are not significantly different than Suburban residents. However, rural residents are different than these two last groups and its coefficient has a larger negative effect on the expected probability of vote.

From the previous two models, we can expect a higher WTP from the people who belong to environmental groups and have visited wetlands, and as expected this is the case for this model. If we choose an even more specific group by only considering suburban residents that belong to environmental groups and have visited wetlands, they have an expected WTP of $156.4 on average.

Three criteria for a valid welfare measure should be satisfied: i) that WTP has a non-negative lower bound and upper bound no greater than income, ii) that the calculation is made without arbitrary truncation, and iii) that there is consistency between randomness for estimation and randomness for calculation. The Turnbull Estimator satisfies these criteria (Haab and McConnell 1997) and we used it to estimate WTP; and, the parametric model was used to explain the effect of variables on the vote.

Non-Parametric Model: Applying the Turnbull Estimator

This method was used to calculate measures of central tendency and dispersion of WTP that rely on the notion that when respondents answer Yes to a contingent valuation question, their willingness to pay is not less than the offered bid price (Haab and McConnell 2003). The estimation of lower bound WTP takes in consideration the number of people who responded No to the referendum question. Figure 4 shows the proportion of people voting NO at the different cost levels (n = 458). In this figure No equals one, otherwise it equals zero. As cost goes up, the proportion of people that responded (voted) NO also goes up. The remaining area between the top of the bar and one, will be proportion of people willing to Pay for the program.

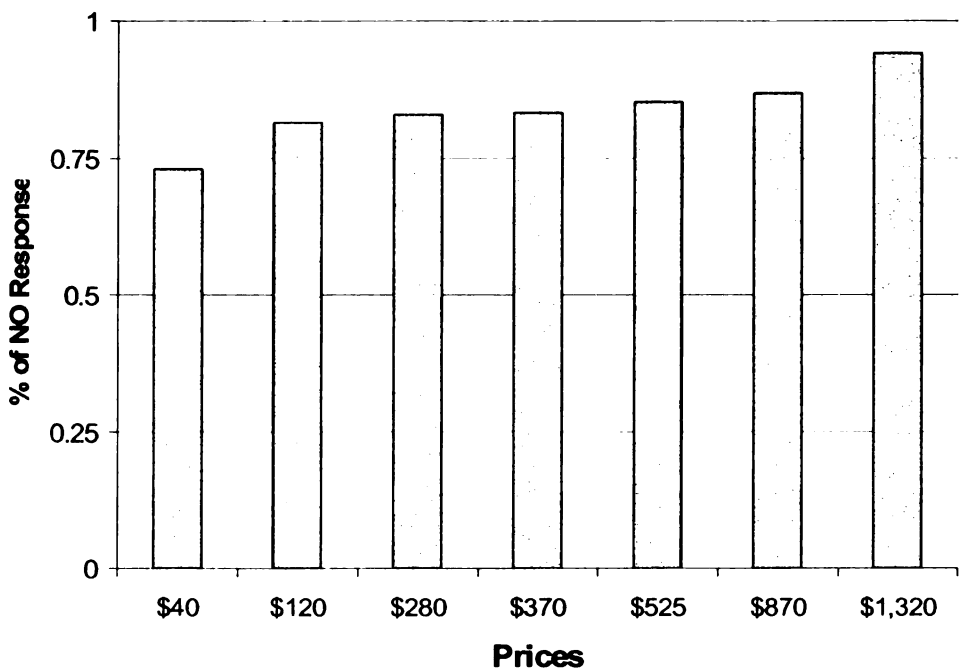


Figure 2. Distribution of No Vote across Prices.

Table 122 shows the calculations to estimate the lower bound WTP, which was estimated in $163.0 per household in MI, with a 95% confidence interval between $116.8 and $209.2

Table 17. Turnbull Estimation Results

					Turnbull (restricted)	
Bid Price (t_j)	**Number of Yes (Y_j)**	**Number of No's (N_j)**	**Number offered (T_j)**	F_j (N_j/T_j)	f_j^*	$E_{LB}(WTP)$
$40	20	54	74	0.730		$0.00
$120	11	48	59	0.814	0.084	$3.35
$280	12	58	70	0.829	0.015	$1.80
$370	11	55	66	0.833	0.005	$1.33
$525	10	58	68	0.853	0.020	$7.25
$870	7	46	53	0.868	0.015	$7.87
$1,320	4	64	68	0.941	0.073	$63.73
				1	0.059	$77.65
						$162.99

Taking the Turnbull lower bound mean WTP of $163, an aggregated WTP for the state of Michigan can be inferred. Accounting for 3.7 million households across the State, the aggregated demand for the program equals $241 million. Since the proposed program offered the protection of 12,000 acres, the aggregated demand suggests a value of $20,000 per acre.

An important limitation of the Turnbull estimator is that it is difficult to use demographic characteristics to explain the vote. There are ways to do it by breaking the sample in groups according to sub-sample characteristics, however the smaller the sample, the less likely it is that the resulting distribution function will be monotonic, which is the case for this research.

Comparing the Estimation Methods

The distribution of the functional forms (probit and logarithmic) can have substantial – and undesirable- effect on the estimates of the WTP, since the parametric (probit) functional form assumes that WTP distribution ranges from minus to plus infinite, allowing for negative values of WTP. Due to the large number of No votes (83% of respondents), the probit model places a large mass of the distribution in the negative side, giving us a negative estimation of the expected mean WTP despite having no negative costs offered for the program. As shown in Figure 4, a logarithmic functional form of the cost truncates the distribution at zero but has the problem of having very large estimates of mean WTP and fat tails (Haab and McConnell 2003). The Turnbull estimation data shows the observed distribution. It is evident that both, the probit regression and the logarithmic form, have a reliable fit of the observed data within the range of prices we used.

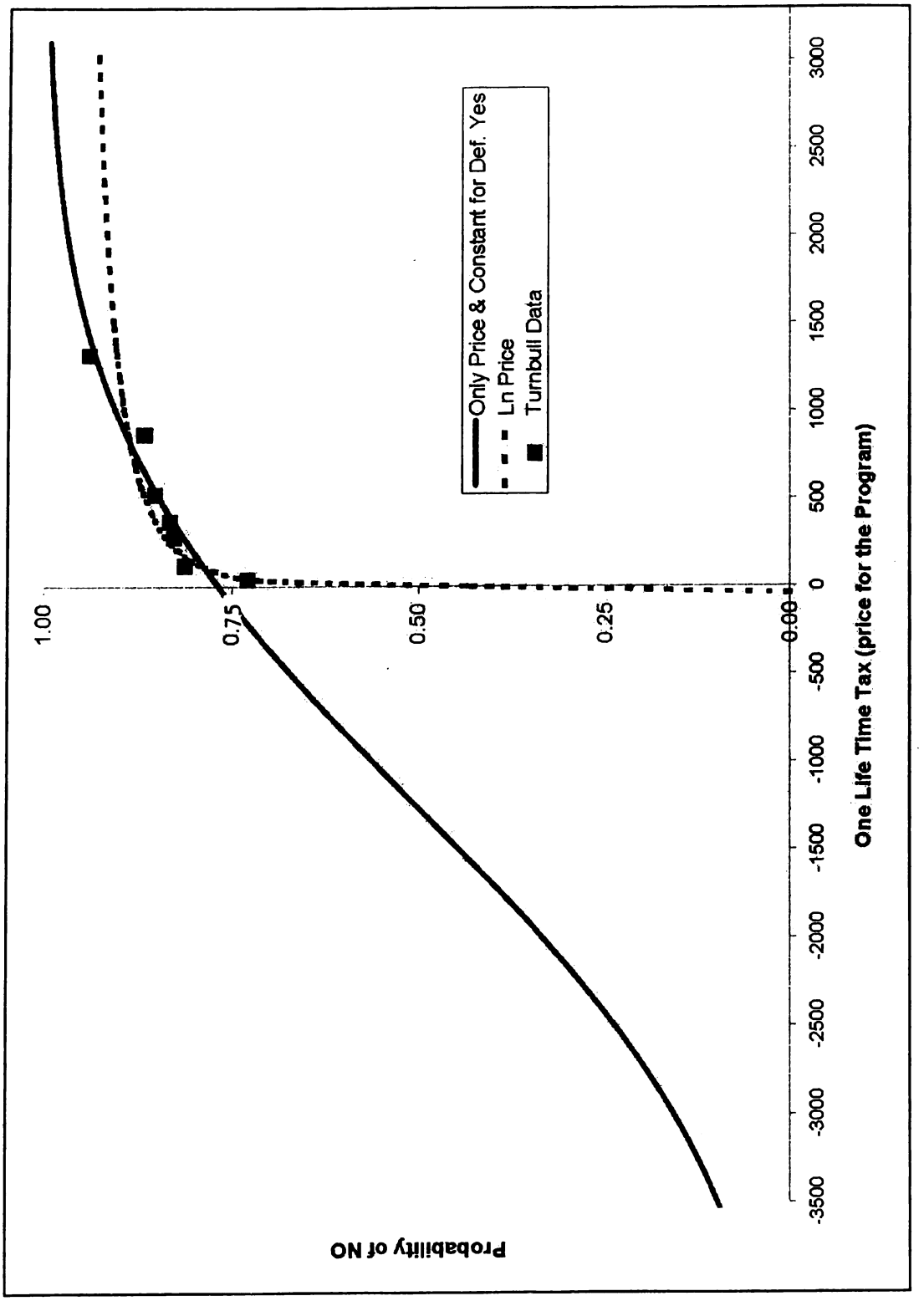


Figure 3. Comparison of Models.

Explaining the NO response

After the referendum section, a follow up question asked respondents to explain the reasons they vote they way they did. The analysis of the follow-up question revealed that some respondents placed a zero value on the program for reasons that differ from the program characteristics itself. These responses can be interpreted as "protest" votes and can constitute a substantial portion of the zero bids that affects negatively the estimation of WTP in CV studies (Mitchell and Carson 1993); it is necessary to distinguish them from those voters that valued the program but preferred to forgo it rather than to have to pay for it. As a measure to explore a possible bias in the estimation of WTP due to protest votes all comments from the follow up question were categorized and coded to be included in the regression as explanatory variables. By qualitatively coding these comments and creating a variable for the protest voters, it was possible to analyze if the "protest" group had any effect on the probability of vote.

As shown previously in Table 12, respondents had the option to cast their vote in a scaled manner. Responses ranging from "Could vote either way" to "Definitely vote AGAINST it" were classified as NO responses, making an 84% of the entire sample.

Three hundred and nine people, 66.3% of the sample, responded to the follow up question; however only one hundred and seventy six (37.8%) of those were from responses categorized as NO's.

All comments from NO respondents were coded according to qualitative criteria to evaluate their acceptance or rejection to the valuation scenario and placed on a scale. The scale included:

Accepting the proponed scenario when voting NO:

Respondents in this category understand and value the program; they may be willing to pay but can't afford it. Some examples of these responses are:

- ✓ I am on social security limited income. $528 is very expensive for me.
- ✓ I would like the vote to pass. The only problem is I don't have an extra $1320.00, seems like a lot of money to pay even though it is for a good cause. If I were rich it would be another story. The reason I will owe on taxes is that I have to choose between paying federal tax or having health insurance. Tough decision!
- ✓ I might vote for it but right now is a poor time for me to fill this out . However I don't want to avoid mailing it. I've had surgery and having problems with my health these days. I do know preserving Michigan Great Lakes wetlands is important for now and future. Clean water, flood control, the wonderful wildlife, great outdoors, etc. Are precious and so important to maintain.
- ✓ At this time I am on a fixed income and could not afford the $280 all at once.
- ✓ Limited income in the future could affect the way I vote.
- ✓ Personal financial status of a crisis is made clear to all. Better to vote for same, regardless.
- ✓ I would like more area helped than just 12,000. I would like to see the bad coastal waste land helped along with the good coastal waste land equal. I would like to learn and hear how the work would be done, on each. What goes into the process.
- ✓ I am not sure I want to be responsible for $1300 out of pocket expense for this project. I think the Govt. should take more responsibility or find matching funding from Corporation / business or Federal Grants before they burden taxpayers.
- ✓ Taxed to death.
- ✓ I am retired on a limited income. Also depends on what the market does to increase my income.
- ✓ I am not quite sure either way and can not afford to pay $870 since I have a lot of medical bills to pay off.
- ✓ Honestly, I cannot afford it with tax levies for the schools, insurance rates skyrocketing and 4 children to support, I need every penny.
- ✓ Money! Who has $120 for anything but food?
- ✓ I'm not sure that money from taxpayers will solve or even help this problem. I feel that the land left alone with out our help has a better chance of developing its own ecosystem after all its been here since the time began. These areas should be off-limits to expansion, no building at all.
- ✓ While I like the program, the price tag is too much. I would agree to pay half of the proposed tax and would like the other half to be absorbed by other funding sources like federal aid or grants (private). Also, I wouldn't trust that the new tax would go toward the wetlands (and not the general fund).

A NO vote with comments related to "weak protest"

Respondent understood the program and provided a reason to vote NO, however in the comment some elements of protest are included. Here are some examples:

- ✓ I am in favor of wetland preservation and restoration and would not object to the "one time" fee if there was assurance that: 1. There would not be a second "one time" fee brought up at a future date. 2. The first "one time" fee would be wisely spent and not get wasted on political projects.
- ✓ 1. State should pay for it. Taxes are too high now. 2. Can't afford any more taxes - Individual ones. 3. Even though coastal wetlands should be protected. 4. We also need to protect farm lands- being sold from farmers for spacious buildings. Pretty soon we'll be short of food supplies because of lack of good farmlands and woodlands.
- ✓ As much as a person may feel strongly about this issue, the bottom line always is who is going to pay for it. I would hope that I would be able to do my part.
- ✓ Cost. Generally, I am not very confident in the government handling these types of programs.
- ✓ We are already overtaxed and there is enough waste and unnecessary programs and inefficiency in Govt. That I feel we could raise this $ elsewhere vs. increased taxes.
- ✓ $870 is a high one time cost for middle low income families, I would rather see funds diverted from current recreational programs temporarily, or use funds from the lottery and have all work supervised by MSU Env. Scientists. Additionally Govt. often converts one time payments into recurring expenses!
- ✓ Not enough information given. What checks and balances are in place to insure the money goes to what it was intended for? What areas do they want to purchase? How much money? Must get the most out of each dollar! What happens to the areas that need restoration?
- ✓ I do believe that taxpayers are already paying too much money in taxes as it is. Maybe the government should utilize the tax money better and for things that really require attention and are important.
- ✓ Nice plan, but I'm sincerely, honestly going to prophecy, "It's too late!" This is a joke to me. I can't afford the bills I have now with various "I owes" at this present time. I say, "No", unless you give the bill to those who have $300,000+ homes living on, around or near wetlands, including golf courses. To secure land requires occupation, occupation pollutes land. Fact of life. Sincerely, thoughtful.
- ✓ I pay enough tax as is. Find a way to fund to program out of existing taxes.
- ✓ Taxes in the state are out of control!!! MI has the worst roads in the country!!! MI has some of the highest property taxes in the country!!! MI has one of the worst deficits in the country!!! School systems are under funded!!! How can MI ask for even one cent more for taxes when our current tax dollars are mismanaged. I am very sorry but I can not back any taxes imposed on MI residents!!!

Weak protest

Respondents while voting no, provided comments focusing on what they believe were shortcomings of the survey or the proposed program's implementation.

- ✓ There are no real specifics about the program. How and what are you going to do to achieve your goals and purpose? Who owns the property currently, farmers or politicians? How much will be collected and who will manage these funds? All too often we collect taxes or fund programs with only small portion going to the intended purpose.
- ✓ My understanding of the problem is not great. I would need to really dive into the wetland situation to present a definitive answer.
- ✓ It's hard to know for sure how I would respond at the time I really had to make this decision. A lot of factors could come into play at that time.
- ✓ I would have to know more about A and B, both before I would cast my vote and feel that the state should not be selling any state game lands or wetland at all. Around where I live there are some spots where you have to know someone to get on the state land cause there is houses all around it and no way into the land but as for the state park I think it is great how they have them set up.
- ✓ I am 80 years old and some of the questions I am not well informed on.
- ✓ Not familiar enough with the exact needs for wetlands and how well the money will be spent.
- ✓ I really don't know a lot about wetlands
- ✓ I would need to do more research before deciding if I am for or against program.
- ✓ 1) I would need to research more on how bad the wetland threat is to MI. 2) I believe in restoring nature... Not always giving in to urban expansion. 3) Nature is beautiful and I enjoy the peacefulness it give when walking or bike riding.
- ✓ Everyone will benefit wetlands would be preserved and restored.
- ✓ I really have no opinion on this matter.
- ✓ We should not have to pay extra for not developing land. Most government programs are poorly run.
- ✓ I want to know how this would affect the majority and if this is necessary.
- ✓ I think is a poorly worded question, if it is to cost me a one time payment of $120, how is that going to be paid. I am all for protecting wetland, I see development ruining wetland every day however a one time of $120 without clarification isn't going to get anyone to vote for it.

Protest (Rejected the scenario)

The respondents in this group provided comments indicating that decided no to vote for reasons not related to the program scenario. They differ from the next category in that their vote for the referendum was "Probably vote against" the program. Examples are:

- ✓ The potential mismanagement of the money that should be used for the wetlands.
- ✓ Tired of paying for everything when you see so much waste in Govt.
- ✓ I feel that the State Government does not use funds correctly. Hunting and fishing funds for example. Too much politics! The monies are never used the way they are supposed to!
- ✓ I believe there are other ways of coming up with the funding.
- ✓ I want to see wetlands protected but don't think many people would be willing to support the program if they personally had to pay $280. A better approach would be education about the problem and working with environmental agencies. In my circumstances, $280 would be a large contribution and I don't have much confidence that the money would be used wisely.
- ✓ I think there are other ways of rising money for these types of things.
- ✓ 1. Most one time assessments are usually brought back time and time again for renewal. 2. No guarantee that this money will not go into the general fund. 3. Would this program grow the state Govt. and how much would be lost in administrative cost? 4. What happens if we approve this program and other surrounding states and provinces don't? 5. I am extremely concerned as to how this would effect private property rights and land use.
- ✓ Distrustful of state to manage a large influx of funds. See tobacco settlement, e.g.
- ✓ You want wetland "YOU" pay for it. Take budget from other useless programs and use it to buy land. Hunting and fishing licenses come to mind. Don't ask the owners of the wetlands to pay taxes on the land they can't use. Stop putting money into state golf courses and put it into wetlands. If the state is not willing to transfer funds then forget it!!! Don't ask me to pay more taxes.
- ✓ State has more money than I do. There are other monies out there!
- ✓ I would vote no on this issue because I would rather have the state set aside money for these priorities if they are that important.
- ✓ I choose to live in a rural area with wetlands. I will not pay for someone who chooses to live in a urban area who wants some wetlands. The state like its tax payers needs to make choices. It should sell some of it state game areas and buy wetlands with the money.

Strong Protest

In this case, respondent decided not to vote for the program for reasons differing from the program scenario or survey procedure. This type of respondent is different from the past category because in this case they voted "Definitely not vote" for the program. Examples:

- ✓ This is just life I could vote other way!
- ✓ (Summarized) Please understand, it is not because it will cost me more taxes. It is because I am convinced those responsible for collecting, use tax dollars for their own personal, professional needs, an none or very little would actually go to wetlands. The problem is us, humans overrunning this planet, overpopulating it. No preservation problem is going to help. We need to address the real problem Greedy People.
- ✓ The way the state has carelessly spent resources on welfare and other entitlement programs is not responsible in my opinion. I think private companies could be hired and are no as apt to foolishly waste finances. Funds now used in the State of Michigan for programs (entitlement, etc.) could be channeled for environmental use.
- ✓ Because it is my business.
- ✓ Would the money be spent wisely?
- ✓ 1. My believe in Gvts. Ability to spend money correctly. 2. My distrust of agendas of "environmental" groups.
- ✓ I believe that we have more pressing social issues that should be addressed, before we concern ourselves with issues of this nature.

The final distribution of frequencies for comments categorized on the previous scale is shown in the next table:

Table 18. Type of No Vote

Category of NO Vote	Description	Observations in Sample
No_1	Accepting the proponed scenario when voting NO	120
No_2	A NO vote with comments related to "weak protest"	16
No_3	Weak protest	19
No_4	Protest	12
No_5	Strong Protest (Reject the scenario)	9
	Total	176

We found that most respondents provided comments indicating their acceptance of the scenario when voting. Further testing of the influence of protest vote in the estimation of WTP was carried on by systematically excluding the protest voter from the model. There was no significant effect on the WTP estimations when dropping the weak protest and protest groups (40 observations).

- CHAPTER 5: IMPLICATIONS AND RECOMMENDATIONS

This research was aimed to assist in the development of a tool for decisionmakers interested in developing a coastal wetland preservation and restoration program. The results demonstrate that the public cares for program characteristics. The data demonstrate that "price" of the programs matters to some respondents. The estimated aggregated demand of $20,000 per acre is a conservative estimation of the public willingness to pay for the implementation of these types of program. Programs aiming to restore or preserve coastal wetlands need to account for the alternative characteristics of the program particularly when funding support will be asked to the public, their decision must be taken into account.

Implications for Michigan Wetland's Policy

Due to the necessity of making trade-offs, policymakers would be better equipped to design programs likely to be widely supported by citizens if they had knowledge about: the public's understanding of coastal wetlands; their choices for protection programs' characteristics; and their willingness to pay for these programs. Lupi et al. (2002) demonstrate that ordinary citizens as quite capable of providing information concerning trade offs between alternative mixes of wetland attributes. Decisionmaking concerning the Great Lakes coastal ecosystems can benefit from incorporating public choices for coastal wetlands and wetland services. This thesis provides a positive step towards a better understanding of what the public values about wetland protection programs designed for Great Lakes coastal wetlands.

Recommendations for Future Research: Methodological Issues

There are approximately five million acres of wetlands in Michigan, which make up approximately 30% of the state. Wetlands are extremely scattered in Michigan and one of the most controversial problems in the regulation of wetlands has been the process of identifying and classifying wetlands according to characteristics attributed to wetlands (Gaddie and Reggens 2000). Perhaps for future research, a physical description and location of the area to be preserved can help respondents to picture the need to protect critical or endangered coastal areas.

Physical descriptions of changes in resource conditions are frequently unavailable. In this case, Contingent Valuation questions often are framed to value the policy change. With unclear or nonexistent information on the resource change (e.g. what are the positive additional wetland benefits provided by additional 12,000 acres under protection), survey respondents are left to their own assumptions regarding what the policy change will accomplish (Barbier, Acreman and Knowler 1997). This can be a source of bias since different respondents will use different assumptions (i.e. they are valuing different resource changes), future research should consider testing this type of bias and explore potential effects, if any, on the estimated WTP.

Survey respondents without a clear understanding of wetland services and State policies, were left to make two assumptions: 1) How the policy change affects resource conditions, and 2) how the change in the resource affects the service they receive (Champ 2003, 117). The use of follow up questions or Spike Models are suggested to separate sub-

samples of respondents that have no economic value for the good in question or have a different perception of the good offered (Haab and McConnell 1997, Kriström 1997). In that sense, further modifications in the survey design needs to be carried out for the open ended, follow up question in order to allow the researchers to better understand what the respondents were thinking about when casting their vote. For this research, an open ended question was included to elicit each respondent's explanation of their vote. Although some respondents provided a comment, the number of comments collected was not enough to separate respondents sub samples that allowed for a deeper understanding of respondent's vote.

Property rights matter in the case of environmental goods, and in the best case respondent should understand what they are currently paying for a given level of supply. It is hard to provide a clear scenario indicating whether the levels of wetland protection are improvements over the status quo, or potential declines in the absence of sufficient payments (Mitchell and Carson 1993, 50). Perhaps Michigan residents perceive high levels of services provided by wetlands and do not foresee any threats to coastal wetlands in their locality for which reason they do not feel that it is important to pay. It is possible that the effect of degradation of GLCW has different degrees of intensity across the State and subdivisions can be useful in explaining localized public preferences.

CONCLUSIONS

This thesis results demonstrate that the citizens of Michigan have a varied understanding of Great Lakes coastal wetlands. The results also reveal that the public has definite preferences about the relative preference for programs to protect Great Lakes coastal wetlands. Because public support of coastal wetland programs can make them more successful, it is important to address the public's understanding and preferences in the design and implementation of wetland protection programs.

The willingness to pay values per household translates into a present value of about $20,500/acre of coastal wetland protected or restored. While these are economically significant values, caution is warranted since less than 17% of the respondents indicated they would "definitely vote for" the program. This means a referendum would not be likely to pass under majority rule. In addition, the large share of potential zero values for WTP suggest that future efforts with this data adopt spike models with discrete probability mass at zero.

The results from the parametric model reveals what attributes are preferred and the demographic variables that are significant in determining the probability of vote for the program. Programs with more effort to preserving wetlands were significantly more likely to be voted for than programs with more effort on restoring wetland ($p<0.05$). The cost for the program had a significant ($p<0.01$) negative effect on votes; while for the program priority, Biodiversity ($p<0.01$), Water quality/flood control ($p<0.01$) and Waterfowl habitat ($p<0.05$) had significant positive effects on votes.

Using the parametric estimations, the data demonstrated that a positive WTP could still be expected if the proposed program provides Biodiversity and the maximum preservation. However, it is evident that conservation cannot serve only one purpose and the program will have trade offs in terms of different priorities and conservation/restoration ratios.

With respect to the tool to acquire land, the results show that none of the three alternatives are different from each other in explaining the vote because they were not significantly ($p<0.05$) different from each other. This can be an indication of either the indifference of our sample with respect to the tool to acquire land, or a low level of knowledge about how these tools are different from one another. The data provides evidence that any policy option that is characterized by changing the tool to acquire land from volunteers will not change the consumer's choice for the alternative programs.
A few demographics had positive effects on the vote, for instance, environmental group members ($p<0.01$) and those who'd visited wetlands ($p<0.05$). Rural residents had a negative effect ($p<0.05$) compared to urban and sub-urban residents.

APPENDIX

1. Pre-notice Letter – used in the first mail contact
2. First Cover Letter – used in the second mail contact with the first copy of survey booklet
3. Reminder Post Card – used in the third mail contact
4. Second Cover Letter – used in the fourth mail contact with the second copy of survey booklet
5. Final Cover Letter – used in the fifth mail contact with the third and final copy of survey booklet
6. Survey Booklet

MICHIGAN STATE
UNIVERSITY

Date

Name Surname
Address
City, State, Zip

Dear Name Surname:

You have been selected to participate in a study of Michigan's Great Lakes Coastal Wetlands. The study is part of research at Michigan State University. The project will provide needed information to local, regional, and state agencies about residents' opinions and concerns about Michigan's wetlands along the Great Lakes.

All that we ask is that you complete a brief survey booklet that you will receive in the mail in about a week. We are writing to you now since many people like to receive advance notice of the survey booklet.

Thank you very much.

Sincerely yours,

Dr. Michael D. Kaplowitz
Principal Investigator

COLLEGE OF
AGRICULTURE AND NATURAL RESOURCES
Resource Development
Michigan State University
323 Natural Resources
East Lansing, Michigan
48824-1222
517/353-1919
Fax: 517/353-8994
kaplowit@msu.edu

MICHIGAN STATE
UNIVERSITY

Name Surname
Address
City, State Zip

Dear Name Surname:

You have been selected to participate in a study about Michigan's Great Lakes Coastal Wetlands. You may recall receiving a letter about this study about a week ago. The study is part of an effort by Michigan State University to learn about citizens' opinions and concerns regarding the wetlands of Michigan's Great Lakes.

Your input is important because managing Michigan's wetlands, including decisions about restoration or preservation, involves trade-offs that affect you. Results of the questionnaire will provide needed guidance to local, regional, and state agencies about residents' opinions and concerns about Michigan's wetlands along the Great Lakes.

You have been selected as part of a scientific sample of Michigan residents. That is why the survey asks a few questions about you and your household--so we can make sure that we get a scientific cross-section of Michigan residents. Your participation is vital to make sure that the information collected represents everyone.

We realize that it takes time out of your day to fill out this survey and have enclosed **three first class stamps** as a way of saying thank you for your help.

By completing and returning this survey, you indicate your voluntary consent to participate in this study and have your answers included in the project data set. The answers are anonymous, and we will keep your individual views entirely confidential. Rest assured, your privacy will be protected to the maximum extent allowable by law.

If you have any questions or comments about this study feel free to call me by phone at: (517) 353-1919, fax at: (517) 353-8994, or e-mail at: kaplowit@msu.edu. If you have questions concerning your rights as a survey participant, please contact Dr. Peter Vasilenko, Chair of the MSU Committee on Research Involving Human Subjects, by phone at (517) 355-2180, fax at: (517) 432-4503, or e-mail at: ucrihs@msu.edu.

Thanks for participating in this study.

Sincerely,

Dr. Michael Kaplowitz
Principal Investigator

COLLEGE OF
AGRICULTURE AND NATURAL RESOURCES
Resource Development
Michigan State University
323 Natural Resources
East Lansing, Michigan
48824-1222
517/353-1919
Fax: 517/353-8994
kaplowit@msu.edu

MICHIGAN STATE
UNIVERSITY

COASTAL WETLANDS STUDY
c/o Dr. Michael D. Kaplowitz
Michigan State University
323 Natural Resources Building
East-Lansing, MI 48824-1222

Name Surname
Address
City, State Zip

Dear Sir or Madam:

We recently sent you a booklet and request to participate in a study of Michigan's Great Lakes Coastal Wetlands. If you returned the booklet, ***thank you very much***. If you have not yet completed the booklet, please take some time to do so now. Your input is important to make sure that policy decisions reflect the views of Michigan citizens. Thank you very much.

Sincerely,

Dr. Michael D. Kaplowitz
Principal Investigator
Michigan State University
(517) 343-1919

MICHIGAN STATE
UNIVERSITY

MICHIGAN STATE
UNIVERSITY

Name Surname
Address
City, State Zip

Dear Name Surname:

About two weeks ago, we sent you a short survey about Michigan's Great Lakes Coastal Wetlands. While we've heard from some people, to the best of our knowledge, we have not yet heard from you. We are enclosing another copy of the survey booklet for you convenience.

Please mail the completed booklet back to us in the enclosed pre-paid envelope.

Your input is important because managing Michigan's wetlands, including decisions about restoration or preservation, involves trade-offs that affect you. Results of the questionnaire will provide needed guidance to local, regional, and state agencies about residents' opinions and concerns about Michigan's wetlands along the Great Lakes.

You have been selected as part of a scientific sample of Michigan residents. That is why the survey asks a few questions about you and your household--so we can make sure that we get a scientific cross-section of Michigan residents. Your participation is vital to make sure that the information collected represents everyone.

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Sincerely,

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517/353-1919
Fax: 517/353-8994
kaplowit@msu.edu

MICHIGAN STATE
UNIVERSITY

Name Surname
Address
City, State Zip

Dear Name Surname:

During the last two months we have sent you several mailings about Michigan's Great Lakes coastal wetlands. Our study is drawing to a close, but we are making one final attempt to obtain your input.

Your completed survey will provide needed guidance to local, regional, and state agencies concerning wetlands along Michigan's Great Lakes. You have been selected as part of a scientific sample of Michigan residents, and ***YOUR PARTICIPATION IS ESSENTIAL*** to make sure that the information collected represents everyone.

Please mail the completed booklet back to us in the enclosed pre-paid envelope.

By completing and returning this survey, you indicate your voluntary consent to participate in this study and have your answers included in the project data set. The answers are anonymous, and we will keep your individual views entirely confidential. Rest assured, your privacy will be protected to the maximum extent allowable by law.

If you have any questions or comments about this study feel free to contact me by phone at: (517) 353-1919, fax at: (517) 353-8994, or e-mail at: kaplowit@msu.edu. If you have questions concerning your rights as a survey participant, please contact Dr. Peter Vasilenko, Chair of the MSU Committee on Research Involving Human Subjects, by phone at (517) 355-2180, fax at: (517) 432-4503, or e-mail at: ucrihs@msu.edu.

Thanks for participating in this study.

Sincerely,

Dr. Michael Kaplowitz
Principal Investigator

COLLEGE OF
AGRICULTURE AND NATURAL RESOURCES
Resource Development
Michigan State University
323 Natural Resources
East Lansing, Michigan
48824-1222

517/353-1919
Fax: 517/353-8994
kaplowit@msu.edu

Michigan Great Lakes Wetlands: Citizens' Survey Questionnaire

This is an opportunity to provide your opinion and feedback on natural resource policy and management in Michigan. Your input will help decision makers make more informed choices on how to restore and preserve Michigan's coastal wetlands.

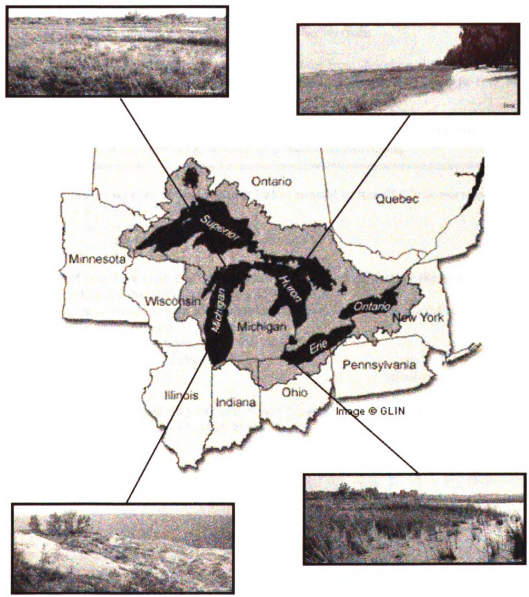
This booklet begins by explaining about Great Lakes coastal wetlands and what they do. It then focuses on how programs can preserve high quality coastal wetlands and restore poorly functioning coastal wetlands. You are then asked about a proposed wetland protection program.

Your answers will help ensure that state level decisions reflect the views of the citizens of Michigan. Thank you for your participation. This booklet's several sections of brief questions should take about 15 minutes to complete.

Please return your completed questionnaire in the enclosed envelope to:
GL Wetland Study, Dept. of Resource Development, 323 Natural Resources Building, Michigan State University, East Lansing, MI 48824-1222

THE GREAT LAKES AND THE GREAT LAKES WATERSHED:

TYPICAL MICHIGAN COASTAL WETLANDS



GREAT LAKES COASTAL WETLANDS

Michigan has many important resources, including Great Lakes coastal wetlands. Coastal wetlands support the health and diversity of the Great Lakes ecosystem.

Coastal wetlands provide **ecological functions** and **critical habitat** for a wide range of plants, fish, and animals. They also provide **storm water retention, erosion prevention, water filtration**, and other services.

In Michigan, Great Lakes coastal wetlands range from shoreline wetlands and marshes along the northern coastline, to extensive wetlands along Saginaw Bay, to the delta marshes of the St. Clair River.

Healthy Great Lakes coastal wetlands also support a range of **recreational activities** including fishing, hunting, bird watching, and hiking.

1. **Have you ever visited a Great Lakes coastal wetland?** (Circle one response)
   - **a.** Yes
   - **b.** No (Skip to Question 3)
   - **c.** I don't know

2. **If you have visited a Great Lakes coastal wetland during the last year, what did you do there?** (Circle all that apply)
   - **a.** I have not been to a Great Lakes coastal wetland during the last year
   - **b.** Fish or hunt
   - **c.** Watch for birds or other wildlife
   - **d.** Enjoy the outdoors
   - **e.** Other _____ (If selected, fill in blank)

3. **How important do you think Great Lakes coastal wetlands are for the following activities?** (Mark ☒ one response for each activity)

Importance of Great Lakes wetlands for...		Extremely Important	Somewhat Important	Not Very Important	Not at all Important	Don't Know
a.	Hunting?	☐	☐	☐	☐	☐
b.	Fishing?	☐	☐	☐	☐	☐
c.	Bird watching?	☐	☐	☐	☐	☐
d.	Hiking?	☐	☐	☐	☐	☐

WHAT COASTAL WETLANDS DO

Water Quality & Flood Control
Wetlands absorb nutrients and chemicals as well as filter sediments. They control flood damage by intercepting and storing storm water.

Open Space near Shore
Wetlands provide areas of open, undeveloped natural areas. They may provide opportunities for public enjoyment and education.

Waterfowl Habitat
Wetlands provide food and breeding habitat that benefits waterfowl. Wetlands support waterfowl such as ducks and geese.

Fish Habitat
Coastal wetlands provide shallow water areas with vegetative cover that serve as spawning grounds, nursery areas, and adult fish habitat.

Non Game Species
Wetlands provide habitat for animals not fished or hunted. Such species include shorebirds, amphibians, and wading birds.

Biodiversity
Wetlands' complex ecosystems support diverse and unique plants and animals. Such biodiversity is important for ecosystem health.

4. In your opinion, how important are Great Lakes coastal wetlands for providing and maintaining the following services?
(Mark ☒ one response for each function)

Importance of Great Lakes wetlands for providing and maintaining ...		Extremely Important	Somewhat Important	Not Very Important	Not at all Important	Don't Know
a.	Water quality & Flood control?	☐	☐	☐	☐	☐
b.	Open space?	☐	☐	☐	☐	☐
c.	Waterfowl habitat?	☐	☐	☐	☐	☐
d.	Fish habitat?	☐	☐	☐	☐	☐
e.	Non-game species?	☐	☐	☐	☐	☐
f.	Biodiversity?	☐	☐	☐	☐	☐

COASTAL WETLANDS STATUS

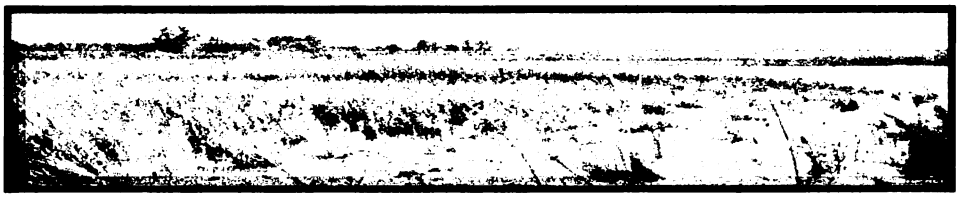
Wetlands historically stretched from the western edge of Lake Erie across Ohio into Indiana, and covered the southern edge of Ontario. However, more than two-thirds of the Great Lakes coastal wetlands have been lost.

Three ways wetlands are typically damaged and destroyed:

- **Loss of Wetland Acres**
  Acres of coastal wetlands are destroyed for land development purposes including agriculture, harbor facilities, shoreline development, resource extraction (such as peat mining), and urban expansion.
- **Interference with Water Flows**
  Coastal wetlands are impaired and lost when activities disturb water flows essential to support healthy wetland plants and animals. Adequate water flows are essential for coastal wetlands.
- **Loss of Plant Diversity**
  Loss of wetland vegetation increases the danger of wetland loss. Wetlands dominated by a single type of plant, including invasive species, typically lead to decreased animal diversity because food and habitat are unavailable.

5. In your opinion, how serious a threat to Great Lakes coastal wetlands are the following activities? (Mark ☒ one response for each activity)

Seriousness as a threat to Great Lakes coastal wetlands of...		Extremely Serious	Somewhat Serious	Not Very Serious	Not at all Serious	Don't Know
a.	Agriculture?	☐	☐	☐	☐	☐
b.	New harbor facilities?	☐	☐	☐	☐	☐
c.	Shoreline development?	☐	☐	☐	☐	☐
d.	Urban expansion?	☐	☐	☐	☐	☐



HOW TO PRESERVE AND RESTORE WETLANDS

State and federal laws try to prevent loss of **wetland acreage** by placing conditions on wetland permits to avoid, minimize, and mitigate wetland loss. However, existing laws do not always protect **wetland quality**.

Wetland protection programs can **preserve high quality wetlands** already in the Great Lakes ecosystem. Wetland protection programs can also **restore damaged or impaired wetlands** to improve Great Lakes ecosystem health.

- **Preservation of High Quality Wetlands**
  Wetland programs can protect wetlands that are high quality, ecologically rich, and hydrologically sound. Wetland preservation is accomplished by agreements with landowners that legally and physically protect wetlands and their surrounding uplands from adverse changes.

- **Restoration of Wetlands and Wetland Functions**
  Wetland programs can improve wetland ecosystems and wetland functions by restoring wetlands that have been degraded. The restored wetlands would then be preserved. Coastal wetlands that are impaired may be restored by improving water flows, planting native species, and removing invasive species.

6. How familiar are you with the following approaches used in wetland protection programs? (Mark ☒ one response for each activity)

	Familiarity with...	Very Familiar	Somewhat Familiar	Not Very Familiar	Not at all Familiar	Don't Know
a.	Wetland preservation?	☐	☐	☐	☐	☐
b.	Restoration of wetlands?	☐	☐	☐	☐	☐

GETTING WETLANDS TO PRESERVE AND RESTORE

When a wetland program is **voluntary**, the wetland program needs to negotiate details of wetland access, restoration efforts, and protection plans with interested **property owners** who **receive compensation**.

Written agreements restrict and **prevent incompatible land uses and activities** around wetlands being preserved and restored. Here are three ways for voluntary programs to get wetlands for preservation and restoration:

- **Purchase Property from Willing Sellers**
  Wetland programs may buy Great Lakes coastal properties that contain wetlands and that may be well suited for restoration or preservation. Purchases are made from property owners who are willing to sell.
- **Voluntary Permanent Easements**
  Programs may pay coastal property owners to place permanent restrictions, called easements, on their wetland property. Permanent wetland easements are voluntary and cost less than the purchase price of the land. Property owners retain their land but are required to permanently protect the wetlands and allow any negotiated restoration efforts to occur.
- **Short-term Contracts (10 Years)**
  Programs may contract with owners to pay them to protect wetlands on their property. Contracts cost less than easements and land purchases. When the contract ends, owners have no obligation to continue protecting the wetlands.

7. **How familiar are you with the idea of programs or agencies protecting natural resources in the following ways?** (Mark ☒ one response for each)

Familiarity with protecting natural resources through ...		Very Familiar	Somewhat Familiar	Not Very Familiar	Not at all Familiar	Don't Know
a.	Purchasing property from volunteers?	☐	☐	☐	☐	☐
b.	Voluntary permanent easements?	☐	☐	☐	☐	☐
c.	Short-term contracts (10-years)?	☐	☐	☐	☐	☐

ALTERNATIVE COASTAL WETLAND PROGRAMS

We need your input on alternatives for protecting Michigan's coastal wetlands. Please review the elements of two alternative programs before answering Question 8.

MICHIGAN'S COASTAL WETLANDS

These programs target the preservation and restoration of Michigan's coastal wetland resources. Today, Michigan's coastal wetlands account for **4%** of Michigan's wetlands and cover **105,855 acres** statewide. The area covered by Great Lakes coastal wetlands has decreased by **70%** in the last 150 years.

PROGRAM PRIORITIES

Wetland protection programs must prioritize their efforts to accomplish their goals with limited funds. Michigan coastal wetland programs can select lands by placing their highest priority on protecting any of the following features:

- **Non Game Species**
- **Open Space near Cities**
- **Water Quality & Flood Control**
- **Fish Habitat**
- **Waterfowl Habitat**
- **Biodiversity**

No wetland provides only one service. Even when one of the above is the priority of a program, some of the other features will also be provided. By placing highest priority on a particular feature, the program ensures that feature will be enhanced.

DIVIDING EFFORT TO PROTECT WETLANDS

Coastal wetland programs protect wetlands in two ways. These programs divide their effort and resources between two types of activities:

- **Preservation** of high quality coastal wetlands
- **Restoration** of coastal wetlands in poor condition

  Wetlands restored by the program are then preserved by the program.

WHICH PROGRAM WOULD YOU PREFER?

The two programs described below take different approaches to coastal wetland protection. Please compare the two programs before answering Question 8.

	PROGRAM A	PROGRAM B
Of the many features coastal wetlands provide, which is the program's highest priority?		
Primary Focus	**Non-Game Species**	**Open Space Near Cities**
How the program effort and resources are divided		
Preservation of high quality coastal wetlands	**10% Preservation**	**25% Preservation**
Restoration of coastal wetlands in poor condition	**90% Restoration**	**75% Restoration**
How the program gets coastal wetland sites from volunteers		
Pays for purchase, permanent easement, or ten-year contract	**Purchase Property**	**Permanent Easements**

8. **If the state had to choose one of these two programs for protecting coastal wetlands, which of these programs would you prefer?**
(Circle one response)

   a. Program A
   b. Program B

YOUR VOTE ON A STATE-WIDE PROGRAM

Now, we'd like your input on one of the wetland programs. We want your input in the form of a vote. Please review the following information before recording your vote in Question 9.

PROGRAM FUNDING
The proposed program will be funded by a **one-time only, tax payment.**
The cost to **your** household will be **$40** added to your 2005 state income tax.

Programs cost money so voters have to decide which programs they want to support. Some people will vote for the proposed wetland program because they think that the program benefits are worth the costs. Others will vote against the proposed wetland program because they think the program is not worth the costs.

We want **your view**.

PROGRAM IMPLEMENTATION
The proposed program would provide funds for the preservation and restoration of Michigan's coastal wetlands.

- The program would do only those things described on the next page.
- The program would begin only if voters approve it.

MICHIGAN'S CURRENT WETLAND LAWS
State and federal laws try to prevent loss of **wetland acreage** by placing conditions on wetland permits to avoid, minimize, and mitigate wetland loss. However, existing wetland laws do not always protect **wetland quality.**

For example, protecting wetland acreage does not always protect the things that wetlands do. Also, existing wetland laws do not fund preservation and restoration of wetlands.

PROPOSED COASTAL WETLAND PROGRAM AND COST

	PROGRAM A
Primary Focus	**Non-Game Species**
Preservation effort	**10% Preservation**
Restoration effort	**90% Restoration**
Get Program Sites	**Purchase Property**
Total acres in program	**12,000 acres**
One-time only payment	**$ 40, one time**

HOW WOULD YOU VOTE?

9. **Think of yourself in the voting booth. There are many things that the State can spend money on. Program A is one specific program. Suppose Program A is on the ballot. If it passes, Program A will be implemented and you pay the one-time, payment. If it does not pass, the program is not implemented and you do not pay for it.**

   With the information you have now, how would you cast your vote on Program A with a one-time cost to you of $40? (Mark ☒ one response)

	Definitely vote FOR it	Probably vote FOR it	Could vote either way	Probably vote AGAINST it	Definitely vote AGAINST it
For Program A I would...	☐	☐	☐	☐	☐

HELP US UNDERSTAND YOUR VOTE

It is very important for us to understand some of the reasons you voted the way you did in Question 9. Please take a moment and share with us some of your reasons. Use as much space as needed.

10. Some of the reasons I voted the way I did in Question 9 are ...

INFORMATION ABOUT YOU

This section asks a few questions about your background so that we can compare our results with the makeup of the state population. Your responses are completely confidential and will not be linked to your identity in any way.

11. Which best describes the area where you live? (Circle one answer)

a. An urban area
b. A suburban area
c. A rural area

12. How strongly do you agree with each of the following statements?
(Mark ☒ one response for each function)

How strongly do you agree with the following statements?		Strongly Agree	Somewhat Agree	Neither Agree or Disagree	Somewhat Disagree	Strongly Disagree
a.	I contribute to/am a member of an environmental group.	☐	☐	☐	☐	☐
b.	I go fishing and/or hunting.	☐	☐	☐	☐	☐
c.	I go camping and/or hiking.	☐	☐	☐	☐	☐
d.	I vote in all state and local elections.	☐	☐	☐	☐	☐
e.	I write letters to newspapers/agencies to express my views.	☐	☐	☐	☐	☐
f.	I follow community issues (e.g., watch public meetings).	☐	☐	☐	☐	☐
g.	I manage my time well.	☐	☐	☐	☐	☐
h.	I am often late for appointments.	☐	☐	☐	☐	☐
i.	I never seem to have enough time.	☐	☐	☐	☐	☐
j.	I have a hectic schedule.	☐	☐	☐	☐	☐

13. **How important is it to know that wetlands are there?** (Circle one response)

    a. Extremely Important
    b. Somewhat Important
    c. Not Very Important
    d. Not at All Important
    e. Do Not Know

14. **How important it is to know that wetlands will be there for future generations?** (Circle one response)

    a. Extremely Important
    b. Somewhat Important
    c. Not Very Important
    d. Not at All Important
    e. Do Not Know

15. **What is your age?** (Circle one response)

    a. 18 to 25 years
    b. 26 to 35 years
    c. 36 to 45 years
    d. 46 to 55 years
    e. 56 to 65 years
    f. More the 65 years

16. **What is your gender?** (Circle one response)

    a. Female
    b. Male

17. **What is your ethnicity and race?** (Circle one response)

    a. Hispanic, Latino, or Spanish origin
    b. White
    c. African American or Black
    d. Hawaiian or other Pacific Islander
    e. Asian
    f. American Indian or Alaska Native
    g. Other: _____

18. **Generally speaking, do you think of yourself as a...** (Circle one response)

    a. Democrat
    b. Republican
    c. Independent
    d. Other: _____

19. **What is the highest level of schooling that you have completed?** (Circle one response)

a.	Some high school	d	Associate degree, 2 year college
b.	High school degree	e.	College degree, 4 year college
c.	Some college	f.	Advanced degree (MBA, MD, etc.)

20. **We are interested in learning about the different ways people may earn their living. Last week, were you?** (Circle one response)

a.	Working full-time	d.	A homemaker
b.	Working part-time	e.	Retired
c.	Going to school	f.	Other: _____

21. **What was your gross household income in 2003?** (Circle one response)

a.	0 to $14,999	e.	$50,000 - $74,999
b.	$15,000 - $24,999	f.	$75,000 - $99,999
c.	$25,000 - $34,999	g.	$100,000 - $149,999
d.	$35,000 - $49,999	h.	$150,000 or more

22. **Which category best describes your primary income source?** (Circle one response)

a.	Construction	e.	Farming
b.	Forestry	f.	Government
c.	Education	g.	Transportation
d.	Real estate	h.	None of these

23. **What is your household size?**

a. Number of adults (18 years old and up): _____

b. Number of children (under 18 years old): _____

24. **Which of the following best describes you?** (Circle one response)

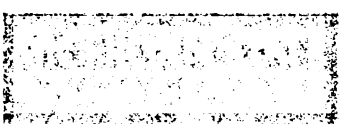
a. The person to whom the letter is addressed
b. A spouse or relative of the person to whom the letter is addressed
c. A close friend of the person to whom the letter is addressed
d. Someone else (fill in please) _____

Thank You! This completes our questions for you.

You may use the back cover to share your ideas or opinions with us.

Please place the survey in the envelope provided and return it to:

GL Wetland Study, Dept. of Resource Development, 323 Natural Resources Building, Michigan State University, East Lansing, MI 48824-1222



Region 1

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